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Small Hive Beetle ***Aethina tumida*** ***Changing Chemical World***

Small Hive Beetle

I have devoted a significant portion of this newsletter to reprinting a newsletter article by Extension Apiculturist Tom Sanford at the University of Florida. Tom's article stimulated quite a bit of e-mail discussion, especially from South Africa, where the beetle originated. Text enclosed in brackets [.....] are additions that I extracted from e-mail comments.

The small hive beetle belongs to the family Nitidulidae. Nitidulids are commonly called "sap beetles" because they are often found where plant fluids are fermenting or souring, around decaying fruits, or associated with fungi. However, the small hive beetle appears to be limited to honey bee connections. It is too bad that this newly introduced species has tarnished my fondness for nitidulids. The picnic beetle, another nitidulid, was the subject of my dissertation for my Master of Science (MS) degree at the University of Minnesota.

Aethina tumida

New Beehive Pest in the Western Hemisphere. The Mantra of free global trade continues to be heard around the world. As part of this philosophy, acronyms have spring up like weeds across a cultivated

field. These include the likes of the North American Free Trade Agreement (NAFTA) and the General Agreement on Tariff and Trade (GATT). Although globalization is considered by most pundits to be "good," there is often a price to pay. One is the possible loss of jobs in a region or industry as shifts in labor costs create opportunities for some at the expense of others. Another is the impact of world movement of biological material around the globe. Examples are legion, from humans and mosquitoes to moths and mussels.

Beekeeping is no stranger to this phenomenon. The honey bee itself is an introduced species in North America as are many of the crop plants it pollinates. In France, an introduced plant from the eastern part of the United States is one of that country's most important nectar sources. In Florida, the melaleuca tree (Melaleuca quinquenervia), a relative to eucalyptus introduced from Australia, was originally thought to be potentially harmful to beekeeping. The tree's strong-tasting nectar, it was feared, would contaminate the citrus and palmetto honey crops. The concern was unfounded. Instead, the plant became extremely useful to bee-

keepers as a prime nectar source for buildup and maintenance in the fall of the year. However, it has also been blamed for everything from being a fire hazard in urban areas to drying up fragile wetlands like the Everglades. Thus, a wide-spread campaign is underway to rid the state of as much of this "noxious weed" as possible.

Both the tracheal and Varroa mites are recently introduced species that have greatly affected North American beekeeping. Most certainly their coming was the result of increased movement across the world of ships and airplanes. After introductions of these extremely damaging parasites, it was anticipate that perhaps only a few other organisms might be introduced that would greatly affect North America's beekeeping industry, the Asiatic bee mites, Tropilaelaps clareae and Euvarroa sinhai. These remain the Animal Plant Health Inspections Service's (APHIS) list of potentially dam-aging organisms. Not present on the APHIS list is Aethina tumida, the small hive beetle from South Africa. This organism merited only a few paragraphs in the second and third editions of Honey Bee Pests, Predators and Diseases (Cornell University Press, 1990, 1997). In his description of this insect in the second edition, Dewey M. Caron wrote, "One can only hope that the beetle will not be transported to other beekeeping areas." Hope springs eternal, but Aethina tumida showed up in southeastern Florida in the spring of 1998, and Florida Agriculture Commissioner Bob Crawford has formally asked the U.S. Secretary of Agriculture for assistance in determining action. [Infestations are confirmed in Florida, Georgia, and South Carolina.]

How the small hive beetle made the long trip from its African homeland remains an enigma. The first sign of its presence was a large number of larvae (worms) found in honey extracting rooms. The larvae superficially look like those of the wax moth (Galleria mellonella) and were considered so at first. Both wax moth and beetle larvae can occur together in the same bee colony. On closer inspection, however, it becomes clear these are not the growth stage of Lepidoptera (butterflies and moths) but are in fact that of Coleptera (beetles). Beetles, like moths and bees, have the kind of insect development called "complete metamorphosis."

