

OHIO STATE UNIVERSITY EXTENSION

Honeybee Basics

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AND ENVIRONMENTAL SCIENCES

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Hello. I am Amanda Bennett. I am the Agricultural and Natural Resource Educator with Ohio State University Extension in Miami County. Today we are going to explore the basics of honeybees.

Objectives

- All about bees
- Pheromones in the hive
- Obtaining bees
- Foraging and nutrition
- Bee diseases



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Today, we'll take a look at honeybee biology, class structure and more. We'll also learn what role pheromones play in the hive and why they are vital for honeybee survival. I'll share with you different ways to obtain honeybees. We will also look at honeybee foraging behavior and what they require for nutrition. Lastly, I'll share some ways that you can protect pollinators and how you can enlist the help of your neighbors, friends, family, and community to do their part in protecting pollinators, and ultimately, our diversity of food.

Honey bees

- White man’s flies
- Social Insects – cooperative brood care, reproductive division of labor and overlapping generations.



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Contrary to what might be popular belief, honey bees are not native to North America. They arrived here as early as 1622, as documented by a ship manifest from the Council of the Virginia Company of London’s Bona Nova and the Hopewell. There are records that indicate several colonies arrived from England to the Virginia Colony in 1622. Further records show that additional shipments were made between 1630 and 1638. No other colonies were listed, but it is safe to assume that they eventually ended up there as well (NY, PA, Carolina and Georgia). Records indicate in Ohio in 1788. Thomas Jefferson even wrote about honeybees, calling them “white man’s flies.”

Although honeybees are not native to the U.S., there are some stingless bees that were native to the West Indies and Central and South America and used by early Indians of these areas. This is hopefully one example of an introduced insect that ends with a positive story, although in recent years that ending has been much debated.

Honeybees are social insects in that they exhibit cooperative brood care (meaning they all work together to care for the young); they have a distinct reproductive division of labor; and have overlapping generations living side by side.

Apis mellifera

- Females divided in a Caste system
 - Worker bees and the Queen
- Drones (males)
- Differences in
 - Biology
 - Division of labor
 - Brood cycle



Honeybees' Latin name is *Apis mellifera*. There are three types of honeybees that make up the colony: the Queen, the worker bees and the drones. The females of the hive are divided into a caste system: the Queen and the workers. The males are known as drones. The three castes of honeybees have differences in their biology, their labor responsibilities and their brood cycle.

Drones

- Males
- Key differences
 - Larger eyes (2x)
 - Larger, barrel body
 - Longer, thicker antennae
- Raised for reproduction



Drones are the male bees in the colony. In terms of biology, they have larger, almost barrel shaped bodies with eyes that are approximately twice as big as the female counterparts in the hive. They also have longer, thicker antennae. They cannot sting as they lack the anatomical structure to do so. Drones are actually the result of the queen laying an unfertilized egg, which means they only have the DNA from the Queen of the hive to pass on to future generations. This is why the colony invests in them. They are only raised for reproduction so that the genetics of the Queen are passed on.

Drones

- Domed caps
- Found on edges
- 6.5 days as a larva
- 24 days to fully develop
- Drones cannot:
 - Produce wax
 - Forage
 - Clean house
 - Guard the hive
- They are an expense



Drone brood are easy to identify on a frame. The caps of the cells are domed in order to allow sufficient room for developing larvae. Typically, the drone brood are laid on the edges of the frame as they seem to thrive in temperatures 1-2 degrees cooler than worker brood. After spending 6.5 days as a larvae, the cells are capped and they pupate. They emerge fully developed when they are 24 days old. For the first couple days of their adult life, worker bees feed them. They learn to then feed themselves, but are often found begging for food in the hive. Drones cannot forage for their own food. They do not produce wax, clean the hive or guard it. They are seen as an expense once mating season is over and during times of drought or insufficient supply of food.

Drones

- Start eating and flying
- Drone Congregation Areas (DAC)
- Number fluctuates during season



Photo credit: Wikipedia

One week after drone adults emerge from their cells, their flight muscles are developed. During mating season, they begin their flight to what is known as Drone Congregation Areas, which is where they mate with queens. We'll discuss this more in depth in a few moments.

The number of drones in the hive fluctuates depending on the time of year. In the spring there are more because they are gearing up for mating season. By fall, drone production slows WAY down. During the summer season, particularly during dearth (aka drought), older drone larvae are removed and literally eaten to conserve protein. Workers regulate the number of drone brood in the colony although the Queen will slow down production. By the fall, drone production all but stops. Any remaining drones are forced out of the hive to literally die of starvation or exposure.

As a beekeeper, if you see drone brood in winter you have a problem. If you see ONLY drone brood ANYTIME you have a problem we'll discuss later.

Worker Bees

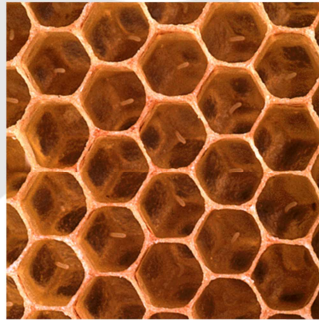
- All female
- Underdeveloped reproductive structures
- Can lay eggs in the absence of a queen



Worker bees are all female but a different caste than queen. Their stinger is part of the reproductive structure that is undeveloped. In the absence of a queen, they can lay eggs. But, since they are unmated, worker bees can only lay unfertilized eggs. They will only lay drone brood. So, if you are inspecting a hive and only see drone brood, you'll know right away that you have a laying worker bee and the Queen is either dead, left, or too old to produce and should be replaced.

