A Field Guide to

Honey Bees

and Their Maladies

PennState Extension

The Mid-Atlantic Apiculture Research and Extension Consortium (MAAREC): Delaware, Maryland, New Jersey, Pennsylvania, West Virginia, Virginia, and the USDA cooperating


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Contents

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Introduction

The key to protecting honey bee colonies from diseases, parasites, and other harmful conditions is the ability to identify and deal with problems early. This publication is designed to assist beekeepers in recognizing the symptoms of common honey bee maladies. Some simple cultural controls are included here; however, for a complete list and discussion of management tactics and currently registered chemicals approved for the control of honey bee maladies, see the MAAREC website, **maarec.psu.edu**.

Normal Honey Bee Development

The Honey Bee

A healthy honey bee colony has three distinct types of individuals: a queen, workers, and drones. Each type of bee has a distinct role in the colony. Collectively, they make up the members of a honey bee colony.

QUEEN HONEY BEE

The queen is critical to the survival of the colony. Usually, she is the only actively reproductive female and lays all the eggs in the colony. Normally, only one queen is present in each colony, and she is the mother of all the individuals in that colony.

WORKER HONEY BEES

The workers also are female but have undeveloped ovaries, so they normally do not lay eggs. They perform all of the work in the colony, including caring for the brood, building the comb, tending to the queen, gathering resources (nectar, pollen, resins, water), and defending the hive. The tasks workers perform change as they age and are influenced by the particular needs of the colony at a given time. A colony may contain 20,000 to 60,000 workers, depending on its age and the time of year.

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DRONE HONEY BEES

Male honey bees are known as drones. Their only task is to mate with virgin queens, usually from colonies other than their own. They are larger than workers and are identified easily by their large, contiguous (touching each other) eyes. Mature drones leave colonies in the early afternoon and fly to drone congregation areas found 40 feet above the ground. Here drones in flight wait for a virgin queen on a mating flight. If successful mating takes place, the drone dies immediately after mating. Colonies may contain none, a few, or several hundred drones, depending on the strength of the colony and the time of year.

In the fall or after an abrupt end to a honey flow, workers force drones out of the colony. They may also remove any developing drone brood from the colony, which can pile up at the colony entrance.

Stages of development

Honey bees develop through a process called complete metamorphosis. Like butterflies, bees begin life as an egg, then enter the larvae stage before spinning a cocoon, pupating, and later emerging as adult bees. Unlike butterflies, bees complete all these stages in one place, a single cell of the beeswax comb.

EGGS

The queen lays eggs one to a cell. Each egg is attached to the cell bottom and looks like a tiny grain of rice. When first laid, the egg stands straight up. Over the three days it takes the eggs to “hatch,” they slowly bend so they lie flat on the bottom of the cell. The egg “coat” then dissolves, resulting in a tiny, C-shaped larva.

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LARVAE

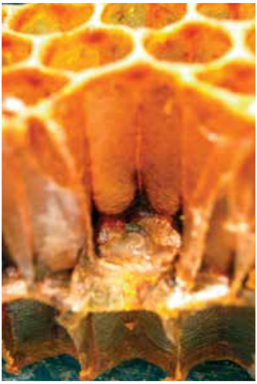
Healthy worker, queen, and drone larvae are pearly white in color with a glistening appearance. When young they are curled in a characteristic C shape on the bottom of the cell and continue to grow during the larval period, eventually filling their cell. In all insects, including bees, the larval stage is the growth stage. Worker bees feed large amounts of food to the developing larvae to accommodate this tremendous growth.

PREPUPAE

When larval bees are fully grown, they stretch out lengthwise in their cells, which are then capped by workers. At this stage they are prepupae and remain pearly white, plump, and glistening. The prepupae then spin a cocoon before entering the true papal stage.

PUPAE

During the pupal stage the bee undergoes tremendous change. After two days, healthy prepupae begin to change from their larval form into the pupal form; healthy pupae remain white and glistening during the initial stages even as their bodies begin to take on the adult form. The compound eyes are the first areas to change color, from white, to pink to purple, and finally to brown. After the eyes darken, the rest of the body begins to darken, taking on the color and features of an adult bee. These changes all occur within the capped cells.



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CAPPED BROOD

Healthy developing worker and drone cells are capped after larvae are approximately 5.5 and 6.5 days old, respectively. A healthy worker brood pattern is easy to recognize: brood cappings are medium brown in color, convex, and without punctures. Healthy capped worker brood normally appears as a solid pattern of cells with only a few uncapped, or open, cells.

EMERGING ADULT WORKER BEE

New queens, workers, and drones emerge approximately 7.5, 12, and 14.5 days, respectively, after their cells were capped. Individually they must chew through the wax cap covering the beeswax cell in which they developed. They assume normal adult duties almost immediately.

ADULT BEES TO CAPPED BROOD

The ratio of adult bees to capped brood cells is typically two adult bees to one capped brood cell. This ratio is affected by the season. In the spring colonies may suffer from “spring dwindle,” where the adult population is lost at a rate faster than brood can emerge to replace them. In the fall as brood rearing slows the ratio may be higher.

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Types of cells

HEALTHY BROOD FRAME

A brood frame from a healthy colony typically has bands of cells with different contents, including capped and uncapped honey, stored pollen (called bee bread), eggs, uncapped brood, and capped brood.

CAPPED HONEY

When bees have ripened their honey, they cap the cells with wax. Different bees cap cells differently; some leave a small pocket of air between the wax capping and honey, giving the capping a snowy white color, while other bees place the wax capping directly on the honey, making the capping look dark. In cases where brood was previously reared, the honey may look dark compared to the honey in surrounding cells. There is no difference in the quality of honey below these cappings.

BEE BREAD

Bees collect and store pollen, which is used as a protein source for the developing larvae. The pollen is transported to the hive as compact pellets in the pollen baskets on the bees' hind legs and placed in storage cells around the brood nest. Bees process the pollen by compressing the pollen pellets in the cells, which is followed by a lactic acid fermentation, and finally covering them with a thin film of nectar.

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QUEEN CELLS

Queen cells differ from all the other cells in the colony in that they are much larger and hang down vertically rather than being horizontally positioned. There are three different types of queen cells: swarm cells, supersedure cells, and emergency replacement cells.

- **Swarm cells**

  Swarm cells are typically found in very strong colonies in spring and occasionally in the late summer/early fall. They are usually found along the edges of the brood nest in large numbers. Swarming is the process by which honey bee colonies reproduce. Once the new swarm cells are capped, the mother queen and approximately half of the colony's population will leave in search of a new nesting site. If managing colonies for honey production, this is not desirable because it reduces honey production. Upon finding swarm cells beekeepers usually remove them and provide the colony with additional space.

- **Supersedure cells**

  Supersedure cells are reared by colonies attempting to replace their aging or damaged queen. There are usually only a few of these cells, which can be found either in the middle or along the edges of brood frames. If it is possible to get a mated queen, consider removing these cells and the mother queen and replacing her with a new, mated queen.

- **Emergency replacement cells**

  Emergency replacement cells are reared by colonies that have suddenly lost their queen. These queens are reared from young worker larvae in typical worker cells that must be modified to hang vertically to accommodate the larger size of the queen. These cells are usually found in the center of the brood nest. If introducing a mated queen, developing queen cells should first be removed for best results.

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DRONE CELLS

Typically, queens lay unfertilized eggs in larger cells, called drone brood cells. These cells tend to be found at the edges of the brood nest. These types of cells are also typically built by workers to fill in any comb that has been damaged.

QUEEN CUPS

These cup-shaped beeswax cells are common in the brood nest and are found at the bottom of combs, usually along the bottom bars. They are identified as queen cells only when they are occupied with eggs or larvae with royal jelly. Capped queen cells are identified as such after they are capped with the enclosed pupae.

BURR AND BRACE COMB

These bits of comb are built between parallel combs, between comb and adjacent wood, or between two wooden hive parts, such as top bars, to fasten them together and allow workers to move easily within the nest and from one box to the next.

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Honey Bee Parasites

Varroa mite

(*Varroa destructor*)

Varroa mites are a serious malady of honey bees. They occur nearly everywhere honey bees are found, and all beekeepers should assume their bees have a varroa mite infestation. These external parasites feed on the hemolymph (blood) of adult bees and capped brood.

