JOURNEYMAN LEVEL MASTER BEEKEEPINJG COURSE

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HONEY BEE PESTS AND DISEASE

TRACHEAL MITE (Acarapis Woodi)

Mites that infest the tracheae (breathing tubes) of honey bees were found in the U.S. for the first time in July, 1984 on the U.S. – Mexican border.

It is microscopic in size.

Female tracheal mite is looking for a newly emerged bee about 3 days old or less, whose exoskeleton's odor is different from an older bees. She will transfer to the host and go into the first thoracic trachea. If she cannot find a host, she will crawl off and die. Grease patties causes all the bees to smell or have the odor like that of an older bee, which the tracheal mite does not like.

Chemical control of the tracheal mite is done with Mitathol which has menthol in it. If the temp is too great, it will run the bees out of the hive. The ***Mitathol*** needs to be put on the bottom, if the temp is too high, greater than 85 degrees.

The adults pierce the trachea and suck blood (hemolymph) from the bee. They live 30 or 40 days.
Hive Treatment--Apply grease patties, one in the fall of the year (early Oct) and one in the spring (early march). Two parts sugar; one part Crisco.

Tracheal Mites
Tracheal mites are microscope mites which reproduce in the trachea (airways) of the bee. A visual aid that would suspect tracheal mites would be a large number of bees walking about the outside of the hive.

- Female mites lay and attach eggs in the trachea
- Eggs mature in 2-3 weeks after hatching
- Female mites migrate to the surface of the bees

The mites affect the bee in two fashions that limit the bees ability to acquire oxygen. The mites physically obstruct the airway. The mites feed on the walls of the trachea causing scarification of the tracheal tubes.

Treatments

The traditional method of treating for tracheal mites is the use of menthol crystals which are placed
on the top of the hive. As the menthol evaporates, it enters the trachea of the bees thus killing the mites.
An alternative treatment is a mixture of powdered sugar and Crisco. The bees go after the sugar and
get covered with the Crisco. This interferes with the mite's ability to detect the young bees. As a
result, the mite remains on the older bee and eventually dies with the bee. Be cautious with this
treatment because it can attract hive beetles.

If you suspect Tracheal mites then you want to treat for the mites and then requeen.

Tracheal Mite

Tracheal Mite

The honey bee tracheal mite, *Acarapis woodi*, or acariosis as the disease is known in Europe, afflicts
only adult honey bees. The parasite was first described in 1921 in bees in Great Britain. This discovery
and concern over the potential impact that this mite would have on beekeeping in the United States led
to the enactment of the Honeybee Act of 1922, which restricted the importation of honey bees from
countries where this mite was known to exist.
There are three *Acarapis* species associated with adult honey bees: *A. woodi*, *A. externus*, and *A. dorsalis*.
These mites are difficult to detect and differentiate due to their small size and similarity; therefore, they
are frequently identified by location on the bee instead of morphological characteristics. However, only
A. woodi can be positively diagnosed solely on habitat; the position of other species on the host is useful,
but not infallible. *Acarapis woodi* lives exclusively in the prothoracic tracheae; *A. externus*, being external, I nhabits the membranous area between the posterior region of the head and thorax or the ventral neck region and the posterior tentorial pits; and

A. dorsalis is usually found in the dorsal groove between the mesoscutum and mesocutellum and the
wing bases. The *A. woodi* female is 143-174 um in length and the male 125- 136 um. The body is oval,
widest between the second and third pair of legs, and is whitish or pearly white with shining, smooth
cuticle; a few long hairs are present on the body and legs. It has an elongate, beak-like gnathosoma
with long, blade-like styles (mouthparts) for feeding.
When over 30 percent of the bees in a colony become parasitized by *A.woodi*, honey

production may
be reduced and the likelihood of winter survival decreases with a corresponding increase in infestation.

Individual bees are believed to die because of the disruption to respiration due to the mites clogging
the tracheae, the damage caused by the mites to the integrity of the tracheae, microorganisms entering
the hemolymph (blood) through the damaged tracheae, and from the loss of hemolymph.

The tracheal mite has now been reported on every continent except Australia. Initial detections of
A. woodi were reported in Brazil in 1974, in Mexico in 1980, and in Texas in 1984. The mites are
transmitted bee to bee within a colony by queens, drones and workers. In addition, the movement
of package bees and queens, as well as established colonies, has resulted in the dissemination of
this mite throughout much of the United States.

One of the first problems that became apparent when the tracheal mite was detected in the United States
was the lack of agreement on their economic impact. The literature from Europe did not always agree
and beekeepers, research scientists and regulatory officials had differing opinions on the interpretation
of the data. However, it soon became evident that the mites were having a serious impact on beekeeping
and spreading faster than predicted. The level of infestation within colonies was higher than expected.

It is apparent that the tracheal mite found an extremely susceptible honey bee host in the United States.

The population of *A. woodi* in a colony may vary seasonally. During the period of maximum bee
population, the percentage of bees with mites is reduced. The likelihood of detecting tracheal mites
is highest in the fall and winter. No one symptom characterizes this disease; an affected bee could have
disjointed wings and be unable to fly, or have a distended abdomen, or both. Absence of these symptoms
does not necessarily imply freedom from mites. Positive diagnosis can only be made by microscopic
examination of the tracheae; since only *A. woodi* is found in the bee tracheae, this is an important
diagnostic feature.

In sampling for *A. woodi*, collect moribund bees that may be crawling near the hive entrance or bees at
the entrance as they are leaving or returning to the hive. These bees should be placed in 70% ethyl or

methyl alcohol as they are collected. Bees that have been dead for an indeterminate period are less than
ideal for tracheal mite diagnosis.
Menthol is the only material that is currently approved by the Environmental Protection Agency (EPA)
for the control of these mites in the United States. Beekeepers can minimize the impact of tracheal mites
by intensive management practices to maintain populous colonies and by using menthol.
Colonies can be treated with menthol when there is no heavy nectar flow and daytime temperatures are
expected to reach at least 60 F. The best time being in the spring when the weather is warm, and in the
late summer or fall of the year immediately after removing the surplus honey.
Directions for Using Menthol: Fifty grams (1.8 ounce) of crystalline menthol should be enclosed in a
7" x 7" plastic screen bag or equally porous material and placed inside a colony for 20-25 days. Menthol
placed on the top bars is the preferred method of treatment provided the daytime temperature does not
exceed 80 degrees F. During hot weather, the menthol should be placed on the bottom board of the colony.
There should be no honey supers on the hive during the treatment, and the menthol should be taken out
of a colony at least one month before any anticipated flow. Before using menthol, read and follow the
approved label carefully.

