Honey Bee Diseases and Pests

Blaine Nay
Iron County Bee Inspector
blaine@ironbee.us
435-590-7569

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Utah Bee Inspection Act

- Utah Bee Inspection Act passed in 1892
- Find the Act at http://tinyurl.com/7v9dcca
- Law requires
  - Licensing of all beekeepers
    - http://webapp.ag.utah.gov/LicenseLookup/
    - Notify UDAF of all apiaries – even temporary sites
  - Removable frames
  - Each apiary identified by a sign showing the owner's registration number
  - Extract honey in a place inaccessible to bees
  - At lease one County Bee Inspector per county
  - Annual inspection of a majority of colonies

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Utah Bee Inspection Law

- Your county bee inspector is
  - A fellow beekeeper
  - On your side in the struggle to keep honey bees health and strong
- Call your county Bee Inspector
  - If you have a significant die-off in your colony
  - Suspect disease or bee pests
  - Suspect Africanization
  - Suspect pesticide damage

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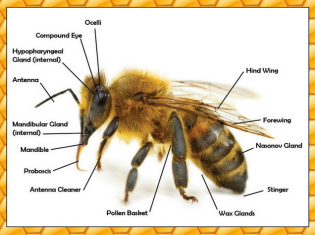
Overview

The for Ps that threaten your honey bees:

1. Pathogens
2. Parasites
3. Pesticides
4. Poor nutrition



Natural / Organic Beekeeping

- Using "natural" or "organic" beekeeping as an excuse to neglect scientific control of disease and pest problems causes harm to other beekeepers -- both hobbyist and commercial
- Being "natural" or "organic" feels nice, but it will not protect your bees
- Bees kept "naturally" will die a natural death within 2-3 years – most commonly due to parasites and parasite-spread diseases
- Better: IPM - Integrated Pest Management

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Natural / Organic Beekeeping

- The honey bee colony is a superorganism
- No honey bee can survive without the support of the colony
- Nature designed the colony to be self-protecting against disease, parasites, and pests
- The colony can still be overwhelmed by a threat
- Man has developed tools to help the bees cope with these threats
- We must be prepared to use these tools when appropriate, but not abuse them
- Commercial beekeepers see backyard beekeepers as a threat to their livelihood because we are resistant to the use of these tools
- Commercial beekeepers will apply pressure to ban backyard beekeeping if backyard beekeepers don't control pests and diseases in their colonies

Basic Sanitary Practices

- Do not acquire used equipment unless you know and trust that it is disease-free
- Do not move bees or hive parts from a suspected unhealthy hive to any other hive
- Sterilize hive tool, gloves, etc. after inspecting a suspected unhealthy hive
- Replace combs every 3-4 years
- Store suppers with honey in a bee-proof enclosure
- Process and store honey in a bee-proof enclosure
- Do not feed unknown honey to your bees

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Basic Sanitary Practices

- Do not allow or incite robbing
- Do not put "wet" supers or combs out in the open for bees to clean up
- Do not open feed

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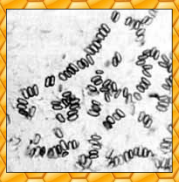
Brood Diseases
American Foulbrood

- Paenibacillus larvae (formerly classified as Bacillus larvae)
- Rod-shaped bacterium
- Spores viable 40 years or more
- Extremely contagious
- Primary reason for adoption of the Utah Bee Inspection Act



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Brood Diseases
American Foulbrood

Normal

Diseased

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Brood Diseases
American Foulbrood

- Affects only young larvae
- Young larvae less than 24 hours old are most susceptible
- Larvae up to 3 days old become infected by ingesting spores that are present in their food
- Spores will not germinate in larvae over 3 days old
- Spores germinate in the gut of the larva and the vegetative form of the bacteria begins to grow, taking its nourishment from the larva
- Infected larvae normally die after the cell is sealed
- Each dead larva may contain as many as 100 million spores
- Larva that die turn a coffee brown and decay into a gooey mass

