Kentucky Beekeeping : A Guide for Beginners

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INTRODUCTION

Beekeeping appeals to those who are curious about plants and animals, who enjoy working outdoors and who appreciate the interplay among weather, the seasons and nature. In this way it is related to gardening, fishing, hunting and care for animals.

Beekeeping is also a type of agriculture. Hives are managed for marketable products. The crop pollinating activity of the bee is worth billions of dollars each year in this country alone.

The honey bee, however, has an additional element which is not evident in plants or most animals. That is the complex social structure of the bee colony. Much of what is fascinating about honey bees is in the way the bees interact and cooperate.

Kentucky is a good place to get started. A large portion of the state is rural or wooded. Some of the best honey plants in the country, such as sourwood and basswood, grow here. Bees rarely have trouble finding pollen. We have relatively little trouble with pesticides poisoning bees, a major problem in some other states. Last but not least, the Kentucky State Beekeeping Association and over 40 local associations hold regular, informative meetings and field days. Beginners are welcome!

The beginner needs little to get started as a beekeeper. A suitable location for the bees, the basic equipment, and of course the bees themselves are needed. From there on, it's a matter of learning from other beekeepers, magazines, books and (most important) personal experience.

PART 1: UNDERSTANDING THE BEES

An understanding of the life of the honey bee colony is essential to good beekeeping. The bee is remarkable for many reasons, including its ability to live in a cooperative society, which we call the *colony.* The colony consists of the live bees, including the brood but not including the structure they live in. The *hive* is the bee colony plus the structure around them: the wooden boxes owned by beekeepers, a hollow tree, or any other structure they might

find. Sometimes a colony will not have a hive, for example a swarm of bees that is searching for a place to live. In practice, many beekeepers use the terms colony and hive interchangeably.

The *queen* is the heart of the colony. She is usually the mother of all the other bees in the colony. Her abdomen is slightly cone-shaped and enlarges greatly when she is actively laying eggs. The *workers* are sterile females, numbering up to 60,000 per colony. They are true to their name -- tending the larvae, feeding the queen, cleaning the hive, grooming each other, constructing beeswax comb, guarding the hive, foraging for nectar and pollen, making honey, and keeping the hive warm or cool as needed. *Drones* are the hopelessly lazy male bees. They do nothing but eat and wait for nice afternoons when they will fly off i with hopes of meeting a young queen bee. A drone can be recognized by his enormous black eyes which cover most of the head. His thorax and abdomen are stockier than those of a worker bee. Both his eyes and his powerful flight muscles are key to his success on a mating flight.

Each bee starts as an egg, which is incubated in its hexagonal, wax cell for three days. It hatches to become a tiny, white, worm-shaped *larva (larvae,* plural). The larva eats food placed in its cell by the workers, and grows very rapidly for about six days. By the time the larva is fully grown it has filled its wax cell. The workers then cover the cell with wax. Soon the larva becomes a *pupa (*PYU-pah; *pupae,* PYU-pee, *is the* plural), which is the transitional stage between larva and adult. As the pupa matures, astonishing changes occur: wings, legs, eyes, antennae, hair and all the other adult bee organs develop. At the end of the pupal stage, the bee chews an opening in the cell cap and crawls out. It is now an *adult* bee. The development periods for the three types of bee are shown below in Table 1. These numbers are very useful for a beekeeper to memorize. With them we can make a lot of sense out of what we see in the hive.

Table 1. Approximate development times (in days)

	Egg	Larva	Pupa	Total
Queen	3	5 ½	7 ½	16
Worker	3	6	12	21
Drone	3	6 ½	14 ½	24

A year in the life of a honey bee colony

We will consider a natural (feral) colony, not managed by a beekeeper. From this we will understand the colony's seasonal story, and why beekeepers manage bees in certain ways.

Let's begin with February and March, when the colony experiences the first few warm days. On sunny days above 55° the bees pour out in search of early flowers, and return with the first nectar and pollen of the new year. The arrival of food in the hive stimulates the queen to begin laying eggs, which soon hatch into hungry worker bee larvae. With some luck, the spring weather is not too bad and the bees are able to satisfy these hungry mouths. The queen lays more worker eggs daily. The first young adult worker bees of the year begin to emerge from their cells three weeks after the queen began her egg laying. They join the other workers, the *winter bees* that were reared last year, to strengthen the colony population.

As March passes into April and May, the colony develops enough worker bees to feed and incubate a larger brood nest. Also, the nights are not as cold, and this helps the bees incubate their brood. With more brood rearing the number of workers grows quickly. In May and June, the weather is almost perfect and everything seems to be blooming at once. The days are longer, so workers can be out foraging for 14 to 16 hours daily. The sheets of *comb,* many hexagonal cells of beeswax, are filled with honey, pollen and brood. This is when the colony makes most of its honey. When bees are foraging for nectar and making it into honey, we call it a *honey flow.* When they are bringing in pollen, it's a *pollen flow.*

April through June is mating time. Drones are reared in great numbers and a few queens develop in the strongest colonies. When a new queen emerges from her cell, the colony is

ready to divide. About half of the adult bees leave the hive in a big cloud, along with a queen -- usually the original, older queen. This colony of bees which is temporarily without a home is called a *swarm.* They soon settle near their original hive in a cluster. In a day or so the swarm moves on to a permanent home. A hollow tree or other cavity is typical.

Meanwhile, a young queen remains in the original hive. She is the daughter of the queen that left in the swarm. As soon as weather permits, she takes a mating flight. Several days later she begins to lay eggs and takes on her new role as colony queen.

The most important honey plants do not bloom abundantly in July and August. During these months the hive often experiences a summer dearth. It consumes stored honey if it isn't finding enough nectar and pollen to satisfy the larvae and adult bees. The number of brood cells diminishes. Often, a second honey flow occurs in early fall but the bees usually make less honey at this time than in the spring. In September and October, winter preparations begin, and brood rearing tapers off. When cold weather hits, the bees cluster tightly to keep warm. From November to February the worker bees are eating honey, clustering, and generating heat by shivering their flight muscles. If the bees are healthy, numerous enough to make a large, warm cluster, and have sufficient honey stored, they should survive the winter.

We can understand more about the honey bee colony by learning details of the lives of the individual bees. An outline of the lives of a queen, worker and drone follows.

The life of a queen bee

The queen begins her adult life when she emerges from her peanut-shaped *queen cell.* If you see the cell just after her emergence, you may see the circular hole she cut for herself at the bottom. The worker bees destroy the empty queen cell soon after the queen has emerged. For this reason, queen cells are seen only in a hive when queens are reared, or just afterward.

As a young virgin, the queen will appear relatively small. She is able to walk quickly across the comb because her ovaries have not yet enlarged. She may be difficult for the beekeeper to find because she is not much larger than the worker bees.

A few days into her adult life, she takes flight in search of a *drone congregation area.*

This is a location that can be near the hive, but is often quite a distance. Drones and queens may find a congregation area several miles from their hives. This will be about 50 feet above the ground where hundreds of drones are circling. We don't know exactly how or why the drones and queens choose certain locations to congregate. It seems that ridges, rows of trees, and large buildings are important cues. Every year new drones and queens choose these same locations again.

Her mating flight will be during the afternoon, usually on a warm sunny day. When the queen approaches the congregation area, the drones speed toward her and attempt to mate. The queen mates with many drones in rapid succession, and then returns to her hive. If the queen was unsuccessful in finding enough drones for mating she may try another mating flight within the following days.

After a successful mating flight, the sperm obtained by the queen moves to a tiny spherical sac inside of her, called the *spermatheca.* The sperm will be stored there, and gradually depleted, for the rest of her life. It will be sufficient to fertilize her several hundred thousand eggs during her two or three years.

When the queen is ready to lay an egg, she first inspects the inside of a beeswax cell. If the cell is empty and clean, she then turns around and inserts her abdomen. Then comes a clever trick: the queen is able to control the sex of the egg she lays. If the egg is to be female, she releases a bit of sperm from her spermatheca as the egg passes through her reproductive tract. Fertilized eggs are female and will develop into workers or queens. If, however, the egg is to be male (drone) the queen withholds sperm as the egg passes. Unfertilized eggs develop into drones.

The queen's ability to control the sex of her offspring is one of her most valuable traits. In this way drones may be produced only for the mating season. This ability is shared by kin of the honey bee. Ants, wasps and other bee species have the same mechanism to control the sex of their offspring.

As spring progresses, the young, mated queen in a healthy hive devotes herself entirely to the task of laying eggs. If the workers bring an abundance of nectar and pollen home, the

queen is fed accordingly. In May and June she will lay 1000 to 2000 eggs daily if she's aided by a strong colony. That's by almost continuous activity day and night. Most of her eggs develop into the workers that run the whole hive. So we can see why beekeepers are so concerned with the vigor and genetic traits of their queens.

When foraging slows in midsummer, the queen is fed less and her egg production tapers off. Her ovaries shrink and she becomes slightly smaller. The last eggs will be laid in October in a typical Kentucky autumn. For the queen, winter is a time only for waiting in the middle of the cluster. The ball of worker bees surrounds and warms her. In February she is fed more and stimulated to lay a few eggs. The cues are the appearance of the first spring flora and a slight lengthening of the days. Honey bees, like many plants and animals, have their own internal clocks which allow them to tell whether the days are becoming shorter or longer.

With springtime's abundant forage and increasing worker bee population, the queen bee is fed more and more by the workers. Most of this food is *royal jelly,* the glandular secretion which is generated by the worker bees. Royal jelly is also fed to larvae as they develop into queens. The queen returns to her role as an "egg-laying machine". This second year, however, she will do more than lay eggs in worker and drone cells. In April, May or June she will find a few wax *queen cups* which have been constructed by the worker bees. These are thimble-shaped cups open downward. They are often seen attached to the brood comb. The queen lays a female (fertilized) egg in each of several cups. They are now queen cells. The eggs hang securely from the inner base of the cells because the queen uses a sticky material to glue them to the wax surface.