This characteristic life cycle begins with an egg, which hatches into a feeding larva (worm) that completes its development during a resting stage (pupa) and finally emerges as an adult, complete with six legs and two pairs of wings, the reproductive phase. While wax moth larvae have many uniform, small "prolegs," beetle larvae possess three pairs of larger, more pronounced legs near the head. Another difference is that the beetle larvae do not gain as great a size as do wax moth larvae before pupation. They also do not spin a cocoon in the hive, but must com-plete their development in the soil outside the beehive. The adult beetle is red just after pupation and then turns black. It is fairly uniform in color, moves rapidly across the comb, and is extremely difficult to pick up by hand because it is covered with fine, hairlike spines. The beetle is visible to the naked eye and is about one-third the size of a worker honey bee.

So far, A. tumida has been found in only three Florida counties (St. Lucie, Indian River and Brevard) [Now six counties.] The Florida Apiary Inspection Service is combing the state for other infested hives. In the meantime, a movement moratorium has been implemented in Florida. Colonies can be relocated after being cleared for beetle presence by a Florida Department of Agriculture and Consumer Services inspector. This procedure will be revisited during a July 7, 1998, meeting of Florida's Honey Bee Technical Council. [Apparently, rescinded.] Most of the heavy honey bee movement has already occurred, as the citrus flow is concluded and colonies have been transported to other sources. It is hoped that those, which have been removed, were not contaminated, but this is yet to be established. Any beekeeper who sees either adult beetles or larvae in colonies should contact an apiary inspector for verification.

The good news is that the beetle is not considered a problem in South Africa and rarely actively destroys colonies. It is in the family named nitiulidae, a group known as "sap beetles." It is also a scavenger and, like the wax moth, must have pollen for protein to ensure its development; there is little evidence it attacks any stage of the honey bee life cycle.

The bad news is that it is an introduced species and may be more damaging than in its homeland. After looking at heavy larval infestations in St. Lucie County, it is difficult to reconcile the rather benign reputation it holds in South Africa. Literally thousands of the larvae can be seen in heavily infested colonies. They crawl out of colony entrances or across honey house floors in an effort to reach soil, where they burrow to complete their develop-ment. This larval army, along with its effect on stored honey as described elsewhere, is a chilling sight indeed.

Published references and electronic communications from South African beekeepers and regulatory authorities indicate that beetle infestations in their country are not common and are generally the sign of sloppy bee-keeping practice. This is because, like the wax moth, the beetle is a scavenger and must get a foothold in a colony before it can reach population numbers sufficient to undermine a beehive. At this time, it is difficult to say how aggres-sive the beetles are in causing colony mortality in Florida. Suffice it to say that some ex-perienced beekeepers have seen strong colonies quickly collapse, which they blame directly on the beetle.

Perhaps the best and most com-plete study done on the beetle is "The Small Hive Beetle, Aethina tumida," by A.E. Lundie (Union of South Africa, Science Bulletin 220, 1940, 30 pp.). It appears to be a tropical insect and not reported in temperate areas. This may mean fewer problems for colder portions of North America. According to Dr. Lundie, the must objectionable behavior of the larvae is that they defecate in honey. This, presumably in conjunction with secretion of other materials into the sweet, eventually results in fermentation and frothiness that has the charac-teristic odor of "decaying oranges." The fermented honey runs out of the comb and may pool on the bottom board or

honey house floor. At that point, honey bees will ignore the mess and may even abscond. Larvae will heavily damage delicate, newly manufactured comb, causing honey to leak out. However, old brood comb reinforced with bee pupal skins can withstand heavy larval infestation without dis-integrating. As a remediation technique, the objectionable, fermented honey can be washed off with a garden hose and the bees will often resume their activity to clean the comb.

Dr. Lundie says that the principal time beekeepers have trouble is when combs of honey stand for long periods in the honey house prior to extraction, especially those that contain pollen. Cappings set aside during the extracting process may also become "wormy." Honey left over Porter bee escapes for a period is also at risk. All these lead to infestations because honey bees are not available to remove either larvae or adults from the colony. Thus, Dr. Lundie concludes, "Any factor which so reduces the ratio of the population of a colony of bees to its comb surface that the bees are no longer able to protect this comb surface adequately is a precursor to the ravages of both the wax moths and Aethina tumida."