VARROA MITE

Biggest problem in the world. We have the Varroa Destructor, was Varroa Jacobsoni. The one that we have is the Korean variety. The one they have in Mexico is the Japanese variety. We have the worst. ***60 % of the varroa mite is found in the larvae or brood***. Feed on the blood (hemolymph) of the brood. They may be spreading a virus which may be the greatest problem.

Apistan-Introduced in the late 1980's. About day 26 you have about 98% effective control. One strip per 5 frames of bees. We have widespread resistance to the Apistan, not confirmed in SC. Varroa is in the capped brood chamber so you leave it on for several cycles. They must come in contact with the Apistan strip.

Checkmite- as effective as Apistan. It is an organic phosphate which is not looked upon as being very desirable.

THRESHOLDS

Pest density 0 to 80 average density, ET (Treatment Level) or EIL (Economic Injury Level).

Measuring methods to determine Varroa Mite Level

1. Ether roll test-collect 300 bees, two short burst in jar. Put lid back on and roll it vigorously. Varroa detach from the bee and stick to interior of the jar. In august, your treatment threshold is 13 to 15 varroa per colony, then you need to treat.

2. Use a sticky board with a screen bottom board. The varroa fall to the bottom board. You are looking for 24 hour period, if you have 57 to 60 varroa mites, this is the economic threshold treatment.

VARROA MITE CONTROL ALTERNATIVES

1. ApiLife, 76 % thymol- use in the fall to avoid damaging brood. Use chemical resistant gloves. (Camphor, eucalyptus, menthol) . Comes in briquette form. Put in each corner of the brood chamber. Use in the fall rather than the spring. Enclose in hardware cloth. Put in three treatments (full 30 day treatment).

2. Another method is to ***remove drone brood***, which the varroa likes. You can use a drone brood frame foundation which can attract the varroa, and then remove the frame, thus removing the varroa. Must be taken out at the right time, every 10 days.

3. If you use Mike Hood's small hive beetle trap, the bees normally build drone cone and thus you can remove the varroa. Put in number 1 and number 10 position in the Brood Hive.

4. Screen bottom boards as a means of controlling the varroa. It will control about 30 percent of the varroa mite. Have to put oil in the tray to collect and hold the mite.

5. Apiguard, a thymol product. Same limitations which might effect brood production.

6. Oxalic Acid- temperature sensitive. Must use when temp is effective to vaporize the product.

7. Formic acid.

8. Powered Sugar method. Must have a screen bottom board with sticky surface. Remember you are only dealing with the mites that are on the bees, not in the brood chambers.

9. Selecting Queens for Resistance-Long term Solution to the Varroa Mite Problem.

Last and biggest way of controlling the varroa is by using the Russian Bee and the SMR which now called the VHR (Varroa Hygienic Resistant) bees. The bees can actually sense the brood which has varroa mite in them. They have found out that the honey bee can sense which varroa mite are non-reproducing.

Varroa destructor

Varroa destructor	
	
Scientific classification	
Kingdom:	Animalia
Phylum:	Arthropoda
Class:	Arachnida
Subclass:	Acari
Order:	Parasitiformes
Suborder:	Mesostigmata

Family:	Varroidae
Genus:	*Varroa*
Species:	***V. destructor***
Binomial name	
Varroa destructor Anderson & Trueman, 2000	

Varroa destructor is an external parasitic mite that attacks the honey bees *Apis cerana* and *Apis mellifera*. The disease caused by the mites is called **varroosis**.

Varroa destructor can only reproduce in a honey bee colony. It attaches to the body of the bee and weakens the bee by sucking hemolymph. In this process, RNA viruses such as the deformed wing virus (DWV) spread to bees. A significant mite infestation will lead to the death of a honey bee colony, usually in the late autumn through early spring. The *Varroa* mite is the parasite with the most pronounced economic impact on the beekeeping industry. It may be a contributing factor to colony collapse disorder, as research shows it is the main factor for collapsed colonies in Ontario, Canada and Hawaii, USA.

Physical description

The adult mite is reddish-brown in color; has a flat, button shape; is 1–1.8 mm long and 1.5–2 mm wide; and has eight legs.

Reproduction, infection and hive mortality

Mites reproduce on a 10-day cycle. The female mite enters a honey bee brood cell. As soon as the cell is capped, the *Varroa* mite lays eggs on the larva. The young mites, typically several females and one male, hatch in about the same time as the young bee develops and leave the cell with the host. When the young bee emerges from the cell after pupation, the *Varroa* mites also leave and spread to other bees and larvae. The mite preferentially infests drone cells.

The adults suck the "blood" (hemolymph) of adult honey bees for sustenance, leaving open wounds. The compromised adult bees are more prone to infections.

With the exception of some resistance in the Russian strains and bees with varroa-sensitive hygiene genes developed by the USDA, the European *Apis mellifera* bees are almost completely defenseless against these parasites (Russian honey bees are one-third to one-half less susceptible to mite reproduction).

The model for the population dynamics is exponential growth when bee brood are available and exponential decline when no brood is available. In 12 weeks, the number of mites in a western honey bee hive can multiply by (roughly) 12. High mite populations in the autumn can cause a crisis when drone rearing ceases and the mites switch to worker larvae, causing a quick population crash and often hive death.

Low temperature scanning electron micrograph of *V. destructor* on a honey bee host

Varroa mites have been found on flower-feeding insects such as the bumblebee *Bombus pennsylvanicus*, the scarab beetle *Phanaeus vindex* and the flower-fly *Palpada vinetorum*. Although the *Varroa* mite cannot reproduce on these insects, its presence on them may be a means by which it spreads short distances (phoresy).