LIFE HISTORY

- **Adult female varroa mite**

  Only mature female mites survive on adult honey bees and can be found on both workers and drones and rarely on queens. Varroa mites are reddish brown in color, about the size of a pin head, and can be seen with the naked eye. Their flat shape allows them to squeeze between overlapping segments of a bee's abdomen to feed and escape removal by grooming bees. Their flat shape also permits them to move easily in the cells of developing bee brood. Male mites are smaller and light tan in color. Adult males do not feed and are not found outside of brood cells.

- **Varroa mite life cycle**

  When female mites are ready to lay eggs, they move into brood cells containing larvae just before the cells are capped. After the cells are capped and the larvae have finished spinning cocoons, the mites start feeding on the brood. The foundress mites begin laying eggs approximately three days after the cell has been capped. A fertilized female mite lays one unfertilized (male) egg and four to six fertilized (female) eggs. The adult female and its immature offspring feed at a hole pierced in the developing pupae by the foundress mite. Only mature female mites will survive when their host bee emerges as an adult.

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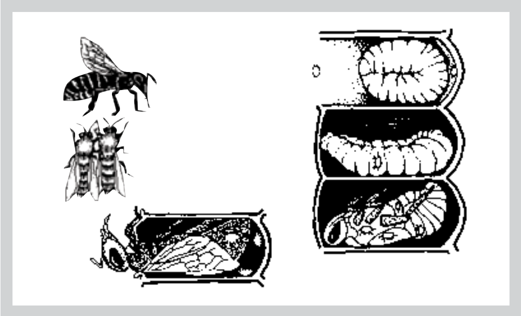

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- **Different life stages of varroa mite feeding on a drone bee (just before emerging)**
  The mite life cycle consists of four developmental stages: the egg, two eight-legged nymphal stages (protonymph and deutonymph), and the adult. The period from egg to adult takes about six to seven days for female mites. Female mites produced in the summer live two to three months, and those produced in the fall live five to eight months. Without bees and brood, the mites can survive no more than a few days.

- **Emerging worker bee with varroa mites**
  Mating of male and female mites occurs in the brood cells before the new adult females emerge. The adult male dies after copulation since its mouthparts (chelicerae) are modified for sperm transfer. The foundress (old) female and the newly fertilized female offspring remain in the brood cell until the young bee emerges. The adult bee then serves as an intermediate host and a means of transport for these female mites.

- **Varroa mites on drone pupa**
  As only mature female mites can survive when the host bee emerges, few of the eggs each foundress mite lays will survive to adulthood. On average a mite invading a worker cell will have 1.2 offspring. If the same female invades a drone cell, she will have on average 2.2 offspring. For this reason, more mites per cell are produced in drone brood.

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FIELD DIAGNOSIS

Monitoring and recognizing a varroa infestation before it reaches a critical level is important. All beekeepers should have a varroa management plan in place before an infestation reaches a harmful level. Beekeepers should integrate a combination of soft chemical and nonchemical techniques to manage mite populations. For detailed information on treatment strategies and currently registered chemicals approved for the control of honey bee varroa mites, see the MAAREC website, **maarec.psu.edu**.

EXAMINING DRONE BROOD

One technique to quickly assess the presence of varroa mites is by examining brood—uncap cells and remove and examine pupae, especially white drone pupae. Individual pupae can be removed using forceps, or many drone pupae can be removed at once using an uncapping fork. In addition, drone brood is often housed between boxes and is broken open when boxes are separated during routine inspections. This is a good place and time to examine brood for mites. A small 10x hand lens will be helpful.

- **Sampling using sugar shake**
  There are several methods for measuring varroa mite infestation. The sugar roll technique is a quick, relatively easy sampling method to check for the presence and number of mites on the worker adults of a colony.

- **Sampling a known quantity of bees**
  To collect an accurate sample (number of bees):

  1. Remove a frame covered with bees from the brood nest, taking care not to include the queen.
  2. Shake the bees into a plastic tub or cardboard box.
  3. Shake the tub to consolidate the bees into the corner.
  4. Scoop a half cup of bees using a half-cup measuring cup (a full half-cup measuring cup contains approximately 320 bees).
  5. Place the bees into a wide-mouth quart mason jar modified with a mesh hardware cloth top.

See **maarec.psu.edu** for a visual tutorial on how to take a sugar sample.

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- **Counting the mites in a sample**
  Add two to three tablespoons of powdered (confectioners) sugar to the bees in the jar. Vigorously shake the jar for about 30 seconds to distribute the sugar over the bees. Allow the jar to sit for approximately one minute. Then shake the loose sugar with dislodged mites out of the mason jar through the modified mesh cover onto a flat surface such as a cookie sheet, pie plate, or hive lid. Add more powdered sugar and reshake until no additional mites appear after shaking. Count the number of mites.

- **Sampling using sticky boards**
  Another way of quantifying mite levels is by using a sticky board placed at the bottom of the hive. You can purchase sticky boards from bee supply companies, or you can make your own using stiff, white poster board and Vaseline as your sticky material. The sticky material must be covered with wire mesh screen elevated about a quarter inch off the sticky surface. If sticky boards are to be placed on solid bottom boards, the bottom board must be cleaned to allow board insertion. Alternatively, sticky boards can be placed beneath screen bottom boards modified for this purpose. Place boards in colonies for a minimum of three days to accurately calculate daily mite drop numbers.

FIELD SYMPTOMS OF A CRITICAL INFESTATION

- **Deformed wings**
  Varroa mites can transmit and/or activate some bee viruses. Few of these viruses produce visible symptoms. An exception is deformed wing virus (DWV), which when present in high levels causes developing bees to have malformed wings. When large numbers of bees in a colony have DWV, the colony likely has high varroa populations and immediate intervention to control the varroa population is required.

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- **Parasitic mite syndrome**
  Parasitic mite syndrome (PMS) is a condition associated with high varroa infestation. The exact cause of PMS is unknown, although viruses are suspect. This condition is characterized by a spotty brood pattern and dead brood found in cells that are discolored, turning a yellow brown to dark brown color. Signs of this condition can resemble American foulbrood, but dead larvae do not string out, as with American foulbrood, when the ropiness test is preformed (see page 34). Dead larvae can also resemble European foulbrood and/or sacbrood infections. Both capped (or once capped) and uncapped brood are affected. Other names associated with this condition include snotty brood and cruddy brood.

- **Crawling bees abandoning the hive**
  Another common symptom of a heavy mite infestation is large numbers of bees that are often hairless, greasy looking with extended abdomens, and unable to fly and are thus crawling out of infested hives. These crawling bees may or may not show signs of viral infection, such as deformed wings.

- **Spotty or irregular brood pattern**
  Brood combs in an infested colony have a scattered or irregular pattern of capped and uncapped cells. This may be especially evident in highly hygienic colonies.

- **Sudden summer/fall collapse**
  The collapse of colonies, particularly strong colonies, in the late summer and early fall is a possible symptom of a significant infestation of varroa mites and the diseases associated with these mites.

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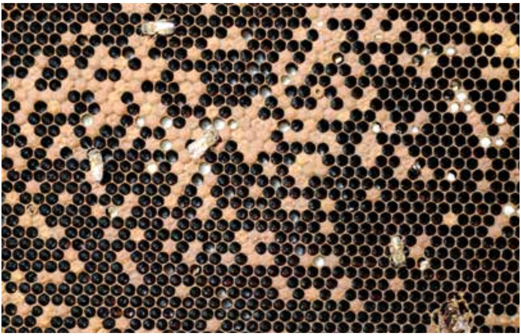

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Honey bee tracheal mite

(*Acarapis woodi*)

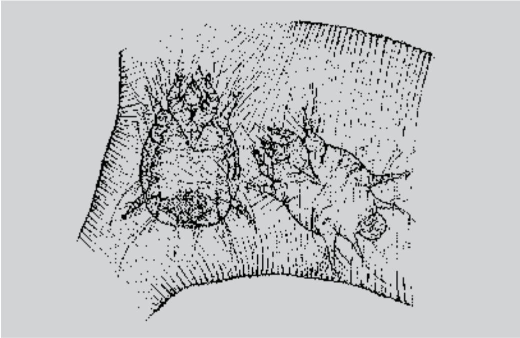
Another mite that can negatively affect honey bees is the honey bee tracheal mite. This internal parasitic mite lives within the tracheae, or breathing tubes, of adult honey bees. The mites pierce the breathing tube walls with their mouthparts and feed on the hemolymph (blood) of the bees. In recent years, tracheal mites have been a minimal problem for beekeepers and it appears that U.S. honey bees have developed resistance to these mites.