This is good advice; it already is common beekeeping practice in both Africa and Florida. The bees in Africa, however, are different than those in most of North America. Apis mellifera scutellata, the African honey bee, has radically different behavior from that found in the European Apis mellifera bee, managed by the bee-keepers of North America. It is already known that African bees in the face of light predation or perturbation readily abscond. In doing so, they leave behind a nest heavily infested with all kinds of possible organisms. Dr. Lundie suggests that this behavior may be a reason why American foulbrood has never taken hold in South Africa. Scavengers like wax moths and A. tumida remove abandoned nests so quickly that the disease reservoir ceases to exist. European honey bees are not as likely to abscond as African bees; they also may not be as hygienic in the nest. Both are reasons that their relatives Africanized bees are thought to be more tolerant of the Varron mite. Another African honey bee, Apis mellifera capensis, is also affected by the beetle, but appears also to be withstanding its effects. What does inferior hy-gienic behavior and the lack of a tendency to abscond portend for North American bee colonies invaded by A. tumida? Dr. Lundie provides a hint of this in his publication; saying that when honey bees cannot eject the beetle easily, strong as well as weak colonies may be equally affected. In addition, even in South Africa, at rare times the beetle can heavily affect colonies.

The cry for control measures has already reached a crescendo in affected parts of Florida. This is no surprise when one is confronted with colonies that appear to collapse overnight into a frothy mass correlated with high infesta-tions of beetle larvae. A. tumida is at its most vulnerable when the larvae leave the hive to pupate in the soil, and this probably represents a good starting point for beekeepers to experiment with controlling this insect by cultural means. [You mention the

possibility of treating ground near the hives with a poison - I have spent much time watching hives with hive beetle infestations at various points. They do not cause a major problem here, but I know for a fact that often the bees cannot kill the larvae and instead carry them out of the hive as they would a dead bee. They then carry them quite a distance and drop them - sometimes up to 150 feet - this is a large area to treat.] Perhaps the larvae can be trapped somehow before they reach the soil. Soil conditions also become important; the larvae may not pupate effectively in too dry, sandy or wet conditions. Dr. Lundie reports some indications that larvae infested with a soil-dwelling fungus died. Certain ants or other insects may prey on the larvae. The imported fire ant (Solenopis invicta) in the southern United States comes to mind. Dr. Lundie reports that stationary colonies are more vulnerable than those that are moved. Thus, relocating colonies may break the beetle's life cycle, a classic control measure used elsewhere in agriculture. Certainly the bees' self-cleaning behavior itself should be used to the utmost. Colonies will probably vary in the ability to withstand infestation and should be monitored for the ability to do so. As part of this, beekeepers should be very careful not to provide more exposed comb than the bees can adequately cover, or purposefully infest a colony that doesn't already have beetles. The beetle's arrival could signal a paradigm shift in honey bee management. It is possible that standard practices like stacking empty or weak colonies on stronger ones, making weak splits, and/or liberally exchanging combs may no longer be good options.

Chemical control either in stored supers or live colonies for A. tumida appears to be problematic. There are no registered materials in South Africa, and there has been little research on this front. Beetles appear to be most damaging when supers are full of honey, which is contraindicated for any pesticide application due to possible product contamination. The possibility of killing large infestations of beetle adults and larvae by using pesticides inside a colony while not harming bees mirrors the current dilemma in Varroa control.

Researchers are now attempting to grapple with this new problem. In the meantime, the following is suggested:

1. Beekeepers should constantly monitor their operations for presence of the beetle. Detection is relatively easy. The larvae can be examined for the six rather large legs on their front end; wax moth larvae have uniform sized prolegs. The Florida Department of Agriculture and Consumer Services has mailed a pest alert along with photos to all registered beekeepers in Florida. It is also available on the World Wide Web in Adobe Acrobat format (http://gnv.ifas.ufl.edu/~entweb/aethina.pdf. In contrast to those of the beetle, wax moth larvae do not usually move toward light, leave a colony nor burrow into the soil. Adult beetles are easy to spot, uniform in color and about one-third the size of an adult worker bee. They rapidly run across the combs and can often be found hiding in places that are not accessible to larger-bodied honey bees. Until more is known about the beetle in

