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BIOLOGY AND BEHAVIOR OF THE SMALL HIVE BEETLE, *AETHINA TUMIDA*, A NEW POTENTIAL PEST IN THE WESTERN HEMISPHERE

M. E. Headings, The Ohio State University, Agricultural Technical Institute
1328 Dover Road, Wooster, OH 44691, USA

ABSTRACT. The beekeeping industry in the Western Hemisphere has faced several major challenges in recent years, namely, bee mites, Africanized bees, and chemical pesticides. The newest threat is the small hive beetle, *Aethina tumida, Murray*, which was first reported in the USA in St. Lucie County, Florida, in June of 1998. It is a member of the beetle family, Nitidulidae, commonly known as "sap beetles." Within less than a year, it had been reported in four southern states, namely, Florida, Georgia, South Carolina, and North Carolina, and recently six more states have been added to the list. Its origin is believed to be in South Africa where it is considered a secondary pest. In the USA, however, the insect appears to be developing into a potential significant pest. The adults and larvae feed on honey and pollen in the beehive. The larvae burrow through the combs and defecate in them causing the honey to ferment and even leak out of the combs. The odor is reportedly similar to that of decaying oranges. Research is needed to explore effective control measures. One important consideration is that the larvae leave the beehive to pupate in the soil.

INTRODUCTION

Beekeeping is a craft that dates back many years. People worldwide have benefited from the honeybee, *Apis mellifera*, due to plant pollination as well as from products, namely, honey, beeswax, royal jelly, and propolis. The honeybee is certainly one of the most beneficial insects to human beings.

During the past decade or two, there has been increasing pressures on the honeybee that threaten its survival. Over the years, various bee diseases such as American and European Fowlbrood, Nosema, Chalkbrood, Sacbrood, etc. have been a threat to honeybees. In recent years, however, additional pressures on the European honeybee in the Western Hemisphere have included the Africanized honeybee, varroa and tracheal mites, chemical pesticides, and now during the past year, the small hive beetle.

MATERIALS AND METHODS

Information for this study comes from a variety of resources that are rapidly becoming available, especially during the past year. Personal observations have come from personal beekeeping for 20 years, teaching several different college-level beekeeping courses, and from having observed beekeeping in several other parts of the world, including South Africa, which is the native home of the small hive beetle.

RESULTS AND DISCUSSION

The first specimen of the small hive beetle, *Aethina tumida Murray*, identified in the Western Hemisphere, was collected in St. Lucie County, Florida. It was identified on June 5, 1998. St. Lucie County is located nearly midway along the East Coast (excluding the Keys).

1. Life Cycle and Characteristics

The small hive beetle is a member of the order Coleoptera and the family Nitidulidae. This family is commonly referred to as sap beetles and are known as scavengers. Most members are small in size, measuring 12 mm or less in length. They are usually associated with decaying fruits, flowing plant sap, with melons and sweet corn, and with certain fungi under the bark of dead trees (Borror, *et al.*, 1981).

The small hive beetle is reportedly attracted to fruits, etc., but prefers to feed on honey and pollen, the latter of which is apparently needed as a protein source. In South Africa, the beetle also reportedly feeds on bee brood as well (Cambray, 1998). Very little has been written about the beetle until the past year. The most comprehensive early writing about this beetle was done by Dr. A. E. Lundie in South Africa in 1940. In regards to the beetle, he is quoted as saying, "there are localities where, and seasons when, it assumes such importance that it becomes almost as serious as the wax moth" (Lundie, 1940). He also noted that colonies that are moved are less susceptible than stationary ones.

The small hive beetle undergoes complete metamorphosis and therefore passes through egg, larva, pupa, and adult stages (Table 1).

Even though small hive beetle larvae somewhat resemble wax moth larvae, it is very easy to distinguish one from the other. Small hive beetle larvae have three pairs of true legs and no prolegs (false legs), whereas, the wax moth caterpillar (order Lepidoptera) has three pairs of true legs plus five pairs of prolegs. Small hive beetle eggs are generally laid in cracks and crevices of hives and in empty honeycomb cells; however, in Florida, they have also been seen attached to the backs of honeybees (Elzen, *et al.*, 1999).

Table 1. Life Cycle and Characteristics of the Small Hive Beetle

Stage	Time	Characteristics
Egg	2-3 days	* White, 2/3 as long as honeybee eggs * Laid in cracks and crevices of hive and empty honeycomb cells * Laid in irregular masses
Larva	10-16 days	* White, with 6 legs * Grow to 10-11 mm in length * Burrow through and eat honey, pollen and brood * Leave feces and smelly slime trail
Pupa	3-4 weeks	* White to brown * Found in soil under or near hive
Adult	Up to 6 months (Dr. Lundie's Study)	* Light yellowish brown to shiny black with age * Broad and flat, 5-7 mm in length, about 1/3 the size of a honeybee * Fly back to hive after emerging to eat and lay more eggs * Begin laying after about 1 week * Quite active and seek dark refuges * In South Africa, 38-81 days are required to develop from egg to adult with potential of 5 generations per year.

Source: Fore, May 1998, *The Speedy Bee*.

2. Distribution in the USA

Since the beetles first identification in St. Lucie County, Florida, about a year ago, it has spread to surrounding counties. Some other states have now reported the presence of this insect (Table 2).

Table 2. States in the USA Where the Small Hive Beetle Has Been Found Since June 1998.