LIFE HISTORY

- **Tracheal mite life cycle**
  The honey bee tracheal mite is difficult to identify and study because of its small size (no bigger than a dust speck). The entire life cycle of this mite is spent within the respiratory (tracheal) system of the honey bee, except for brief migratory periods. Female tracheal mites migrate to young adult bees (less than four days old). Once in the bees' tracheae, the mites feed and reproduce. Each female mite lays five to seven eggs, which require three to four days to hatch. Male and female mites develop from egg to adult in approximately eleven to fifteen days. Eggs hatch into six-legged larvae, then molt to a nonfeeding or pharate nymph stage, and finally molt to the adult stage. All stages of the mite may be found in the tracheae of older infected bees. Only adult females emerge from the tracheae through spiracles (openings to the outside). Close contact among bees permits the mites to transfer to uninfested young bees. Bees less than four days old are the most susceptible.

FIELD SYMPTOMS

- **Winter cluster with reduced population**
  A tracheal mite infestation shortens the lives of adult bees and affects flight efficiency and perhaps the ability of bees to thermoregulate. As mite populations increase, colony populations dwindle, which ultimately leads to colony death. Infested colonies often die in late winter or early spring. Severely infested colonies also can die during the spring, summer, or fall.



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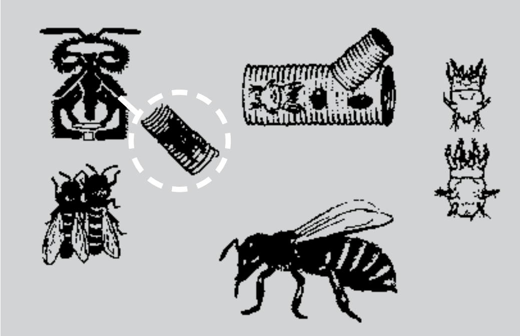

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- **Mass of bees exiting hive**
  When a colony is near death, large numbers of bees can be seen crawling out of the hive, unable to fly. These bees may display abnormally positioned wings that look disjointed ("K" wings) and may be trembling, symptoms that can result from diseases associated with the tracheal mites.

FIELD DIAGNOSIS

- **Infested tracheae** ▶▶▶
  A severe infestation can be identified in the field by detaching the head from the thorax to expose the large tracheal trunks in the thorax. This is most easily done with drone bees. Normally, these tracheal tubes are opaque. When infested with a high level of mites, the tubes will be blotchy with patches of brown or black. When infestation is particularly severe, the tubes can be solid black. A light infestation is difficult to detect and can be identified only with the aid of a microscope.

- **Healthy and infested tracheae (under microscope)** ▶▶▶
  Positive identification of tracheal mites is best done by dissection and microscopic examination of worker bee thoracic tracheae. The tracheae of uninfested bees are clear and colorless or pale amber in color (healthy). In a slight infestation, one or both tracheal tubes contain a few adult mites and eggs, which may be detected near the spiracular openings. At this stage, the tracheae may appear clear, cloudy, or slightly discolored (infested). The tracheae of severely infested bees have brown blotches with brown scabs or crustlike lesions, or may appear completely black, and are obstructed by numerous mites in different stages of development. Feeding by the mites damages the walls of the tracheae. Flight muscles in the bee's thorax also may become atrophied as a result of a severe infestation.

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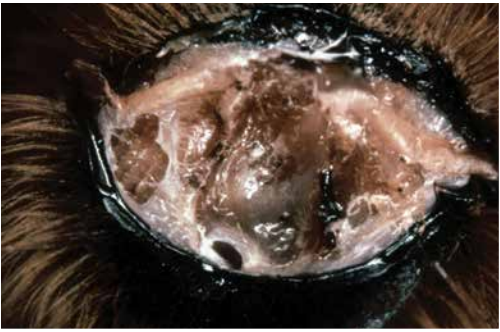

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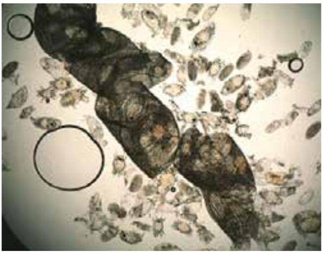

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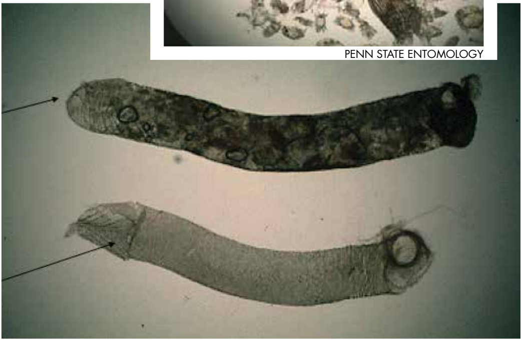

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Honey Bee Diseases:
Brood Diseases

American foulbrood

American foulbrood (AFB) is an infectious brood disease caused by the spore-forming bacterium *Paenibacillus larvae*. It is the most widespread and destructive of the brood diseases. Adult bees, while not affected by AFB, do carry the disease. American foulbrood spores are highly resistant to desiccation, heat, and chemical disinfectants. These spores can remain viable for more than seventy years in combs and honey.

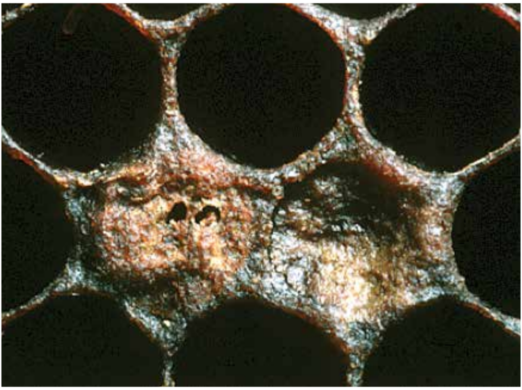
LIFE HISTORY

- **Punctured, sunken cappings**
  Paenibacillus larvae occur in two forms: vegetative (rod-shaped bacterial cells) and spores. Only the spore stage is infectious to honey bees. Larvae less than 2.5 days old become infected by swallowing spores present in their food. Older larvae are not susceptible. The spores germinate into the vegetative stage soon after they enter the larval gut and continue to multiply until larval death. Death typically occurs after the cell has been capped, during the last two days of the larval stage or the first two days of the pupal stage. New spores form after the larva or pupa dies. Symptoms of this disease are only present in larvae that are or were once capped. Adult bees typically puncture but often delay removing diseased larvae.

FIELD SYMPTOMS

- **Dead, melted larvae**
  Dead larvae change gradually from a healthy pearly white to a light brown and then to a darker brown. This color change is uniform over the entire body. The infected larvae look melted and lie flat on the bottom side of the cell. The disease has a distinctive odor, but the odor alone is not a reliable symptom for identification and so should be backed up with lab confirmation.

USDA



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- **Scale of American foulbrood**

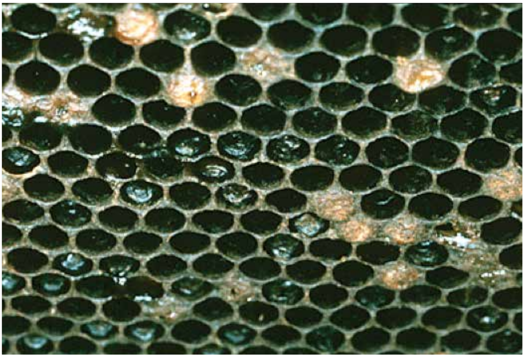
  Within a month or so, these dead larvae dry out and form brittle scales that are almost black. Each scale contains as many as 100 million AFB spores. The scales lie flat along the lower walls of the cells with the rear portion curving partway up the bottom of the cell. It is very difficult for bees or beekeeper to remove the scales from the cells.