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Brood Diseases
American Foulbrood

- Housecleaning bees try to remove the dead larva and in the process become contaminated with the bacterial spores that are now dormant
- The house bees then carry the spores to other bees and into the honey stores
- The disease is rapidly spread within the colony
- The colony is then weakened and eventually killed
- Robbing bees will take back contaminated honey to their own hives
- The disease will spread to many colonies within several miles from the infected hive
- Always check for American foulbrood when examining your hives
- If you catch this disease early, further spread can be prevented
- Call your county bee inspector for help

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Brood Diseases
American Foulbrood

- Stage of brood when symptoms evident - after capped
- Symptoms
  - Coffee color, ropey with a fine thread about 2.5cm
  - Odor - sulfurous, "chicken house"
  - Appearance - chocolate brown to black, perforated cappings
  - Scale - brown to black, brittle

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Brood Diseases
American Foulbrood Diagnosis

- Diagnosis
  - Place a thin stick, twig, or straw into a cell with this coffee brown gluey substance
  - Stir and draw the thin stick out.
  - If the gluey substance sticks and ropes, it is most likely AFB
  - Take a sample of comb from this frame and have your bee inspector send it in for confirmation of AFB

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Brood Diseases
American Foulbrood Prevention

- Be extremely cautious when buying used equipment
- Good sanitary practices
- Discarding old frames
- Disease resistant stock
- Prophylactic application of Terramycin or Tylan
  - No longer allowed except by prescription
  - Can prevent AFB from reaching a threshold where the colony cannot resist the disease
  - These only mask the disease – not a cure
  - Spores are not killed and can re-infect the hive
  - Must be used and consumed by the bees at least 4 weeks prior to a honey crop

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Brood Diseases
American Foulbrood Treatment

- Antibiotics are never an appropriate treatment
- Burning
  - The only way to effectively destroy the disease
- Sterilization of equipment
- Phages (phagehunters.byu.edu)

Brood Diseases
American Foulbrood Treatment

- Sterilization can be done by:
  - Scorching all surfaces of the affected box, bottom, cover, etc
  - Sodium Hyperchloride (bleach)
    - A 3% solution has been shown to destroy the spores of AFB
    - Soak the equipment for several hours
    - Change the solution frequently as sodium hyperchloride reacts with organic material (wax, wood)
  - Dry heat sterilization – placing the woodenware in an environment at 180° f for a minimum of 1 hour should sterilize woodenware
  - Irradiation
- Frames and foundation must be destroyed for the health of all colonies in the area

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Brood Diseases
European Foulbrood

- Caused by the bacterium Melissococcus pluton
  - No lng-lasting spores
- Larvae are most susceptible to infection when they are less than 48 hours old
- The bacteria multiply vigorously in the gut of larval bees which have been given contaminated food
- Larvae usually die while still in the coiled state
- Larvae first turn yellow then brown in color

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Brood Diseases
European Foulbrood

Normal

Diseased

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Brood Diseases
European Foulbrood

- Stage of brood when symptoms evident - before capped
  - Appearance - twisted, dull to yellow to dark brown, tracheal tubes often visible
  - Can be slightly ropey with threads less than 1.5cm, but usually not ropey
  - Odor - sour or none
  - Scale - brown to black, rubbery

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Brood Diseases
European Foulbrood

- Stress
  - Parasites
  - Poor nutrition
  - Pesticide poisoning
  - Weak colonies
- Usually noticed in early spring, and to a lesser extent in autumn
- EFB can be spread by bees robbing infected hives
- Transferring infected honey supers and combs to clean hives
- Using contaminated beekeeping equipment
- Feeding infected honey and pollen.