Varroa mites on pupa

Varroa mites on pupae

Varroa destructor on bee larva

Introduction around the world

- Early 1960s Japan, USSR
- 1960s-1970s Eastern Europe
- 1971 Brazil
- Late 1970s South America
- 1980 Poland
- 1982 France
- 1984 Switzerland, Spain, Italy
- 1987 Portugal
- 1987 USA
- 1989 Canada
- 1992 England
- 2000 New Zealand (North Island)
- 2006 New Zealand (South Island)
- 2007 Hawaii (Oahu, Hawaii Island)[

As of mid-2012, Australia was thought to be free of the mite. In early 2010, an isolated subspecies of bee was discovered in Kufra (southeastern Libya) that appears to be free of the mite.

Identification

Until recently, *V. destructor* was thought to be a closely related mite species called *Varroa jacobsoni*. Both species parasitize the Asian honey bee, *Apis cerana*. However, the species originally described as *V. jacobsoni* by Anthonie Cornelis Oudemans in 1904 is not the same species that also attacks *Apis mellifera*. The jump to *A. mellifera* probably first took place in the Philippines in the early 1960s where imported *A. mellifera* came into close contact with infected *A. cerana*. Until 2000, scientists had not identified *V. destructor* as a separate species. This late identification in 2000 by Anderson and Trueman corrected some previous confusion and mislabeling in the scientific literature.

Varroosis

The infection and subsequent parasitic disease caused by varroa mites is called *varroosis*. Sometimes, the incorrect names *varroatosis* or *varroasis* are used. A parasitic disease name must be formed from the taxonomic name of the parasite and the suffixe -osis as provided in the Standardised Nomenclature by the World Association for the Advancement of Veterinary Parasitology. For example, the World Organisation for Animal Health (OIE) use the name *varroosis* in the OIE Terrestrial Manual.

Treatments have been met with limited success. First, the bees were medicated with fluvalinate, which had about 95% mite falls. However, the last five percent became resistant to it, and later, almost immune. Fluvalinate was followed by coumaphos.

Control or preventive measures and treatment

Chemical measures

Varroa mites can be treated with commercially available miticides. Miticides must be applied carefully to minimize the contamination of honey that might be consumed by humans. Proper use of miticides also slows the development of resistance by the mites.

Synthetic chemicals

- Pyrethroid insecticide (Apistan) as strips
- Organophosphate insecticide (Coumaphos (Check-mite)) as strips
- Manley's Thymol Crystal and surgical spirit recipe with sugar as food

Naturally occurring chemicals

- Formic acid as vapor or pads (Mite-Away)

- Powdered sugar (Dowda method), talc, or other "safe" powders with a grain size between 5 and 15 µm (0.20 and 0.59 mil) can be sprinkled on the bees.
- Essential oils, especially lemon, mint and thyme oil
- Sugar esters (Sucrocide) in spray application
- Oxalic acid trickling method or applied as vapor
- Mineral oil (food grade) as vapor and in direct application on paper or cords
- Natural hops compounds in strip application (Hopguard)

Physical, mechanical, behavioral methods

Varroa mites can also be controlled through nonchemical means. Most of these controls are intended to reduce the mite population to a manageable level, not to eliminate the mites completely.

- **Heating method**, first used by beekeepers in Eastern Europe in the 1970s and later became a global method. In this method, hive frames are heated to a certain temperature for a period of time, which kills the varroa larvae, but doesn't harm the bees and broods. In Germany, anti-varroa heaters are manufactured for use by professional bee keepers.

- **Perforated bottom board method** is used by many beekeepers on their hives. When mites occasionally fall off a bee, they must climb back up to parasitize another bee. If the beehive has a screened floor with mesh the right size, the mite will fall through and cannot return to the beehive. The screened bottom board is also being credited with increased circulation of air, which reduces condensation in a hive during the winter. Studies at Cornell University done over two years found that screened bottoms have no measurable effect at all. Screened bottom boards with sticky boards separate mites that fall through the screen and the sticky board prevents them from crawling back up.

- **Limited drone brood cell method**, is based on limiting the brood space cell for *Varroa* mites to inhabit (4.9 mm across — about 0.5 mm smaller than standard), and also to enhance the difference in size between worker and drone brood, with the intention of making the drone comb traps more effective in trapping *Varroa* mites. Small cell foundations have staunch advocates, though controlled studies have been generally inconclusive.

- **Comb trapping method** (also known as swarming method), is based on interrupting the honey bee brood cycle. It is an advanced method that removes capped brood from the hive, where the *Varroa* mites breed. The queen is confined to a comb using a comb cage. At 9-day intervals, the queen is confined to a new comb, and the brood in the old comb is left to be reared. The brood in the previous comb, now capped and infested with *Varroa* mites, is removed. The cycle is repeated. This complex method can remove up to 80% of *Varroa* mites in the hive.

- **Freezing drone brood method** takes advantage of *Varroa* mites' preference for longer living drone brood. The beekeeper will put a frame in the hive that is sized to encourage the queen to lay primarily drone brood. Once the brood is capped, the beekeeper removes the frame and puts it in the freezer. This kills the *Varroa* mites feeding on those bees. It also kills the drone brood, but most hives produce an excess of drone bees, so it is not generally considered a loss. After freezing, the frame can be returned to the hive. The nurse bees will clean out the dead brood (and dead mites) and the cycle continues.

- **Drone brood excision method** is a variation applicable to top bar hives. Honey bees tend to place comb suitable for drone brood along the bottom and outer margins of the comb. Cutting this off at a late stage of development ("purple eye stage") and discarding it reduces the mite load on the colony. It also allows for inspection and counting of mites on the brood.

Genetic engineering

Researchers have been able to use RNA interference to knock out genes in the *Varroa* mite. The aim is to change the bees genetic traits so that the bees can smell infected brood and remove them before the infestation spreads further.

