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SMALL HIVE BEETLE

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Order: Coleoptera
Family: Nitidulidae
Species: *Aethina tumida* (Murray)

Over the past 20 years, small hive beetles have been spreading across the United States, infesting hives and evading control attempts. Since the discovery of small hive beetle in central Florida in 1998, these beetles from sub-Saharan Africa have travelled to almost every state in the US and arrived in Virginia by 2004. Although small hive beetles are not as economically significant as Varroa mites, they were estimated to have caused around $3 million dollars in damage each year in the United States by 2004. As the geographic range has continued to expand, it is likely that the economic impact from small hive beetles has increased as well. The large geographic range and significant damage caused by these pests warrants greater awareness and insight into small hive beetle management. This fact sheet will provide details about small hive beetle biology, which is a crucial part of identification and treatment, along with popular small hive beetle control methods.

BIOLOGY AND DESCRIPTION:

Adult small hive beetles are 5-7 mm (approximately ¼ inch) long and 3-4.5 mm wide. Adult beetles are brown in color, which darkens to black over time (Figure 1). Small hive beetles are also strong fliers, which is how they travel to hives. Although small hive beetles belong to the sap beetle family and can live outside of honey bee colonies, these scavenging beetles will seek out colonies, likely for the protection and easy access to food that colonies offer. When adult beetles are approximately two weeks old, they are sexually mature and find hives. After mating, females lay eggs on pollen and brood comb, sometimes chewing holes

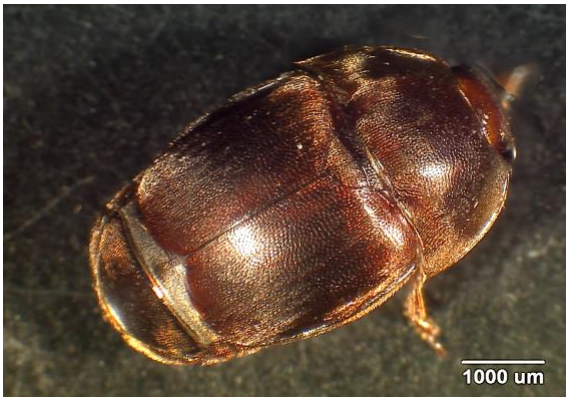

Figure 1. Small hive beetle adult (1000 µm = 1mm).

in capped brood. A single female is capable of laying 1,000-2,000 eggs throughout their lifetime. Small hive beetle sex ratios are female biased (more females than males), so only a few adult beetles can quickly lead to heavy infestations. Eggs are a translucent white color with a cylindrical shape, measuring approximately 1.4 mm in length, and 0.26 mm in width (Figure 2). Females will lay eggs in small clusters and tend to lay eggs in pollen or capped brood to provide food for emerging larvae. Egg hatching is influenced by hive humidity and temperature, and in ideal conditions the eggs will hatch in three days. Unlike honey bee brood, small hive beetle eggs will not necessarily be maintained at consistent temperatures.

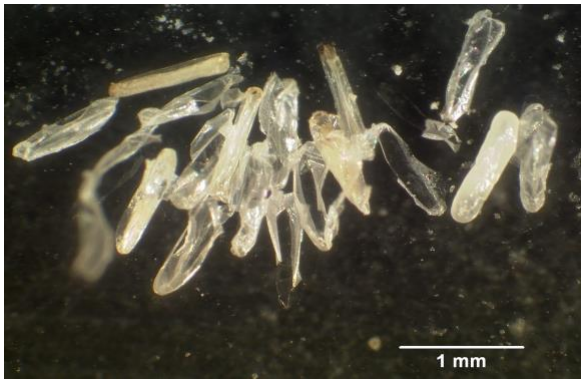

Figure 2. Small hive beetle eggs.

Figure 3. Small hive beetle larva. Note the two rows of spines running along the back of the insect.

After hatching, small hive beetles go through three larval stages, growing from approximately 1.3 mm to 1 cm in length (Figure 3). Distinguishing larval features are the paired rows of short spines that run along the back of each segment, and the two larger spines on the last segment of their light-yellow bodies. These spines are also useful in distinguishing between wax moth larvae and small hive beetle larvae. Once the third larval stage (instar) is reached, which generally takes from 10-14 days, larvae must migrate to soil surrounding the hives to pupate. Larvae can crawl over 200 meters on top of the surrounding soil before burying themselves, generally at depths of at least 4-8 cm. Pupation time depends on soil temperature and can last anywhere from 15-100 days. At first, the pupae have a white color that's slowly darken as it approaches emergence (Figure 4).