Worker Bee Development

- Size of cell determines fertilization
- 95% should be fertilized
- Eggs will remain upright for 3 days

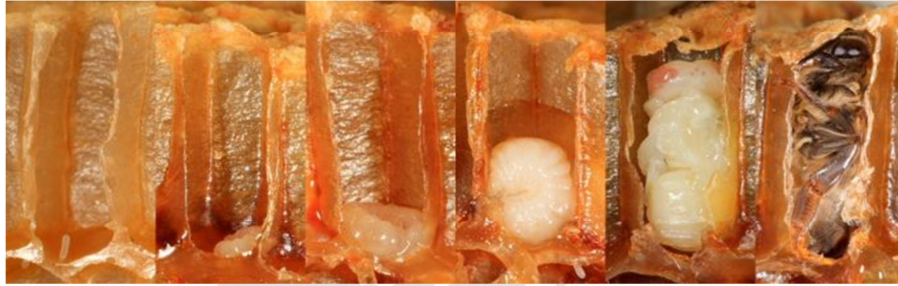


In the hive, the Queen inserts her head into each individual cell to determine its size. Based on that information, she either lays an egg in the bottom of the cell and releases sperm from her spermatheca (sperm-a-thee-ka) to fertilize it which will result in worker brood OR if the cell is of adequate size she will lay an unfertilized egg which will result in drone brood.

The eggs are held upright with a type of “cement.” They are always laid directly in the bottom of the cell, standing upright and only one per cell. If the egg is laying on the side of the cell wall or there are multiple eggs per cell, this could be the work of a laying worker.

Worker Bees

- Complete metamorphosis
- Days as egg = 3
- Days as larva = 6
- Days pupate = 12



Total is 21 days of [development](#)

Honeybees undergo what is known as complete metamorphosis. They go from egg to adult. The workers spend three days as an egg, 6 as a larva, and it takes 12 days to fully pupate for a total of 21 days of development. This development can be affected by season, nutrition, temperature and colony health, but are generally good guidelines.

For the first three days, the larvae are fed the same diet, “royal jelly.” Royal jelly is a mix of protein from pollen, carbohydrates from honey, and enzymes produced by special glands within the worker bees. This jelly is added to each cell and the larvae literally float in it. After three days, the ration of the worker larvae get cut which results in her reproductive and glandular organs not fully developing. Larvae that are selected for queen development are fed royal jelly throughout their larval stage until they begin pupating.

At nine days old, worker larvae cells are capped with a mixture of propolis and wax. In contrast to the dome shaped drone capped cells, worker bee cells are flatly capped.

This development timeline is important to know when we start to do inspections. As a beekeeper, you’ll be able to determine a lot of information by what you see in the hive. If you see eggs standing up, you’ll know that the queen has been active within the last three days. If you see no eggs, you might have a queen problem.

Worker Bees

- Lots of hive tasks that change with age
 - Eating
 - Cleaning
 - Feed others (including queen)
 - Comb construction
 - Takes nectar from foragers



Worker bees are the workhorses of the hive as their name suggests. They each have tasks that change with age, but they are flexible and switch tasks if needed. When they first emerge as adults, they beg food from other worker bees. She eventually ventures out into the hive further to find the stored pollen. This protein-rich food helps her glands mature for future tasks.

Other worker bee tasks will include cleaning cells of cocoons and frass; feeding larvae – the job of a “nurse bee”; and taking nectar from foragers of the hive. When the workers are approximately 12 days old, they can produce wax and begin to build comb. Wax is excreted as a clear liquid from a gland on underside of their abdomen. The liquid cools and becomes a moldable flake. The beekeeper can sometimes see these flakes on bottom board of the hive.

Worker Bees

- Guards
 - Inspection by odor
 - Drawn to your face
 - Defend against intruders
 - Defense position
 - 100 +/- on duty at one time



Another important job of the worker bees is that of “guard bee.” They utilize the colony scent to determine whether or not a approaching bee is a member of the colony. For the beekeeper, these are the bees that might cause the most problems for you during an inspection. They are drawn to our face by our eyes and breath. If you are being attacked, it’s best to get out of site or walk to tall shrubs or bushes to confuse them. Using your smoker is no effective because they can still see you.

At any given time there can be 100 to 1,000 guard bees on duty and more can be recruited by the emission of an alarm odor that signals others to defend the colony. In addition, there are many unemployed bees in hive (resting, no bees to feed, no comb to build, etc.)

Worker Bees

- Foragers
 - 3-4 weeks old
 - Scout bee or recruited
 - Gather
 - Nectar
 - Pollen
 - Water
 - Propolis
 - Total lifetime about 6 weeks



Perhaps the most important job of a worker bee is that of the foragers or field workers. These are the older worker bees, usually 3-4 weeks old. They might serve as a scout bee who is looking for new sources of nectar, pollen, or water or they might have been recruited to a source by another bee. They can either gather nectar, pollen, water or propolis, but usually not at the same time (except for pollen and nectar). During the warm seasons, they typically live only six weeks when they often quite literally wear out.

Queen Bee

- Days as egg = 3
- Days as larva = 5.5
- Days pupa = 7.5
- Queens are different = 15.5-16 days



Queen bees mature in just 15.5 to 16 days. Their cells are larger because she develops into larger bee and is typically peanut shaped and opens at the bottom.