SMALL HIVE BEETLES

Adult flies into the hive.

Ways of controlling the small hive beetles is:

1. To use check mite, put it on cardboard and turn it over, and put it in the back of the hive. Must be used on the bottom board for a bout 40 days. The bees must come in contact with the CheckMite. It can not be used in nectar flow, when the beetles become the problem. The other opportunity is to put in on in late August. ***The small hive beetle is not considered to be a major pest in the US.***

2. The other registered product is Guard Star. This is 40 % permethrin. It must be cut with water. It is a soil impregnated product. Stays active for about 30 days.

Small Hive Beetle Treatment Threshold

How many small hive beetles warrant pesticide treatment in a managed colony of honey bee? The answer is not known but it appears that it is 300 beetles. This is what Mike Hood and Keith Delaplane have come up with.

The best method is to trap the beetle before it gets to the hive. This does not seem to be an acceptable process to control the SHB.

The best recommendation is to have a well populated and strong colony.

A .Varroa mite control
b. Tracheal mite control
c. Disease free
d. Adequate food available
e. Swarm prevention

F, Recommended is a minimum colony manipulation. Do not go into the hive unless necessary.

G. GENECTIC CONTROL-Select queen for beetle control. The AFB is one that will control the SHB.

Aggression toward beetles
Confinement behavior
Propolis collection and utilization
Removal of beetle larvae
Hygienic removal of beetle eggs from capped brood

H. CULTURAL OR MECHANICAL CONTROL

1. Good sanitation around honey houses; extract honey in 1—2 days
2. Feed bees cautiously
3. Colony movement to new locations
4. Avoid wet apiary sites-soil must be moist for SHB to pupae.

5. Physically remove the hive beetles with vacuum or some other means.

6. Another way is to use West Trap; slotted cover, tray with oil, spacer, and bottom board. Colony has to be very level.

7. Piedmont – Charlie Holden - trap. Hardware screen, tray insert with oil.

8. Mike Hood has developed a SHB trap. Put one on the frame in the bottom hive or in the top of the hive. . The material that goes in the trap is water and cider vinegar. Most of Mikes work has been in the deep hive body.

USDA SHB Yeast Based Attractant. Mixed with pollen substitute and oil in the side compartments. Looks like the USDA Yeast based attractant is more effective. It does not evaporate, especially in the summer. Other than summer, the vinegar seems to be as effective as the Yeast.

Once they reach the larval stage of maturity, it is best to get the hive out of the apiary and freeze it. The soil must be treated after the hive has moved. (Look up information on the small hive beetle in the texts that you have on

BIOLOGICAL CONTROL FOR THE FUTURE

Parasitoids
Soil fungi
Nematodes
Fire ants

CONCLUSIONS

1. Beekeepers should practice good honey bee colony management practices.
2. Allow bees to use their own natural defense measures.
3. Reduce beetle populations by non chemical means: vacuuming, trappings, etc.
4. Remove heavily beetle- infested colonies from the apiary prior to colony collapse.
5. Use chemical control as a last resort.

Small hive beetle

Small hive beetle

Scientific classification	
Kingdom:	Animalia
Phylum:	Arthropoda
Class:	Insecta
Order:	Coleoptera
Family:	Nitidulidae
Genus:	*Aethina*
Species:	***A. tumida***
Binomial name	
Aethina tumida Murray, 1867	

The **small hive beetle** (*Aethina tumida*) is a beekeeping pest.[1]

Endemic to sub-Saharan Africa, the small hive beetle, *Aethina tumida* was first discovered in the United States in 1996 and has now spread to many U.S. states including, Georgia, South Carolina, North Carolina, Michigan, Pennsylvania, New Jersey, Ohio, Illinois, Minnesota, Maryland, Missouri, New York, Connecticut, Virginia and Hawaii. The small hive beetle has become established in the state of Texas as well. The movement of migratory beekeepers from Florida may have transported the beetle to other states. Recent findings also indicate transport of the beetles in packages.

Internationally, the Small Hive Beetle has spread to Australia being first identified at Richmond, NSW in 2002. Subsequently it has affected many areas of Queensland and New South Wales. It is speculated that a combination of importing queens from other countries and beekeepers moving their hives has caused the spread.

In Canada, the small hive beetle has been detected in Manitoba (2002 and 2006), Alberta (2006), Québec (2008, 2009), and Ontario (2010). In the Prairie Provinces, measures were taken to control the pest and small hive beetles failed to establish a population. It is still to be determined whether the small hive beetle has been able to establish a resident population in Ontario or Québec.[4]

The small hive beetle can be a destructive pest of honey bee colonies, causing damage to comb, stored honey and pollen. If a beetle infestation is sufficiently heavy, they may cause bees to abandon their hive. Its absence can also be a marker in the diagnosis of Colony Collapse Disorder for honey-bees. The beetles can also be a pest of stored combs, and honey (in the comb) awaiting extraction. Beetle larvae may tunnel through combs of honey, feeding and defecating, causing discoloration and fermentation of the honey.

Life history

Aethina tumida was previously known only from the sub-Saharan regions of Africa where it has been considered a minor pest of bees. The life cycle information is known primarily from studies in South Africa.

The small hive beetle is a member of the family of scavengers or sap beetles. The adult beetle is dark brown to black and about one-half centimeter in length. The adults may live up to 6 months and can be observed almost anywhere in a hive, although they are most often found on the rear portion of the bottom board of a hive. Female beetles lay irregular masses of eggs in cracks or crevices in a hive. The eggs hatch in 2–3 days into white-colored larvae that will grow to 10–11 mm in length. Larvae feed on pollen and honey, damaging combs, and require about 10–16 days to mature. Larvae that are ready to pupate leave the hive and burrow into soil near the hive. The pupation period may last approximately 3–4 weeks. Newly emerged adults seek out hives and females generally mate and begin egg laying about a week after emergence. Hive beetles may have 4–5 generations a year during the warmer seasons.