When the eggs in queen cells hatch, the workers feed the new young larvae royal jelly. This liquid is thick enough to be suspended inside the cells. The workers add wax to the cells, extending them downward. Since they are created in anticipation of the swarming process, they are often called *swarm cells.* The young larvae hang from the inverted surface of the royal jelly. For the first two days, each larva is surrounded by an abundance of this very rich food. The worker bees visit the cells frequently, adding jelly and extending the cell

walls downward with wax. The larvae grow very quickly and by the fifth or sixth day after hatching they have eaten nearly all of the food. By that time they are large enough to fill their cells and the cells have been capped at the bottom by the worker bees. The larvae then enter the pupal stage inside their cells. The rudiments of wings, eyes, antennae and legs appear. Twelve to fourteen days after hatching from an egg, each developing queen has finished her pupal period and has become an adult.

While these larvae and pupae develop in their queen cells, the adult queen is eating less. Her ovaries shrink, she lays fewer eggs and soon she is light enough to fly.

When the developing queens are nearly ready to emerge from their cells, our story becomes more complicated. The colony typically rears more queens than it will actually need for the swarming process, so there is a rivalry among these new queens. If left to their own devices they would hunt each other down and try to sting each other to death. So the worker bees must mediate this conflict to prevent a destructive battle, which could leave the swarming process with no queens at all.

The colony is now on the verge of *swarming,* a dramatic process in which one honey bee colony becomes two or more colonies. Just as her queen daughters are ready to emerge from their cells, the original queen leaves the hive with a cloud of worker and drone bees. They quickly settle in a cluster somewhere near the hive, often on a branch.

The most mature new queens in the hive chew open the bottoms of their cells. The worker bees may prevent their exit by holding them inside until their mother has left, and then release one from her cell. The first queen out then hunts for the other queen cells and kills the queens in them by stinging through the cell wall. As the survivor, she has become the new queen. She inherits the original nest from her mother and reigns over the bees which have remained in the hive. After feeding for a few days she becomes strong enough to take her mating flight, and begin a life much like her mother's at the head of the colony.

During the time just after the departure of the original queen, the remaining queens make curious honking and tooting noises. Some honk from inside of their cells, so that the sound is muffled. If you open a hive just after a swarm departs, you may hear these queen

noises. The function of the noises is not completely clear. They appear to be signals indicating the viability and number of young queens in the hive, allowing the queens and workers to regulate the final number of queens and swarms from the original hive.

A populous colony may generate a second and even a third swarm shortly after the first prime swarm departs. These are called *afterswarms.* In this case, the workers have protected several new queens for the process. Each afterswarm leaves with one of the new virgin queens, which must mate after her colony finds a permanent nest site.

The best queens are productive and vital into their second year and rarely into a third year. But all queens age, and this is perceived by the workers. Older queens lay fewer eggs and relatively more drone eggs. Eventually the worker bees begin to feed royal jelly to some of the young female larvae, initiating queen cells. These are *supersedure cells.* One of these daughter queens is allowed to emerge, mate and begin laying eggs. Often the original, mother queen remains in the hive during this process, but she is fed less and less by the workers. Gradually she is starved and dies. This process is called *supersedure.* If you see two queens in a hive, you might be witnessing supersedure in progress.

The life of a worker bee

The worker bee has a life far more complex and flexible than that of a queen or drone. We are still far from understanding all of the intricacies and interactions of the workers. Only a brief overview follows here.

A young adult worker chews her way out of her brood cell and joins her many nest mates. You can often observe emerging workers when examining a frame of nearly mature capped worker brood. Within a few hours of her emergence, the young worker can be identified by her slightly whitish hair and awkward movements. She is unable to fly or sting for the first day of her adult life. She feeds herself on honey and pollen to strengthen herself. By the second day she has started to help the colony with the first of a series of tasks: cleaning cells. Several days later her brood food glands have developed and she is able to secrete food for young larvae. This worker is now a *nurse bee.* A few days later she is old

enough to secrete wax from a set of eight glands under her abdomen. If the colony needs new comb, she may participate by pulling newly secreted wax scales from her abdomen and molding them into hexagonal cells. Other workers that are one to several weeks old will fill colony needs by guarding the hive entrance (*guard bees*), ripening honey, circulating air through the hive by fanning their wings, and attending the queen. A few even specialize as "undertaker bees", removing dead nestmates and dropping them outside of the hive. Individual bees generally remain with one or a few tasks at any given time. They will switch as they age and as the needs of the colony change.

At an age of two or three weeks, a worker first ventures outdoors for a *play flight.* In doing so she makes a transition from *house bee* to *field bee.* In play flight a worker circles in the area around the hive. She is memorizing landmarks, the direction of the sun and the appearance of her hive. Within a day or so, she is off to the flowers to collecting nectar, pollen, or both. Once she has discovered a patch of blooming flowers, she is likely to specialize in that type of flower. It makes sense for her to specialize because it takes a little time to learn just how to collect nectar and pollen from that type of flower, and where it grows. Specialization is part of the efficient nature of the colony. Some worker bees will specialize on water or propolis collection. (See **Water for bees,** p. 44 and **Propolis,** p. 81)

The spring and summer life of a worker bee is concerned much with brood rearing and foraging. A worker bee will fly many miles daily and her wing margins eventually become badly tattered. Workers rarely live longer than two months during this time. The bees that are reared in early fall are destined to become the *winter bees.* Their job in winter will be to cluster, consume honey, and generate heat. In early spring, the surviving winter bees must forage and rear the first brood until they are finally replaced by a new generation of young workers. The winter bees must live from four to six months for this wintering process to be successful. For this reason a beekeeper should nurture as many well-fed bees into fall as possible.

A good beekeeper is aware of the worker bee tasks, their relationship to the ages of the bees and their function in the colony. Here are three examples: (a) If the beekeeper wants to

divide one hive into two or more, it's helpful to divide the worker population so that young house bees and older field bees are in each of the new hives. (See **Dividing Hives**, p.71) (b) A hive can be requeened most successfully if the new queen is put in contact mainly with younger house bees. (See **Requeening a hive**, p. 67) (c) If a hive is moved during the day when bees are flying, it will lose many of the older bees with foraging experience and keep the younger house bees which rear the brood (see **Moving Hives**, p. 73).

The life of a drone bee

The drone bee leads a simple and melancholy life. It usually begins in late spring time or early summer, when the queen is most inclined to lay male eggs in drone cells. When the drone emerges from his cell as a young adult he feeds himself on honey and pollen. Within a few days he is ready to fly. His first flights may be primarily play flights. Eventually he begins to fly to a drone congregation area. He fills up on honey before each flight in order to be airborne for as long as possible. These flights continue on sunny afternoons for as long as he is able. A small number of the drones in a colony, about 1%, actually succeed in mating with a queen. Those that do so die immediately afterward.

Those drones that survive until fall are evicted from the hive as they would be nothing but honey consumers in winter. Since the drones are unable to rear brood, clean the hive, secrete wax, sting, forage or perform other useful tasks, they would be only a liability during winter and early spring. Drones have no stingers, so they are useless for colony defense.

Watch the hive entrance on a warm day after the first cold October nights. Drones are dragged struggling from the hive by the workers. If one breaks free the workers capture him again and force him out, perhaps stinging him in the process. Finally, the exhausted drones are left to die outside.

COMMUNICATION IN THE HIVE

For the colony to thrive, individual bees in the complex society of the hive must communicate with each other. Their methods of communication are quite different from

those used by humans. The inside of the hive is dim in daytime and completely dark at night, so vision is useless there. Bees do use noises, but to a limited extent. Piping and honking noises from queens (See **The life of the queen bee,** p. 4) and buzzing noises by dancing forager bees (See **The waggle dance,** p. 11) have special purposes. The real story of colony communication is by touching, odor, and food sharing.

The waggle dance

No description of honey bees would be complete without a mention of the famous dances which bees use to communicate the location of nectar and pollen-bearing flowers. This behavior was deciphered by the Austrian biologist Karl von Frisch. He went on to win the Nobel Prize, awarded in part for his work on honey bees.

A curious behavior called the *waggle dance* is performed by *scout bees* to announce the appearance of new bloom. Scout bees are foragers which specialize in the discovery of new nectar and pollen sources. Successful scouts return to the hive and perform a dance which describes the distance, direction and quality of the food source. The scout walks in a figure-8 pattern on the comb, waggling in the middle part of the "8". The direction the bee faces while waggling communicates the direction of the bloom from the hive relative to the direction of the sun. The number of seconds spent waggling indicates the distance from the hive to the blooming flowers.

The dancing bee also communicates distance with buzzing noises, which humans can't hear. The vigor of the waggle tells the other bees how rich and available the food is. Other forager bees -- the *recruits* -- follow the dancing bee closely. The dancing bee may stop occasionally and offer a taste of the nectar she has collected to the surrounding recruits, as further information about the quality of the food. The recruits smell the body of the dancer to learn the scent of the flowers she visited. If the vigor of the dance and a taste of nectar are convincing, the recruits then use the distance and direction information to find the bloom. They also remember the scent of the flora to find the bloom.

The coordinated search efforts of the honey bee are one key to their success as honey makers. Large hives that are full of bees have more scouts than weaker hives. This is one reason larger colonies are so much better at making honey. One colony with 40,000 worker bees will make more honey than two hives each containing 20,000 bees.

The waggle dances and many other types of behavior can be seen best with an *observation hive.* This is a specially constructed hive with transparent sides. Scout bees will waggle also on the surface of a clustered swarm to communicate possible nest sites. This is easily observed when watching bees on the surface of a swarm that has been clustered a day or more after leaving its hive.

Sense of smell

We humans are woefully inadequate at smelling the world around us, compared to many other animals. This is obvious every time we take our dogs for a walk. Most insects are acutely sensitive to odors, especially the smell of their foods and of mating attractants. Honey bees are no exception.

In addition to detecting flowers and intruding animals, bees are very good at smelling each other. Each hive has a characteristic odor. Bees from another hive are intercepted at the hive entrance when guard bees smell the foreign hive odor. Bees are also very sensitive to pheromones (below).

Pheromones

Bees are especially sensitive to the smell of signaling chemicals called *pheromones* (FER-o-mones). Pheromones are chemicals used by animals to communicate with others of their own species. Insects which form colonies (honey bees and some other bees, ants, some wasps, termites) rely heavily on pheromones.