a particular area, it should be assumed that it is far more aggressive a scavenger than the wax moth and may overwhelm even strong, healthy colonies.
2. If A. tumida is suspected or detected, the following precautions are suggested: **A**. Be scrupulously clean around the honey house. Leave filled supers standing only a short time before extraction. Beetles may rapidly build up in stored honey, especially where honey has been stored over pollen. **B**. Be careful stacking infested equipment or extracted supers onto strong colonies. Beekeepers doing this before the beetle was identified may have inadvertently dealt a deathblow to uninfested, healthy colonies by providing space for the beetles to build up that the bees could not protect. **C**. Pay close attention when supering colonies, making splits or exchanging combs; all these activities could provide room for the beetle to become established away from the cluster of protective bees. **D**. Monitor colonies for hygienic behavior; are the bees actively attempting to rid themselves of both larval and adult A. tumida? If not, replace them.
E. Experiment with traps in an attempt to keep larvae from reaching the soil where they complete their development. Try moving bees from place to place. Adult beetles can fly, but their range is not known with certainty. Some areas may be much more hospitable to beetles due to local soil conditions than others. **F**.
Forget chemical control until research promises some answers. No materials are registered; no materials are legal. Most compounds that kill beetles will also kill honey bees.

The arrival of Aethina tumida is not good news for beekeeping in North America. This beetle adds to an already large litany of bee-keeping challenges. It is every-one's hope that this insect will not be a significantly worse problem than in its homeland. Until this is known, however, it must be considered an aggressive scavenger that in many instances will over-whelm even relatively strong colonies of North American honey bees of European extraction. Finally, it is a wakeup call. Serious consideration continues to be given to the risk of moving biological material across inter-national borders, and the bee-keeping industry should not consider itself immune from this potentially harmful practice.

Changing Chemical World

Eric Natwick, entomology Farm Advisor from Imperial County, shared this pesticide information with the readers of Imperial Ag Briefs, July 1998.
New Insecticides May Replace old Standards For Worm Control: Several new insecticides have become or will soon become available for control of worm pests in vegetables and field crops. Insecticides such as Lannate, Larvin, Lock-On, and Lorsban are becoming less effective for control of worm pests such as beet armyworm, cabbage looper and diamondback moth larvae. These insecticides are in two chemical classes, carbamate and organo-phosphate insecticides. Carbamate and organophosphate insecticides are currently under review by U.S. EPA following the first phase implementation of the Food

Quality Protection Act (FQPA). Many currently labeled uses of organophosphate and carbamate insecticide could be lost or severally restricted following the EPA review.

New insecticides that may be replacing many current uses of carbamate and organophosphate insecticides for worm pest control on vegetables and field crops include: Alert, Avaunt, Confirm, Proclaim, Steward, Success, and Tracer. Some of these insecticides have been available over the past couple of years under Section 18 Emergency Exemption Labels and some have recently received or will soon receive Section 3 Federal Labels and Cal EPA Labels.

Alert is the trade name of chlorfenapyr, a porprietary insecticide-miticide discovered by American Cyanamid. Alert controls many insect and mite pests in-cluding those resistant to car-bamate, organophosphate, and pyrethroid insecticides. Some of the worm pests controlled by Alert include: alfalfa caterpillar, beet armyworm, cabbage looper, corn earworm, cutworms, diamondback moth, tobacco budworm and many others. Alert is in the chemical class called pyrrole and has a unique mode of action by disrupting the electrochemical gradient in insect mitochondria. Since Alert does not act on the nervous system of insects, the mode of action of most older insecticides, it will control many pests that have developed resistance to insecti-cides. Alert has been used under a Section 18 Label in California for control of mites on cotton.

Avaunt and Steward are trade names of indoxacarb, a proprietary insecticide discovered by DuPont Agricultural Products. Some of the worms pests controlled by Avaunt and Steward include: alfalfa caterpillar, beet armyworm, cabbage looper, cutworms, diamond-back moth, and others. The preliminary mammalian toxicological profile for indoxacarb may place it in the "reduced risk" category. Indoxacarb is in the oxadiazine class and cross resistance to older insecticides is unlikely.

