Diseases and Pests In A Beehive

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Tenth In A Series . . . Examine How These Materials Are Used In The Hive

In this session, we will look at the nature of the beehive and how it supports a wide range of diseases, parasites and pests. The instructor's emphasis is on recognition of healthy bees and brood, and being able to detect that something is not right in the hive.

Classroom discussion

The social nature and nest of the bee colony provides a remarkable opportunity for disease, parasites and pests to develop and thrive. The treasure trove of resources bees collect – honey and pollen – combine with the tremendous riches of developing bee brood to attract creatures of a diverse nature that eagerly exploit these items as food. From the large powerful bear to the odoriferous skunk to a tiny pollen mite, various creatures stand ready to enjoy a meal at the colony's expense.

Nest habitats – in a tree trunk, a rock outcropping or the side of a building – provide a dark, humid and temperature controlled environment where both parasites and diseases flourish. The darkness allow insects like the **small hive beetle** and the **wax moth** to enter and hide in crevices in the comb so bees are unable to detect or physically remove them. Adult moths enter the hive at night, soon after dark, when they are harder for the bees to detect. Hive beetles enter hives that are weak, diseased, undergoing queen change, or are released from propolis prisons after being visited by a beekeeper, taking advantage of the disruption of ordinary colony control and entrance protection.

Integrating adaptions to bee behavior with a unique body shape allows ***Varroa* mites** to feed on the bee in the late larval and pupal stage within the darkness of the cell, at first hiding in the royal jelly and brood food deposited at the cell bottom as food for the developing bee. Once the bee emerges the adult mite crawls between the abdominal plates of the bee to feed on the haemolymph, or blood, of the bee. When worker bees are able to make contact with the mite they may attack it and damage its body, but the mite is only exposed to the adult bees during a short period of its life cycle.

Natural hives are unique combinations of architecture and bee modification. When we review the features of the bee nest, its volume, entrance size, and orientation to the sun, we realize that the bee colony has rather specific needs to occupy a space that is not too large or too small. New swarms begin comb construction from the top of the empty chamber, attaching beeswax to the wood or rock of the site. As the colony grows in size the bees build a large percentage of the comb they will ever need, doing so in about three months time. The wood or rock are cleared of debris and coated with plant resins called **propolis** that can be quite thick. The propolis serves to waterproof the nest while its remarkable properties reduce the development or rate of growth of numerous fungi, bacteria and viruses. The exception is the bottom of the nest, which seems to serve as a natural recycling area for the debris of the colony – dropped pollen, bits of wax, comb pieces and wood trimmings. The bees do not coat these materials with propolis, but seem to invite organisms to degrade this waste. Mites, small beetles, and other insects are found inside a hive feeding on the debris of the colony but pose no concern to the bees themselves.

This unique ecological habitat is complex and we continue to learn more about the relationship between various other organisms and the bee colony. It is remarkable that some beekeepers will place a hive over a nest of fire ants in the southern states as a means of controlling wax moths and other pests, without harm to the bees or their valuable resources. Newer beekeepers must learn to approach each non-bee occupant of a hive with the query – is this creature a threat to the colony, or is it actually beneficial to the social nest? Many hive occupants are undoubtedly benign, causing no harm to the bees but simply exploiting the cast-off riches of the hive.

Various pathogens from several disease categories are indirect benefits of the community feeding and stomach bee colonies use to share food and queen pheromones. Bacteria, fungi and viruses are easily spread throughout a colony by the mouthparts of contaminated bees to those that have not had contact with the pathogen. These diseases have exploited this unique bee behavior as a method of spread and growth within the hive, sometimes leading to colony death.

Laboratory activities

Examine bee free-nests of the bee colony for evidence of other organisms. These may be colonies that have died in the field, perhaps overwinter. Set all hive materials on heavy paper or layers of newspaper to allow for sanitary removal in case of disease contamination.

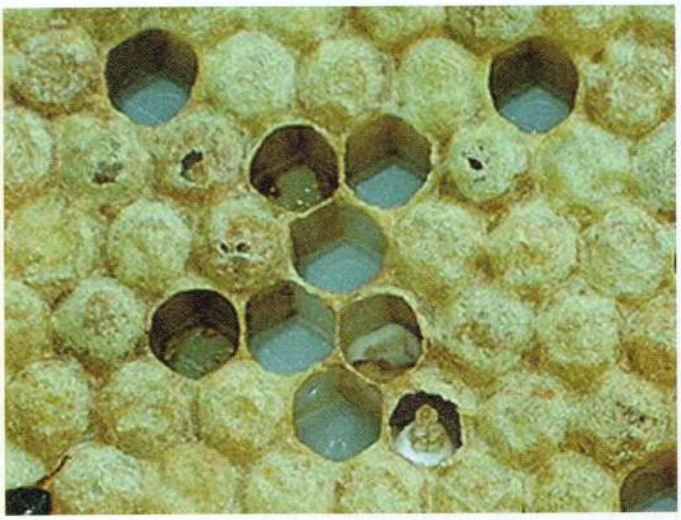
Look for evidence of wax moths for start, searching for the **trail of**

silk in the comb to the **chewed wood** where pupal cocoons were formed by the metamorphosing larvae. Look at the deposits of propolis in the hive, where the propolis is thickest, and consider how this has protected the bees. In natural nests examine the bottom of the nest for debris of pollen, wax, wood and other material found there. Then look at the wide range of mites, beetles and other organisms that thrive in this energy-rich environment.