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Brood Diseases
European Foulbrood <u>Treatment</u>

- Good beekeeping sanitary practices
- Prevent any robbing of the hive
- Frames from this hive should not be transferred to any other hive
- Control mites
- Requeen if the bees are not cleaning up the disease
- Treatment with Terramycin or Tylan
  - Prescription required

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Brood Diseases
Chalkbrood

- Fungal disease caused by Ascosphaera apis
- Called chalk brood because the mummies are chalk-like in appearance and touch
- Found throughout the United States
- A disease of stress in the early spring to early summer
- Severe cases can be found in the comb later in the year
- Adult bees will try to remove the mummy larva
- Mummies can often be seen at the entrance of the hive

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Brood Diseases
Chalkbrood

Normal

Diseased

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Brood Diseases
Chalkbrood Treatment

- No approved chemical treatment for this disease
- Provide adequate Winter ventilation
- Avoid "chilled brood"
- Strengthen a weak colony with more brood and bees from a health colony
- Replace the queen
- Good sanitary practices
- Avoid mixing frames of comb from a chalkbrood hive with other hives

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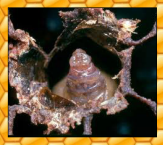
Brood Diseases
Sacbrood

- A viral infection of the larva
- Named for the sac-like appearance of dead larvae
- The skin of the larva is tough and rubbery and if pulled from the cell with a pair of tweezers, will look like a thin sac covering the dead larva
- Not a common bee disease



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Brood Diseases
Sacbrood Prevention & Treatment

- No chemical treatment for viral diseases
- Use good sanitary beekeeping practices
- If you find a colony with this disease, do not mix other hive frames etc. with this colony
- Replacing the queen with a queen from less susceptible stock may help.
- Control Varroa mites

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Adult Disease
Nosema

- A disease caused by two single celled microsporidian parasites which are now classified as a fungus.
  - Nosema apis
  - Nosema cerana
- Caused by spores which germinate in the midgut of the honey bee
- Newly emerged bees are always free from infection
- Spores must be swallowed by an adult bee for the infection to be initiated

Adult Disease
Nosema

- Nosema is typically spread in an oral-fecal manner. Healthy bees do not defecate in the hive, but sick, heavily infected bees may do so. Other healthy workers become exposed when they clean up after the sick bees.
- Spores are very resistant to changes in temperature, to desiccation, and can survive outside of the bee in the hive environment for extended periods of time
- Female worker bees are most strongly afflicted
- May cause queen failure

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Adult Disease

Nosema Apis

- Mostly supplanted by Nosema ceranae
- Arises mostly in the spring after periods of bad weather
- Infects the cells lining the gut of older bees
- May also be a winter disease that is only noticed in the spring when beekeepers first inspect their hives
- Many beekeepers do not consider this a major disease
- Very damaging to colonies of bees that over winter in the north

Adult Disease

Nosema Apis

- Symptoms:
  - Shortened life span
  - Fecal deposits on the inside of the hive
  - Fecal deposits on the outside of the hive

Adult Disease

Nosema Ceranae

- Has largely supplanted Nosema Apis
- Present throughout the year, and thrives in summer
- Moves right into the bees' body tissues instead of reamining in the gut
- Appears to infect queens shortly before the collapse of the colony
- Dr. Diana Cox-Foster found N. ceranae in 100% of the CCD colonies that they tested

Adult Disease

Nosema Ceranae

- Symptoms:
  - No dysentery associated with a N. ceranae infection.
  - Lack of colony growth, due to early death of foragers and nutritional stress
  - Going "off feed" -- may not take sugar syrup.
  - Bees may drown en mass in division board feeders
  - The colony may suddenly collapse.
  - Colonies may struggle or collapse even during a spring or summer bloom.

