

Chalkbrood infections are not always visible in the brood nest. Therefore, beekeepers who collect pollen to sell or to feed to their bees should check the pollen and pollen traps from each colony for whole mummies or mummy parts. No treatment is presently available for control. However, colonies with persistent cases may benefit from requeening, particularly with hygienic stock.

### STONEBROOD

Stonebrood is also a fungal disease. Several fungi belonging to the genus *Aspergillus* are associated with the disease, the most common being *A. flavus* and *A. fumigatus*. However, *A. flavus* is considered, by far, the most important.

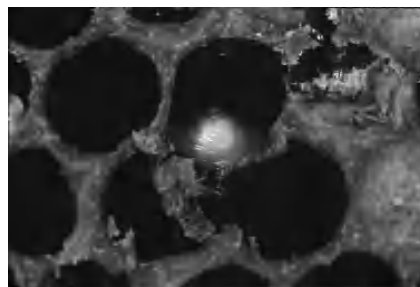
Both larvae and pupae are susceptible. The disease causes mummification of the infected brood. Mummies are hard and solid, not sponge-like as in the case of chalkbrood. Brood infected by *A. flavus* become covered with a powdery green growth of fungal spores. The spores are found most abundantly near the head of the affected brood.

This disease is considered of minor importance and is rarely encountered. No treatment is recommended. The bees remove the dead brood on their own and the colony normally recovers in a short period of time.

### PARASITIC MITE SYNDROME (PMS)

For the past several years, we have been seeing diseased bee larvae with symptoms resembling a cross between foulbrood and sacbrood. The USDA Beltsville Bee Lab has found these diseased larvae to be infected with one, or commonly several, viruses. This situation is associated with varroa mites. The complex of symptoms has been given the name "Parasitic Mite Syndrome" or PMS.

Affected larvae die in the late larval or prepupal stage, stretched out in their cells often with their heads slightly raised (Figure 45). In the early stage of infection, they are white but dull rather than glistening, and they look deflated. Later, the larva may have gray or brownish spots. Prepupae die after the cell has been capped, and the cappings may be perforated or completely removed by the bees. When the larval remains are stirred with a toothpick or small twig, they do not rope out but are globular (similar to European foulbrood).



**Figure 45. Virus-infected larva.**  
(Courtesy Maryann Frazier)

Since the virus complex is associated with varroa mites, controlling varroa is important in combating or at least controlling these viruses. Because many infected colonies seem to collapse in early fall, dealing with mite populations well before this time is necessary. Please see information under "Varroa Mite" for details on managing these mites in honey bee colonies.

Several years of survey data collected in the MAAREC region indicate that beekeepers treating varroa mite-infested colonies in autumn with fumagillin (Fumidil-B®) significantly improved colony winter survival. Fumagillin fed in sugar syrup is used to suppress nosema disease in overwintered colonies and newly established packages. Nosema disease weakens the digestive tracts of infected bees and may allow pathogens to enter the honey bees' guts where they can cause significant damage. Treating colonies in fall with fumagillin might help to protect bees from some of the pathogens associated with varroa mites, thus improving their chances of survival. Please see "Nosema" and the appendix at the back of this book for more information on treating colonies with fumagillin.

## Diseases of Adult Bees

### NOSEMA

Nosema disease, an obscure killer, is caused by a spore-forming protozoan (*Nosema apis*) that invades the digestive tracts of honey bee workers, queens, and drones. Spores of the disease are ingested with food or water by the adult bee. The spores germinate and multiply within the lining of the midgut. Millions of spores are shed into the digestive tract and eliminated in the feces. Damage to the digestive tract may produce dysentery and weaken the bees. 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. When queens become infected, egg production and life span are reduced, leading to supersedure. Infected workers, unlike healthy workers, may defecate in the hive. Diseased colonies usually have increased winter losses and decreased honey production. The loss of queens in colonies newly started from package bees is the most serious effect of the disease.

Even though nosema is a common disease of bees, it generally goes unnoticed in the apiary since it does not produce signs or symptoms that are easily recognized under field conditions. In fact, the presence of the disease is not usually realized until most of the bees in the colony are infected. The only positive way of identifying the disease is through dissection of adult bees. The hind gut and digestive tract of diseased bees are chalky white or milky white. Healthy bees, on the other hand, have amber or translucent digestive tracts. In addition, individual circular constrictions of a healthy bee's gut are visible, whereas the gut of an infected bee may be swollen and the constrictions not clearly visible. Infection is best detected by the microscopic examination of macerated abdominal tissue for the presence of spores.

Nosema disease is most prevalent in the spring. Severity of infection varies among colonies, geographic regions, and from year to year. In overwintered colonies, confined infected bees may defecate on the combs and infect healthy bees as they clean the combs in the spring. Food stores and soiled shipping cages are other sources of infection. Spores are spread by infected package bees, splits, and contaminated equipment. Combs from weakened colonies that died during the winter often have nosema-contaminated feces. Installation of packages or divisions on this equipment in the spring hampers colony development and often results in queenlessness.