Worker bees communicate with several types of pheromones. One is released from a gland at the tip of the abdomen, the *Nasanoff gland.* This *Nasanoff pheromone* is used when

the bee colony needs to congregate. It says to the other bees "Come this way, the rest of the colony is over here." This behavior is called *scent fanning.*

For example, when the bees in a captured swarm or a purchased package are installed in a hive, several dozen workers will perch at the hive entrance where they open their Nasanoff glands and fan their wings. Straggler bees which might be left on the package box or other equipment near the hive will be drawn to their colony by this odor. If you lean close to the bees as they fan, you might catch the scent they emit. It smells like lemon grass tea, and has some of the same chemicals.

Worker bees use their Nasanoff glands also when traveling as a swarm to a new nest. The scout bees -- those workers which have picked out the best place to call home -- lead the rest of the colony by releasing this pheromone. If you happen to see a swarm on the move you might notice the pleasant scent. It's enjoyable and safe to walk along with the cloud of bees as it moves slowly through the air.

Workers release another pheromone when they sting. When the stinger breaks off of the bee, and remains embedded in its victim, it releases a banana-like smell. This is the *sting pheromone.* It encourages other bees to sting in the same place. Hobby beekeepers rarely experience stinging which results in much pheromone release. However, the African bees attack in numbers great enough to make good use of this pheromone. (See **African bees** p. 16.)

The queen bee also communicates with pheromones. A variety of chemicals are released from her mandibles, abdomen and feet. When a queen flies to mate, drones find her partly by her pheromones. In the hive, workers cluster around her in a retinue as they lick these chemicals from her body. The workers then pass the *queen pheromones* to worker bees not near the queen. Eventually some of the pheromone reaches all of the worker bees in the colony. In this way, all of the workers perceive her existence, even those which have never been close to the queen. The human nose cannot detect this pheromone.

If the queen dies or is removed by a beekeeper, the entire colony begins to sense the disappearance of queen pheromone within a few hours. The behavior of the worker bees

changes dramatically as the colony enters the *queenless* condition. Nurse bees select several to a dozen young female larvae in worker brood cells to become potential queens. These larvae are fed copious amounts of royal jelly, just as if they began their lives in queen cells. The workers add wax to the hexagonal, horizontal cells, extending them downward as they become the peanut- shaped queen cells. In this case they are *emergency queen cells.* The worker bees change their behavior in other ways also. Queenless workers are more likely to sting, they forage less for food, and are less meticulous in cleaning their nest. When a new mated queen becomes established in the colony, workers detect her pheromones and their behavior returns to normal.

Trophallaxis

Colonies of social insects share food extensively. This is a behavior called *trophallaxis* (tro-fa-LAX-is). In trophallaxis, one honey bee will extend her *proboscis* (pro-BAH-sis), or tongue, to another bee. This is how one bee will ask for food from her nestmate. If the other bee has a crop full of honey or nectar, she may produce a droplet, which the requesting bee then consumes with her proboscis. This is not often observed in routine beekeeping, but can be seen with specially constructed observation hives.

When a colony is on a honey flow, the house bees receive plenty of nectar by trophallaxis from the foragers and share it among themselves. The house bees, including nurses, are then more generous in offering food to larvae and the queen. Other house bees will ripen the nectar into honey. Some pheromones are spread among the bees by trophallaxis.

VARIETIES AND BREEDS OF HONEY BEES

The honey bee, which goes by the scientific name *Apis mellifera,* is a species native to Europe, Africa and Asia as far east as Saudi Arabia, Iran and the Ural Mountains of Russia. Within this enormous range at least 24 varieties, technically called "subspecies" developed. One subspecies, *Apis mellifera lamarkii,* is native to the Nile River Valley. For thousands of

years the Egyptians moved hives of this bee up and down the river in barges. Another, *A. m. sahariensis,* is native to isolated oases in the Sahara Desert. Others thrived on individual islands such as Cyprus and Madagascar. Each of these types of honey bee has its own set of characteristics. As they are all the same species, they can potentially interbreed to produce hybrids.

When the first European settlers came to North America they brought their bee hives, along with crops and livestock. Since those people were mainly northern Europeans, the bees too *(A. m. mellifera)* were from that region. These bees are often called "German bees", although this term is misleading. The original range of these bees was quite extensive: from the British Isles and France, across northern Europe and into western Russia. The first German bees were established in North America in the early 1600's. In the 1800's, bees from Italy were brought to the U.S. These Italian bees *(A. m. ligustica)* soon became the preferred type because they were much better tempered than the German bees. Carniolan (CAR nee oh lan) bees (*A. m. carnica)* from southeastern Europe and Caucasian bees *(A. m. caucasica)* from the Black Sea area are also popular with American beekeepers.

The German bee is dark and often mean-tempered. Its main virtue is that it overwinters very well in cold regions. These bees end brood rearing relatively early in fall, and are slow to build up a population in the spring. For perhaps two hundred years, eastern Kentucky forests were populated by feral German bees. In the 1990's, the twin epidemics of tracheal mites and varroa mites eliminated nearly all of these feral bees.

Italian bees are relatively gentle, have good disease resistance and are often yellowish. They rear brood early in the spring and continue it late into the fall, so they tend to consume more honey through the winter than other types of bees.

Carniolan bees are gentle and overwinter with a relatively small population, so they need relatively less honey through the winter. They rear brood rapidly in springtime, building up their population quickly.

Caucasian bees are usually gray and tend to be quite gentle. They swarm less often than other bees. However, they build up slowly in the spring, use propolis heavily and are more susceptible to nosema disease.

The African bees

In 1990 the African bees entered Texas from Mexico. Since then they have become established in a dozen southern states. Years after the entry of the bees into the U.S., they continue to expand their range. In the late 1990's they reached the outskirts of San Diego and Los Angeles. Recently, they have been found in southern Georgia, parts of Florida and other Gulf Coast states. These bees are very prone to sting and swarm. They can be managed but with greater difficulty than our familiar strains of honey bees.

We can understand these bees by considering their origin and history. They are derived from bees *(A. m. scutellata)* brought from South Africa to Brazil in 1956, for a research project. The bees escaped in 1957 and rapidly populated the region. Since they are a tropical bee, they thrived in Brazil and other tropical countries. With time they moved through Central America and Mexico, displacing nearly all of the European stock bees that had been kept previously. Some call them "Africanized bees" because they have interbred somewhat with the European bees kept by beekeepers. We are familiar with another name, the unfortunate term "killer bees".

As they entered the southern United States their reproduction and dispersal slowed. This was probably due to several factors. Most important, our country is not the tropical environment ideal for African bees. Also, large scale beekeeping operations in Texas and other states have interbred with and probably "diluted" the population so that they are significantly more European. Possibly, fire ants and varroa mites have killed many of the colonies. We in Kentucky are unlikely to have permanently established African bees. Our winters are too cold for this tropical bee. It is possible that some swarms might survive for a summer after they "hitch-hike" a ride north on a barge or large vehicle. African bees traveled

to the San Joaquin Valley of California in 1985 and to Virginia in 2000 this way. In both of those cases the bees were quickly eradicated.

The bees are very dangerous because they are easily disturbed and will attack in great numbers. They also swarm and abscond frequently, so they can be quite difficult for the beekeeper to manage. The greatest danger is to people and animals that cannot run away or get indoors quickly. In 2010 an elderly man was killed by these bees in southern Georgia. Animals that are tied or kept in pens are most vulnerable.

However the Brazilians have done quite well with these bees. With the right protective equipment, and by locating hives away from houses and farm animals, the Brazilians have learned to manage the bees effectively. A breeding program has led to less aggressive African bees. In Brazil, the African and Africanized bees produce three to four times the honey that the European-stock bees produced previously.

In the U.S., only a small number of people have died due to African bee attacks. This is a credit to the thorough educational campaign mounted by Texas and the other affected states.

Breeds of bees

Bee breeders have developed particular varieties or breeds of bees, based on desirable traits in various subspecies. Perhaps the best known is the Buckfast bee. Also, several research labs and beekeepers have developed bees with tracheal mite and varroa mite resistance. These breeding programs are often described in beekeeping magazines.

Buckfast bees were bred over many decades by Brother Adam, a dedicated monk at Buckfast Abbey in England. The Buckfast strain has some resistance to tracheal mites, and is good for honey production and other traits desired by beekeepers. It does well in Kentucky.

More recently researchers at the U.S. Department of Agriculture developed a stock of "Russian bees" which began with bees taken from eastern Russia. These bees had been exposed to varroa mites in Russia for many years, where they seemed to have developed resistance to varroa.

Beekeepers will also read and hear about "hygienic" bees. These are bees with the ability to detect diseased and mite-infested brood. The bees then remove the larvae or pupae from the hive. This trait greatly reduces disease and varroa mite problems, without the use of chemicals. Kentucky beekeepers with several years of experience may wish to learn how to breed bees for valuable traits, at workshops held during spring and summer.

Which is the best type of bee for a beginner?

The best information usually comes from other beekeepers. Talk to those in your local and state beekeeping associations. Gentle behavior is very important for beginners. It is also essential if your hives are near your neighbors.

As you gain experience, you may become more interested in honey production, mite resistance, or overwintering ability. All of these traits have some genetic basis, so they are determined partly by the breed of queen you have.

When you chose your bees it is good to know that stock sold in this country is rarely "pure". For example, bees advertised as "Italian" are probably not the same as what arrived from Italy many years ago. The only way to maintain a pure line of bees is to instrumentally inseminate all of the queens with semen from drones of a known source. Bee breeders cannot do this on a large scale. Instead, the common practice is to let the queens fly to mate naturally in an area where the breeder keeps an overwhelming majority of bees with the desired genes. In this way the breeder "floods" the drone congregation areas with drones from the desired colonies. This is a very acceptable practice. It nearly always results in high quality, mated queens for sale to beekeepers. The main factor in choosing a source of bees should be whether it has the traits important to you.

PART 2: THE HIVE

The bees need a place to live. Beekeepers need to be able to open and examine it without destroying the carefully constructed comb. Consequently, we use hives with removable

frames. The equipment is made to standard dimensions so that hive parts are interchangeable, even if they are bought from different companies.