Queen cells

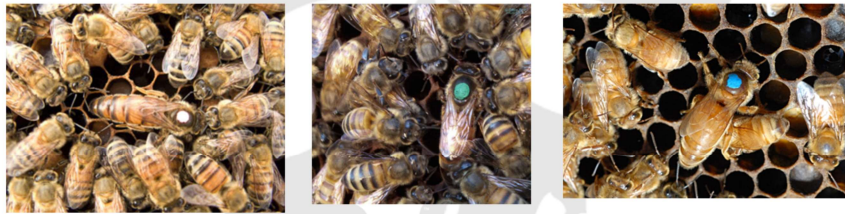
- Can be found on both sides of frame
- 2-3 or 20+ developing at one time
- First to emerge is the winner!
- Fight to the death, often with help from sisters

Queen cells can be found on either side of the frame. There can be multiple queens developing at the same time. The first to emerge will usually kill the other rival queens as they emerge. She will often have help from her “sisters” as there are “bee families” within the hive – those born of the queen and the same drone sperm. As a queen mates with multiple drones and has stored sperm from these drones, multiple “bee families” can exist within the hive.

Rarely, an older queen and daughter can co-exist for a time. This is good for the colony as the increase in egg production will be a benefit for the colony. Eventually, the older queen will die.

Queen Development

- Virgin queen continues to mature
 - Eats and then takes orientation flights to prepare for mating flight
 - Identifies landmarks near hive



When the virgin queen emerges, she matures and is fed by other bees, often called “attendant bees.” She then takes orientation flights to prepare for her mating flight. She sights landmarks along the way to ensure she can make it back to her hive.

I want to take a moment here to explain the markings you’ll often see on queens. Here you see three pictures of queens with different color dots on their thorax. The color corresponds to the year the queen was born. An internationally accepted color code is as follows:

Years ending:

- 1 or 6 - WHITE
- 2 or 7 - YELLOW
- 3 or 8 - RED
- 4 or 9 - GREEN
- 5 or 0 - BLUE

Mating

- DAC – 30' to 300' above open fields or forest clearings
- Same place every year – how do they know?
- Emits pheromone to entice drones

Honeybee mating happens in Drone Congregation Areas. These are typically 30 to 300 feet in the air above open fields or forest clearings. They are the same place every year and the fact that the drones die right after mating and the queen only mates once – how do they know where they are? This phenomenon is not well understood.

The queen emits a pheromone to entice drones to mate with her. The fastest drone catches her, inserts his reproductive apparatus and then falls and dies, leaving his mating sign behind. The next drone removes it and inserts his own. The queen mates with 2-5 drones per flights over several days for an average of 12-20 partners in total. The more, the better for genetic diversity. Factors such as bad weather during mating season will lead to less genetic diversity as she mates with less drones. Often this results in not enough sperm to sustain her lifetime.

Pheromones

- Virgin queens produce some
- Colony uniting scent after mating
- Signals queen is present
- “Queen substance” = 17 different chemicals produced in queen glands
- Reduced over time

Pheromones are emitted by the queen to unite the colony. Virgin queens produce some amount so others won't lay eggs and no more queens are being developed. After mating, the queen produces the colony uniting scent to signal to others that she is present. The pheromone is produced in glands near her mouth parts and is made of 17 different chemicals. The amount is reduced as she gets older. When this happens, a couple different things can happen.

You're outta here!

- Crowding, egg laying ↓



First, the colony can swarm. This happens when the colony is overcrowded and the pheromone is reduced simply by overcrowding; there is not enough to go around. A tell-tale sign of the beginning stages of swarming is the presence of queen cell cups on bottom of frames.

In preparation for the swarm, the queen slows down her egg production. She is fed less and in 3-4 days stops laying eggs and slims down enabling her to fly. Foragers stop looking for food and start looking for a new home. They gorge themselves on honey in preparation for the move. When larvae is ready to be capped and pupate, the old queen leaves. Scout bees scurry around stirring up the colony. The queen, some drones and thousands of workers pour out of hive. The remaining bees carry on as if nothing has happened—they forage, ripen nectar and a newly mated queen starts laying eggs.

Supersedure

- Queen becomes lost, injured, crushed, diseased
- Workers choose youngest larvae <3 days



Another reason we might see queen cells developing is during supersedure. This happens either when the queen is lost, injured, crushed, or diseased. The workers choose the youngest larvae (under three days old that are still being fed the royal jelly). This is the reason the cells might be built on any part of the frame. The queen cells are constructed

Buying Bees

- Buy an established colony
 - Market value
 - Disease, pests
 - Condition of equipment
 - Full strength colony difficult to manage for beginners (swarm prevention, disease management, pests, etc.)
 - Not recommended for beginners

When I started beekeeping, this was one of the questions I had, “Where do you buy bugs?” Of course, I’ve come along way since then. First, I know that honeybees are not “bugs.” They are insects. There is a difference. Second, I now know how to buy these insects.

One most obvious way might be to buy an already established colony or hive. Maybe you’ve talked with a neighbor or friend or found someone online that is interested in getting out of the business. However, this is not the way that I would recommend as there are multiple drawbacks for this method of obtaining bees. First, the market value of an already established colony is difficult to understand or predict. In addition, disease and pest presence can be a concern. The equipment might not be in the best condition. The longer equipment is in use, the dirtier and more worn it gets. Frames get blackened. The honeycomb darkens. Lastly buying an established colony can be difficult for novice beekeepers to manage.