- **Pupal "tongue"**

  If death occurs during the pupal stage, pupae undergo the same changes in color and consistency as larvae. In addition, the pupal "tongue," or proboscis, sometimes sticks to the top wall of the cell. The presence of this pupal tongue, though not always present, is a characteristic symptom of American foulbrood.

- **Irregular brood pattern**

  Brood combs in an infected colony have a scattered and irregular pattern of capped and uncapped cells. Infected cells are discolored, sunken, and often have punctured cappings. This appearance contrasts with the yellowish brown, convex, and entirely sealed cells of a healthy brood comb.



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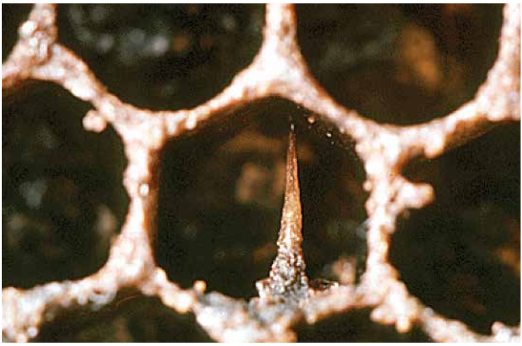

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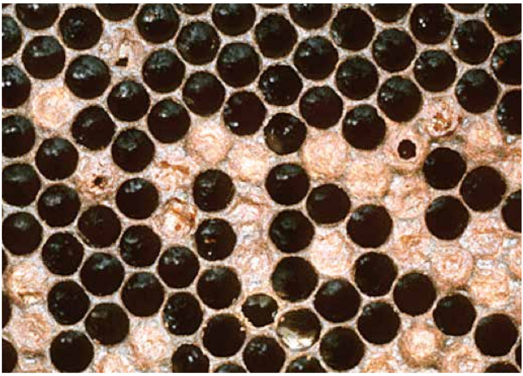

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FIELD DIAGNOSIS

- **Field testing**

  During the early stages of decay until about three weeks after death, the dead larvae have a gluelike consistency. To test for the disease, choose a larva that is discolored and exhibits a melted appearance. Insert a match, twig, or toothpick into the cell, stir the remains of the dead larva, and then slowly withdraw the test stick. If a portion of the decaying larva clings to the twig and can be drawn out about an inch or more while adhering to the dead mass, its death was probably due to AFB. This "ropiness" of freshly dead larvae is a characteristic symptom of AFB.

- **Laboratory diagnosis**

  To obtain positive confirmation of AFB, contact your state apiary inspection service (see the AIA website, **www.apiaryinspectors.org**, for a complete list of state apiary inspection programs) or send a sample of diseased larvae to the Beltsville Bee Lab (see resources for address). Samples for lab diagnosis can be collected in one of two ways: several diseased larvae are collected using a toothpick or thin twig and placed into plastic wrap or wax paper, or a 1-inch-by-1-inch piece of comb can be cut from the diseased frame and wrapped in wax paper. A diagnostic test kit by Vita is also available from some beekeeping supply companies.

- **HOLTS milk test—preparing powdered milk**

  Another field test to confirm the presence of AFB can be conducted using powdered milk. Combine one teaspoon of the powdered milk with 100 milliliters (slightly less than half cup) of water and mix thoroughly. Pour the milk into two small, clear, glass vials or other similar containers.

  Collecting an AFB sample

  Collect a sample from the suspect AFB colony by opening a diseased cell and stirring the contents with a toothpick. Collect as much of the larval remains as possible on the toothpick and place in a clean container or wrap in foil.

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Positive AFB sample
Insert the previously collected AFB sample into one of the prepared vials. Do nothing with the second sample. Place both vials in a warm location for one hour. After one hour examine the samples. If the sample is positive, the vial with the AFB sample will become clear. Use the second sample for comparison.

CULTURAL CONTROL

- **Hive inspection**
The secret to successfully controlling American foulbrood in the apiary is to find the disease in its early stages. The beekeeper should therefore make careful inspections of the brood area of the colonies minimally once in spring and again in the fall and always be alert for possible signs of the disease.

European foulbrood

European foulbrood (EFB) is a bacterial brood disease caused by the bacterium *Melissococcus pluton*. This disease is considered a stress disease and is most prevalent in spring and early summer. *Melissococcus pluton* does not form spores but often overwinters on combs. It gains entry into the larva in contaminated brood food and multiplies rapidly within the gut of the larva.

European foulbrood frequently disappears with a nectar flow. Occasionally, the disease remains active throughout the entire foraging season. All castes of bees are susceptible, although various commercial strains differ in susceptibility.

LIFE HISTORY

- **Young diseased larvae in open cells**
European foulbrood disease and its symptoms are highly variable, probably because several other types of bacteria are often present in dead and dying larvae. EFB generally kills larvae that are two to four days old while they are still C shaped in the bottom of the cells. Unlike American foulbrood, most of the larvae die before their cells are capped. A spotty pattern of capped and uncapped cells develops only when EFB becomes serious. Occasionally, pupae die from the disease.

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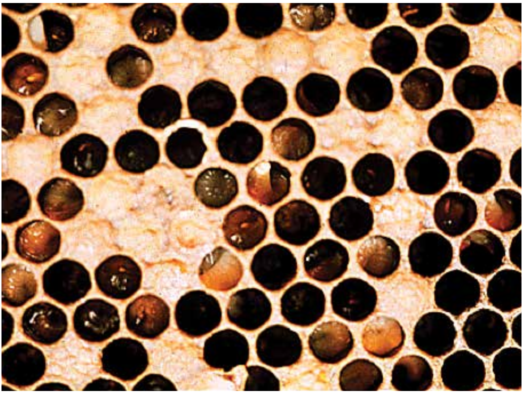

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FIELD CHARACTERISTICS AND DIAGNOSIS

- **Blotchy and twisted EFB brood**
  The most significant symptom of EFB is the nonuniform color change of the larvae. They change from a normal pearly white to yellowish, then to brown, and finally to grayish black; they can also be blotchy or mottled. Infected larvae lose their plump appearance and look undernourished. Their breathing tubes, or tracheae, are visible as distinct white lines. Larval remains often appear twisted or melted to the bottom side of the cell. Unlike larvae killed by AFB, recently killed larvae rarely pull out in a ropy string when tested with a toothpick. The dead larvae form a thin, brown or blackish brown scale that can be easily removed. EFB usually does not kill colonies, but a heavy infection can seriously affect population growth.

Chalkbrood

Chalkbrood, a fungal brood disease of honey bees, is caused by the spore-forming fungus *Ascophaera apis*.

LIFE HISTORY

Bees ingest spores of the fungus with the larval food. The spores germinate in the hind gut of the bee larva, but mycelial (vegetative) growth is arrested until the larva is sealed in its cell. When the larva is about six or seven days old and sealed in its cell, the mycelia break through the gut wall and invade the larval tissues until the entire larva is overcome. This process generally takes from two to three days.

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FIELD SYMPTOMS

- **Chalkbrood mummies**

  Dead larvae are chalky white and usually covered with fungus filaments (mycelia) that have a fluffy, cottonlike appearance. These mummified larvae may be mottled with brown or black spots, especially on the undersides, because of the presence of maturing fungal fruiting bodies. Larvae that have been dead for a long time may become completely black as these fruiting bodies fully mature. The chalkbrood mummies are hard and resemble pieces of chalk when white.

- **Chalkbrood in cells**

  Diseased larvae can be found throughout the brood-rearing season but are most prevalent in late spring when the brood nest is expanding rapidly. Affected larvae are found on the outer fringes of the brood nest where insufficient nurse bees are available to maintain an elevated brood nest temperature. Drone brood is particularly susceptible to chalkbrood. Symptoms appear only after capping; however, workers often puncture or remove cappings.

- **Chalkbrood at hive entrance**

  Nurse bees remove infected larvae, which are stretched out in their cells. Dead larvae (mummies) are often found in front of the hive, on the landing board, or in a pollen trap. In strong colonies, most of these mummies will be discarded by worker bees outside the hive, thus reducing the possibility of reinfection from those that have died from chalkbrood. Improving ventilation can help prevent chalkbrood.