Damage to colonies and stored honey


Comb slimed by hive beetle larvae. *Hives infested at this level will drive out bee colonies.*
See also: Diseases of the honeybee#Small hive beetle

The primary damage to colonies and stored honey caused by the small hive beetle is through the feeding activity of the larvae. Hives and stored equipment with heavy infestations of beetles have been described as a mess. A summary taken from various reports of damage caused by these beetles is listed below:

Larvae tunnel through comb with stored honey or pollen, damaging or destroying cappings and comb. Larvae defecate in honey and the honey becomes discolored from the feces. Activity of the larvae causes fermentation and a frothiness in the honey; the honey develops a characteristic odor of decaying oranges. Damage and fermentation cause honey to run out of combs, creating a mess in hives or extracting rooms. Heavy infestations cause bees to abscond; some beekeepers have reported the rapid collapse of even strong colonies.

Control

The small hive beetle is considered a secondary pest in South Africa, and, as such, has not been the subject of major control efforts. The beetle is most often found in weak or failing hives and rarely affects strong hives. However, differences in the housecleaning traits of the bees found in South Africa and the U.S. may mean very different responses to the beetles. Some early reports from Florida and South Carolina suggest the beetles may be more damaging there than in Africa. PDB (paradichlorobenzene) has been used for protecting empty stored combs. Coumaphos bee strips (Bayer Corporation) have been approved for use in hives for the control of small hive beetles in some states under an emergency registration.

Biological control through beneficial soil nematodes specific to the SHB is also effective.Nematodes are microscopic roundworms found living naturally in most soils. Many species of nematodes exist and each has a unique purpose in nature. Also they pose no threat to the environment and are exempt from registration and regulation by EPA and FDA.

Beneficial nematodes are used by applying them to the soil while suspended in water. They may be applied as a pressurized spray or simply poured from a watering can. Nematodes applied to soil burrow downward in search of insect pests. Once found, nematodes enter the body of the insect and release a powerful bacterium which quickly kills the pest. Released bacteria dissolve the internal tissues of the insect which becomes food for nematode growth and development. Matured nematodes then mate and lay eggs to produce more nematodes within the dead insect. Several such generations may occur over just a few days. After the inside of an insect is consumed, tiny infective stage nematodes leave the dead insect shell and begin searching for more pests. As many as 350,000 nematodes may emerge from a single dead insect after only 10-15 days. Numbers depend on insect size.

The most effective control against small hive beetle is maintaining colony strength. Coupled with minimizing empty frames of comb, this will all but eliminate the chances of colony failure.

There are also several traps currently on the market. The more effective ones are the Beetlejail Baitable, Hood Trap, the Freeman Beetle Trap, the West trap, the Australian, AJ's Beetle Eater and the Beetle Blaster. All these traps use non-toxic oil to suffocate the beetles. This allows beekeepers to avoid having toxic chemicals in their beehives.

To preserve the beetles for identification, it is recommended to submerse the beetle in a container or methylated spirits or vinegar. This will kill live beetles.

Regulations

In New South Wales (Australia), infestation of hives by Small hive beetle is notifiable as a honey bee pest under the Stock Diseases Act 1923. The maximum penalty for failing to notify is $11,000

HONEY BEE DISEASES

BROOD DISEASES-
- American Foul Brood
- European Foul Brood
- Chalk Brood
- Sac Brood

ADULT DISEASES
- Nosema
- VIRUSES

Bacterial pathogens
AFB- EFB

Fungal Pathogens
Chalk brood

VIRAL PATHOGENS
SAC BROOD
BPMS

AMERICAN FOUL BROOD DISEASE

Normally brood dies in the pupae form. They have to consume the disease in the early larval stage, which after the egg hatches into the larval stage. If larvae are 50 hours or older, they will not be circum to the AFB.
If affected, they dry up and form a scale. It does sporalate and spread over the hive.

Field test:

1. Tooth pick and if it ropes out about an inch, it is definitely AFB.
2. Pupae tongue.
3. Dead animal odor is another indicator.
4. The cap cells are perforated-small holes in the cap. AFB will remain on equipment for 50 years.

IS THERE A PROBLEM?

Beekeeper is 1st line of defense.

State inspection services backup-both man & beast.

IDENTIFICATION OF AMERICAN FOUL BROOD

Sunken capping w/perforated hole
Unhealthy Larvae
Pulpal tongue & scale.

SOME SPECIFIECS

DIAGNOSIS
Foul Odor
Ropy brood then scales
Sunken cappings
Confirmation of bacterial

HOW DOES IT GET SPREAD
Robbing
Movement of equipment (frames, dead out, buying used equip, especially drone cone)
Spread by beekeeper's hive tool, gloves)
Drifting
Feeding honey

TREATMENT AND PREVENTION

Terramycin
Burn the hives
Tylosin-New treatment. Use as a powder form
Some states have treatment tanks
Selection of Queens that are resistance to AFB- Hygienic traits, which include keeping the hive clean and uncapping cleaning out the dead larvae.

American foulbrood


Field test for American foulbrood

American foulbrood (AFB), caused by the spore- forming *Paenibacillus larvae ssp. larvae* (formerly classified as *Bacillus larvae*), is the most widespread and destructive of the bee brood diseases. Paenibacillus larvae is a rod-shaped bacterium, which is visible only under a high power microscope. Larvae up to 3 days old become infected by ingesting spores that are present in their food. Young larvae less than 24 hours old are most susceptible to infection. Spores germinate in the gut of the larva and the vegetative form of the bacteria begins to grow, taking its nourishment from the larva. Spores will not germinate in larvae over 3 days old. Infected larvae normally die after their cell is sealed. The vegetative form of the bacterium will die but not before it produces many millions of spores. Each dead larva may contain as many as 100 million spores. This disease only affects the bee larvae but is highly infectious and deadly to bee brood. Infected larvae darken and die.

