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# G96-1302 Managing Varroa in the Midwest

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# Managing Varroa in the Midwest

**There are important regional differences in varroa population dynamics and control. This NebGuide offers recommendations on varroa management for beekeepers in the Midwest.**

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Varroa management has become an essential aspect of successful beekeeping since the mite was first discovered in the United States in 1987. Unlike most parasites which coexist with their host, varroa eventually destroy honey bee colonies of European descent. A good understanding of this important bee parasite is essential for successful beekeeping.

## Host-Parasite Relationships

When two organisms live together in close association, with at least one of them benefitting from the association, biologists refer to the relationship as symbiotic. Symbiotic relationships can occur in several forms: mutualism, in which both organisms benefit from one another; commensalism, in which one organism benefits and the other neither benefits nor is harmed; and parasitism, in which one organism benefits while the other is harmed. Parasites are considered to be efficient when they approach a commensalistic existence and do not seriously harm their host. A parasite's host is likewise considered an efficient host if it does not react strongly to the parasite. After living together under natural conditions for a long time, the parasite and host populations tend to adjust to one another. The symbiotic relationship becomes more commensalistic and the two organisms have less difficulty coexisting.

Until the 1950s, varroa was a parasite on *Apis cerana*, the Indian honey bee. Varroa is commensal on the Indian honey bee and causes little harm to its host. When European honey bees, *Apis mellifera*, were moved into the Indian honey bee's range, varroa found a new host upon which it could proliferate without the checks and balances present with the Indian honey bee. The severe parasitism that

**Figure 1. Varroa mites on worker bee pupa. Heavy infestations result in under nourished and deformed bees. (40K JPG)**

occurs when varroa infest European honey bees is not unusual for a parasite that moves to a new host. In nature, it often takes thousands of years of selection for a more commensalistic relationship based on tolerance to develop. Therefore, it is unlikely that resistance will provide a quick solution to the varroa problem. For now, beekeepers must learn to detect and manage this parasite.

## Life Cycle

Varroa is an obligate parasite of honey bees (*Figure 1*). It cannot survive on bumblebees, wasps, or any other insect. Varroa must feed on both adult bees and brood to reproduce. Like many other parasites, varroa depend upon hormones obtained from their hosts to regulate internal processes such as egg development. Female varroa feed on adult bees for 4-13 days before entering brood cells. After feeding on adult bees, they seek out cells containing larvae preparing to pupate. They enter the cells just prior to sealing, feed for about 60 hours on the developing pupa, and then begin laying eggs. They lay approximately one egg every 30 hours with the first egg becoming a male and subsequent eggs females. Immature mites are white and soft-bodied. Varroa females mature in six days and become reddish-brown and hard bodied. Mites that do not complete their development before the adult bee emerges do not survive. Male mites are smaller than females and remain white and soft bodied throughout their brief lives. They mate with females in sealed brood cells and die shortly thereafter. They do not feed and are only important for their role in fertilizing females. In worker brood, varroa can increase their population only slightly. Estimates of the number of mature female varroa offspring per worker cell entry range from 1.0 to 1.7. When drone brood is present, varroa will preferentially enter drone brood. As the drone brood cycle is longer, more varroa offspring develop per cell. The average number of mature female offspring per drone cell entry is usually between two and three. Varroa populations increase rapidly when drone brood is present.

## Spread

Varroa can be spread by beekeepers moving bees and/or brood from one colony to another. They also can be spread by workers and drones drifting within an apiary. Package bee and queen shipments can spread varroa if shippers do not take appropriate precautions. The most serious spread of varroa occurs in colonies where the social structure has been weakened by mite infestation. As these colonies lose the ability to defend their nests, many varroa mites disperse on robbing bees.

## Detection

The two detection tools recommended for monitoring varroa infestation levels are the ether roll and drone brood examination. The drone brood examination can be performed whenever drone brood is present and is the best approach in this case. A capping scratcher is used to remove approximately 100 mature drone pupae onto a white lid or paper. The pupae are visually examined for oval reddish-brown mites (*Figure 2*). Often they can be observed moving about on the brood. When drone brood is present, more than 70 percent of the mites in an infested colony can be found in drone brood cells.

