MANAGING SMALL HIVE BEETLES

The small hive beetle (Aethina tumida: Nitidulidae) is originally from to sub-Saharan Africa, where it inhabits almost all honey bee colonies in its native range, but does little damage to the colonies of African bees, and is not considered a serious pest. It is unknown how this pest found its way to the U.S., but was first discovered to be damaging honey bee colonies in Florida in 1998, and has since spread to much of the southeastern U.S. and parts of the southwest and midwest, probably transported in package bees and by migratory beekeepers. In the U.S. it is usually considered to be a secondary or opportunistic pest, only causing excessive damage when bee colonies have already been stressed or weakened by other factors. It has potential to become a significant problem, however. If large populations of beetles are allowed to build up, even strong colonies can be overwhelmed in a short time. Infestations of beetles can put significant stress on bee colonies, which can be compounded by the stress of varroa mites and other conditions.

Honey bee colonies appear able to contend with fairly large populations of adult beetles with little problem. However, high beetle populations are able to lay enormous numbers of eggs. These eggs develop quickly and result in rapid destruction of unprotected combs in a short time. There is no established threshold number for small hive beetles, as their ability to devastate a bee colony is related to many factors of colony strength and overall health. By maintaining strong bee colonies, and keeping adult beetle populations low, the beekeeper can suppress the beetles' reproductive potential.

DESCRIPTION

Adult beetles are around 6 mm (1/4") in length, oblong or oval in shape, tan to reddish brown, dark brown or black in color, and covered in fine hairs, but their size and appearance is highly variable within a population. The adult beetles are usually observed in the hive with their heads tucked down beneath the thorax, so that antennae and legs are often not apparent (Fig. 1).

The larvae are elongated, cream-colored grubs, growing to 10-12 mm (1/2"). They may be mistaken for young wax moth larvae, which can be differentiated by the number and appearance of their legs and the presence of numerous dorsal spines (Fig. 2). Honey bees are not able to efficiently remove adult beetles from the hive, and their hard shells resist stinging. Rather, the bees are observed to pursue to the beetles across combs. Beetles will seek cracks and crevices in which to escape from the bees, who in turn attempt to imprison the beetles in these cracks, guarding them from escaping. Opening hives for inspections may free the beetles from their confinement.

Fig. 1. The adult small hive beetle is usually observed with its head and antennae tucked down beneath the thorax. They are around 6 mm long, with variable coloration that ranges form tan to reddish-brown, dark brown or black.

LIFE CYCLE

The adult female beetles will lay egg masses directly on pollen and brood combs, or in cracks and crevices around the hive. A single female beetle can produce over 1000 eggs in her lifetime. Beetle eggs are similar in shape to those of honey bees, but approximately 2/3 the size. Eggs generally hatch in 2-4 days, and the larvae immediately begin to feed on pollen, wax, honey, and bee brood. In 10-16 days, the beetle larvae complete their development and will exit the hive to finish pupation in the soil. The majority of larvae remain within about 90 cm (3') of the hive they exit, and burrow up to 10 cm (4") into the ground. Pupation takes 3-4 weeks to complete. Within 1-2 days of emerging from the soil, adult beetles will seek a bee colony, which they locate by odors.

The adults are strong fliers, and can disperse to other beehives easily. Beetles are also thought to travel with honey bee swarms. Individual beetles can live up to 6 months or more, and several overlapping generations of beetles can mature within in a colony in a single season. Beetle reproduction ceases during the winter, when adult beetles are able to overwinter within the bee cluster.

Fig. 2. Larvae of the small hive beetle (a) are sometimes confused with wax moth larvae (b). Hive beetle larvae can be distinguished by the numerous spines along its body, as well as three distinct pairs of legs near the anterior end. Wax moth larvae lack true legs, but have short, less developed prolegs. Both pests can be found in the same hive.

DAMAGE

Economic damage from beetles occurs when the bee population is insufficient to protect the honey combs from the scavenging beetle larvae. This can be caused by to any factor that reduces the bee population or increases the area that the bees must patrol: swarming, splits, queenlessness or the addition of supers. When adult beetles first invade a colony, they may go unnoticed until their populations increase through reproduction or immigration. Adult and larval beetles will prey upon bee eggs and brood. When large numbers of beetle eggs hatch in weak colonies, the combs of honey can become "wormy" and take on a slimy appearance (Fig. 3). Unlike wax moths, these beetle larvae do not necessarily damage the combs themselves. Ruined honey can be washed from the combs, which may be frozen for 24 hours and then be placed back into a strong hive to be cleaned and repaired by the bees. When large numbers of adult beetles defecate in the honey, they introduce yeasts, causing the honey to ferment and run out of the cells. In this case, the queen may cease laying, and the entire colony may abscond. Weak colonies are particularly vulnerable to attack, but even strong colonies can be overwhelmed by large populations of beetles. Nucleus colonies used for queen production or colony splits can be especially vulnerable to beetle attacks.