Hive parts

One or two deep boxes, or *brood boxes,* sit on a bottom board. This is usually where the queen is active. Smaller boxes, *supers,* rest on top of the deep boxes. All of these boxes are called *hive bodies.* Some beekeepers use deep boxes as honey supers. However, a deep box with 9 or 10 frames of honey can weigh over 50 pounds. A super is more manageable. At harvest time, most beekeepers don't want to carry this much at once. On top, an *inner cover* and *outer cover* shelter and insulate the whole hive. A brick or small cement block should be placed on the outer cover in windy locations.

The hive parts are shipped from beekeeping supply companies in pieces. They are easily assembled with nails and glue. Recently, some companies have started to sell fully assembled equipment. The outer surfaces of the hive should be painted with exterior house paint. Inner surfaces, the inner cover and the frames should never be painted. Some beekeepers treat the hive bodies, bottom board and outer cover with wood preservatives instead of paint. Be careful not to use a wood preservative containing toxic substances.

Traditionally, beekeepers paint their hives white. Practically, any light color will do. Some beekeepers buy odd lots and leftover house paint at reduced prices. If you do this, add white paint to lighten dark colors so that the hive does not overheat on sunny summer days. A multicolored apiary is striking in appearance, and the different colors help the bees to identify their own hives. Consequently, drift among hives will be reduced. (See **Drifting,** p. 59.)

The hive should be elevated a few inches above the ground. This helps with hive ventilation, reduces problems with weeds and grass growing in front of the hive entrances, and prevents wooden bottom boards from rotting. Use a very stable and level hive stand. I make hive stands from lengths of 4" x 4" treated lumber. Cinder blocks and wooden pallets

are also used. If your hive has standard bottom boards, tilt the hives just slightly forward that rainwater does not pool inside. This is not necessary for hives with screened bottom boards.

Each newly constructed frame will need a sheet of beeswax *foundation* before it goes into the hive. Foundation is embossed with the bees' comb pattern, and often wires are embedded into it. The wires will strengthen the comb which the bees will build on the foundation, inside the wooden frame. The sheet of foundation guides the bees as they construct their wax cells on it. This bee activity is called *drawing out* the foundation into comb. Without foundation in the frames, bees not will make their comb neatly inside the frames. Instead you would have comb constructed every which-way and be unable to remove the frames without destroying the comb.

Deep or shallow frames hang inside the brood boxes or shallow supers, respectively. When the foundation has been drawn into comb, the added wax makes the frames thicker. The frames are then quite tightly wedged together in the box. Some beekeepers prefer to keep nine of these "fatter" frames to a hive body because they are then much easier to remove without squashing bees.

Considerations about hive materials

Bee space. A critical dimension in the hive is the space between the adjacent wax combs in the hive. This distance, about 3/8 of an inch, is called *bee space.* It is the amount of space the bees leave between their naturally constructed sheets of comb. If frames in the hive are separated by more than this dimension, the bees will create another layer of comb in that area. If the separation is less than 3/8", the bees will add wax comb to join the adjacent combs. With this in mind, beekeeping supply companies construct frames so that when they are pushed together the combs inside them will be separated by this critical dimension. By keeping the combs at the bee space distance, the frames will be easy to pull out of the hive one by one, without interference from extra comb between them.

The concept and usefulness of bee space was developed a century and a half ago by Lorenzo Langstroth, an Ohio beekeeper. This simple idea created a revolution in beekeeping.

With carefully constructed frames, beekeepers were able to remove or add frames without serious disruption of the hive. Hive inspections, divisions, honey harvesting and all other manipulations became easy. Today, frames and hive bodies from all American beekeeping supply companies are called Langstroth equipment because they conform to the bee space dimensions.

Wood or plastic? All of the hive parts described above can be made from plastic. Is this better than wood? At first it might seem that plastic is best because it cannot be damaged by rot, wax moths or mice. Recently Styrofoam hive bodies have been on the market because they are very light and do not require paint.

However wood has several important advantages. Most important, wood absorbs the odor of the bees. This hive odor is important to the bees, because they must recognize their own home this way.

In some ways a plastic bottom board is very nice. It is the hive part most vulnerable to rot, since it is close to the ground, and plastic is easy to clean. But plastic hive bodies, frames and inner covers are not such a good idea. This large amount of plastic around and in the hive creates problems. Two problems are that the plastic does not absorb the bee odor which is important to the colony, and that the plastic is a poor insulator compared to wood. In winter, condensation will develop on the inner plastic walls. All in all, the bees do better with wooden hive bodies, frames and inner covers. The outer cover can be plastic, or wood covered with metal sheeting. Both are good.

Some types of plastic will warp over time. This does not usually happen with the bottom board because of the continuous weight from the hive.

Plastic foundation is also sold. This can be good if the bees build on it during a strong honey flow and when the colony is vigorous. Then the frame is very strong with this internal plastic sheet. But if conditions are not favorable the bees will be reluctant to build comb on it.

SPECIAL EQUIPMENT

Queen excluders

Many beekeepers use a *queen excluder,* which is a wire or plastic grid that retains the queen in the lower part of the hive. It has spaces between the wires that are just wide enough to allow the workers through, but not the queen. The queen excluder is handy because it prevents the queen from laying eggs and starting a brood nest in the honey supers. When the time for honey harvest comes, it's convenient to have only honey in the supers. One problem is that brood rearing leaves layers of cocoons in the cells. When it's time to uncap the honey-filled cells, those with cocoon layers are very difficult to open with an uncapping knife.

The excluder also prevents the whole colony from moving up and abandoning the lower hive bodies. This is a common occurrence, and part of natural bee behavior.

But excluders have their down side. A hive may make less honey with an excluder than without. This is because the effort needed to wiggle through the excluder can discourage the worker bees from storing honey in the supers. And any drones trapped above the excluder will be caught and die in the excluder because they are too fat to pass through. I suggest excluders for those beekeepers who are too busy for frequent hive inspections during the honey flow. Otherwise, occasional adjustments can counter the problem of the queen moving up.

Screened bottom boards

Many beekeepers prefer bottom boards which have a large opening to the ground, which is covered with screen. These are used for control of varroa mites (see p. 46). Research has shown that many live mites fall from the bees inside the hive. The screened bottom allows the mites to fall to the grass below where it is almost impossible for them to return to the hive. This is an effective way for beekeepers to reduce mite infestations without chemical treatments or special procedures. These bottom boards may be wooden or plastic.

Some beekeepers prefer to construct their own screened bottom boards, or modify conventional bottom boards. This is fairly easy to do as long as the bottom board is sturdy and keeps to standard hive dimensions. The screen is purchased as "8-mesh hardware cloth",

with 8 holes to the inch. This prevents bees from entering through the bottom but allows the mites to fall through.

This large opening at the bottom of the hive has other advantages. It can help with ventilation, especially when the bees are ripening honey or dissipating heat on hot days.

Pollen traps

A pollen trap is a device that fits across the entrance of the hive and removes the pollen loads from returning pollen foragers. It has small holes that the bees can just barely wiggle through. As they do, clumps of pollen fall from the bees' legs into a drawer below.

Pollen traps are used when the beekeeper wants to collect pollen for human or animal consumption, or to mix with sugar and water for bee feed at a later time. They also increase the number of bees which forage for pollen, making a hive a better pollinator of crops.

However, a pollen trap deprives the bees of essential nutrients so it should not be left on a hive for more than a few weeks, it should never be used on a weak hive. The trap will weaken even a strong hive if on the hive for many weeks. And the bees will become irritable because of their efforts to wiggle through the trap. Pollen should be removed from the trap every week or so. Some types of pollen traps do not protect the pollen from rain. Wet pollen is spoiled. Pollen trapping is a special activity that requires some extra attention from the beekeeper.

PART 3: ESTABLISHING AND EXAMINING THE HIVE

Choosing a location for the bee hives

The best site for bee hives is accessible to the beekeeper, where the bees will thrive, and where they will not bother people or animals. The site for the hives is called an *apiary,* although some will simply call it a bee yard. Choose a spot which gets considerable sun,

especially in the morning. It's good to place the hive so that the entrance faces south or east. The sunlight stimulates bee activity, especially early in the morning.

The location should be sheltered from the wind by trees, bushes or buildings. In Kentucky, wind comes most often from the west so a windbreak to the west is most important. In winter, the chilling effect of the wind can be very significant.

Bees need blooming flowers to make honey, so the beekeeper should think about what plants grow within a mile or two from your hive site. Bees will fly up to 3 miles from the hive in search for flowering plants if they need to. The best plants include many that grow nearly everywhere including black locust, tulip poplar, clover and roadside weeds. Orchards and some ornamental plants are good too. Some central Kentucky horse farms are planting more clover to add nitrogen to the soil, because fertilizer has become more expensive. The ideal rural location is one that is near a mixture of wooded and open weedy areas or orchards. Areas that include mostly grass land or tobacco are not helpful for the bees, although they will often fly beyond these crops to find good forage. The small scale of Kentucky farms means that the bees can find something in bloom near almost every location.

Towns and cities can be surprisingly good for honey production. The diversity of trees and gardens make for excellent honey production. One beekeeper with hives in Lexington produced over 300 pounds of honey from several hives, in one year when the weather and other factors were favorable. The trees and buildings in a town provide good windbreaks. On winter nights, urban areas are slightly warmer than rural areas.

If the hives are located in a backyard or any spot near your neighbors, it's a good idea to have a tall fence or row of bushes around your yard. The bees will fly above this barrier when they leave the hive, and continue to fly at that height. If your barrier keeps their flight path at least eight feet above the ground you will have fewer problems with the bees bothering your neighbors.

If many hives are near parked cars or laundry drying outdoors, bee defecation will be a problem. This will be very evident on the first nice day after the bees have been confined by several days of rainy weather.

Basic equipment

The basic items needed for routine beekeeping are the bee veil, beekeeping gloves, smoker and hive tool. When the beekeeper is ready to harvest the honey from the hive, some additional equipment is required.

Bee veil. No one should open a bee hive without a bee veil to protect the head. Most veils fit over a hat or helmet so that they surround the entire head and neck. The best veils are made of strong material, reinforced so that it is held away from the head. Several types of veils attach to a jacket by a zipper. These are nice because they are completely secure around the neck.