Collecting Bees

- Acquire a swarm



Another way to obtain bees is to acquire a swarm. This is usually done in the spring time when the natural swarming season is in full swing. These swarms include a queen and worker bees who have left their hive due to overcrowding and are seeking a new home. They send scout bees out to look for a new home. Depending on the length of time to find a suitable habitat, swarms can be in place for a few hours up to 24 hours or more – it is unpredictable. Local beekeeper associations usually maintain a list of members that are willing to come and retrieve swarms. Often times people will call their local Extension office when they find a swarm and I'll refer them to the local beekeepers association list. You as a novice beekeeper can get involved with a local association and get yourself on the list to obtain a swarm should a call come in. Beekeepers collect them in a variety of ways depending on the physical location of the swarm this can be fairly easy (if they are swarmed on a low hanging branch of a tree) or it could be very high and require large equipment to retrieve. I have caught one swarm successfully. It was at my neighbor's house and it was in a mature tree about 50 feet off the ground. Luckily, I'm a farm kid and have access to lots of equipment including a large boom. I cut the branch off and shook the bees into a cardboard box. I then was able to transfer them to an empty brood box that I had. If you are interested in catching swarms, it's very handy to have some additional brood boxes on hand for such an occasion.

Buying bees: Nucs

- Nucleus
- 5 frame boxes
- Consists of mated queen, bees, drawn frames of foundation with honey and pollen
- Queen laying minimum of one month
- Usually from a local breeder
- Equipment compatibility

Buying an nucleus is a way to obtain bees. It usually consists of five frames that come in either a cardboard or corrugated cardboard boxes. They consist of a mated queen, bees, drawn frames of foundation with honey, pollen and brood on each frame. The queen will have typically been laying for a minimum of one month. These are usually obtained locally from a local breeder. One word of caution is to make sure your equipment is compatible to what they have. Ie. don't buy a nucleus from a breeder that runs 8 frame boxes and you run 10 frame boxes. So, just be aware and ask questions.

Buying bees: Packages

- Come in pounds usually 3#
- Come from Southern breeders
- Queen is mated, caged
- Cheap option - \$110-150
- Get what you pay for



One of the easiest ways to obtain bees might be to buy packages from a bee breeder. They usually come in pounds, either 3 or 5 pounds, but most commonly three pounds. These are typically from Southern breeders. The bees come in a screened box with a queen that is in a cage. This is cheaper than buying a nucleus. But, be wary. You get what you pay for.

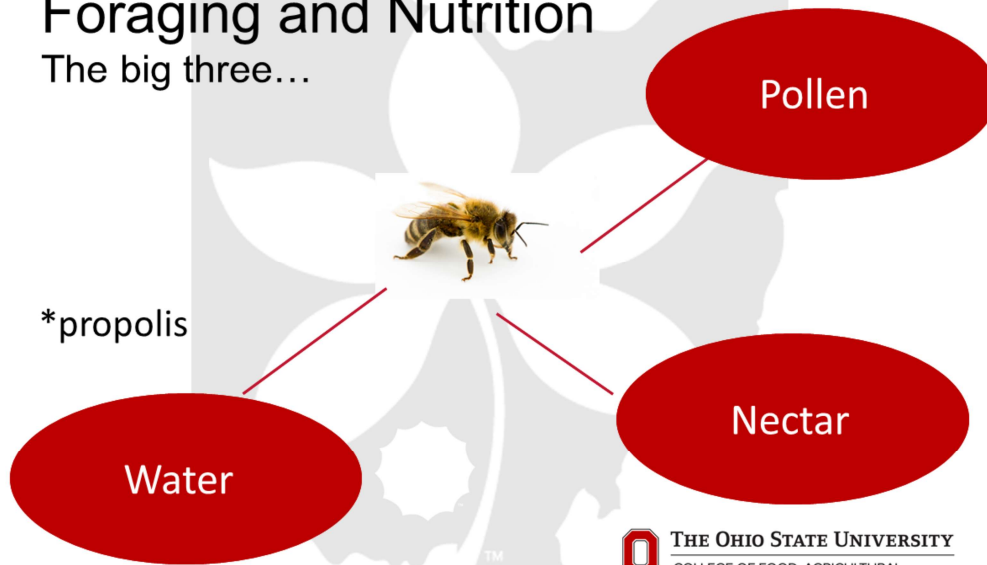
Buying bees

- Nucleus (nucs)
 - Most sold out Jan/Feb, possibly sooner
 - Find a local breeder
 - Availability depends on winter survival
- Packages
 - Generally never sell out
 - Come from the southern states
 - Several associations place group orders