Beetles can create sudden problems if bee escapes are used prior to harvesting, and supers of honey are left virtually undefended by bees. If honey is removed from the hive, but not immediately extracted, beetles can invade the honey house and quickly spoil a large portion of a honey harvest. Wet cappings from recently extracted honey are also extremely attractive and vulnerable to beetle infestation. Honey contaminated by small hive beetles is entirely unfit for human consumption, and should never be bottled or mixed with other honey for packing.

Fig. 3. Honey comb infested with small hive beetle larvae takes on a glistening or "slimed" appearance. Honey contaminated by beelte larvae is unfit for consumption.

DETECTION

Beetles are easily detected by visual inspection of bee colonies. When a hive is opened, adult beetles can often be observed running across the underside of the outer cover, on either side of the inner cover, and on the top bars of frames. Also, beetles may be seen running across the surfaces of combs (Fig. 4). To detect beetles in the top hive body, open the hive and place the outer cover on the ground or on top on another hive, then place the top hive body into the cover. If present, the adult beetles will retreat from the sunlight, and in a few minutes, you may lift the hive body, and look for beetles in the cover. Beetles in the lower hive body will similarly retreat to the bottom board.

Strips of corrugated cardboard with the paper removed from one side, or pieces of corrugated plastic (obtained as scraps from a sign shop) can be placed on the bottom board at the rear of the hive. Adult beetles, fleeing from bees, will seek shelter in the small spaces of the corrugations, and can be easily seen. Varroa sticky boards are usually ineffective in detecting small hive beetles. Adult beetles prefer dark conditions, and will migrate toward the tops of hives that have screen bottoms, and may be more easily detected by placing corrugated strips on the top bars of the upper super or above the inner cover.

Small hive beetle larvae are often found clustered together in corners of a hive or on frames. This behavior also differentiates them from wax moth larvae, which are found scattered throughout a hive. Older beetle larvae orient toward light sources, and in the honey house, a single fluorescent light near the floor may attract beetle larvae exiting the hives, seeking a place to pupate. These larvae can be swept up and drowned in soapy water.

Surfaces of combs that appear slimy, or fermented honey bubbling from the combs, are positive signs of beetle activity. Fermented honey has an odor described as decaying oranges.

If you suspect the presence of hive beetles, you may contact your state apiary inspector to arrange a visit, or you may bring a specimen in alcohol to your local Cooperative Extension office for positive identification.

Fig. 4. Adult small hive beetles can sometimes be seen running across the surface of the combs during hive inspections, often pursued by honey bees.

CONTROL

Prevention is the most effective tactic of small hive beetle control. Chemical controls are available, but are of limited use. Good beekeeping management practices, in the bee yard and the honey house, are sufficient to contain hive beetle problems in most cases. A combination of cultural and mechanical controls will usually help to maintain beetle infestations within a manageable range.

- Maintain a clean apiary and honey house, to reduce the attraction to beetles. Avoid tossing burr comb onto the ground around hives, which may attract pests.
- Honey that is removed from a colony should be extracted within 1-2 days. Wax cappings are an attractive food for beetles, and should be processed quickly or stored in sealed containers.
- Store empty supers under conditions of good air circulation and less than 50% humidity.
- When debris is left to accumulate on a bottom board, beetle larvae can complete pupation within the hive. Screen bottom boards used for varroa control can prevent this build-up of debris.
- Reduce colony stresses from diseases, mite parasitism or poor quality queens.
- Maintain and propagate bee stocks with hygienic traits that are best able to get rid of beetles and larvae.
- Eliminate, requeen, or strengthen weak colonies. Use caution when combining infested colonies, because the combined population of beetles may be sufficient to overwhelm the hive.
- Maintain hives and frames in good conditions. Warped, cracked and rotten hive bodies provide beetles with many places to hide, and make them more difficult to detect by bees or beekeepers.
- Honey supers can be removed from weak colonies to lessen the territory of combs that the bees must patrol. If not ready for extraction, these supers can be placed on strong colonies, in a manner similar to protecting them from wax moth infestations. However, if small hive beetles or their eggs are present on the combs, the addition of these beetles can be sufficient to cause the strong colony to collapse. Honey supers can be frozen at -12°C (10°F) for 24 hours to kill all stages of beetles before transferring supers to a strong colony.
- Exchanging combs from infested hives can spread beetles and their eggs.
- Making splits from heavily infested hives can cause a serious outbreak if insufficient numbers of bees remain to protect the hive.
- Avoid over-supering hives, which increases the area that the bees must patrol.
- Adult beetles appear to prefer shady locations. If possible, locate hives where they receive bright sunshine at least part of the day.
- Utilize mechanical traps in the hive to reduce the number of adult beetles that can produce eggs, while reducing the need for pesticides.