Gloves. Beginners will usually want to wear gloves. However, some experienced beekeepers prefer to work bees barehanded because it allows them to be more agile. With time and experience, a few stings on the hands may not seem as bad as the discomfort of wearing heavy gloves in hot weather. Some beekeepers wear gloves only when weather or other conditions will cause the bees to sting a lot.

Smoker. The smoker consists of a metal container that holds smoldering material and a bellows to pump the smoke out. Smoke is very helpful in calming the bees. When used correctly, it greatly reduces the tendency of bees to sting. Smoker fuel is usually dry wood shavings, twine, bark or pine needles. Wood shavings can be obtained from livestock supply stores, pet stores, and lumber mills. Burlap may be used, but only if it has not been treated with any chemicals.

Hive tool. The hive tool is simply a heavy-duty paint scraper. It is indispensable for separating hive bodies, removing frames from the hive, scraping debris, and many other chores.

GETTING YOUR BEES

There are four ways to get a colony of bee hives. You can (1) get established hives from a beekeeper nearby, (2) get small hives made by dividing a beekeeper's stronger hive *(splits* or *divides),* (3) purchase packages of bees from a commercial package bee producer, or (4) catch swarms. Each method has its advantages and disadvantages.

An established hive may be purchased any time of year, but it's not a good idea to move a hive in winter. The move disrupts the bees when they are trying to maintain their winter cluster. An established hive is easiest to move in early spring when the bee colony is smallest and its stored honey is depleted. Splits should be made only in the spring (April through June) when they have will time to grow in preparation for winter. Packages are shipped in April and May. Swarms are most frequent in spring and early summer. Package bees and swarms also need the whole summer to get ready for the coming winter.

1. Acquiring an established bee hive

Often an experienced beekeeper with many hives is willing to sell one of them. This means you will have a complete hive with worker bees, brood, a laying queen and some stored honey and pollen. Since the hive is already up and running, you will probably have some honey to harvest after the first May-June honey flow. It may not be necessary to construct extra frames and hive bodies right away.

The disadvantages are that it will be more expensive than a divide or swarm, that it is possible to get a hive with brood diseases, that the move to your location may be a difficult chore (see **Moving hives,** p. 73), and that a hive with many bees can be intimidating to a novice. The cost of an established hive depends on many things: the strength (number of bees in the hive), condition of the wooden parts (hive bodies, frames, bottom board, inner and outer covers), the amount of honey in the hive, the time of year, whether diseases are present, and whether the hive has been recently and correctly treated for parasitic mites. Do not buy a weak hive in late summer or fall, or one with conspicuous disease or mite problems. The hive will need to be strong and relatively healthy to make it through the winter. Hive parts can be painted, repaired or replaced if you are willing to do so.

To be sure that diseases and mites are not a problem in the hive you are planning to get, have an experienced beekeeper examine the brood for you. You may want to have a sample of bees examined for tracheal mites, by the state apiarist or extension specialist. Generally, a strong hive in late spring or summer has very few problems with tracheal mites.

Try to get a hive that is not extremely full of bees, or that is especially defensive. A gentle hive is one of the keys to starting out right. For this reason, it's nice to get a hive in March or April when the colony population has not grown much.

2. Making a split (also called a divide or "nuc") from an existing hive

Possibly, a beekeeper will be willing to sell you a hive made by dividing an existing hive. (See **Dividing hives** p.71.) This will cost you less than a full size hive, so it is a fairly economical way to get started. It gives you an opportunity to watch a less intimidating hive grow through the year into a productive hive. However, a divide is usually only made in April, May or June, and it will probably not make any surplus honey in the first year. A small hive is often called a *nuc,* short for *nucleus.*

3. Buying a package of bees

Many beekeepers prefer to start their bees from a two or three pound package. This will be a box made of wood and wire screen containing the workers, a small cage containing the queen, and a can of sugar syrup. This is sometimes called "buying a swarm" of bees because, like a swarm, the bees are temporarily without a hive.

Important advantages of buying a package are that you can watch the colony grow from a relatively small size to a vigorous population, and that you will usually not get brood diseases (since no brood or comb comes with the package). Orders for packages are placed in late winter or early spring, some time before they are received. April or May is the time to receive and install your package, just as many flowers are beginning to bloom and the weather is turning warm.

Installing the package bees. This is an easy and interesting procedure that takes only a few minutes once your hive is ready for the bees. Set up the hive as one deep hive body, with five frames inside. The extra space in the hive body allows room for the package of bees. You can use frames with new foundation, or frames with drawn wax. Have a feeder full of sugar water ready.

The bees will be gentle when released from the package. But as a beginner you will want your gloves, hive tool and smoker. Of course, your veil is always worn when working with bees. Open the package by removing the syrup can. Next, remove the small queen cage hanging inside of the package. Brush the bees off of it and examine it to be sure the queen inside is alive. Sometimes a few of the worker bees in the queen cage will be found dead, but that is not important. Now place the package of bees sideways (screen side up) in the hive body. Remove the cork from the queen cage and suspend it between two frames. The workers will eat through the candy and then the queen will walk out to join them. Soon, all of the bees will move between the frames and begin housekeeping.

Place the inner cover on the hive. A day or so later you can remove the package and place it in front of the hive. Fill the gap with five frames. Any straggler bees will soon leave the package find their way into the hive, and the empty package may be disposed of.

Package bees must be fed, beginning immediately after they are installed, unless you have provided them with frames of honey. If the bees need to add wax onto the foundation ("draw out" the foundation), more feed will be needed than if they have drawn comb provided. Place the syrup feeder over the hole in the inner cover. Then place an empty hive body and outer cover over the feeder. (See **Feeding bees**, p. 41.)

Refill the feeder as it is emptied, for a week. Then examine the hive to see whether honey is being stored. Feed for a longer time if the weather has been very rainy. In May and June, the bees will soon find abundant forage and become self-sufficient. Do not expect to harvest any honey from your bees the first year if they have been installed from a package. As you can see, they have plenty to do before they are able to make any surplus for their keeper. Possibly, you will need to feed them sugar syrup in August and September to be sure they have the reserves needed for the winter.

One problem beekeepers have experienced with package bees is that the bees leave in a swarm soon after they have been installed. It's often impossible to find and catch the swarm, so this is a big loss of time and money. (See **Absconding**, p. 59.) One technique to inhibit this behavior is to move a frame of brood and a frame of honey from an established hive into

the hive you have set up for the package bees. This helps the package bees "feel invested" in their new home.

4. Catching and installing a swarm of bees

Swarm catching is one of the joys of beekeeping. Often it is very simple and safe to catch the swarm, if it is near the ground. You will usually be doing someone a favor by removing unwanted bees from their property, and the bees are free! However, you should give yourself a year or two of beekeeping experience before going after swarms.

The first step in finding swarms is to make it known that you are interested in collecting them. Your county extension personnel, police and fire departments, and schools are often willing to keep your name and phone number on hand in case someone reports a swarm. When you get a call, first determine exactly where the bees are clustered. Are they accessible? If they are high in a tree, for example, it will not be worthwhile to even come by for a look. Ask how long the bees have been there. If they have arrived within the last day or two, they should be fairly gentle and easy to handle. If they have been clustered for a week, they will be more likely to sting. Perhaps they have begun to build comb there because they haven't found a good place to live. A swarm that has settled for several days without finding much food is a *dry swarm,* and will be more irritable.

Try to determine whether the caller knows that they really are honey bees. If they are clustered in a ball, they are probably honey bees. Some people will report just a few bees or other insects flying about. If the insects are nesting in the ground, suspect yellow jackets. Yellow jackets are commonly reported in August and September while honey bees tend to swarm in spring and early summer. I was once called for a swarm that turned out to be an aggregation of Japanese beetles!

Is the cluster the size of a softball? A basketball? The bigger the swarm the better a colony it will be for you. Also, assure the caller that honey bee swarms are usually quite passive. They are settled only temporarily and are unlikely to sting anyone.

Try to collect the swarm as soon as possible. Remember that the bees are looking for a permanent place to live and may take off at any time, especially if the weather is good.

You should bring your veil, a smoker, a bee brush, a queen cage, and a hive body with one frame of honey, bottom board and inner cover. A frame of brood from an established hive can be helpful also, to encourage the swarm to stay in its new home. Some wire screen and a staple gun will also be useful for covering the entrance and holes in the hive. Rope to tie the hive together for the trip to its new location is also a good idea. A few large pieces of stiff paper or cardboard will be useful. I bring a large makeshift funnel made of metal sheeting or cardboard.

The next step is to get those bees! This can depend a little on your ingenuity, and maybe the help of a beekeeper friend the first time you try it. Find the swarm and position your hive body or box just under it. If the swarm is hanging from a small branch, just shake the branch sharply. Most of the bees will fall in, and many will fly around. If it's a small branch, cut it off and slowly place it and the bee cluster into the hive.

Keep your eyes peeled for the queen. If possible, scoop her into a queen cage and put her in with the rest of the bees after they are all settled in the new hive. Shake and brush as many bees as you can into the box, and then close it. If the bees are on a wall or another inconvenient spot, use sheets of paper or thin cardboard to encourage them into their new home. Some of the bees will return to their clustering spot.

Repeat the procedure, shaking, scooping and brushing the bees. Then use the smoker to blow thick smoke across the original clustering spot. This will chase the last bees away, until they recognize that most of the colony has moved to a new location. Note that many bees are scent fanning at the entrance to the hive. (See **Pheromones,** p. 12.) In this way they are attracting the stragglers.

At this point some of the bees are out foraging for food or searching for nest sites. You have three options. You can depart with your bees, knowing that you have most of them. In doing so, tell the property owner some of bees out flying will cluster over the next day or two, and eventually die because they are queenless and too few to form a viable colony.

Staple wire screen over the entrance and any other holes. Tie the hive together securely with rope.

A second option is to do the above and also leave an empty hive at the location. The returning bees may move into the empty box which you can pick up that evening or a later evening.