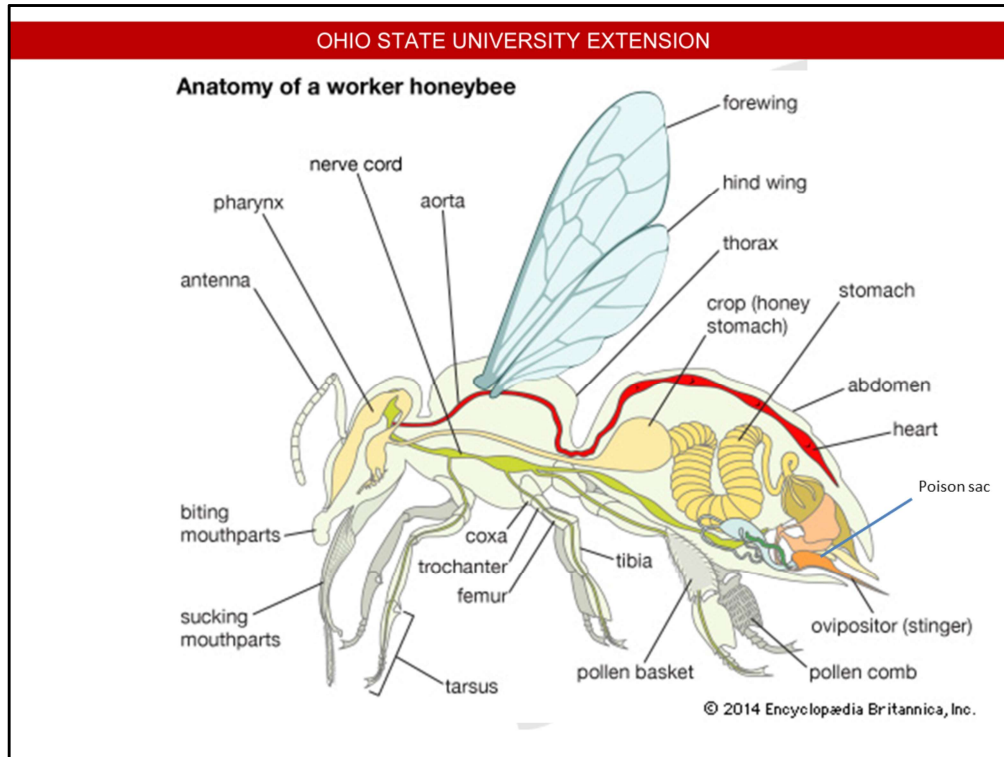
As you might see, buying bees is not exactly straightforward. But, I want to share with you the most common ways side by side. In terms of availability, packages trump nucs. This is due to the fact that nucs are highly sought after and are totally dependent upon winter survivability of local breeders. Sometimes local breeders can be hard to find and word of mouth seems to be the way their existence is known. Another advantage to nucs would be that they are from local breeders whereas packages come from southern states and some beekeepers think that overwintering could be an issue. Many associations also do group orders so they might be more affordable or more easily obtainable.

Foraging and Nutrition

The big three...



IN terms of foraging and nutrition, bees are after the big 3: pollen, nectar and water. And sometimes, propolis.

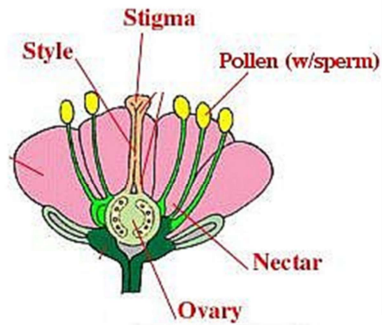


A look at the honeybee biology might be a good point to stop here and review.

Worker bees have specialized parts to complete different tasks

1. They have a crop or honey stomach, a separate compartment ahead of their typical stomach as we might think. This is used as a storage organ when they suck up nectar at a flower the nectar is stored here as the honeybee then flies back to the colony and then they regurgitate it back.
2. Another point of biology of interest to us is the honeybees' stinger. The stinger is a modified ovipositor, the part of the female bee that is typically used for depositing eggs. Because worker bees do not lay eggs (remember, only in the absence of the queen), their ovipositor is modified into a stinger. For this reason, only female workers can sting. Drones do not have this anatomy and cannot sting. The queen bee does have a stinger. She usually reserves it for killing rival queens within the hive.
3. Another part of the honeybee worker is their glands on their bodies that are used to make wax.
4. The last part that I'll point out is the pollen basket on the hind legs of a honeybee. These are stiff hair on their hind legs that are used for carrying pollen back to the hive. This capacity makes them very adept at being pollinators.

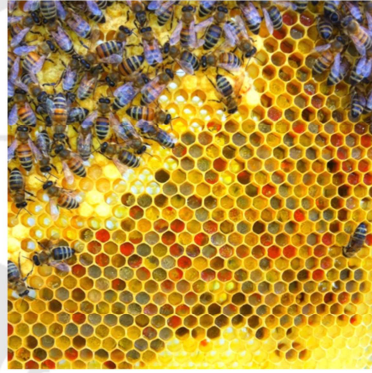
Foraging: Nectar



The most recognizable thing that bees collect is nectar from flowers which is produced at the base of the flower. This substance has the consistency of water. It is stored in that honey crop of the bee and transported back to the hive. The nectar is then dried down to form what we know and recognize as honey.

Foraging: Pollen

- Protein, starch, fat, vitamins and minerals
- Varies in color
- Produced by flower anther
- Covered with layer of honey to preserve it



One of the things that honeybees gather is pollen. This is full of protein, starch, fat, vitamins and minerals. Interestingly, by weight pollen has more protein than beef. Because of the different sources of pollen, it can vary in color. Pollen is produced by the male or anther part of the flower.

Foraging: Pollen

- Use pollen baskets to transport



Pollen is carried back to the hive on the pollen baskets as I mentioned earlier. It is then deposited into the cells of the honeycomb and covered with a layer of honey to preserve it. It is usually stored near developing brood to provide easy access for the nurse bees.