The ether roll method can be performed any time. To test colonies, collect approximately 300 adult bees in a jar by raking the open jar across the surface of a comb. Force the bees to the bottom of the jar by tapping the jar on a soft surface such as the palm of your hand. Give the bees a one to two second burst of engine starter fluid (which contains ether). Replace the lid and shake and roll the jar (*Figure 3*). If present, mites can be observed sticking to the side of the jar. Because many mites are in brood cells during the summer, the number of mites detected using this method will vary greatly depending on the brood rearing status of the colony. (Do not perform this test near a burning smoker or other ignition source because ether is highly flammable.)

**Figure 2. Drone brood examination for detecting varroa in brood. (23K JPG)**

Midwest beekeepers should test their colonies for varroa twice a year using one of these methods. The best times to test colonies are mid-March to May 1 and again in August. Both methods sacrifice a few bees to provide beekeepers with information needed to make varroa management decisions. Bees lost in sampling will be quickly replaced.

**Figure 3. Ether roll method for detecting mites on adult bees. (23K JPG)**

## Varroa Injury

**Figure 4. Worker bee deformed by varroa feeding injury. (56K JPG)**

Varroa injury can result in deformed or under-nourished bees, bees with reduced longevity, and increased incidence of pathogens (*Figure 4*). When infestation is extensive, severely deformed bees can be observed around the colony entrance. By this point, however, colonies are severely injured and may not recover if treated. Varroa feeding injury provides a port of entry for pathogens, although little is known about this process. One aspect of varroa injury that seems contrary to logic is that the strongest colonies are often the most vulnerable to injury. This is because they raise more drone brood and are more likely to rob weak colonies.

## Control

When varroa mites are detected in the spring, colonies should be treated prior to the main honey flow and drone rearing period. Varroa infestation levels do not increase in colonies that are not rearing brood and increase very slowly in colonies with only worker brood. Therefore, by going into the drone rearing period with few or no mites in the colony, they are protected from the explosion of mites that can occur when drones are being raised. For spring treatment place one Apistan® strip for every five frames of bees and brood in the brood nest (*Figure 5*). It is critical for successful mite control that Apistan strips be placed in contact with the cluster of bees and brood. This is easy in the spring since the cluster is almost always in the second hive body near the lid. Another advantage of spring treatment is that one strip will often suffice as colony populations are at their seasonal low. It is important to treat all colonies in an apiary at the same time to minimize reinfestation.

Fall treatment is rarely necessary if a good spring control program was implemented. However, beekeepers should test colonies in August and treat again if warranted. Varroa infestation can increase in colonies by two routes, existing mites multiplying or new mites invading the colony. Spring treatment is almost always adequate to eliminate damage from mite reproduction; however, invasion pressure of mites from surrounding untreated infestations can make fall treatment necessary. Ether roll testing is the preferred method in August and can be done with bees collected from the honey supers. If six or more mites are found, remove supers as soon as possible and treat colonies with Apistan strips (one strip for every five frames of bees and brood). It is critical to treat these colonies while the queen is still laying so the colony will enter winter with a healthy

adult bee population. Colonies with one to five mites detected by ether roll in August may benefit from fall treatment. However, most will winter with good populations and can be treated more economically the following spring. Ether roll tests conducted in late fall when colonies have ceased rearing brood will yield more mites than similar tests conducted when brood is present. A colony yielding no more than ten mites on an ether roll test in November will usually winter in good condition. A colony yielding one or two mites on an August test may yield 10 or more mites in November.

**Figure 5. Apistan treatment. (50K JPG)**

There are many other factors that influence colony response to infestation. When wintering bees with low levels of varroa, beekeepers should pay careful attention to other factors such as: adequate food reserves, freedom from brood diseases, freedom from nosema, sheltered wintering locations, winter cartons or other colony packing, and colonies headed by young queens.

When varroa first arrived in the United States, the standard recommendation from Europe was to treat colonies in the fall after brood rearing ceased. This approach has not been adequate in the Midwest. Varroa increase rapidly when drone brood is present, and Midwest beekeeping conditions often provide five months of intensive drone brood rearing. Spring treatment terminating immediately prior to the honey flow prevents the extensive mite reproduction that can occur during drone rearing. The fall treatment approach to mite control is more expensive. Three or more Apistan strips may be required to treat populous colonies. Also, the bee cluster is frequently located in the bottom of the hive body. This necessitates removing a heavy second hive body twice for proper placement and removal of Apistan strips.