A third option, usually the best, is to collect the flying bees by leaving the hive with the swarm at that location. Return to collect the hive at dusk. In this case, it's best to have the queen caged or the entire colony confined by screen stapled across the entrance and any holes. Otherwise the entire swarm may leave before you return. At dusk you will find many bees clustered on the outside, but they will be docile if you carry them with a minimum of jostling.

The rest is easy. Place the hive at your chosen location (see **Choosing a location for the bee hives**, p. 23.), and remove the screen. Place a sugar syrup feeder on the hive. A few days later you can make any needed adjustments. Remove the branch if that went in with the bees, add more frames so that the hive body has a full set of ten frames, and uncage the queen if she has been caged.

It is also possible to collect a swarm with a screened box. This is simply a deep hive body with 8-mesh screen attached to the bottom, and a standard hive cover. This system is nice for collecting swarms in hot weather, because the ventilated bottom prevents the colony from overheating. Follow the same procedure for installing package bees (see **Installing the package bees**, p. 27). The bees will rapidly adapt to their new site.

Mites made a huge impact on swarming in Kentucky and the rest of North America during the 1990's. Swarming became much less frequent. But now swarm calls are back to the frequency we saw before the mite epidemic. We seem to be past the worst of the problem. (See **Mites, diseases and predators**, p. 45.)

How many hives?

Most beginners will be happy to start with one hive. But I suggest that you get a few more soon. With several hives (or colonies), certain remedial activities are possible. For example, in spring or summer, a weak hive can be strengthened with a frame of brood from a stronger hive. By early fall, a hive too weak to be ready for winter can be united with another hive. (See **Uniting hives**, p.72 and **Preparations for winter**, p. 75.) If one hive dies, you can easily create a new hive by making a divide from another hive. (See **Dividing hives**, p.71.)

Three or four hives are not much more work than one hive if they are in the same apiary. Once you get out to your bees, put your veil on and light your smoker, it's easy to manage another two or three hives. The time it takes to extract honey from several hives is only slightly more than the time to extract from one hive, considering all of the preparation and clean up. But, on average, four hives will produce four times as much honey as one hive. Your honey production will be more efficient.

Perhaps most important, you will learn more quickly about bees if you have several hives. Each hive grows and behaves a little differently. You can experiment with different techniques, queens or types of equipment if you have at least several hives.

GETTING READY TO WORK THE BEES

How the bees sense the world around them

The first step in beekeeping is to understand how bees perceive the world. As a part of the bees' world, the beekeeper must learn how to disrupt the hive as little as possible. In this way the hive will function well and be less likely to sting. Vision and the sense of smell are most important. (See also **Communication in the hive,** p. 10)

Vision. The bees see colors, but not exactly the same colors we see. They see a spectrum of colors from orange to violet and then to the next "color" which is ultraviolet. Bees can't see red, so red object looks black to them. Many flowers have ultraviolet patterns invisible to us. In general, bee-pollinated flowers are not red.

Bees are inclined to sting dark objects because many natural predators are dark: bears, skunks, etc. So the beekeeper wears white or light colors. And remember that red counts as black for bees. Bees are also sensitive to rapid movements. Beekeepers, especially beginners, should move slowly when the hive is opened.

The sense of smell. Like many insects, bees have a very acute sense of smell. They need this ability for several reasons --to discover flowers, to detect the pheromones of the other bees in their colony, and to detect enemies near their hive. And the bees will smell you too especially if you carry a strong scent from soap, perfume, or other scent. It might smell nice to your human friends, but the bees interpret it as a foreign odor and an invitation to sting. Before working with bees, try to make yourself as odor-free as possible. Additionally breathing or blowing into the hive while working it will excite the bees.

Hearing. Bees do hear, but sounds are much less important to bees than they are to people. Beekeepers may talk as they work the hives, without any apparent effects on the bees.

Fuzzy materials. Bees associate fuzzy clothing with their predators, which are also pretty fuzzy. Beekeepers should avoid textured clothing in favor of smooth cotton or synthetic fabrics. A white nylon windbreaker that is too smooth for the bees to get their stingers into is one example. It's good in cool weather but too warm during the summer. Some beekeepers like the full coveralls, but they are also hot in the summer. Suede leather would be about the worst possible clothing to wear because it looks, smells and feels like an animal.

Vibrations. Vibration of the hive or the ground nearby is important to the bees. If you bump the hive or run a lawnmower nearby, the bees will be alerted and be more likely to sting. If tractors, mowers or weed eaters must be near the bees, the operator should wear a veil and full bee suit. Avoid opening the hive just after the bees have sensed vibrations and exhaust odors of machines near the hive.

Weather changes. Bees are very sensitive to the weather, and they apparently have their own internal barometers. When the barometric pressure drops, the bees sense that bad

weather is on the way. They all come home from foraging, and they definitely don't want anyone opening the hive at that time. Windy, cool or rainy weather also makes the bees grouchy.

Other factors which influence bee behavior

Recent experience. If you know that the hive has been badly disturbed recently, leave it alone for a few days. A pass nearby with a lawnmower, nighttime visits by skunks, and other disturbances will make the bees more likely to sting.

Large colony population. A hive with many bees is always more likely to sting, because it has more worker bees on guard duty. This is one reason beginners may want to start with a smaller colony, often called a *nuc*.

The end of a honey flow. In July you may notice that your industrious, gentle worker bees have become lazy and cranky. This is because the honey flow has stopped, and the bees have switched from forager duty to guarding, for lack of better activities.

Queenlessness. A hive without a queen is always more inclined to sting. Look for queen cells and the absence of eggs and young larvae. Listen for the characteristic buzzing common to queenless bees. (See **Queenlessness**, p. 57.)

Genetics. Some strains of bees are just plain nastier than others. If you can rule out the factors listed above, consider the possibility that the problem is a genetic trait. In this case, the only solution is to requeen the hive (see **Requeening a hive**, p. 67.).

Stings

Stings will always be a part of beekeeping but there are ways to greatly reduce the number of stings you get. The trick is to imagine what the bees are sensing based on how bees understand the world around them (above). With experience you will be able to anticipate the behavior of your bees.

The worker bee has a barbed stinger with a small venom sac attached. When you are stung, the barbs prevent the bee from removing her stinger from your skin. The bee breaks

away from her stinger and dies soon afterward. But the stinger continues to inject venom even though the bee is gone. This is why you should remove the small, white venom sac left by a sting. Scrape it off with a hive tool, knife blade or fingernail.

The stinger releases a scent which can stimulate other bees to sting. This is called a *sting pheromone*. If you receive many stings you may notice it -- a banana smell from the stingers. By removing the venom sac you will eliminate the source of the pheromone. It's a good idea to remove the stingers in your gloves and clothing also.

The queen has an un-barbed stinger which she uses only against rival queens. The drone has no stinger.

Occasional stings are probably beneficial to the beekeeper, although most beginners would not agree. Some evidence suggests that occasional stings prevent serious allergies to bee stings from developing. This is one reason I encourage beekeepers to accept a few stings. Over the years you will probably notice that your reaction to stings is less. Also, you will be more agile in manipulating the hive if you don't wear gloves. You will know that you are a true beekeeper when you decide that the fascination with bees far outweighs the pain of an occasional sting.

Bee sting allergy. If you experience any of the following symptoms, be aware that you may have a serious reaction to stings: light headedness, a flushed face, wheezing. These symptoms indicate a systemic (whole-body) reaction to the sting, and possibly an allergy. You should consult your doctor.

In contrast, a swelling only near the spot you are stung is usually not so serious. In my early experiences with bees, I would at times develop puffy hands. With continued and occasional stings, my body became accustomed to this and the swelling no longer occurred.

EXAMINING THE HIVE

You may wish to have an experienced beekeeper with you the first few times you open your hive. Watching another beekeeper work the bees is a big help. Try to get a feeling for how the bees act as you work the hive. Remember that not all hives behave the same, so

experience with another beekeeper's bees may be a little different from work with your own. Kentucky has over 40 local beekeeping associations, and many people willing to share their experience.

Opening the hive

In addition to your bee veil and gloves, you will always need your hive tool, smoker, matches, and extra smoker fuel. Place a handful of smoker fuel inside your smoker and light it. Puff the bellows a few times. When the fuel has burned down to about an inch of embers, add a few more handfuls and continue puffing. Once you have it going use the bellows to puff it occasionally. You should have thick smoke but no flame. Open your smoker occasionally and add more fuel as needed.

Stand to the right or left side of the hive, not in front of the hive where you would block bee flight. Puff a little smoke into the hive entrance. The bees at the entrance will move inside. Now remove the outer cover and gently pry the inner cover off slowly with the hive tool. Puff just a little smoke in at the top. Most of the bees will run down between the frames and start buzzing.

Remove the inner cover. Soon the bees will come back up. Use smoke only to keep the bees from getting irritable. Over-smoking the hive is stressful to the bees.

Now you will remove several frames for examination. Standing at the side of the hive, use the hive tool as a lever to push the three or four frames nearest to you away from the side. Then push the nearest frame a little bit back toward you. This procedure allows a little space on either side of the first frame so that you can remove it without crushing bees against the adjacent frame.

Slowly remove the frame, hold it up and examine both sides. Most of the bees will stay on it. Lean the frame gently against the outside of the hive so that no bees are crushed. Remove the second and third frames by first pushing them into the space where the first was and lifting them out slowly.

By removing a frame nearest the side of the hive first, you will be least likely to hurt the queen bee. She will probably be closer to the center of the hive. The most important rules to follow when examining your hive are to work in a way that is safe to you and anyone nearby, to avoid hurting the queen, and to disturb the bees as little as possible.

What to observe

The bees develop their nest according to some clear rules. The outermost frames (those you remove first) will either be empty or have honey. As you examine frames closer to the center of the hive, you will see less honey and more pollen and brood. A very strong hive may have honey, pollen and brood even in the outer frames.

Frames in the center of the hive have a special pattern. Brood is in the center of the frames, then a ring of brightly colored pollen around the brood, and honey around the edges. This makes sense --the brood nest needs to be kept warm in cool weather, and pollen for the nurse bees should be near the brood nest.