IN-HIVE TRAPS

- A Hood Trap attaches to a standard frame. It has a compartment filled with apple cider vinegar, as an attractant, and compartments filled with mineral oil, which drown the beetles as they enter. A drawback of this trap is the empty space around the trap, which bees will often fill with drone comb, potentially creating a greater problem with varroa if left unattended.
- A West Trap or Freeman Trap fits beneath a hive, and is filled with a layer of oil and is covered by a slatted or mesh screen. Adult beetles enter the trap to hide from bees, and drop into the oil and drown. Larvae also fall into the trap as they attempt to exit the hive to pupate. This design has been reported to eliminate some varroa mites as well. Hives must be kept extremely level for these traps to work.
- Beetle Eater Traps consist of shallow oil-filled troughs with grooved lids that are suspended between frames of brood or honey. Adult beetles enter the traps to hide from bees, are drowned in the oil. These traps are inexpensive and easy to use, but must be emptied and refilled regularly, and the bees tend to propolize over some of the grooves.
- Sonny-Mel Traps are often homemade, consisting of a small plastic sandwich box, with 3mm (1/8”) holes, filled with a layer of mineral oil, and a container of liquid bait. (To make a bait combine 1 cup water, ½ cup apple cider vinegar, 1/4 cup sugar, and the peel of 1 ripe banana, chopped in small pieces; allow to ferment for 1-2 days.) The trap is placed on the top bars of the upper super, and requires shims to provide space for the trap.

CHEMICAL TREATMENTS

The pupal stage is a vulnerable time in the beetle life cycle. Slightly moist, loose, sandy soil is optimal for their development. Locating colonies on hard clay or rocky soil, rather than light sandy soil, can reduce the number of beetle larvae that successfully pupate. If larvae are present in the colony, soil around the hive can be treated with a permethrin drench to prevent the larvae from pupating, killing them in the soil. USE WITH CAUTION! PERMETHRIN IS HIGHLY TOXIC TO BEES!

- Prepare the site by removing vegetation and weeds under and around the hives to be treated, allowing the solution to directly contact the soil.
- Mix 5 ml (1 teaspoon) GardStar® 40% EC into 1 gallon of water.
- Apply the solution using a sprinkler can or watering can – do not use a sprayer – to avoid contaminating the bee hive surface with pesticide drift.
- Thoroughly drench the area in front of the hive (and beneath it, if screen bottom boards are used), wetting an area 18-24 inches around the hive, ensuring that emerging beetles will contact the treated soil.
- Make applications late in the evening when few bees are flying.
- Do not contact any surface of the bee hive or landing board with insecticide.
- USDA testing indicates that permethrin binds to the soil and remains active for 30-90 days, depending on soil type, pH, and moisture content. Reapply as needed.
- Permethrin is corrosive and can cause irreversible eye damage. Avoid contact with eyes, and wear proper eye protection during application.
- These instructions are a general guideline. Read and follow all label instructions for the legal and appropriate use of any pesticide.

Coumaphos (sold as Checkmite+ for varroa control) is the only chemical pesticide registered for in-hive treatment of adult small hive beetles.

- Use 1 strip of Checkmite+ per hive.
- Treatments must not be applied while surplus honey is being collected.
- Treat after honey supers have been removed. Do not place honey supers on a hive for 14 days after Checkmite+ strip has been removed.
- Prepare a 5x5” piece of corrugated cardboard by removing the paper surface from one side, and cover the smooth side with duct tape or shipping tape to prevent the bees from tearing up or removing it.
- Cut a single strip of Checkmite+ in half and staple both pieces to the corrugated side of the cardboard.
- Chemical resistant gloves must be worn while handling strips. DO NOT USE LEATHER BEE GLOVES WHEN HANDLING THIS PRODUCT!
- Insert the cardboard square, strip side down, onto the center of the bottom board, or above the inner cover if screen bottom board is used.
- Leave treatment strips in place for a minimum of 42 days, but no more than 45 days.
- Dispose of strips according to label directions.
- Do not treat the same colony with coumaphos more than 2 times in a year.
- Honey supers may not be placed on a hive for 14 days after Checkmite+ strip has been removed.
- These instructions are a general guideline. Read and follow all label instructions for the legal and appropriate use of any pesticide.