History

Until 1906 the two foulbrood diseases were not differentiated and the condition was generally referred to as foulbrood. Thereafter, the terms European and American were used to distinguish the diseases. However the designations did not refer to the geographical distributions but to the areas where they were first investigated scientifically. In 1907 it was demonstrated conclusively that a bacterium called Bacillus larvae was the cause of American foulbrood disease by fulfilling Koch's postulates The geographical origin of AFB is unknown, but it is found almost worldwide

Diagnosis

Lab testing is necessary for definitive diagnosis, but a good field test is to touch a dead larva with a toothpick or twig. It will be sticky and "ropey" (drawn out). Foulbrood also has a characteristic odor, and experienced beekeepers with a good sense of smell can often detect the disease upon opening a hive. In the photo at right, some larvae are healthy while others are diseased. Capped cells with decomposing larvae are sunken, as can be seen at lower right. Some caps may be torn, as well. Compare with healthy brood. The most reliable disease diagnosis is done by sending in some possibly affected brood comb to a laboratory specialized in identifying honey bee diseases.

Disease spread

When cleaning infected cells, bees distribute spores throughout the entire colony. Disease spreads rapidly throughout the hive as the bees, attempting to remove the spore-laden dead larvae, contaminate brood food. Nectar stored in contaminated cells will contain spores and soon the brood chamber becomes filled with contaminated honey. As this honey is moved up into the supers, the entire hive becomes contaminated with spores. When the colony becomes weak from AFB infection, robber bees may enter and take contaminated honey back to their hives thereby spreading the disease to other colonies and apiaries. Beekeepers also may spread disease by moving equipment (frames or supers) from contaminated hives to healthy ones.

American foulbrood spores are extremely resistant to desiccation and can remain viable for more than 40 years in honey and beekeeping equipment. Therefore honey from an unknown source should never be used as bee feed, and used beekeeping equipment should be assumed contaminated unless known to be otherwise.

Beehives with American foul brood should be burned due to spores that remain viable for up to 40 years.

Treatment

Antibiotics, in non-resistant strains of the pathogen, can prevent the vegetative state of the bacterium forming. Drug treatment to prevent the American foulbrood spores from successfully germinating and proliferating is possible using oxytetracycline hydrochloride (Terramycin). Another drug treatment, tylosin tartrate, was approved by the US Food and Drug Administration (FDA) in 2005.

Chemical treatment is sometimes used prophylactically, but this is a source of considerable controversy because certain strains of the bacterium seem to be rapidly developing resistance. In addition, hives that are contaminated with millions of American foulbrood spores have to be prophylactically treated indefinitely. Once the treatment is suspended the American foulbrood spores germinate successfully again leading to a disease outbreak.

Because of the persistence of the spores (which can survive up to 40 years), many State Apiary Inspectors require an AFB diseased hive to be burned completely. A less radical method of containing the spread of disease is burning the frames and comb and thoroughly flame scorching the interior of the hive body, bottom board and covers. Dipping the hive parts in hot paraffin wax or a 3% sodium hypochlorite solution (bleach) also renders the AFB spores innocuous. It is also possible to sterilize an infected hive without damaging either the structure of the hive or the stores of honey and pollen it contains by sufficiently lengthy exposure to an atmosphere of ethylene oxide gas, as in a closed chamber, as hospitals do to sterilize equipment that cannot withstand steam sterilization.[

OTHER BROOD DISEASES

EFB-is also bacteria –does not sporalate- normally see EFB in the spring of the year. It is a stress disease. Coiled stage of the larvae is a sure sign of EFB. Larvae die before they are capped. Can use Terramycin to treat it. It does not kill all the brood but really weakens the colony. Must treat during the major nectar flow in April and May, so it is really not a good idea to do that.

Chalk brood-it is a fungus. Brood die and looks like a mummy. Looks like a little chalk down in the cell. Normally pollen is the culprit.

Sacbrood- this is a virus. Can treat for it. Normally you have to re-queen.

EFB Specifics

A stress disease
How/why diagnose
Should we treat with antibiotics?

Life of Cycle of Sac brood

ADULT DISEASES

1. Nosema (protozoan) Feed bees with Fumidil- B
2. Paralysis (virus)
3. K wing hairless b lack syndrome (virus)

HONEY BEE DISEASE MIMICS

Dysentery
Pesticides and Plant Poisoning
Pests Problems
Brood Chilling- In the spring time when the colony has built up to strong and the hive does not have enough adult bees to keep everyone warm

European foulbrood

Melissococcus plutonius is a bacterium that infects the midgut of the bee larvae. European foulbrood is considered less serious than American foulbrood. *M. plutonius* is not a spore-forming bacterium, but bacterial cells can survive several months on wax foundation. Symptoms include dead and dying larvae which can appear curled upwards, brown or yellow, melted or deflated with tracheal tubes more apparent, or dried out and rubbery.

European foulbrood is often considered a "stress" disease — dangerous only if the colony is already under stress for other reasons. An otherwise healthy colony can usually survive European foulbrood. An outbreak of the disease may be controlled chemically with oxytetracycline hydrochloride, but honey from treated colonies could have chemical residues from the treatment. The 'Shook Swarm'[11] technique of bee husbandry can also be used to effectively control the disease, the advantage being that chemicals are not used. Prophylactic treatments are not recommended as they lead to resistant bacteria.

Fungal diseases

Chalkbrood

The entrance to this beehive is littered with Chalkbrood mummies that have been expelled from the hive by hygienic worker bees.

Ascosphaera apis is a fungal disease that infests the gut of the larva. The fungus will compete with the larva for food, ultimately causing it to starve. The fungus will then go on to consume the rest of the larva's body, causing it to appear white and 'chalky'.

Chalkbrood is most commonly visible during wet springs. Hives with Chalkbrood can generally be recovered by increasing the ventilation through the hive.

Stonebrood

Stonebrood is a fungal disease caused by *Aspergillus fumigatus*, *Aspergillus flavus*, and *Aspergillus niger*. It causes mummification of the brood of a honey bee colony. The fungi are common soil inhabitants and are also pathogenic to other insects, birds, and mammals. The disease is difficult to identify in the early stages of infection. The spores of the different species have different colours and can also cause respiratory damage to humans and other animals. When a bee larva takes in spores, they may hatch in the gut, growing rapidly to form a collar-like ring near the head. After death, the larvae turn black and become difficult to crush, hence the name stonebrood. Eventually, the fungus erupts from the integument of the larva and forms a false skin. In this stage, the larvae are covered with powdery fungal spores. Worker bees clean out the infected brood and the hive may recover depending on factors such as the strength of the colony, the level of infection, and hygienic habits of the strain of bees (there is variation in the trait among different subspecies/races).