Look for the three stages of brood. The eggs are hardest to see. Hold the frame so that direct sunlight is over your shoulder and down into the cells. Look for tiny white "hot dogs" standing on end, one at the base of each cell. Larvae are the white worm shapes. See how some are just barely larger than the eggs. Older larvae fill their cells. Other cells are capped over. These *capped brood cells* contain the oldest larvae and the pupae. Use the corner of your hive tool to uncap a few of these cells. Inside, the white pupae are going through the complex changes that carry them from the larval to the adult stages. If you are observant and lucky, you may see a few new adult bees chewing through the cells and emerging.

Look also for the queen. She will almost always be on a frame in the brood nest, looking for an empty cell where she can lay an egg. She is sometimes hard to find. Direct sunlight on the frame helps a lot. If the hive is upset, she will often run to a comer and hide among the worker bees. A white mark on her back will make the queen much easier to find (see **Marking and clipping a queen**, p. 70).

Drones will be abundant in late spring and early summer. They are distinguished by their very large eyes which actually touch each other at the top of the head. Drone brood in larger cells will be seen too. Capped drone brood cells protrude from the surface of the comb. On a nice afternoon many drones will be seen coming and going at the hive entrance.

Closing the hive

When you are done with your hive inspection, return the frames to the hive in their original order. This keeps the arrangement of honey, pollen and brood that the bees prefer. Use the hive tool to space the frames evenly. If you make the mistake of leaving too much space between two frames, a strong colony will build a sheet of comb between them. This "burr comb" makes hive examination and management difficult. You must remove it from the hive, and then space the frames correctly.

Place the inner and outer covers back on and you're done. Any straggler bees left on the ground will soon find their way back inside.

Extinguish the smoker carefully. I like to put my smoker inside of a large bucket with a top that seals. This puts the smoker out, prevents it from getting wet in the rain and keeps it from stinking up the building where I store it.

HOW THOROUGHLY SHOULD A HIVE BE EXAMINED?

There will be times when a very brief check on your hive is sufficient. At other times a thorough examination is desirable.

The quick check. Beekeepers with many hives rely on a few signs that quickly give a rough indication of how each hive is doing. These signs allow one person the efficiency to manage a hundred hives or so. With experience, you will instinctively look for them. This "quick check" will not teach a beginning beekeeper as much as the more extensive examinations described below.

Look first for bees flying in and out. Depending on the weather and time of year, you should see bee flight. Bees returning with pollen loads on their legs are always a good sign.

It tells you that the bees are rearing brood, and that pollen bearing flowers are available. Bees waddling in with large balls of pollen indicate that pollen is abundant. At other times they will carry very small loads, indicating that pollen has been hard to find. Estimate the number of bees returning in a 10-second interval. During a honey flow in late spring, 50 or more bees may return to a vigorous hive in 10 seconds. Returning bees will be far fewer for weak hives and when they are not on a honey flow. If you see no pollen foragers returning, your colony may be in trouble. Or worse, the colony may be dead. In this case, the bees entering may actually be robber bees from another colony, raiding the leftover honey. Robbing bees never carry pollen.

Remove the inner and outer covers. How many of the frame top bars are covered with bees? Compare your observations with what you saw during the previous examination, and consider what you would expect for the time of year and the colony's history. Look for tiny bits of white wax added to the edges of the dark, older comb. This is also a good indicator of colony health. It is commonly seen when the bees are on a honey flow. It may be observed also when the bees are feeding on sugar syrup from a feeder.

Look for bees with deformed wings, often a sign of varroa infestation. Bees crawling in the grass on warm days in late winter suggest tracheal mites. Flattened grass and skunk feces in front of the hive point to the need for skunk guards. Lean over the opened hive and sniff for honey in the making, or the unpleasant odor of American foulbrood. Listen for the distinctive buzz of a queenless hive. (These and other problems are addressed later in this publication.) If problems suggest themselves, you should take additional time to remove frames for a thorough examination and to do some trouble shooting.

If the bees are on a honey flow, check to see whether they have enough storage space (frames with many empty cells). Frames with most cells full of brood, honey and pollen tell you it's time to add an extra hive body or super so that the colony can expand and store food.

In two or three minutes, this quick check will generally tell the experienced beekeeper of obvious problems and needed maintenance.

The general examination. This is a set of observations generally sufficient for routine visits to your hive. Once your veil is on and smoker puffing, this examination won't take more than 10 minutes per hive.

After the "quick check" observations described above, you will need to look at a few frames. If you have supers on the hive, pull several frames out to determine how many in each super contain honey. By looking down between the frames you can tell the frames which seem to be the outermost of the honey storage area.

Set each super aside, and remove several frames from the brood box or boxes. Examine the brood nest for the brood pattern, an estimate of the total amount of brood, and signs of brood disease. You can be encouraged by seeing many eggs and young larvae, since this tells you the queen is laying well and the nurse bee workers are feeding the larvae well. Hold the frame up so that sunlight shines directly into the brood cells. Ideally, each young larva in its worker cell is surrounded by a bit of glistening white food, the worker jelly. A hive which is struggling to feed itself cannot provide an abundance of worker jelly for each larva. A large amount of capped worker brood tells you that many young worker bees will soon emerge and support the activity of the colony. A bad brood pattern -- insufficient brood, scattered brood, excessive drone brood, or disease -- means that remedial action is needed. In summer, use tweezers or the sharp corner of your hive tool to break open a few capped drone cells and check for reddish-brown varroa mites. See the following sections and other publications for descriptions of these problems. Usually it is not necessary to look at every brood frame. A serious problem will show itself on the first few frames with brood.

As always, compare your observations with what you saw the previous times you examined that particular hive. Beginners and experienced beekeepers often keep a notebook to follow the trends and compare one year to the next. The brood nest and adult bee population should be increasing from February to June, and declining gradually from July to November. If the supers are filling with honey, make a rough prediction about when the next super will be needed. For example, if the bees are filling five frames a week, another 10-

frame super may be needed every two weeks. Of course, the honey flow can accelerate or slow down according to the weather and what's blooming nearby.

The thorough examination: On certain occasions the beekeeper will need to go through the whole hive frame by frame. If possible, do this on a warm, calm, sunny day. If you are battling a case of American foulbrood I recommend that every brood frame be examined for this disease, periodically over at least a year, until it is clearly eradicated. If you are requeening your hive, it could be necessary to examine every frame in the brood boxes to find the old queen. (See **Finding the Queen**, p. 65.)

Also, it is very instructive to occasionally examine an entire hive. The experience will give a beginner confidence to do this complete examination when it actually becomes necessary.

PART 4: HIVE MANAGEMENT

The transition from novice to expert beekeeper is largely a matter of three types of skill. One is knowing how to nurture a struggling colony. A second, closely related to the first, is learning to recognize and control the many problems that can arise. The third is working the bees so that they can realize their potential when conditions are good.

FEEDING BEES

Honey bees lived for a long time before beekeepers came along, but they will do better if they get a little help now and then. This is especially true when we are nursing weak hives, establishing new hives, or getting them winterized.

Feeding sugar syrup

Bees are often fed sugar syrup as a substitute for nectar. They concentrate it into a thicker syrup, and add enzymes as they do to nectar. But we can't really call it honey because

it's made from artificial feed. Whatever the bees store in their comb from syrup feed cannot be removed later and sold as honey. It would not taste much like honey anyway.

Syrup is made from common table sugar (a type of sugar called sucrose) and water. Mix it up 50:50 sugar to hot water. In fall it's better to make it more concentrated (around 60:40) because the bees need the sugar more than the water at that time. Several types of feeders exist, and the difference is important. The best method is to feed the bees at the top of the hive.

Bottle or pail on top. Most inner covers have a hole about 1" in diameter, in the center of the cover. If yours do not, you should cut a hole which will help with feeding and also allow the bees to ventilate their hive more effectively. This is the best location for a feeder. Now find a large (one quart to one gallon), wide-mouth container with a lid that fits securely. Put 20 to 30 small holes in the lid. A 1/16 " drill bit works for a plastic lid, or use a small nail to punch holes in a metal lid. When the feeder is filled and inverted over the hole in the inner cover, the bees can take the syrup from the small holes very easily. Next take an empty, deep hive body and place it on the inner cover, around the feeder. The outer cover goes on top. It's good to elevate the feeder about l/4" above the hole so that the bees are able to reach the entire feeder lid.

This has many advantages over other feeders: The bees take the feed readily because they like to come up to the top of the hive, even in bad weather. You can replace an empty feeder quickly, without opening the hive, bees from other hives have no access to it so it will not stimulate robbing behavior, it's good for nursing weak hives, and it's free! The main disadvantages are that (1) the bees tend to add propolis to the holes in the feeder when it's empty, and (2) an extra hive body is needed to enclose the feeder. Use a paper clip or small nail to open the feeder holes.

Reservoir feeder on top. Several beekeeping supply companies sell syrup feeders that have the same dimensions as the hive bodies. These feeders rest on top of the hive, with the outer cover on top of the feeder. The bees come up a slot inside of the feeder. It is easy to

remove the outer cover and fill the reservoirs with syrup. An added plus is that dry feed can be fed in this type of feeder. Cold weather limits the ability of the bees to reach the syrup.

Plastic bags. Another practical method is to fill a 1-gallon zip-lock plastic bag with syrup and lay it on the top bars of the hive. Then make one or two slits across the top of the bag with a razor blade or similar. The bag will hold the syrup and the bees will drink it easily through the slit. It's simple to replace an emptied bag with another full bag as needed. To allow space for the bag you will need to place a shallow super without frames on the hive, and place the inner and outer covers above it.

Entrance or Boardman feeder. I mention this type because it's advertised in catalogs and often comes with beginner kits. It's a small jar that attaches to the entrance of the hive. Don't use it. The bees don't feed from it in bad weather or if the colony is weak. And bees from other hives will often find it and start robbing from it. When the feeder is empty, the robbers may then go into the hive you're trying to feed, and start to rob honey from it. So this type of feeder may actually make the hive weaker, if it is near stronger hives. And the jar is so small it needs to be refilled frequently.