Foraging: Propolis

- Microbially active resinous substance
- Gathered on warm, dry days (77< degrees)
- Alders, birch, willows, conifers



Propolis is a microbially active resinous substance that is used by trees to protect leaf and flower buds during development. The bees scrape with their mandibles from alders, birch, willows and conifer trees. They pack into their pollen baskets and other bees from the hive remove it due to stickiness of the substance. Think of chewing gum consistency. This material is easily gathered on warmer, summer days and is used by the bees to seal up cracks in the hives. Drafts can be detrimental to bees in the winter, so propolis is used to reduce this problem.

Bee Breeds

- German Black Bee/Northern European bee
 - First imported bee
 - Flourished along east coast
 - Stung a lot
 - Prone to serious diseases

On the lookout for another bee

You might hear a lot of bees in terms of their breeds. Truthfully, this can be hard for a breeder to keep pure due to the nature of the drone congregation areas unless the breeder utilizes artificial insemination for their queen breeding.

As I mentioned earlier, *Apis mellifera* is not native to the United States but rather were imported by early American settlers from their homeland. One of the first breeds of bees were just those, often referred to as German Black Bees or Northern European bees. They flourished along the East coast but were quite hostile. They tended to sting keepers a lot and were prone to serious disease problems. Likely due to the fact that they were in a new location with different weather, predators, other insects, fungi, bacteria and viruses. It is doubtful any of these exist anymore. Most likely, they became a melting pot as other imports arrived and pests wiped the breed out.

Due to all the issues with this breed, keepers were interested in looking for another breed of bee.

Bee Breeds

- Italians (1850s)
 - Most popular
 - Yellow in color
 - Overwinter well
 - Build up quick in spring
 - Prone to robbing b/c of large populations

*Cordovans

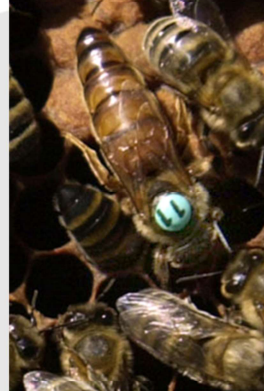


With improved steam technology making the voyage from Europe to the Americas faster, came a wave of unregulated bee importation. One of those imported was the Italian bees as early as 1850. They are among the most popular breed we have in existence today. They are more yellow in color than many of the other breeds. They overwinter a larger population compared to other breeds and therefore, utilize more resources throughout the winter. If they do overwinter well, and they are known to do so fairly well, they build up a nice population fairly quickly in the spring. In periods of insufficient resources (nectar, pollen, water, etc.) they are prone to robbing other hives.

Cordovan bees are also included in this breed as they are Italian bees that have been selected for the single recessive gene that determines the cordovan color which is the golden color like the picture on the slide. This makes the queen bee easier to see on a frame.

Bee Breeds

- Carniolans
 - Austrian Alps (Yugoslavia)
 - Gray/brown
 - Conservative with winter food stores
 - Construct new comb slowly
 - Build up quickly in spring
 - Swarm frequently



Carniolan bees originate from parts of Eastern Europe. They are gray and brown in color. They are fairly conservative with their winter stores to make it last and therefore, tend to overwinter pretty well. They are slow to construct more comb but do build up quickly in the spring similar to the Italians. The drawback with this breed is that they tend to swarm frequently. For that matter, the same could be said for the Italians. Therefore, the beekeeper who chooses to keep either of these breeds must manage swarms during the spring season. I'll share how to manage swarms in another presentation.

Bee Breeds

- Caucasians
 - Caucasus Mountains (Black & Caspian Seas)
 - Lead gray color
 - Very gentle
 - Swarm infrequently
 - Poor overwintering
 - Slow spring buildup
 - Susceptible to Nosema
 - Propensity to gather large amounts of propolis

Caucasian bees come from the Caucasus Mountain regions on the border of Europe and Asia. These bees tend to be a little grayer in color and are very gentle bees. For the novice beekeeper they might be a nice choice as they do not swarm easily. However, the drawbacks with this breeds are many. They don't overwinter well and are slow to build up their populations in the most critical spring time. Additionally, they are susceptible to nosema, a parasitic fungi of Western honeybees. They also collect a large amount of propolis, which can be an annoyance to a beekeeper.

Bee Breeds

- Africanized
 - East Africa
 - Imported by Brazil



Another breed of bee that gets much attention, rather negatively, is the Africanized bee. They are a cross breed between an East Africa species and European breeds such as the Italians.

They were imported into Brazil in the 1950s in order to increase honey production. However, several swarms escaped the quarantine project and ended up mating and therefore spreading throughout South America. They made their way to the U.S. as early as the mid 1980s. They are very aggressive and react much quicker to disturbances than other breeds. They have been reported to chase people for tenths of a mile.

Bee Breeds

- Russians
 - Some resistance to varroa mites
 - Highly resistant to tracheal mites
 - Darker than Italians
 - Only raise brood during periods of pollen availability



These next few breeds of bees are being explored as a way to manage a parasite called the varroa mite. There are some interest in Russian bees as they have been co-existing with the varroa mite for decades. They are also highly resistant to tracheal mites, another pest of honeybees. They tend to be darker than many of the other breeds we have discussed today including the Italian bees. Another positive attribute of the Russian bees are they only raise brood when there is sufficient pollen available to do so. Therefore, not contributing to stress.