Adult Disease

Nosema Prevention & Treatment

- Winter only strong colonies with plenty of honey in the proper position and with young vigorous queens
- High-quality protein in pollen
- The antibiotic Fumagillin sold as Fumidil-B mixed with sugar syrup and fed to the bees in the fall and spring
  - Fumidil B inhibits the spores reproducing, but does not kill the spores
  - No longer available
- Heat treatment in 120° f for 24 hours can be used to kill the spores on contaminated equipment
- Good sanitary practices
- Discard old frames

Honey Bee Pests

Varroa Mites

- This mite is known as Varroa destructor
- Natural host is apis cerana
- Found throughout the United States including at least two islands in Hawaii
- Small but can be seen with the naked eye
- About the size of a pin head
- Reddish/brown in color

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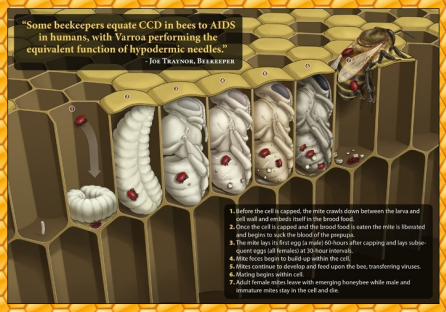
Honey Bee Pests
Varroa Life Cycle



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Honey Bee Pests
Varroa Life Cycle

- Cell is capped
- Foundress mite feeds on the larva
- Begins laying eggs about 3 days later
- Between 3-6 eggs, the first being male mite, remaining are females that mate with their brother in the cell
- Mites pierce an opening in the pre-pupa honey bee larva and the whole family of mites feed from that one wound
- From egg to adult takes 6-7 days for females and 5-6 for males
- When the bee emerges, the foundress mite will leave the cell with her daughters
- The male mites die and never leave the cell and the bees clean them out
- The adult females then attach to adult bees – primarily nurse bees -- for an average of 7 days before finding a new cell to enter and reproduce again

Honey Bee Pests
Varroa Mites

- During her lifetime the foundress mite will go through approximately 3 reproductive cycles.
- One female Varroa mite multiples by 12-15 in 4 months
- 75-85% of the mites in a colony are in capped brood cells and are not visually detectable or via tests such as sticky boards, sugar/ether rolls, etc.
- The Varroa mite population in sealed brood doubles every 22 days

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Honey Bee Pests
Varroa Mites

- Arrived in USA in 1987 in Utah in 1988-1989
- Varroa destructor can only replicate in a honey bee colony
- It attaches to the body of the bee and weakens the bee by sucking hemolymph or fat body
- Spreads RNA viruses including Deformed Wing Virus
- Shortens the life of the bee by 25-35%
- May lead to the death of a honey bee colony, usually in the late autumn through early spring
- Leading cause of colony mortality
- Severe economic impact on the beekeeping industry

Honey Bee Pests
Varroa Mites

- Spreads at least 50 voruses such as Deformed Wing Virus
- The combination of parasitism and viral transmission
  - Shortens the life of the bee by 25-35% or more
  - Reduces honey bee learning ability
- Leading cause of colony mortality
  - In a typical mite-free colony, approximately 20% of the bees die during the Winter
  - In a mite with a significant mite load, up to 70% of the bees will die before Spring

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Honey Bee Pests
Viruses Transmitted by Varroa Mites

- Deformed wing virus →
- Sacbrood virus
- Black Queen Cell Virus
- Israeli Acute Paralysis Virus
- Slow Bee Paralysis Virus
- Chronic Bee Paralysis Virus →
- Acute Bee Paralysis Virus
- Kashmire Bee Virus
- Lake Sinai Virus
- Varroa Destructor Virus
- At least 14 more

Honey Bee Pests
Varroa Mites

- Shortened lifespan also means an adult worker bee spends significantly fewer days foraging before she dies
- Younger bees move into the foraging role early – before they are ready
- These too-young foragers apparently are getting lost
- New theory for CCD

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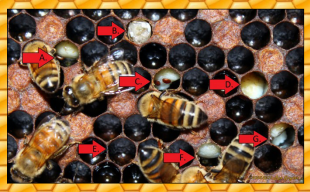
Honey Bee Pests
Parasitic Mite Syndrome (PMS)

Honey Bee Pests
Parasitic Mite Syndrome (PMS)