Division board feeder. This is also advertised in catalogs, but I'm not a big fan of this type either. It is plastic, the size of a standard, deep frame, and it fits inside a deep hive body in place of a frame. It's hollow so that you can fill it with syrup. Sometimes it works great. Other times you will come back to find it still full of syrup, with many dead bees floating in it One problem is that the bees become chilled in cold weather when they leave the cluster to crawl into the feeder, and then fall into the feeder. Even if the feeder has roughened inside walls, and floating bits of wood inside, it is still not very functional. Weak colonies (those that need the feed the most) will often not even find the syrup in the feeder. Another disadvantage is that you need to open the hive to check and refill it

Open feeding. Some beekeepers feed the easiest way. They leave a large container of syrup open near the hives. The bees find it quickly, especially during a dearth, and consume it in no time. This is called *open feeding* and there are several reasons not to do it, especially if you have more than one hive.

The first reason is that this method of feeding can stimulate robbing by the bees after they finish the syrup (see **Robber bees** p. 58). Second, the strongest hives will get most of the syrup while the hives that need it the most will get very little. Finally, the bees flying over the feeder will defecate in the syrup, spreading diseases such as nosema to the bees feeding there.

Feeding pollen supplements or substitutes

Beekeepers are often advised to feed solid cakes or powdered food containing protein-rich materials such as soy flour or yeast. This is to supplement the pollen they normally eat. The cakes are placed inside the hive where the bees eat them quickly. A reservoir feeder (above) can be used also. Generally these are not necessary in Kentucky because we have an abundance of pollen-producing plants. However, pollen supplements can be useful in spring if an extended rainy period interferes with foraging.

WATER FOR BEES

In July and August the bees need to find water to cool the hive. Forager bees will collect water from streams, lakes, puddles, dripping air conditioners, swimming pools and wherever they can. The bee returns to the hive and deposits a water droplet inside an empty cell. Other bees are busy fanning their wings to circulate the air through the hive. The hive is cooled by the evaporation of water.

Since bees will fly several miles to find water, they will nearly always find some in Kentucky. But it can be helpful to give them a water source if a good one is not already nearby. If no clean water is within a quarter of a mile, you will save the bees energy by providing one. In towns and cities, your neighbors may begin to find bees in their swimming pools and complain to you. If you leave a water source near the hive, fewer bees will go swimming with your neighbors.

One good water source for bees is a slowly dripping outdoor faucet or air conditioner. Place a sloping board underneath so that the bees can line up along the trickle of water.

Another source is a basin or bucket of water. You will need to float pieces of wood in it so that the bees can land easily to collect the water. And the basin should not be directly in front of the hives, because that is where the bees will drop feces and dead nestmates.

MITES, DISEASES AND PREDATORS

Until recently, only a few diseases troubled bees in the U.S., and these were controlled fairly easily. In the 1980's, everything changed. The tracheal mite was discovered in the U.S. in 1984 and in Kentucky in 1989. The Varroa mite was reported in this country in 1987 and in Kentucky in 1991. These two new parasites have devastated beekeeping. However, treatments for both mites have been developed, and mite-resistant bees seem to be on the way. The late 1990's were a time of recovery and regrowth for American and Kentucky beekeeping.

Colony Collapse Disorder

Several years ago, a new malady called Colony Collapse Disorder (CCD) was observed. This disorder was defined as the sudden disappearance of most of the adult worker bees, without loss of the brood or queen. Typically the queen, brood and a few newly emerged worker bees would be found. The disorder was distinct from some well known problems with mites, disease or pesticide poisoning. No significant numbers of dead bees would be seen in front of the affected hives.

Originally, beekeepers suspected a new pesticide or disease was the cause. Apparently, something was affecting worker bees so that they could fly out but could not return to their hives. It is true that some types pesticides, the neonicitinoids, cause changed behavior. Low doses of these pesticides affect the learning and memory of bees. Possibly, bees could not learn and remember the landmarks around their hives so that they could not navigate home.

At this time most of the losses seem to be due to a combination of familiar problems : mites, diseases, pesticides and poor nutrition. The effects are cumulative. When bees have two or three of these problems simultaneously they are much worse off than with one of the problems alone.

The treatment for CCD is achieved primarily by control of varroa mites and Nosema disease, avoiding pesticides as much as possible, and establishing the hives in good locations where honey plants and pollen plants are abundant. See discussion of these problems in the following pages.

The CCD problem has received a great deal of publicity, and a fair amount of nonsense has been circulated. One hypothesis is that the bees are affected by transmission signals from cell phone towers. This idea has no validity, and there is no physical basis for such a mechanism. It originated from misunderstandings about a German study on bees and electromagnetic signals. It's useful to note that beekeepers in the British Isles have had very little CCD-type symptoms with their bees, and they use their cell phones as much as we do.

One of the oddest claims is that Albert Einstein predicted the demise of the entire human race if honey bees were to become extinct. For some reason, this claim has "gone viral", probably via the internet. To rebut this claim, let's consider two facts. First, honey bees are not native to the western hemisphere, eastern Asia or Australia. (See Varieties and Breeds of Honey Bees, page.) Second, people lived in all of those regions before European colonists began to move and establish honey bees around the world. Many plants native to the western hemisphere – corn, potatoes, cranberries, blueberries, to name a few – are part of our regular diet. An entomologist at the University of Illinois, May Berenbaum, went so far as to search Einstein's collected publications and letters and found no fabulous claim about human dependency on honey bees. We beekeepers should be clear about the large value of bees to crop pollination, but avoid exaggeration.

Varroa mites

The varroa mite is a reddish-brown external parasite of bees, about 1/16" across. It grows and reproduces in the capped brood and the mated female mites live on the adult bees. This parasite is by far the most serious enemy of honey bees in the U.S. and most parts of the world. We now know that varroa mites make viruses and nosema disease worse, by weakening the bees and stimulating outbreaks of these diseases.

This mite can be seen easily, especially with a magnifying glass. To check your hive remove pupae from capped cells, especially drone cells, and examine them carefully. This is where most of the mites will be living during the warm season.

Varroa mites are controlled with a combination of chemical and non-chemical methods. Chemical treatments should be used as infrequently as possible because they adversely affect the bees. Chemical treatments in plastic strips (Apistan, Checkmite) lead to toxic residues in the bees wax. Mites are now highly resistant to these chemicals, so these treatments are ineffective as well as harmful to the bees. Chemicals which evaporate inside the hive are generally less hazardous than the strips, although they often kill larvae. All such chemicals may be used only when the bees are not making honey for human consumption.

Mite-resistant bees and "screened bottom boards" are the best approach. These bottom boards eliminate live mites that fall from the bees, and hence reduce mite populations.

Tracheal mites

The tracheal mite is still a serious problem, but we are past the epidemic period in which thousands of hives died. This is a microscopic mite that lives in the "lungs", or tracheal tubes, of the bee. Part of the problem is that the symptoms are not obvious when the mites are at low levels, unless the bees are examined by microscope. So it's necessary to treat the hives regularly even when the bees seem to be doing fine.

The symptoms of a bad infestation are bees crawling on the ground near the hive, unable to fly and bees with wings at an odd angle on one side. This is called "K-wing" because the wings and the body form the letter "K".

There are several treatments for tracheal mites. One is a mixture of vegetable shortening (like Crisco) and sugar. A one-pound patty of shortening and sugar, mixed 50:50, is placed inside the hive on a piece of wire screen where the bees will walk over it. A very fine coating of shortening on the bees kills the mites. Menthol, ApiLife VAR (a mix of plant oils) and Mite-away II (formic acid) are three products sold commercially. One of these may be placed inside the hive where they evaporate and act as fumigants.

American foulbrood (AFB)

This is a bacterium which infects the larva. It is the most serious of the honey bee diseases. Diseased larvae die quickly, turning to a chocolate brown liquid with a distinctive "foul" odor. The brood cappings become greasy and perforated with small holes.

The disease can spread quickly within a hive and from hive to hive in an apiary by drifting bees. If one hive in an apiary is diseased the beekeeper must examine all other hives, and treat them with antibiotic.

Several control measures are possible. If a very few cells contain AFB, cut them out of the comb with a knife. Then treat the hive with an antibiotic called terramycin, sold through many beekeeping supply companies. Instructions on the terramycin package should be followed carefully. Clean your gloves, hive tool and any other equipment which comes in contact with diseased comb before opening another hive. A hive tool can be sterilized with flames from a bee smoker. Gloves, brushes and bee suits can be sterilized with dilute bleach water.

A frame containing many cells with AFB must be removed and destroyed. In a badly diseased hive this will mean removing all of the brood frames and transferring the adult bees to clean hive bodies. Then treat with terramycin. Do not leave the diseased frames in the open where bees may find the unprotected honey and go home with AFB.

This one treatment may not completely eliminate the disease, so it is necessary to follow up with further hive inspections and treatments until no sign of AFB remains. Check every

brood frame once or twice weekly. Repeat the procedure of removing diseased brood comb and then treating with terramycin.

Wooden hive parts including hive bodies and frames can be saved if you are willing to carefully sterilize them. A gas torch or bleach diluted with water (1 part bleach in 10 parts water) is effective in killing the bacteria.

If you have had AFB problems within the past two or three years it is best to treat your hives yearly with terramycin. Prevention is far easier than dealing with a full-blown AFB problem.

Recently, AFB bacteria resistant to terramycin have been discovered. New antibiotics are currently under study for AFB control in bee hives.

Chalkbrood

This is a fungal disease of the larvae, and is present at low levels almost everywhere in Kentucky. It usually will not kill a hive, but it destroys enough larvae so that the hive is weakened somewhat. The beekeeper will notice the dead larvae in cells and at the hive entrance. These are white and dark gray, resembling pieces of chalk. Like most fungi, it does best in cool, wet weather. When summer comes, chalkbrood often disappears.

No treatment for chalkbrood is approved for use in the U.S. A mild case is usually ignored. A severe case should be treated like AFB (above) except that terramycin will be ineffective.

Nosema

Nosema disease is caused by a microbe that infects the stomach of the adult bees. It weakens the bees and can cause defecation inside the hive and at the hive entrance. Since this disease interferes with food digestion, we can understand that the bees that must eat the most food are those that are most seriously affected. The nurse worker bees must consume plenty of pollen in order to generate plenty of the glandular food for larvae. Hence a nosema-infected hive will have a diminished brood nest. Forager worker bees must fill up with honey