1. Florida (first recorded in June)	4. North Carolina
2. Georgia	5. Pennsylvania
3. South Carolina	6. New York
4. Minnesota	7. New Jersey
5. Maine	8. Ohio (most recent detection - late April 1999)

Source: Sangiacomo, May 5, 1999, *The Plain Dealer*.

The above list represents a rapid expansion from four to currently ten states. Undoubtedly, more states will soon be added to this list. Beetles were first detected in Ohio as recent as late April 1999. The shipment of bee packages across the USA and the practice of migratory beekeeping to provide pollination services are certainly primary causes for the rapid spread of this pest across the country.

It has been reported that this insect was found to have overwintered in the adult stage in a colony in Minnesota (Connors, 1999). This beetle is native to South Africa and is reported to survive in many areas including the Amatola Mountains, which experience snow fall, to the southern cape that has a climate similar to central California. Based upon the apparent temperature range tolerated by this beetle, it is likely only a matter of time until it infests honeybee colonies in the Caribbean basin.

In South Africa, the beetle is considered more of a secondary pest, and becomes a serious problem in weak colonies, or in poorly-managed colonies, or in empty hive boxes in storage (Cambray, 1998). It should be noted, however, that the primary honeybee in South Africa is *Apis mellifera scutalata*, which is known for its aggressive behavior and excellent house-cleaning trait. In contrast, the honeybees present in North America are primarily *Apis mellifera liqustica* and *Apis mellifera carnica*, which exhibit quite different behavior.

Sanford (1998) noted that the first sign of the presence of this beetle in Florida was a large number of the larvae found in honey extracting rooms. Bees in a healthy colony are reported to generally remove beetle larvae from the hive, but the adult is difficult for the bees to sting or remove due to the slick hard body of the beetle (Lee, 1998). The adult may fly an estimated distance of up to five miles (Imirie, 1999).

3. Damage to Honey Bee Colonies and Stored Honey

The larvae and adults both feed on the honey, pollen, and possibly brood. In the process, they burrow through the honeycomb dropping feces and causing the honey to ferment and bubble out of the cells. The odor is reportedly similar to decaying oranges (Thomas, 1999). In severe cases, the honeycomb may break down causing the honey to drip down on the bottom board and even flow out the entrance.

The beetle does not do direct damage to adult honey bees. However, due to the mess caused, the bee colony may abscond or become weak and die due to lack of replacement bees. The bee eggs and larvae in the brood comb may be killed due to burrowing and feeding by the beetles. As of December 1998, it was estimated that the small hive beetle had invaded 60,000 hives in Florida and destroyed 5,000 colonies (Woolverton, 1998).

1. Control

It has been reported that intensely manipulating a hive one day may cause it to succumb to beetles the next day. The disorientation of the bees may give the beetles the advantage to overcome the colony (Fore, 1998).

The best defense against this pest is early detection. If the beetle is detected, following are some options to consider:

a. Check colonies for hygienic behavior and replace if necessary. Select queen lines that demonstrate some beetle resistance.

b. Be careful when making splits, exchanging combs and supering colonies. Avoid providing room for beetles to become established away from the cluster of protective bees.
c. Practice cleanliness in and around the honey house. Extract filled honey supers in a timely manner and avoid allowing cappings to be exposed for long periods of time.
d. Avoid stacking or storing infested supers on colonies.
e. Do not store empty hive bodies and honey supers unprotected. Paradichlorobenzene (PDB) flakes can be used to protect empty combs.
f. Moving colonies away from an apiary may be advisable in order to reduce beetle numbers. This is because the beetle pupates in the soil.
g. Trapping beetle larvae as they attempt to migrate to the soil may be another option (Delaplane, 1998; Sanford, 1998). A larva trap has been developed and is available (Rorie, 1999).
h. Bayer Bee Strips, which contain 10 percent coumaphos impregnated in plastic strips, are available on a limited basis for use in beehives in certain states that have emergency Section 18 approval. This product is currently (1999) available only through Mann Lake Ltd., Hackensack, Minnesota (http://www.mannlakeltd.com/cuma.html).
I. Use of an insecticide (GoldStar®) to drench the ground around hives to kill small hive beetle larvae.
j. Maintain strong colonies. This could include requeening and uniting weak colonies.

CONCLUSIONS

* The beekeeping industry in the USA is facing a serious threat from the newly introduced small hive beetle, *Aethina tumida*. It is native to South Africa.
* It was first identified in Florida in June of 1998, and has since been reported in a total of ten states.
* This insect is a member of the family Nitidulidae commonly known as sap beetles.
* The beetle has complete metamorphosis. When larvae are mature, they leave the hive to pupate in the soil.
* The beetle could become a threat across the Western Hemisphere including the Caribbean Basin.
* The insect reportedly feeds on honey, pollen, and honeybee eggs and larvae as it burrows through the honeycomb. The honey becomes fermented and smells like decaying oranges. As a result, honeybees may leave the hive or the colony may weaken and die due to lack of replacement bees.
* Early detection and preventative measures are recommended.
* Empty hive boxes and honey supers should be protected with PDB and states in the USA with emergency Section 18 approval may obtain limited quantities of Bayer Bee Strips containing 10 percent coumaphos for controlling the beetles.
* Substantial research is needed to better understand the biology and behavior of this insect in the Western Hemisphere setting and the best strategies for controlling it.

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