Viral diseases

Cripaviridae

Chronic paralysis virus

- *Syndrome 1* Abnormal trembling of the wings and body occurs. The bees cannot fly, and often crawl on the ground and up plant stems. In some cases, the crawling bees can be found in large numbers (1000+). The bees huddle together on the top of the cluster or on the top bars of the hive. They may have bloated abdomens due to distension of the honey sac. The wings are partially spread or dislocated.

- *Syndrome 2* Affected bees are able to fly, but are almost hairless. They appear dark or black and look smaller. They have a relatively broad abdomen. They are often nibbled by older bees in the colony and this may be the cause of the hairlessness. They are hindered at the entrance to the hive by the guard bees. A few days after infection, trembling begins. They then become flightless and soon die.

In 2008, the chronic bee paralysis virus was reported for the first time in *Formica rufa* and another species of ant, *Camponotus vagus*.

Dicistroviridae

Acute bee paralysis virus

Acute bee paralysis virus (TaxID 92444) is considered to be a common infective agent of bees. It belongs to the family Dicistroviridae, as does the Israel acute paralysis virus, Kashmir bee virus, and the black queen cell virus. It is frequently detected in apparently healthy colonies. Apparently, this virus plays a role in cases of sudden collapse of honey bee colonies infested with the parasitic mite *Varroa destructor*.

Israeli acute paralysis virus

A related virus described in 2004 is known as the Israeli acute paralysis virus (IAPV). (TaxID 294365) The virus is named after the place where it was first identified—its place of origin is unknown. IAPV has been suggested as a marker associated with colony collapse disorder.

Kashmir bee virus

Kashmir bee virus (TaxID 68876) is related to the preceding viruses. Recently discovered, it is currently only positively identifiable by a laboratory test. Little is known about it yet.

Black queen cell virus

Black queen cell virus (BQCV)(TaxID 92395) causes the queen larva to turn black and die. It is thought to be associated with *Nosema*.

Cloudy wing virus

Cloudy wing virus (CWV) is a little-studied, small, icosahedral virus commonly found in honey bees, especially in collapsing colonies infested by *Varroa destructor*, providing circumstantial evidence that the mite may act as a vector.

Sacbrood virus

Perina nuda, a picorna-like virus, causes sacbrood disease. Affected larvae change from pearly white to gray and finally black. Death occurs when the larvae are upright, just before pupation. Consequently, affected larvae are usually found in capped cells. Head development of diseased larvae is typically retarded. The head region is usually darker than the rest of the body and may lean toward the center of the cell. When affected larvae are carefully removed from their cells, they appear to be a sac filled with water. Typically, the scales are brittle but easy to remove. Sacbrood-diseased larvae have no characteristic odor.

Iflaviridae

Deformed wing virus

Main article: Deformed wing virus

Deformed wing virus (DWV) is the causative agent of the wing deformities and other body malformations typically seen in honeybee colonies that are heavily infested with the parasitic mite *Varroa destructor*. DWV is part of a complex of closely related virus strains/species that also includes Kakugo virus, *Varroa destructor* virus 1 and Egypt bee virus. This deformity can clearly be seen on the honeybee's wings in the image. The deformities are produced almost exclusively due to DWV transmission by *V. destructor* when it parasitizes pupae. Bees infected as adults remain symptom-free, although they do display behavioral changes and have reduced life expectancy. Deformed bees are rapidly expelled from the colony, leading to a gradual loss of adult bees for colony maintenance. If this loss is excessive and can no longer be compensated by the emergence of healthy bees, the colony rapidly dwindles and dies.

Kakugo virus]

Kakugo virus is an iflavirus infecting bees; varroa mites may mediate its prevalence.

Iridoviridae

Invertebrate iridescent virus type 6

Applying proteomics-based pathogen screening tools in 2010, researchers announced they had identified a co-infection of an iridovirus; specifically invertebrate iridescent virus type 6 (IIV-6) and *Nosema ceranae* in all CCD colonies sampled. On the basis of this research, the *New York Times* reported the colony collapse mystery solved, quoting researcher Dr. Bromenshenk, a co-author of the study, "[The virus and fungus] are both present in all these collapsed colonies." Evidence for this association, however, remains minimal and several authors have disputed the original methodology used to associate CCD with IIV-6.

Secoviridae

Tobacco ringspot virus

The RNA virus tobacco ringspot virus, primarily a plant pathogen, can infect honeybees through infected pollen.

Dysentery

Dysentery is a condition resulting from a combination of long periods of inability to make cleansing flights (generally due to cold weather) and food stores which contain a high proportion of indigestible matter. As a bee's gut becomes engorged with feces that cannot be voided in flight as preferred by the bees, the bee voids within the hive. When enough bees do this, the hive population rapidly collapses and death of the colony results. Dark honeys and honeydews have greater quantities of indigestible matter.

Occasional warm days in winter are critical for honey bee survival; dysentery problems increase in likelihood during periods of more than two or three weeks with temperatures below 50°F (10°C). When cleansing flights are few, bees will often be forced out at times when the temperature is barely adequate for their wing muscles to function, and large quantities of bees may be seen dead in the snow around the hives. Colonies found dead in spring from dysentery will have feces smeared over the frames and other hive parts.

In very cold areas of North America and Europe, where honey bees are kept in ventilated buildings during the coldest part of winter, no cleansing flights are possible; under such circumstances, it is common for beekeepers to remove all honey from the hives and replace it with sugar water or high fructose corn syrup, which have nearly no indigestible matter.