A. Varroa mite on larvae
B. Mite was detected, pupa was uncapped, bees started to cannibalize the head and will eventually remove the pupa
C. Two Varroa mites on a larva
D. This is similar to B. The bees have chewed down a larvae or pupa because they detected a mite
E. Note the absence of eggs and larvae -- the colony is unable to rear healthy brood
F. Varroa mite on a larva
G. Mite on a larvae

Honey Bee Pests
Varroa Mites

- Effects on Drones
  - Varroa prefers drones – 10-20x more attractive the worker brood
  - 1 drone cell will have as many mites as 10-20 worker cells
  - Fewer flights
  - Shorter flights
  - Reduced sperm counts
- Reduced queen fertility
- More frequent queen replacement

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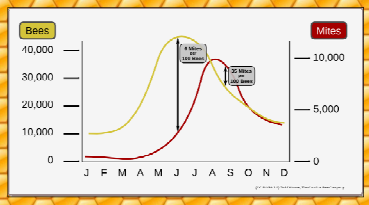
Honey Bee Pests
Colony Collapse due to Varroa



- Total Varroa population growth lags behind total bee population
- Number of mites per hundred bees increases greatly in Fall

www..scientificbeekeeping.com/ipm-3-strategy-understanding-varroa-population-dynamics/

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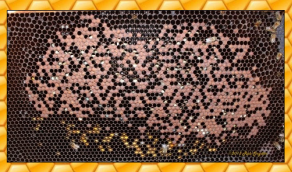
Honey Bee Pests
Colony Collapse due to Varroa



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Honey Bee Pests
Varroa Detection

- Varroa screens and a sticky board
- A protective 8-mesh screen is placed over the sticky board and the sticky board is left in the hive for a period of 24 hours
- Mites fall through the screen onto the sticky board where they can be counted to determine the infestation level
- Treat if more than 50 mites in 24 hours

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Honey Bee Pests
Varroa Detection

- Naked eye – one mite is too many
- Check drone brood for mites
- Check individual capped drone cells
- Use your hive tool or a capping fork to remove pupa from the drone comb
- Treat if more than 10% of pupae have mites



Honey Bee Pests
Varroa Detection

https://www.youtube.com/watch?v=KGi5SqDfd90

Honey Bee Pests
Varroa Detection

http://youtube.com/watch?v=Zv9pdvuCGeM

Honey Bee Pests
Varroa Detection

- Test monthly
- Sugar roll, ether roll, or alcohol wash
- Scoop up approximately 1/2 cup of bees (approx 300 bees) into a pint jar with screened lid
- Add 1-2 tablespoons of powdered sugar
- Shake and roll the jar
- Let sit 5-10 minutes
- Shake sugar & mites into white tub then spritz with water
- Treat if more than 6 mites in the summer, and 10 to 15 in the fall


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Honey Bee Pests
Varroa Detection

https://www.youtube.com/watch?v=nfOL243vBYs&t=4s

Honey Bee Pests
Varroa Treatment

- Winter preparation begins with controlling mite populations in Summer
- Critical time for last-ditch mite treatment is August 15
- If you wait until you see obvious mites on your bees or deformed wings, it is too late. Do a regular mite count!
- One common cause of increased mite counts is from bees robbing hives that are collapsing due to mites
- If you are not keeping your mites under control, you are not only endangering your own bees, but your neighbors' bees too

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Honey Bee Pests
Varroa Treatment

- 60% of beekeepers who responded to the 2013-14 Bee Informed Partnership Management Survey did not treat for mites
- Beekeepers who did not treat for mites suffered as much as double the losses of those who treated
- Backyard beekeepers suffered double the rate of losses of commercial beekeepers (45% vs 22%)
- Migratory beekeepers lost 33.3% fewer colonies than non-migratory beekeepers

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Honey Bee Pests
Varroa Treatment