Queens may become infected from various sources after they emerge from the queen cells or are released in mating nuclei. When the disease is severe, colony populations may become depleted and eventually dwindle to a handful of bees and a queen. This is often referred to as "spring dwindling." In colonies that are only mildly affected, brood rearing eventually allows the colony to recover.

Colony confinement during winter or inclement weather in the spring encourages nosema disease buildup. Winter cleansing flights enable bees to

defecate outside, thus preventing spore contamination within the cluster. Nosema-sick bees often fly from the hive at marginal flight temperatures, probably because they are under stress. Since they are weak, they drop to the ground, become chilled, and are unable to return to the colony. Sick bees are thereby eliminated from the colony. The intensity of infection usually subsides in April as field flights begin and brood emergence accelerates.

Brood emergence, the colony's primary natural defense against nosema, replaces infected bees with young healthy bees. If nosema is already present, any break in the brood-rearing cycle will likely increase the incidence of the disease, especially in early spring. Newly hived package bees are very susceptible to nosema. During the first 3 weeks following installation, when the colony has no emerging young bees, the disease can spread rapidly through the old adult population and to the queen.

The best defense against nosema is to winter only strong colonies with plenty of honey in the proper position and with young vigorous queens. Many different chemicals have been tested for control of the disease, but only Fumidil-B® (fumagillin) has proven effective. Fumagillin is especially effective in suppressing nosema in overwintered colonies and newly established packages. However, since fumagillin does not affect spores of the nosema parasite, treatment with this drug will not completely eliminate the disease from the colony.

For detailed information on using fumagillin for the treatment nosema disease, see the appendix or visit the MAAREC Web site: [maarec.cas.psu.edu](http://maarec.cas.psu.edu). If you do not have Internet access, contact your local cooperative extension office.

**CAUTION:** *No medication should be fed to colonies when there is danger of contaminating the honey crop. Be sure to stop feeding fumagillin at least 4 weeks before the onset of the honey flow.*

## **PARALYSIS**

Paralysis, a minor disease of adult honey bees, is usually associated with virus. Two different viruses, chronic bee paralysis virus (CBPV) and acute bee paralysis virus (ABPV), have been isolated from paralytic bees. Other suspected causes of paralysis include pollen and nectar from such plants as buttercup, rhododendron, laurel, and some species of basswood; deficient pollen during brood rearing

in the early spring; and consumption of stored fermented pollen.

Bees affected by this disease tremble uncontrollably and are unable to fly. In addition, they lose the hair from their bodies and have a dark, shiny, or greasy appearance. Often mistaken for robber bees, infected bees are submissive to attack whereas robbing bees are not. When paralysis is serious, large numbers of infected bees can be found at the colony entrance, crawling up the sides of the hive and blades of grass, and tumbling to the ground. Healthy bees often tug at these bees in an effort to drive them away from the hive.

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, colonies should be requeened 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.

### DYSENTERY

Dysentery, a condition rather than a disease, is caused by an excessive amount of water in a bee's body. Afflicted bees cannot hold waste products in their bodies. Unable to wait until cleansing flights, these bees void their feces on the combs, at the hive entrance, on the exterior of the hive, and on the snow near the hive in late winter. Two leading causes of dysentery are prolonged confinement during winter and early spring and consumption of food with high water content. Nosema disease and damp hives may also contribute to the problem.

To prevent dysentery, make sure hives are well ventilated and stocked with high-quality food. If fall feeding is necessary, do it early enough so that the bees can properly ripen their stores.

## Parasitic Mites

### VARROA MITE

The varroa mite, *Varroa destructor*, is considered by many to be the most serious malady of honey bees. It now occurs nearly worldwide. This external parasite feeds on the hemolymph (blood) of adult bees, larvae, and pupae. Heavy parasitism results in

heavy bee mortality and subsequent weakening of the colony and can lead to colony death. This is especially true if certain viruses are present and being transmitted by varroa mites.

This mite is an external parasite visible to the naked eye. The female mite is brown to reddish-brown in color and is about the size of a pinhead. Males are slightly smaller and light tan in color. Adult males do not feed and are not found outside of brood cells.

Adult female mites can live outside the brood cells and are primarily found on adult drone and worker bees (Figure 46). This behavior allows them to invade new host colonies and survive the winter in these colonies. The flattened shape of the female's body makes it easy for the mite to hold onto a bee and move easily into the cells of developing bee brood. When on adult bees, female varroa are found mainly on the top of the bee's thorax at the point where the wings attach, between the head and the thorax, between the thorax and the abdomen, or between overlapping segments of the abdomen. These are places where the mites can easily use their piercing mouthparts to penetrate the exoskeleton of their host and gain access to the bee's hemolymph. These are also places where mites are less likely to be removed by the bee's grooming.

When female mites are ready to lay eggs, they move into brood cells containing young larvae just before the cells are capped. They go to the bottom of the brood cells and immerse themselves in the remaining brood food. After the cells are capped and the larvae have finished spinning cocoons, the mites start feeding on the larvae. They begin laying eggs approximately 3 days after the cell has been capped.



**Figure 46. Varroa mites on adult worker bee. Note deformed wings on this newly emerged adult worker. (Courtesy Maryann Frazier)**