Now examine the cells of wax. Find the cells where the bees raised brood. Look for remains of materials in the bottom of these structures. You need to carefully determine if there are dried dead bees, called scale, in these cells, as this may be due to one of the most dangerous bee diseases, called **American foulbrood**. The scale, formed from the diseased larval or pupa in the cell that has been killed by the ABF bacteria, will be tightly attached to the bottom of the cell. Submit a sample of the comb to a recognized government laboratory that will examine the material and determine that is or is not AFB. Once you finish the examination of material, treat the samples as if they are diseased, and seal up the hive bodies and sanitize all equipment that contacted the sample.

Another common cause of colony death is **starvation**. The bees crawl into the cell as part of the winter cluster and generate heat with the last of the honey available to them. Should the cold persist while they are unable to reach additional honey, the bees will die of starvation. Because the colony shares food, they will all die at nearly the same time. There may be stored honey in the hive located in comb some distance from the cluster. This honey is safe to use in other colonies or to harvest in most situations.

Bees that have died of starvation usually come out of the cell with ease when removed by a pair of laboratory forceps. Since the inside of a winter colony is moist due to colony respiration burning honey for heat, this promotes growth of fungi on the dead bees, and this can present as a pretty disgusting mess. Removal is more difficult, but not necessary. A frame with moldy, starved out bees poses no clear risk to a strong colony. Add a frame or box to a strong colony and return in a few days and you will find that much of the dead bees and fungal growth has been removed, the cells polished, and perhaps some new food stored in the cells.



Bees transfer the fungal spores with their mouthparts, making disease removal a challenge. Many beekeepers change the queen, looking for a more resistant stock as well as creating a break in the brood cycle, so the re-infection process if broken.

Colony debris should also be examined. Look for white and dark mottled cadavers of dead bees in brood cells as well as at the entrance. These are the dead bodies of a fungus-infested larvae form a disease called **chalkbrood**. This is often observed when the season has been cool and damp, although some strains of bees seem to be more susceptible than others. Chalkbrood spores are airborne and probably found in all bee yards – it is the environmental conditions that determine susceptibility. Drone brood seems to be more susceptible than worker brood.

Hive Inspections

Key to healthy hives is the beekeeper's ability to look at a colony and determine, accurately, that there are no problems in the hive. This is strangely difficult for some people to do. They see diseases in healthy bees and brood, but fail to recognize disease or infested bees.

Healthy bee recognition – Healthy bees will be fully developed, their wings will be crossed over their bodies and they will be at rest or actively working in the hive. Diseased or malnourished bees may be reduced in size, or their wings unhooked, creating a condition called **K-wing**. Don't confuse newly emerged worker bees with those that are deformed. Bees being removed by other bees at the entrance should be examined for deformities. They may also be old or pesticide-exposed.

Healthy brood recognition – Eggs, larvae and pupae are pearly while and shiny. Any discoloration, yellowing, browning, or lack of shine should command a second look. Bees removed in the sealed pupal stage

A disturbed wax moth larvae moving rapidly over a brood comb. Even the smallest larvae move quickly, and are usually hidden in silk in the midline of brood combs, or along edges until the colony is overtaken. Wax moths are Lepidoptera, and lack the spines on the body that are found on the small hive beetle, order Coleoptera. Most beekeepers keep there colonies strong and healthy to avoid both beasties!

should show normal pigmentation and be free of *Varroa* mites. Drone brood is about nine times more attractive to *Varroa* than worker brood, so look there first. *Varroa* mites move quickly and are sometimes missed on inspection.

Screened bottom board droppings – I recommend the use of screened bottom boards as a means of increasing hive ventilation as well as providing a means of detecting problems inside the hive. The obvious use is to insert the tray that is part of the screened bottom board, apply cooking spray or another sticky material, and return in two or three days and count the number of *Varroa* mites found on the board. Small hive beetles and wax moth larvae will also fall through the screen and be detected there. Wax moth caterpillar droppings are easily recognized as symmetrical cylinders of dark material (not round mites). Other secondary pests are found there including other beetles and pollen mites, so examine with care and get help or submit a sample if suspicious of something that does not appear right. BC

Once wax moths take over a weak or dead colony their population explodes. The larvae feed on the pollen, broodcomb and beeswax. They produce silk cocoons that are the larvae chew into the wood and fasten the silk to, making removal difficult. Freezing kills the wax moth, so outside storage is better then heated storage. The black fecal pellets are one of the things a sharp-eyed beekeeper looks for on a tray in a screened bottom board.

Vocabulary

Colony social nature, nest habitat, wax moths, small hive beetles, role of darkness inside the hive, bee blood, nest architecture, nest volume and characteristics, new swarm comb construction, material at the bottom of a hive, debris feeding insects and mites, bacteria, fungi, viruses, contaminated mouthparts, trail of silk, chewed wood, propolis deposits, American foulbrood, scale, disease sanitation, starvation, reusing comb after dead-out, chalk brood, hive inspections, disease cadavers, characteristics of healthy bees, characteristics of healthy brood, screened bottom board evaluation.

References

Connor, L.J. 2012. *Bee-sentials: A Field Guide*, Chapter 8. Wicwas Press. Kalamazoo, MI. www.wicwas.com