Chilled brood

Chilled brood is not actually a disease, but can be a result of mistreatment of the bees by the beekeeper. It also can be caused by a pesticide hit that primarily kills off the adult population, or by a sudden drop in temperature during rapid spring buildup. The brood must be kept warm at all times; nurse bees will cluster over the brood to keep it at the right temperature. When a beekeeper opens the hive (to inspect, remove honey, check the queen, or just to look) and prevents the nurse bees from clustering on the frame for too long, the brood can become chilled, deforming or even killing some of the bees.

Pesticide losses

Honey bees are susceptible to many of the chemicals used for agricultural spraying of other insects and pests. Many pesticides are known to be toxic to bees. Because the bees forage up to several miles from the hive, they may fly into areas actively being sprayed by farmers or they may collect pollen from contaminated flowers.

Carbamate pesticides, such as carbaryl, can be especially pernicious since toxicity can take as long as two days to become evident, allowing infected pollen to be returned and distributed throughout the colony. Organophosphates and other insecticides are also known to kill honey bee clusters in treated areas.

Pesticide losses may be relatively easy to identify (large and sudden numbers of dead bees in front of the hive) or quite difficult, especially if the loss results from a gradual accumulation of pesticide brought in by the foraging bees. Quick-acting pesticides may deprive the hive of its foragers, dropping them in the field before they can return home.

Insecticides that are toxic to bees have label directions that protect the bees from poisoning as they forage. To comply with the label, applicators must know where and when bees forage in the application area, and the length of residual activity of the pesticide.

Some pesticide authorities recommend, and some jurisdictions require, that notice of spraying be sent to all known beekeepers in the area, so they can seal the entrances to their hives and keep the bees inside until the pesticide has had a chance to disperse. This, however, does not solve all problems associated with spraying and the label instructions should be followed regardless of doing this. Sealing honey bees from flight on hot days can kill bees. Beekeeper notification does not offer any protection to bees, if the beekeeper cannot access them, or to wild native or feral honey bees. Thus, beekeeper notification as the sole protection procedure does not really protect all the pollinators of the area, and is, in effect, a circumventing of the label requirements. Pesticide losses are a major factor in pollinator decline.

Colony collapse disorder

Main article: Colony collapse disorder

Colony collapse disorder (CCD) is a poorly understood phenomenon in which worker bees from a beehive or western honey bee colony abruptly disappear. CCD was originally found in western honey bee colonies in North America in late 2006.

European beekeepers observed a similar phenomenon in Belgium, France, the Netherlands, Greece, Italy, Portugal, and Spain, and initial reports have also come in from Switzerland and Germany, albeit to a lesser degree. Possible cases of CCD have also been reported in Taiwan since April 2007.

Initial hypotheses were wildly different, including environmental change-related stresses, malnutrition, pathogens (i.e., disease including Israel acute paralysis virus), mites, or the class of pesticides known as neonicotinoids, which include imidacloprid, clothianidin, and thiamethoxam. Unproven and less credible theories include radiation from cellular phones or other man-made devices, and genetically modified crops with pest-control characteristics. In 2010, US researchers announced they had identified a co-infection of invertebrate iridescent virus type 6 (IIV-6) and *Nosema ceranae* in all CCD colonies sampled.

Wax moths.

Galleria mellonella

From Wikipedia, the free encyclopedia

Galleria mellonella

adult

Scientific classification

Kingdom:	Animalia
Phylum:	Arthropoda
Class:	Insecta
Order:	Lepidoptera
Family:	Pyralidae
Tribe:	Galleriini
Genus:	***Galleria*** Fabricius, 1798
Species:	***G. mellonella***
Binomial name	
Galleria mellonella (Linnaeus, 1758)	
Synonyms	
Numerous, see text	

The **greater wax moth** or **honeycomb moth** (***Galleria mellonella***) is a moth of the family Pyralidae. It is the only member of the genus ***Galleria***. It is found in most of the world, including Europe and adjacent Eurasia, its presumed native range, and as an introduced species on other continents, including North America and Australia.

Its close relative, the lesser wax moth (*Achroia grisella*), is also a member of tribe Galleriini of the pyralid subfamily Galleriinae. The greater wax moth is the type species of this tribe and subfamily.

Description, ecology and use by humans[edit]

Mounted, dorsal view

Mounted, ventral view

The adults' wingspan is 30–41 mm. This moth flies from May to October in the temperate parts of its range, such as Belgium and the Netherlands.

The caterpillar larvae, or waxworms, feed on the honeycomb inside bee nests and may become pests of apiculture. Less often, they are found in bumblebee and wasp nests, or feeding on dried figs.[1] The larvae are commercially available. They can be used as food for the rearing of captive animals in terraria, such as geckos or predatory insects.

Common Name: Greater wax moth
Scientific Name: *Galleria mellonella* (Linnaeus)
Order: Lepidoptera

Description: Full grown caterpillars vary in color but are generally dirty white, 1 ½ inches long. Adult moths are grayish to purplish brown, have dark markings and lead-colored tips on the forewings, pale brownish or yellowish hind wings and have a wingspan of about 1 to 1 1/4 inch. Wings are held over the back when at rest.

No other caterpillar pests are known to infest bee hives. Red imported fire ants, *Solenopsis invicta* Buren (Hymenoptera: Formicidae), occasionally invade bee hives and prey on immature stages of honey bees. Winter is spent mainly in the larval or pupal stages although adult moths can emerge during warm periods. Mated females lay eggs at night. Tiny caterpillars hatching from eggs are initially white and turn yellow, brown to black on the upper side as they develop through seven or eight stages (instars). They pupate in tough silken cocoons in and around the hive in protected places. Up to three generations occur annually.

Habitat and Food Source(s): Caterpillars have chewing mouthparts. Adults have siphoning mouths. Caterpillars tunnel through wax of honeycombs in bee hives during the night and construct silken tunnels and feed on wax, pollen, cocoons. Older, dark honeycombs of weakened colonies are more frequently attacked and seriously damaged. Tunnels through infested honeycombs are littered with fragments, silk webs and excrement (frass). Caterpillars can be dissected from infested bee hives. This insect is cultured for fish bait and scientific studies.

Pest Status: Caterpillars (larvae) are destructive to bee hives because of their tunneling and feeding habits on honeycombs