Confirm is the trade name for tebufenozied, a proprietary insecticide discovered by Rohm and Hass Company. Confirm is a benzyl hydrazine compound used as an insect growth regulator and is only active against Lepidoptera insects (worm pests). Confirm is not harmful to beneficial insects such as pollinators, predators and para-sites. Confirm is a "reduced risk" insecticide as it is not harmful to non-target organisms. Some of the worm pests controlled by Confirm include: alfalfa caterpillar, beet armyworm, cabbage looper, corn earworm, cutworms diamondback moth, tobacco budworm and many others. Confirm has been used under Section 18 Labels in California for control of worm pests in cole crops and sugar beets. Cross resistance to Confirm is unlikely.

Proclaim is a trade name for emamectin benzoate, a new, semi-synthetic avermectin insecticide derived from the fermatation product avermectin B_1 (abamectin). Proclaim was discovered by Merck and is now under development by Novartis. Proclaim is also a "reduced risk" insecticide as it is not harmful to most non-target organisms including many beneficial insects. Cross resistance of older insecticides to Proclaim is un-likely. Proclaim controls many pests such as thrips and leaf-miners. Some

of the worms pests controlled by Proclaim include: alfalfa caterpillar, beet armyworm, cabbage looper, corn earworm, cut-worms, diamondback moth, tobacco budworm, tomato fruitworm, tomato pinworm, and many others. Proclaim has been used under Section 18 Label for control of worm pests in cole crops.

Success and Tracer are trade names of spinosad, a new insecticide and bacterial fermentation product, in the naturalyte class discovered by DowElanco. Success and Tracer are not harmful to most non-target organisms including many beneficial insects. Many pests insects including thrips and leaf-miners are controlled by Success and Tracer include: alfalfa caterpillar, beet armyworm, cabbage looper, corn earworm, cutworms, diamondback moth, tobacco budworm, tomato fruitworm and tomato pinworm, and many others. Success recently received a Section 3 Federal Label for use on almonds, leafy vegetables, apples, citrus and cole crops.

Insecticide resistance and FQPA may limit the use of some of the older insecticide products used for worm control, but replacement insecticides that are efficacious and safer for people, beneficial insects and the environment may soon be available. Integrated pest management programs will likely benefit from some of these new worm control insecticides as they are gentle on beneficial insects. [Editor's Note: It is too soon to state what effects these new chemistries have on honey bees, but those that I could find in the 1998 Farm Chemicals Handbook did not mention bee toxicity as a problem.]

Easy Bee Rig

Did you ever wish that your brood boxes could be on a drawer mechanism that would allow you to pull them out without removing all the supers above? Well, that dream is now a reality compliments of the Bee Guard company in Kariat Gat, Israel.

The Easy Bee Rig is a large metal framework that holds four Langstroth hives bodies with bottom boards at about knee height. The framework has two "drawers" that allow two bottom boxes to be pulled out on each side for examination.

Above that frame is fastened a second frame that holds four supers. The upper frame sits on top of the lower frame in such a manner that the hives are sealed shut. So, the drawers can be pulled out while the honey supers remain undisturbed. The theory is that the easier access will encourage more frequent visits to the brood nest, less swarming, better control of pests and diseases, easier requeening, and significantly increased production. With frequent visits, single hive bodies should suffice for brood rearing.

When the upper supers become filled with honey, they can be moved four stacks at a time, if you have a crane, boom, or forklift that can handle that much weight (1300 pounds with four full supers on each hive). They didn't say how to get the bees out of the stacks.

If you wish to learn more about this $300 device (which they say can be stacked two or more deep for moving hives), contact Bee Guard, 19 Polk St., Kiriat Gat 8202, Israel [Tel. 972-7-6810055 or FAX: 972-7-6810044]. They can be e-mailed at beeguard@inter.net.il or better yet find someone with access to

the web and look at the pictures and prices at www.bee-guard.co.il.

Sincerely,

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