Bee Breeds to Fight Disease

- Indiana Leg chewers (Purdue Leg Chewers)
- Minnesota Hygienic Queens
 - Italian bee
 - High hygienic behavior
 - American Foulbrood, chalkbrood, mites

The last bee breeds that I'll cover today are two breeds that are being bred here in the U.S. by researchers. The first, called the Indiana Leg Chewers (or Purdue Leg Chewers due to the University that is breeding them). These bees have a grooming propensity to each other and when they come across a varroa mite, they will chew the legs off the mite, making them fall off the bees.

Another breed that is being explored is named Minnesota Hygienic queens. They are Italian in origin and have a highly hygienic behavior which can help reduce other types of disease such as American foulbrood or chalkbrood.

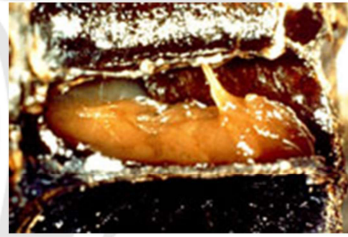
Quiz



Another check: What is wrong with this picture? What are we seeing? There are many eggs on the walls of the cell and there are many eggs in one cell. Because the eggs are on the sides of the wall of the cell, I might conclude that a worker is laying eggs as her body is not long enough to reach the bottom of the cells.

Brood Diseases: AFB

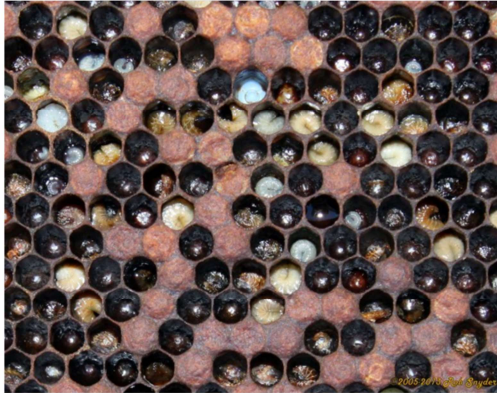
- American Foulbrood Disease (AFB)
- State Bee inspection programs
- Easily spread by bees and keepers



There are many diseases of honeybees to be aware of as a beekeeper. The first, is American Foulbrood Disease. This is caused by a bacterium though spores. Your first indication that the hive might have AFB is the smell of sulfurous odor, somewhat like a chicken house. The caps of working brood might be sunken and are often perforated. There are a few tests that a beekeeper can perform to check for AFB. One is the roapy test utilizing a fine pointed instrument to perforate the caps of the brood. If when pulled back there is a “goo” that can be a sign of AFB. Unfortunately, there is not “cure.” The best way to handle this disease is to burn the colony: equipment, bees and all. Prevention is key. Integrated pest management including sanitation (heat sanitizing your hive tools between colonies) is a must.

Brood Diseases: EFB

- European Foulbrood disease



Another similar disease is European Foulbrood disease. This is also caused by a bacteria and is often mistaken for American Foulbrood Disease. There are antibiotic treatments that can be used. However, due to the Veterinary Feed Directive Act, they must be prescribed by a Veterinarian. Another way to deal with this is to add brood to the colony (donated brood) and decrease supplemental feed. As you increase brood to compete for resources, the attention of nurse bees is diverted and the infected brood starve.

Adult Diseases: Nosema

- Fungus *Nosema apis* or *Nosema ceranae*
 - Feces on entrances and inner parts
 - Periods of confinement or stress
 - Symptoms are subtle



There are two different types of nosema which is a fungus. It is difficult to tell between the two, but labs can tell. Ceranae is more common these days. Telltale signs of nosema is feces on the entrances and inner parts of the hive. This usually shows up after period of confinement or stress. The fungus gets in the midgut of the bees and causes something akin to dysentery. Products such as Fumagilin can be administered in spring and fall (off season of honey due to contamination issues) to help mitigate this fungal pathogen.

Parasites

- Tracheal Mites
- Lives and reproduces in tracheal opening
- Common symptom – empty hive
- Pelletized menthol crystals or Mite-Away II[®]
- Api-Life VAR[®] or Apiguard
- Grease patties

There are a number of parasites that plague honeybees. One is the tracheal mite. It was found in 1984 in Texas and believed to originate from Mexico. The mite lives in the breathing opening of bee and essentially feeds on its blood. The mite crawls out and then looks for a new host, usually a worker less than 3 days old or a drone. Infestations vary seasonally. When populations are high, the mite count is low.

Symptoms of tracheal mites are subtle: dwindling populations, k-wing (adult wings are folded over the other on the abdomen forming a 'K'), but these are non-specific and could be signs of other viral diseases. Bees with this condition cannot form clusters which results in clumps of bees on different comb making winter survivability unlikely.

The only way to diagnose this parasite is to dissect the bee. This is not a major pest at this point and only represents minor losses. There are a number of products on the market approved for prevention including: Mite-away II which is formic acid to be used as part of an IPM approach and approved for organic honey production. There are also some products that are made from essential oils such as thymol, eucalyptol, menthol, and camphor) that treat both tracheal mites and varroa mites which we'll discuss next. Some beekeepers utilize "grease patties" which are a mix of granulated sugar, Crisco, and sometimes either wintergreen or peppermint oil as a way to prevent tracheal mites. The effectiveness is rather unknown as it is hard to test.