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Sacbrood

Sacbrood, a disease caused by a virus, usually does not result in severe losses. It is most common during the first half of the brood-rearing season and often goes unnoticed since it usually affects only a small percentage of the brood. Adult bees typically detect and remove infected larvae quickly. Often, if sacbrood is widespread enough for the beekeeper to observe the symptoms, the disease may be too severe for the adult worker population to handle.

FIELD SYMPTOMS

- **Sealed cells with punctures and affected larvae**
  Both worker and drone larvae can be infected by sacbrood. Death usually occurs after the cell is sealed and the larva has spun its cocoon. Pupae may be killed occasionally, but adult bees are not susceptible to the disease. Dead brood is often scattered among healthy brood. The cappings over dead brood are punctured first, and the affected brood is later removed by the bees. The larvae gradually change from pearly white to dull yellow or gray and finally to black. The head of the larva, the first part of the body to change color, becomes black. Larvae die in a stretched-out position with their heads raised.

- **Sacbrood-infected larva**
  Larvae with sacbrood are easily removed intact from the cells, unlike those killed by foulbrood. When removed, the contents of the larvae are watery, and the tough outer skin appears as a sack of fluid filled with millions of sacbrood virus particles. The dried sacbrood scale lies flat, with the head end raised and darkened and the tail flat on the bottom side of the cell. The scales are rough and brittle and do not adhere tightly to the cell wall. Sacbrood usually disappears in the late spring when the honey flow has started.

CULTURAL CONTROL

If symptoms persist, requeening—especially with hygienic stock—is recommended.

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Honey Bee Diseases:
Adult Diseases

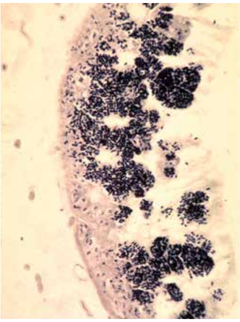
Nosema

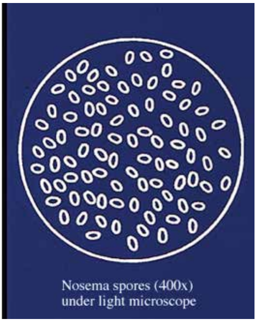
Nosema is caused by the spore-forming microsporidium *Nosema apis* or *Nosema ceranae*, which invades the digestive tracts of honey bee workers, queens, and drones. Adult bees ingest *Nosema* spores with food or water. The spores germinate and multiply within the lining of the bee's midgut. Millions of spores are shed into the digestive tract and eliminated in the feces.

FIELD SYMPTOMS

- **Fecal staining on outside of hive**
  Nosema disease may be present at any time during the year. *Nosema ceranae* appears to be more common during summer and is sometimes referred to as "dry nosema" as heavy loads of this pathogen do not cause the characteristic fecal staining associated with *Nosema apis*, which appears in fall and winter. Damage to the digestive tract may produce symptoms of dysentery (diarrhea). Especially in winter, infected workers, unlike healthy workers, may defecate in or on the outside of the hive rather than out in the field. Diseased colonies usually have increased winter losses and decreased honey production. When queens become infected, egg production and life span are reduced, leading to supersedure. The loss of the queen in colonies newly started from package bees is a serious effect of the disease. Infection in worker bees inhibits digestion of food in the stomach and production of royal jelly. As a result, the productive life of the worker is shortened and its ability to produce brood food decreases, thus retarding brood production and colony development.

- **Comparison of healthy and diseased honey bee gut**
  The only way to positively identify nosema disease is through the dissection of adult bees. The hind gut and digestive tract of diseased bees are chalky or milky white. Healthy bees, on the other hand, have amber or translucent digestive tracts. In addition, the individual





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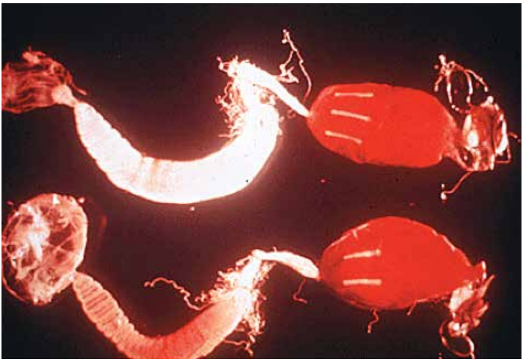

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circular constrictions of a healthy bee's gut are visible, whereas the gut of an infected bee may be swollen and the constrictions may not be clearly visible.

More commonly, bee abdomens are masticated in a known quantity of water and an aliquot of the suspension is examined under 100x magnification for presence of *Nosema* spores.

CULTURAL CONTROL

Keeping colonies strong and producing abundant healthy brood in fall is important.

Honey bee viruses

Viruses are small packages of genetic material that rely on another organism to reproduce. More than sixteen viruses have been found in European honey bees, eleven of which have been found in North America. Most viruses do not cause overt symptoms in the colonies they infect. Many viruses are not thought to have a significant impact on colonies unless the colony is also infested with parasites (e.g., varroa and honey bee tracheal mites) or other pathogens (e.g., *Nosema*) that aggravate and or transmit the virus. Most viruses are associated with adult bees, except sacbrood (discussed on page 42) and black queen cell virus (BQCV).

BLACK QUEEN CELL VIRUS

This virus is closely associated with nosema infection, although infected colonies typically do not show overt signs of nosema infection. It is unique in that the virus only replicates in the larvae of queens. Diseased larvae or prepupae die after the queen cell has been capped. After death the larvae have a pale yellow appearance and are surrounded by a tough saclike skin that resembles sacbrood infection. This disease may be problematic in queen-rearing operations, where cells containing diseased individuals develop dark brown to black cell walls.

DEFORMED WING VIRUS

Varroa mites can transmit and/or activate some bee viruses. While few of these viruses produce visible symptoms, an exception is deformed wing virus (DWV), which when present in high levels causes developing bees to have malformed wings. When large numbers of bees in a colony have DWV, the colony likely has a high varroa population, requiring immediate intervention to control the infestation.

CHRONIC PARALYSIS VIRUS

Chronic paralysis virus produces two sets of symptoms. Both sets of symptoms can occur in the same colony, but one usually predominates, probably because the symptoms an individual bee is likely to manifest are heritable.

TREMBLING SYNDROME AND HIVE ABANDONMENT

Some bees infected with chronic paralysis virus are unable to fly and can be seen crawling, often climbing up stems of grass. In severe cases, thousands of bees from a colony may demonstrate this behavior. The individual bee's body and wings often tremble abnormally, and the abdomen may appear distended. Infected bees die within a couple of days of symptoms appearing, and colonies can suddenly collapse if large numbers of bees are infected.

HAIRLESS BLACK SYNDROME

Some bees infected with chronic paralysis virus appear smaller than other bees, are dark to black in color, and have a shiny, greasy appearance. Nest mates are sometimes seen "nibbling" on infected individuals, making it easy to mistake them for older robber bees. Symptomatic bees are unable to fly, will begin to tremble, and die within a couple of days.

GREASY, HAIRLESS BEES

Some bees infected with chronic paralysis virus tremble uncontrollably and are unable to fly. In addition, they lose the hair from their bodies and have a dark, shiny, or greasy appearance. They are often mistaken for robber bees, but paralytic bees are submissive to attack, whereas robbing bees are not.

BEES WITH K WINGS

When chronic paralysis virus is serious, large numbers of afflicted bees can be found at the colony entrance crawling up the sides of the hive and/or blades of grass around the hive and then tumbling to the ground.

Healthy bees often tug at infected bees in an effort to drive them away from the hive. Infected bees may also exhibit abnormally positioned wings that look disjointed (the K-wing symptom).

A colony may recover from paralysis after a short time, or the condition may continue for a year or more without killing the colony. Usually, only one or two colonies in an apiary will show signs of the disease. Research has shown that susceptibility to the disease is often inherited. If paralysis persists, requeen colonies with a different strain of bees. Adding a frame or two of sealed brood from a healthy colony to build up the number of young bees in the diseased colony is also helpful.