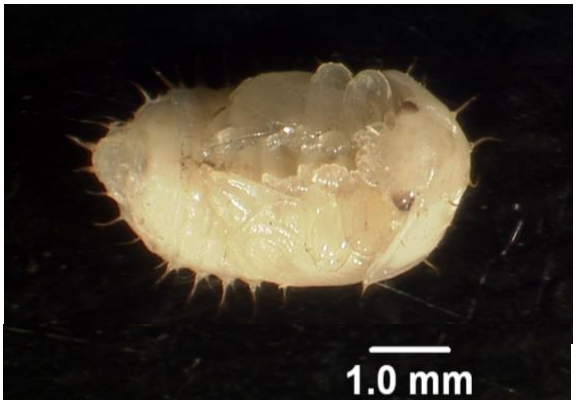

Figure 4. Small hive beetle pupa.

DAMAGE: Small hive beetles are attracted to various volatiles and pheromones that come from adult bees, brood, uncapped honey, pollen, beeswax, and wax byproducts. As small hive beetle larvae destroy hive products, this increases the

release of volatiles, which attracts more adult beetles. Small hive beetles carry a symbiotic fungi (*Kodamaea ohmeri*), which can be found on each life stage. This fungal symbiont is thought to help with small hive beetle digestion and also ferments pollen in the hive to produce pheromones that attract more beetles. Adult beetles have a strong sense of smell, thanks to the fact that these beetles have a well-developed sensory system. Once adults arrive at a hive, they often hide in cells, other small crevices, or hive debris, and congregate at specific sites within the hive. These congregation sites tend to be in darker and cooler areas of the hive. Although bees will try to attack adult beetles, the beetles have various evasive strategies, like falling and hiding, that help them avoid attack. Beetles will also huddle with their legs pulled beneath their bodies, which helps protect them from attacks (Figure 5). Bees will use propolis to corral small hive beetles on the top of frames, although the beetles trapped in these corrals are able to trick bees into feeding them by rubbing the mouthparts of the bee with their antennae. Corralling alone will not stop a heavy infestation. The most significant damage is caused by small hive beetle larvae, which eat brood, honey, and pollen, as they tunnel through comb. This feeding process leads to contamination of the hive with fermenting waste, which is sometimes called slime. When damage becomes extensive, the bees may abscond, leaving their hives to collapse in a mass of small hive beetle larvae and waste. Stored hive products, such as honey supers, can also be seriously damaged by small hive beetles, so care should be taken to protect these resources by storing them in properly sealed locations. Although egg laying and pupation stop during the winter in colder climates, adult small hive beetles will overwinter in hives, stealing heat from clustering bees.

Figure 5. Honey bees will attack small hive beetles, however, these beetles will avoid attack through crouching and protecting their legs and antennae, running, falling and hiding behaviors.

CONTROL PRACTICES:

Scouting: Although small hive beetles have been causing damage outside their natural range for 20 years, successful management tools are still being developed. Beetles are generally detected by visually examining the hives for adults or larvae. Digging in surrounding soil for pupae can also be a way to assess small hive beetles in the vicinity of the hives. Adult beetles can be easily collected either by hand or through use of an aspirator. Adult beetles can also be easily crushed by hive tools during inspections of the hive.

Figure 6. Two popular Small Hive beetle traps, the Better Beetle Blaster™ (left) and Beetle Jail™ (right), inserted between frames.

Cultural and mechanical control practices: Cultural control methods center around maintaining strong colonies and clean hive environments. Although small hive beetles can be present in strong colonies, the most serious damage is generally inflicted on weak colonies. Maintaining strong colonies involves a variety of factors, including practices of requeening weak colonies, managing and treating for other pests, such as Varroa mites, and using hygienic stock that will be more efficient in removing pests. Removal of excess hive products that could be attractive to small hive beetles is also an important way to minimize infestations. Reduction of hive humidity, shade, and hive body cracks can also make the hive more unfavorable to small hive beetles. The pupation of larvae in the soil surrounding hives has led to treatment strategies targeting this life stage, including placement of diatomaceous earth and slaked lime, which kills larvae by tearing the cuticle and causing desiccation. Using traps that are baited or filled with oil to catch the beetles (Figure 6) are popular mechanical control methods. There are also fabric entanglement traps that can be placed in hives (Figure 7). Traps can also be placed in the bottom of hives to catch small hive beetle larvae that are exiting the hive to pupate.

Figure 7. One popular fabric entanglement trap is the Beetle Bee-Gone™ sheet. When honey bees chew on the fabric, beetles walking by get caught in the fibers and eventually die.

Biological control: These methods mainly include release of the entomopathogenic nematodes *Steinernema riobrave* and *Heterorhabditis indica* into the soil surrounding the hives. These nematodes have been found to reduce beetle populations by infecting larvae and pupae in the soil. Another management method that is still being developed is the release of sterilized small hive beetle adults, which could potentially reduce beetle population dispersal.

Chemical control: Several synthetic insecticides have been tested, the most common and successful of which are coumaphos strips (CheckMite+), although bees can also be negatively affected by this compound. Permethrin (GardStar) soil drenching has also been attempted, but because of the difficulty of timing these treatments

correctly, this method is not thought to be highly effective. Alternative cultural, mechanical, and biological control methods have generally received more attention, and are thought to be more useful, than chemical controls.

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