In addition to the basic management plan, a few "do's and don'ts" are important in managing varroa.

1. Do not leave Apistan strips in bee hives throughout the year. It is illegal to leave them in hives for longer than the prescribed four to six weeks. Continuous treatment provides an optimum environment for varroa to become resistant to Apistan. Apistan strips should be used once and discarded.
2. Cull combs with large patches of drone comb from your brood nest. This has always been a good management practice for honey producing colonies. It will also reduce the growth potential for varroa in your colonies.
3. Don't waste time visually inspecting adult bees for varroa. Most of the mites feed by piercing the flexible membrane that connects the hardened plates of the abdomen and are not readily visible. When mites are readily visible on adult bees the colonies are heavily infested and usually cannot be saved.

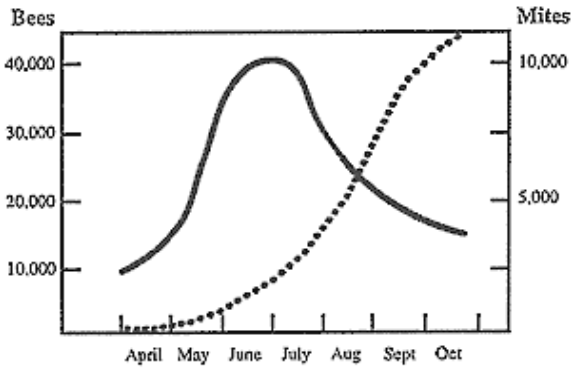


**Figure 6. Plot of bee and mite population development.**

Colonies that collapse due to varroa infestation typically die from mid-August to mid-October. Frequently, they will look like populous colonies in July and store a good crop of honey. As the amount of brood rearing in the colony declines, emerging varroa mites have nowhere to go except into the reduced cycle of brood in the late summer colony. This relationship is illustrated in the plot of bee and mite population development shown in *Figure 6*. Colony populations crash as entire cycles of brood are parasitized. Unwary beekeepers find dead colonies with no bees and neighboring colonies robbing the honey from the supers. If infested apiaries are not treated as needed, beekeepers may find dead colonies with wax moths destroying the combs. The sudden collapse typical of varroa is difficult to grasp until you have experienced it.

## Resistance

Within the races of *Apis mellifera*, only the Africanized honey bees in Brazil exhibit a stable tolerance to varroa parasitization. Recent studies found that 40 percent of the female mites in Africanized bee worker brood were infertile, whereas in European bees only 10-20 percent infertile varroa females were found. Additional resistance mechanisms have been reported for the Indian honey bee. Beekeepers should be alert to colonies exhibiting higher degrees of grooming behavior, colonies which remove parasitized brood, colonies whose worker brood matures in less than the standard 21 days, and colonies with female mites in brood cells which do not have offspring. When surviving colonies are found in untreated apiaries, beekeepers should examine them carefully for evidence of one or more of these resistance mechanisms. Colonies exhibiting resistance should be used as breeding stock. Resistant colonies should also be reported to an apiculture specialist for confirmation of resistance and assistance with stock selection and improvement.

## Varroa and Pollination

Pollination is so unobtrusively accomplished that it is often overlooked; however, poor set of many fruit, vegetable, and seed crops will occur if pollinators are insufficient. An unfortunate consequence of varroa is that many wild colonies of honey bees have perished. The number of beekeepers also has declined sharply since varroa's introduction. Growers who produce large acreages of insect pollinated crops have always provided bees to assure adequate pollination. Homeowners with small fruit orchards and vegetable gardens who have benefitted from wild honey bees may find it necessary now to provide for their crop's pollination.

## For More Information

Several excellent books are available that provide detailed information on varroa and how beekeepers around the world are learning to live with it. They can be ordered from: International Bee Research Association, 18 North Road, Cardiff CF1 3DY, UK:

**Biology, Detection and Control of *Varroa jacobsoni:***
**A Parasitic Mite on Honey Bees.** 1988. Alfred Dietz and Henry R. Hermann.
**Living with Varroa.** 1993. Edited by Andrew Matheson.
**New Perspectives on Varroa.** 1994. Edited by Andrew Matheson.

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