- Chemical mite treatments
  - Coumaphos – CheckMite+
  - Fluvalinate – Apistan strips
  - Amitraz – Apivar
  - Thymol – Api-Life VAR, Apiguard
  - Formic Acid – Mite Away Quick-Strip - penetrates cell capping
  - HopGuard II
  - Oxalic acid
- *Use only registered and tested materials*
- *Rotate treatments*
- *Follow the label exactly!*

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Honey Bee Pests
Non-Chemical Varroa Treatment

- Resistant and hygienic stock
- Interrupt brood cycle
- Poor effectiveness
  - Drone comb
  - Screened or open bottom boards
  - Powdered sugar dusting
  - Small-cell foundation

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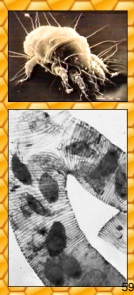
Honey Bee Pests
Tracheal Mites

- This mite is named Acarapis woodi
- Found in the tracheae (breathing tubes) of adult honey bees
- First identified as the Isle of Wight Disease 1921
- Well established in the US (since 1984) except Hawaii
- Can be observed under a microscope



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Honey Bee Pests
Tracheal Mites

- Highly infested hives usually die in the fall or winter
- One may find few bees in a dead hive. This is contrary to starvation when most of the bees will be on the face of the comb -- dead
- Early detection is important. If the beekeeper notices a rapid decline in population, the situation is already out of control
- Treatments: Menthol crystals, acaricides, grease patties
- Treatments for Varroa mites and resistance to the tracheal mite has reduced the tracheal mite problem

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Honey Bee Pests
Wax Moth

- Two general types found in the US:
  - Galleria mellonella L. - the Greater Wax Moth
  - Achroia grisella F. - the Lesser Wax Moth
- Both do considerable damage to bee hives that are in weak condition and to stored comb in supers
- The larvae are a serious problem in warm weather and dark conditions
- They can do a lot of damage in a very short period of time

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Honey Bee Pests
Wax Moth Prevention & Treatment

- Wax moths attack weak hives. Strong hives will keep them under control
- Wax moths do not like light - keep stored equipment exposed to light
- Freezing
- Close up equipment tightly and fumigate with "Para-moth" (Para-Dichlorobenzene crystals)
- Biological control such as Bacillus thuringiensis

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Honey Bee Pests
Wax Moth

https://www.youtube.com/watch?v=YIZ0xkD6qyE

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Honey Bee Pests
Small Hive Beetle

- Aethina tumida found primarily in the Southern states of the US
- Now found in many other states especially states that import bees for pollination
- The small beetle is black and can be found moving rapidly inside the hive when exposed to sun light

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Honey Bee Pests
Small Hive Beetle

- The larvae may be mistaken for wax moth larva but they do not spin cocoons
- Larvae leave a slime trail within the hive
- Can result in the loss of comb in the frames and loss of honey crop
- This beetle seems to prefer weak hives especially queenless hives

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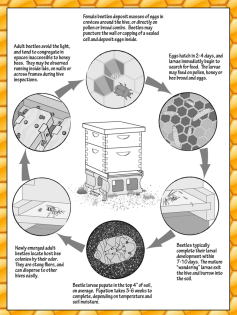
Honey Bee Pests
Small Hive Beetle Life Cycle



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Honey Bee Pests

Small Hive Beetle Treatments

- Ground drentrance of a hive and pupate in the ground around tench - GardStar® - SHB larva crawl from the he hive stand
- CheckMite+ - TM a strip which controls both SHB and Varroa mites.
- Traps

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Honey Bee Diseases and Pests

- Prevention & treatment options will not last indefinitely
- IPM – Integrated Pest Management
- Stay informed
  - Read a good beekeeping magazine every month
  - Read a good beekeeping book at least once a year
  - Attend a beekeeper's club
  - Learn from your bees
- Distinguish between
  - Science
  - Fads & myths
  - Obsolete techniques
- Practice food sanitary practices
- Stay optimistic
- Enjoy your bees

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Questions?

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