ISRAELI ACUTE PARALYSIS VIRUS (IAPV)

This new honey bee virus was found in the United States in 2007 in association with Colony Collapse Disorder (CCD). IAPV was first described in 2004 in Israel. Infected bees had “shivering” wings, which progressed to paralysis, and then the bees died just outside the hive.

Honey Bee Diseases:

Diseaselike Conditions and Colony Collapse Disorder

Brood frame of drones in worker cells

Female bees are the result of fertilized eggs, while drones come from unfertilized eggs. If a queen does not mate or runs out of the sperm stored after mating, the eggs she lays will become drones. The result is drones developing in worker cells. In this case, the resulting brood pattern is spotty and has a characteristic bullet shape. Beekeepers should replace the queen immediately.

Chilled brood

If larvae are underfed or the brood covers a larger area than the bees can keep warm, some of the brood will die. Uncapped brood killed by chilling turns gray and resembles sacbrood. Bees will remove such brood from the cells as soon as the colony grows stronger and returns to normal. Prevent the loss of brood from chilling or lack of food by taking the following precautions: (l) work with the bees as little as possible when the weather is cold; (2) replace combs in the same order in which they were removed, especially if the colony is weak and it is early spring; and (3) do not leave frames of brood standing outside the hive any longer than necessary.

Dysentery/spotting on hive

Dysentery, a diarrhealike condition, is a symptom caused by the buildup of an excessive amount of fluid in the bee's gut and the inability of the bee to retain waste products in its body as it normally does. Unable to wait until cleansing flights are possible, these bees void their feces on the combs, in front of the hive entrance, and on the exterior of the hive. Factors leading to this situation include nosema disease, prolonged confinement during winter, and early spring consumption of food with a high water content. Colonies located in moist areas or areas with poor air drainage may often exhibit signs of dysentery. To prevent dysentery, make sure hives are well ventilated and stocked with high-quality food. If fall feeding is necessary, be sure

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to do it early enough so the bees can properly ripen their stores. Hives should be rainproof and situated in a dry location. Good air circulation is important.

Pesticide kill

Pesticide poisoning of honey bees can be a serious problem for beekeepers, especially near areas of intensive agricultural crop production or when serious pest outbreaks warrant increased pesticide applications. Pesticides can have lethal or sublethal impacts on bees. Some pesticides necessary in crop production are toxic to honey bees. Colonies may be completely destroyed by a pesticide, but more commonly only field bees are killed. Large numbers of dead bees (sometimes piled) around the outside of the colony are characteristic of a pesticide kill. Sublethal pesticide kills are difficult to diagnosis. Colonies exposed to pesticides that do not kill bees outright may be more susceptible to disease, have difficulty replacing aging queens, and/or be less productive.

Winter kill/starvation

Overwintering colonies sometimes run out of honey or the cluster is positioned so that the bees cannot reach the honey, and the bees starve to death. This is characterized by large numbers of dead bees piled on the bottom board and/or a cluster of dead bees found with their heads in the cells. Mold may be evident on the comb from decaying brood and/or adult bodies.

Robbing

Colonies will sometimes rob one another of honey. This happens particularly when there is no nectar flow or when honey is being removed by the beekeeper. Typically, stronger colonies will rob weaker colonies, but in some cases even strong colonies can be robbed out. Robbing behavior is characterized by large numbers of bees clumping on the outside of a colony seeking entry at various sites and the bees being more aggressive in general.

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Paralysis

Paralysis is a symptom of adult honey bees and is usually associated with viruses. Two different viruses, chronic bee paralysis virus and acute bee paralysis virus, have been isolated from paralytic bees. Other suspected causes of paralysis include pollen and nectar from plants such as buttercup, rhododendron, laurel, and some species of basswood; pollen deficiencies during brood rearing in the early spring; and consumption of fermented stored pollen.

Laying workers

On occasion, a colony that is attempting to replace its queen due to swarming, supersedure, or emergency loss will not be successful. In the absence of the queen and capped brood in the colony, some workers will begin to lay eggs. Eggs produced by laying workers are easy to distinguish from normal queen-laid eggs. Typically, many eggs are laid per cell and not positioned in the bottom of the cell. Colonies in this condition are termed “hopelessly queenless” and will not rear new queens, even after receiving a frame of young brood or accepting an introduced mated queen.

Colony Collapse Disorder (CCD)

Colony Collapse Disorder is the name given to colonies that die exhibiting the following symptoms: (1) the rapid loss of adult worker bees from affected beehives, resulting in weak or dead colonies with excess brood present relative to adult bees; (2) a noticeable lack of dead worker bees both within and surrounding the hive; (3) the delayed invasion of hive pests (e.g., small hive beetles and wax moths) and kleptoparasitism from neighboring honey bee colonies; and (4) the absence of varroa and nosema loads at levels thought to cause economic damage. CCD can cause large-scale wintering losses.

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Honey Bee Diseases:
Predators of Honey Bees

Skunks and opossums

In some locations, skunks, opossums, and occasionally raccoons are serious threats to successful beekeeping because they hamper the development of strong colonies. Being insectivorous (insect eating), skunks will raid bee yards nightly, consuming large numbers of bees. Although such attacks are most common in the spring, they can also occur throughout the summer and fall.

FIELD SYMPTOMS

- **Indications of skunk feeding at hive entrance**
  To capture bees, skunks scratch at the hive entrance and eat the workers when they come out to investigate the disturbance. A successful skunk will repeat the process several times and may feed at the hive entrance for an hour or more, rapidly depleting the bee population. Since skunks usually return night after night, colonies visited by skunks may become defensive and weakened. You can detect skunk predation by the scratch marks and mud at the entrance of the hive and the packed-down or torn-up vegetation in front of the hive.

- **Skunk feces with honey bee exoskeletons**
  Skunks also leave behind small piles of chewed-up bee parts. The skunk chews the bees until it consumes all the juices and then spits out the remains, which resemble cuds of chewing tobacco. Opossums and raccoons sometimes attack an apiary in a similar manner and cause damage similar to that of skunks. The feces of these animals also contain large numbers of honey bee exoskeletons since animals cannot digest this material.

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CULTURAL CONTROL

- **Elevated hives**
  Strong bee colonies sometimes put up a good fight against skunks and other hive visitors, but weaker colonies usually fall victim. Maintaining strong colonies, therefore, is a partial deterrent to animal predation. One method to discourage predators is to attach screens or queen excluders to the hive entrance. These devices hamper the skunk's efforts to scratch at the entrance. Elevating the hives on blocks or stands may help by making the skunk's belly vulnerable to stings. Fencing the bee yard with a low fence is an effective, but more costly, technique. Moving your bees to a new location is another option.

Bears

Bears are a serious threat to beekeeping operations because they do a great deal of damage to hives and equipment. They normally visit apiaries at night, smashing the hives to eat brood and honey. Once bears locate an apiary, they return again and again, and controlling their marauding behavior becomes exceedingly difficult.

CULTURAL CONTROLS

- **Apiary location**
  Beekeepers can take several precautions to reduce the chances of bear damage. Bears typically move through their home ranges using preferred travel lanes, which often follow certain ridges, ravines, streambeds, or forest edges. Beekeepers may prevent bear damage by carefully selecting the apiary site. Placing colonies on or near bear crossings or dumps that serve as bear food sites will most likely result in problems. Research has shown that the farther bee yards are located from forest edges and ravines, the lower the chances of bear visitation.

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- **Exclusion—bear fence**
A sturdy electric fence can protect an apiary from bears. Such a fence must be dependable, relatively cheap to construct, and capable of operating in remote locations. Fences are totally ineffective if not installed and managed properly. Avoid a site with overhanging trees because limbs might fall across the wires. It also is quite common for bears to climb trees and then drop down inside the fence. Control grass and weeds along the fence so they will not contact the charged wires and short them out. For more detailed information about constructing bear fences, see the MAAREC website, **maarec.psu.edu**.

- **Bear trap (culvert-style)**
Whenever possible, game commission personnel try to trap a nuisance bear and move it to an area where damage is less likely to occur and where it is desirable to increase bear population levels. To capture problem bears they use special foot snares or baited culvert traps mounted on small trailers.