Parasites

- Varroa mite
- See without microscope
- Thresholds 2-5%
- Sampling
 - Cap scratcher
 - Sugar shake
 - Sticky boards



Perhaps the most problematic pest of the Western honeybee is the varroa mite. It was once only in Europe and limited to drone brood and therefore, did not affect colony life to a large degree. Now, presence of varroa mites are spread to everywhere honeybees are except Australia and a few other islands. The parasite makes its home on the thorax of the honeybee and could easily be overlooked by a novice beekeeper. Beyond staying vigilant each and every time you are in the hive, there are some methods that you can employ to ascertain the level of infestation your hive might have. Randomly pulling out capped brood (the preferred host for mites) with a cap scratcher is one way. Dusting your frames overtop with powdered sugar so that the bees groom each other, hoping they also groom off the mite and the mite falls to the bottom board below is another way of sampling. However, sampling is not exactly effective. It just tells you have an infestation. There are special bottom boards you can buy with grids on them. A quick count of the number of mites on the grids multiplied by 50 for a total population can get you close to a good calculation of your level of infestation. Under 3,000 is ideal. There are treatments for varroa mites ranging from products containing a hops derivative to essential oils to formic acid.

The reality of modern American beekeeping is that you will get this mite. It is only a matter of time. You must have a plan. I have been keeping bees for seven years. We've treated for mites almost every year. This year we did not and we saw mites in a hive that died in late November. Lots of mites.

Hive Pests: Wax Moth



Another pest is the wax moth. These are a predator of a dead or weakened colony. Essentially anytime you have a colony with too much comb to protect and not enough bees to protect the comb, they are in danger of succumbing to wax moth. As they say, an ounce of prevention goes a long way. Maintaining a healthy colony with adequate numbers is a prevention control. Freezing any frames that are not being used is another way to kill moth eggs and prevent them from hatching. Making sure you don't add additional boxes to colonies when there are not needed – following the 7 of 10 rule. Bees need to be working on 7 of the 10 frames in a box before you add another box on top whether that's a second brood box or an additional honey box. Working means drawing comb, filling with honey, pollen or brood.

What do we do if we have an infestation? Depends on when you find it. If we were in the South, we might put the super on a mound of fire ants that eat the larvae, eggs and pupae of the wax moths. But, more than likely you are going to find something like the pictures. This is one of my hives a couple years ago. The hive died over the winter. We could not get to the beeyard due to flooding after the weather had started to warm. With no bees to protect it, the wax moth took over and destroyed the hive. We ended up burning all the equipment from that hive. It was beyond saving. The pupae dig into the wood and cause little indentations. It was incredible. Unfortunately.

Hive Pests: SHB

- Small Hive Beetle

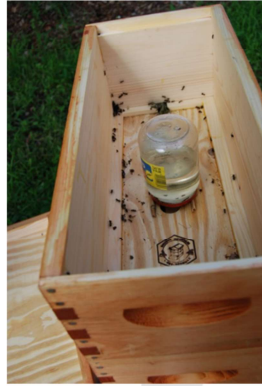


- Many marketed products

One of the most common nuisance type of pests is the small hive beetle. You can see them there in the picture, those small little beetles. These beetles lay eggs in the crevices and cracks in the hive. The larvae come out, eat resources in the hive, mostly pollen, and then they make their way out of the hive and actually pupate in the ground near the hive. The adults then emerge later and crawl back into the hive. The beetles are attracted to the resources in the hive. Bees usually live synonymously with the beetles. They sometimes trap them in propolis cages or chase them away.

There are a few ways to manage the beetle population in a hive. First, like many of these pests is to maintain colony strength. Another possibility is a soil drench to the soil around the hive. However, there are many non-target insects that could have a negative effect. Some beekeepers utilize diatomaceous earth to “cut” larvae so they dry up and die. However, this product is rendered useless as soon as it rains. Another integrated pest management option is a beetle trap. These are laid in-between frames and filled ½ way with vegetable oil. The beetles are attracted to the trap and then they get trapped by the oil and die. One word of caution, sometimes beekeepers utilize a pollen patty in the early spring as a source of additional pollen for the bees. These are used to “fool” the bees into thinking that pollen sources are abundant, making the queen ramp up her brood production and therefore will mean more bees to collect nectar which will equate to more honey production. The caution is that leaving these patties on too long in the spring can actually serve as a hot spot for beetle production as seen in the picture on the right. That is a pollen patty that was left on the hive too long and became a breeding ground for hive beetles. How do I know this? Once again, this is my hive. My picture.

Predators



- Bears – not in this part of OH-IO
- Ants - Use cinnamon sprinkled on inner cover
- Skunks
- Hornets
- Mice, moles, shrews, rats

Lastly, I'll just cover some predators. Woodpeckers, termites, spiders can all be predators. Luckily in this part of the world, we don't need to worry about bears like beekeepers in other parts of the country. Ants are a common pest that might be deterred by sprinkling cinnamon on the inner cover. Skunks can eat a whole hive in one night which is why it is important to elevate your hives slightly. Hornets are more like problems. They attempt to rob hives of their resources, especially during periods of insufficient resources (think August dearth). Mice like to eat honey and comb as do moles and shrews. Rats are often too large to be of much concern to hives, but they can be problematic in certain situations. Some birds like to eat drones and queens best like mockingbirds and thrushes.



In summary, honeybees are fascinating, complicated creatures. They have been of interest to mankind for thousands of years and continue to be active in our everyday life as we realize the importance of the pollinating jobs they perform.