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Pests of Honey Bees

Wax moths

Two species of wax moth attack hive products: the greater wax moth, *Galleria mellonella*, and the lesser wax moth, *Achroia grisella*. Of the two, the greater wax moth is considered the most destructive. Larvae of this moth cause considerable damage to beeswax combs left unattended by bees. Beeswax combs in weak or dead colonies and those placed in storage are subject to attack. Wax moths pose a continuous threat, except when temperatures drop below 40°F (4°C).

LIFE HISTORY

- **Adult wax moths**
  Adult female wax moths fly at night and deposit masses of eggs on unprotected beeswax combs and in the cracks between hive bodies. After a few days, these eggs hatch. The larvae crawl onto the comb and begin feeding in protected areas, often near the center midrib of the cells. They spin silken galleries for protection from bees, which will remove the wax moth larvae if they get the chance.

FIELD SYMPTOMS AND DIAGNOSIS

- **Damaged combs showing silken galleries**
  Wax moth larvae damage or destroy the combs by chewing through the beeswax cells as they feed on bee cocoons, cast skins, and pollen. Initially, only a few silken galleries will be seen, but within in a short time, beeswax combs are often reduced to a mass of webs and debris. Wax moth larvae seldom attack new beeswax combs or foundation, and they will not feed on blocks of pure beeswax, candles, or other such items made from beeswax.

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- **Cocoons attached to frames**
  When fully grown, the wax moth larva spins a rough silken cocoon, which is usually attached to a frame or the inside of the hive. The larva frequently cements the cocoon inside a boat-shaped cavity chewed into the wood. Chewed wooden frames are weakened and easily broken. Within the cocoon, the larva changes to the pupa and overwinters in the pupal stage. Under warm conditions, adults may emerge at almost any time of year.

CULTURAL CONTROL

- **Strong colonies**
  The best defense against wax moths is to maintain strong, healthy colonies. Strong colonies can defend themselves against wax moths, whereas weak colonies cannot. Comb honey and equipment stored off colonies must be protected from this pest. During the winter, store honey and brood combs in an unheated shelter to prevent wax moth damage. During periods when wax moths are problematic (summer and fall), store honey supers, brood combs, and comb honey in a freezer or exposed to light twenty-four hours a day.

Hive beetles

The small hive beetle (*Aethina tumida*), North America's newest beekeeping pest, was first identified in Florida in the spring of 1998. This pest originated in Africa, where it is not considered a serious pest. Some U.S. beekeepers experiencing heavy infestations, however, have blamed it for the quick collapse of colonies. The beetle also defecates in the honey, causing it to ferment and run out of the combs. Most vulnerable are weak hives with stored honey or full honey supers either in storage or above bee escapes.

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LIFE HISTORY

- **Adult hive beetles** ▶ ▶ ▶

  The adult beetle is small (about one-third the size of a bee), black, and covered with fine hair. Adult beetles are good fliers and can travel long distances. When it finds a honey bee colony, the beetle lays its eggs on or near beeswax combs.

- **Masses of small hive beetle larvae** ▶ ▶ ▶

  The eggs hatch, producing masses of small larvae similar in appearance to wax moth larvae. The larvae consume pollen and comb but will also eat eggs and young larval honey bees. After completing the larval stage, they crawl out of the hive and pupate in the soil. Areas of the country with sandy soils appear to be most suitable for successful small hive beetle pupation and reproduction.

- **Comparison of beetle and wax moth larvae** ▶ ▶ ▶

  You can differentiate the hive beetle from wax moth larvae by examining their legs. Both species have three sets of legs just behind the head, but small hive beetle larvae lack the series of paired prolegs that run the length of the wax moth larva's body.

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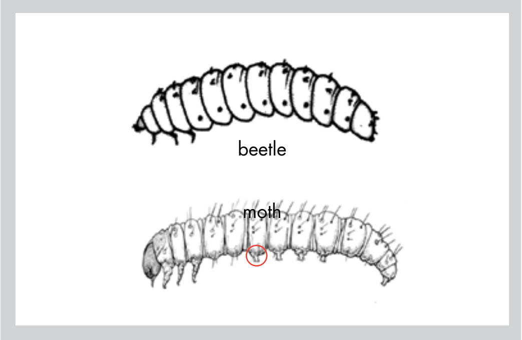

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FIELD SYMPTOMS AND DIAGNOSIS

- **Signs of small hive beetle damage**
  Adult beetles can sometimes be observed in cracks and crevices within a bee hive. Small hive beetle damage by larvae can often first be noticed by looking at the bottom board. Heavily infested colonies often have fermenting honey leaking from their entrances. While it seems unlikely that small hive beetles actually kill colonies, weak colonies are often overrun by the larvae in a very short period of time.

CULTURAL CONTROL

- **Strong colonies**
  The best defense against hive beetles is to maintain strong, healthy colonies. Strong colonies can defend themselves against this pest, whereas weak colonies cannot. In areas where this pest is found, honey removed from colonies and stored for extracting must be protected by extracting immediately or storing at low humidity (less than 50 percent).

Bee louse (*Braula coeca*)

Braula coeca, commonly known as the bee louse, is actually a wingless fly. The adults are small (slightly smaller than the head of a straight pin) and reddish brown in color. Although several adult flies may live on a queen, usually only one will be found on a worker. These pests do little harm, and because they are susceptible to treatments for parasitic mites, *Braula coeca* are found only rarely in colonies today. A casual glance, however, may lead one to mistake *Braula* for varroa mites because they are so similar in color and size. *Braula coeca* have six legs while varroa mites have eight.

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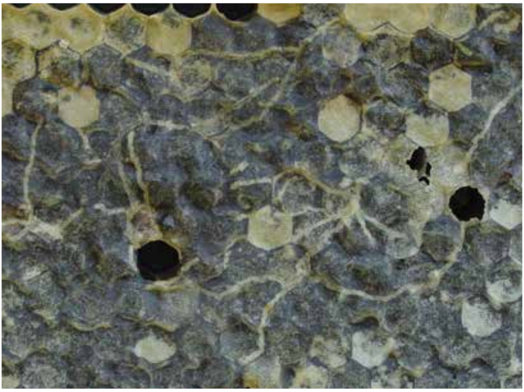
LIFE HISTORY

Braula move rapidly over the body surface of adult bees, settling on the dorsal surface at the junction of the bee's thorax and abdomen. They remain there until a hunger response causes them to crawl up to the bee's head near its mouthparts. This movement seems to cause the bee to regurgitate a drop of nectar. The bee louse then inserts its mouthparts into those of its benefactor and takes its food. The louse lays its eggs on the cappings of honey storage cells from May through July. Upon hatching, the young burrow into the cappings. The larva pupates inside the tunnel. Soon after emergence, the young adult crawls onto a bee.

FIELD SYMPTOMS AND DIAGNOSIS

- **Bee louse tunnels under honey cappings** ▶ ▶ ▶
  As the larvae grow, their tunnels lengthen and broaden. These tunnels are symptomatic of the presence of immature *Braula*. The tunneling larvae can damage the appearance of comb honey.

- **Queen with attached *Braula*** ▶ ▶ ▶
  If present, *Braula* adults are often found on queens, but their damage to a honey bee colony is minor. The amount of food taken by the larvae and adults is negligible.



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Other pests

MICE

Mice are a serious pest of stored comb and wintering honey bee colonies. These rodents chew combs and frames to make room for building their nests. They also urinate on combs and frames, making bees reluctant to use the combs or clean out these nests in the spring.

- **Mice damage to combs**

  Adult mice move into bee colonies in the fall and usually nest in the corners of the lower hive body, away from the winter cluster. Bee colonies located near fields or at the edge of wood lots where mice are common are especially vulnerable. Mice can build a nest successfully even in a strong colony. They move in and out of the colony while the bees are clustered. Their activity may disturb the bees, but their nest building causes the greater damage to combs and equipment.

- **Hardware cloth fitted to hive entrance**

  To keep the mice out, restrict the entrance to bee colonies with entrance cleats or three-mesh-to-the-inch hardware cloth early in the fall. Chase out any mice found inside a colony, then remove the nest and insert the hardware cloth. If comb chewing is extensive, replace the frames. When bees repair damaged beeswax comb, they often replace worker-sized cells with drone comb.

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ANTS

Ants are not usually serious pests in honey bee colonies. Occasionally, however, certain species may enter colonies to search for food or establish nesting sites. Ants are typically found between the inner and outer covers of the hive and in pollen traps. Although ants seldom disturb the bees, they can be a nuisance to the beekeeper.

- **Colonies raised off ground**
  Ants are difficult to control once they are established in a colony. To minimize ant problems, maintain strong colonies and keep bottom boards raised off the ground. Also, remove brush, rotten wood, grass, and weeds from around the colonies. If ants are a persistent problem, place single colonies on stands with the legs in containers of oil or coated with a sticky barrier. Allowing the bees access to the space between the inner and outer covers may reduce ant problems between the covers. Sometimes moving the colony a short distance or placing colonies in the sun rather than the shade will alleviate ant problems.

OTHER INSECTS

Bee hives are attractive to other creatures besides ants. Termites attack wooden hive parts; earwigs and roaches live inside covers; and more than a dozen other types of insects and related arthropods can be found inside a bee colony. Virtually all are minor pests that cause little harm. Outside, spiders and a whole host of insects may feast on bees captured at the entrance or at flower foraging sites. Yellowjackets are common hive scavengers in the fall and in some regions, such as the West Coast, are constant pests. Fortunately, most are of minor significance and healthy colonies can survive losses of occasional foragers to such pests.

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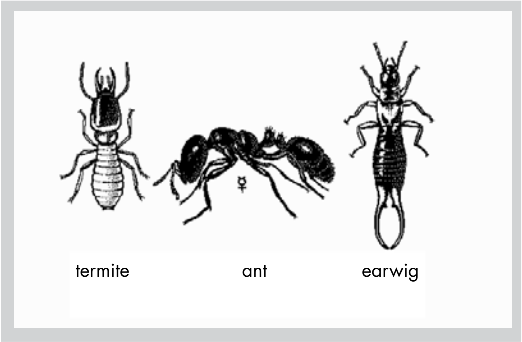

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African/Africanized Honey Bees

Apis mellifera scutellata

African bees are the subspecies or races of *Apis mellifera* that evolved long ago under tropical and subtropical conditions in Africa. The original Africanized honey bee was the hybrid resulting from the cross between African and European honey bees. This cross was accidentally released from a bee breeding study in Brazil in the 1950s and since has spread throughout most of South America, Central America, and Mexico. It moved into Texas in 1990 and continues to spread in southern states.

RANGE

The spread and current range of the Africanized bee in the United States can be viewed at **ars.usda.gov/Research/docs.htm?docid=11059&page=6**. The eventual range to which these bees will extend is unclear; however, considering the negative impact stinging incidences can have on the beekeeping industry, all beekeepers should be on the lookout for possible behaviors and traits that may be evidence of Africanized stock.

Africanized and European bees are nearly identical in appearance. The only way to be sure which strain of bee is in a hive is to perform morphometric or genetic testing on a sample of bees. However, Africanized honey bees demonstrate several behaviors that may help in selecting colonies that should be sampled. None of these traits on their own should be used for diagnosis.

FIELD SYMPTOMS

- **Swarming**

  The successful spread of Africanized bees across the Americas is in part due to their high rate of reproduction—they swarm far more frequently than European bees. Africanized bee colonies will often rear numerous swarm cells, and on occasion several virgin queens can be found in a colony at the same time. Africanized colony swarms tend to be smaller and much more numerous than swarms from European races of honey bee. The cavities in which Africanized honey bees swarms settle also tend to be smaller than European honey bees would accept. Africanized bee colonies can be found in closed BBQs, upturned plant pots, and used rubber tires.

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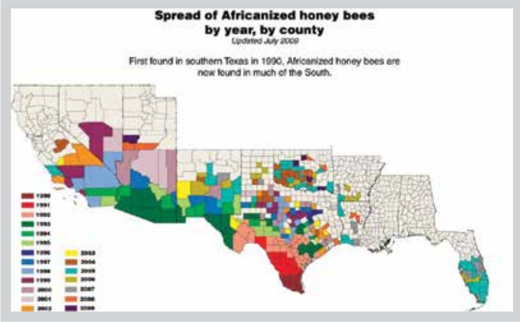

USDA

D. SAMMATARO, USDA

- **Colony usurpation**

  Another behavior that has contributed to the successful spread of Africanized honey bees is referred to as usurpation. This occurs when a small swarm of bees settles on the front of a European colony. The swarm of bees, with its accompanying queen, then moves into the colony and kills the original queen, and the Africanized queen takes over. Queenless colonies are particularly susceptible to usurpation.

- **Defensiveness**

  Africanized honey bees, sometimes referred to as "killer bees," are notorious for their defensive behavior. While defensiveness can vary, Africanized bees are much more sensitive to the alarm pheromone. Once the pheromone is released, individuals within a colony or from other colonies within an apiary are very likely to respond. Attacking bees will often pursue individuals for a quarter mile or more. If you are attacked, cover your face, run, and get inside.

- **Brood pattern**

  The typical brood area on a frame in European colonies is surrounded by a ring of bee bread and honey, with the capped and uncapped brood in the center. Africanized honey bees sometimes fill brood frames wall to wall with brood, leaving little room for honey or pollen to be stored at the frame's edge. They tend to collect more pollen and use a higher percentage of comb cells for brood rearing.

D. GILLEY, USDA

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M. SPIVAK, U. OF MN

- **"Runny" behavior**
  When examining an Africanized honey bee colony, the bees will often run excessively on the combs and/or fly from the frame in large numbers. A ball of bees hanging from the lower frame edges and a lack of bees covering brood is distinctive. This behavior additionally makes finding Africanized honey bee queens particularly challenging.

CULTURAL CONTROL

If colonies exhibit the characteristics above, requeening with European stock is highly recommended. Maintaining gentle, manageable stock is especially important in populated areas.

D. CARON, U. OF DE

D. SAMMATARO, USDA

Pests Currently Not Found in North America

A number of important honey bee pests are not currently found in North America. These are potentially destructive, so beekeepers should be familiar with them and on the lookout for their presence.

Large hive beetles

(*Oplostomus haroldi*)

This scarab beetle is about ¾ inch (18 mm) long and, when present, is very conspicuous in the hive. It can vary in color from solid black to black with orange or red longitudinal stripes. This beetle is common in some areas of Africa and seems to be "tolerated" in the hive by the bees. Like the small hive beetle in Africa, it is typically considered an incidental pest. But in coastal areas of Kenya where 200–300 of these beetles have been found in a single colony, their presence can cause a colony to abscond.

Euvarroa

This mite is parasitic on the brood of the tiny Asian honey bee, A. *florae*. Euvarroa females are brown in color, pear shaped, and smaller than *Varroa destructor*. Their biology is similar to V. *destructor*, except that in Thailand they were found to enter only drone brood. Adult females are phoretic on both workers and drones.

Tropilaelaps

(*Tropilaelaps clareae*)

This mite (on right) compared with *Varroa* (on left), another native of Asia, is parasitic on A. *dorsatas* and is light reddish brown and elongated. It has been reported on A. *florae*, A. *cerana*, and *Apis mellifera* in the Philippines where it has been problematic for beekeepers.

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E. MULI, INTERNATIONAL CENTRE OF INSECT PHYSIOLOGY AND ECOLOGY

B. SMITH, USDA

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WEBSITES

Mid-Atlantic Apiculture Research and Extension Consortium (MAAREC): maarec.psu.edu

Center for Pollinator Research (CPR): ento.psu.edu/pollinators

eXtension: www.extension.org/pages/Bee_Health_is_Focus_of_New_National_Web_Resource

FOR MORE INFORMATION

To learn more about honey bees or view slide shows on this material, visit the Mid-Atlantic Apiculture Research and Extension Consortium website at **maarec.psu.edu**.

To order A *Field Guide to Honey Bees and Their Maladies* as a CD, contact:

Department of Entomology
The Pennsylvania State University
501 ASI Building
University Park, PA 16802

For brood disease laboratory diagnosis, send samples to:

The Beltsville Bee Lab
Bldg. 476
BARC-East
Beltsville, MD 20705

Phone: 301-504-8250

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Notes

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