Diseases, Parasites, and Pests of Honey Bees – Part 2

http://articles.extension.org/pages/60674/effects-of-nosema-on-honey-bee-behavior-and-physiology

Thomas Anderson
Johnston Co. Beekeepers Association

Environmental Contaminants

- Bees can be very effective at concentrating environmental contaminants
  - Pesticides
  - Heavy Metals
  - Other organic pollutants (PCBs, etc.)
- Concentrate in wax
- Change out frames after 2 years

Nutritional Deficiencies

- *"honey bee colonies are astoundingly resilient to nutritional stress"* (Drs. H. Hendriksma and S. Shafir, Hebrew Univ. of Jerusalem)
  - Bees were fed diets deficient in different nutrients
  - Bees shifted foraging efforts to compensate
- *"bee foragers seem to have evolved the sophisticated ability to bias their efforts towards finding food that balances the colony's nutritional deficiencies"*

Read more at: https://phys.org/news/2016-04-bees-diversify-diet-nutritional-deficiencies.html#jCp

What do these have in common?

Answer: Viruses

Royal Caribbean
Explorer of the Seas
4,000 passengers

Your Bee Yard
~40-60,000 bees
per hive

All viruses are asymptomatic at lower levels of infection and most shorten the life span of bees to varying degrees. The diagnostic symptoms for the major virus diseases have been described in detail by Bailey and Ball (1991) and can be summarized as follows:

1.1.1. Acute bee paralysis virus /Kashmir bee virus /Israeli acute paralysis virus

1.1.1. Black queen cell virus

1.1.3. Aphid lethal paralysis virus & Big Sioux River virus

1.1.4. Deformed wing virus /kakugo virus /Varroa destructor virus-1 /Egypt bee virus

1.1.5. Sacbrood virus /Thai sacbrood virus

1.1.6. Slow bee paralysis virus

1.1.7. Chronic bee paralysis virus /satellite virus

1.1.8. Cloudy wing virus

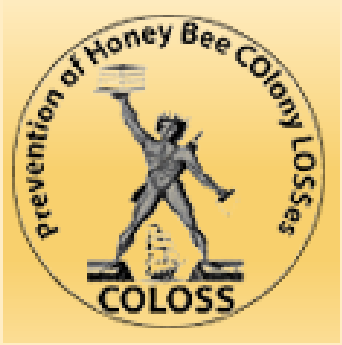
1.1.9. Bee virus X /Bee virus Y

1.1.10. Lake Sinai virus-1 /Lake Sinai virus-2

1.1.11. Arkansas bee virus & Berkeley bee virus

1.1.12. Apis mellifera filamentous virus

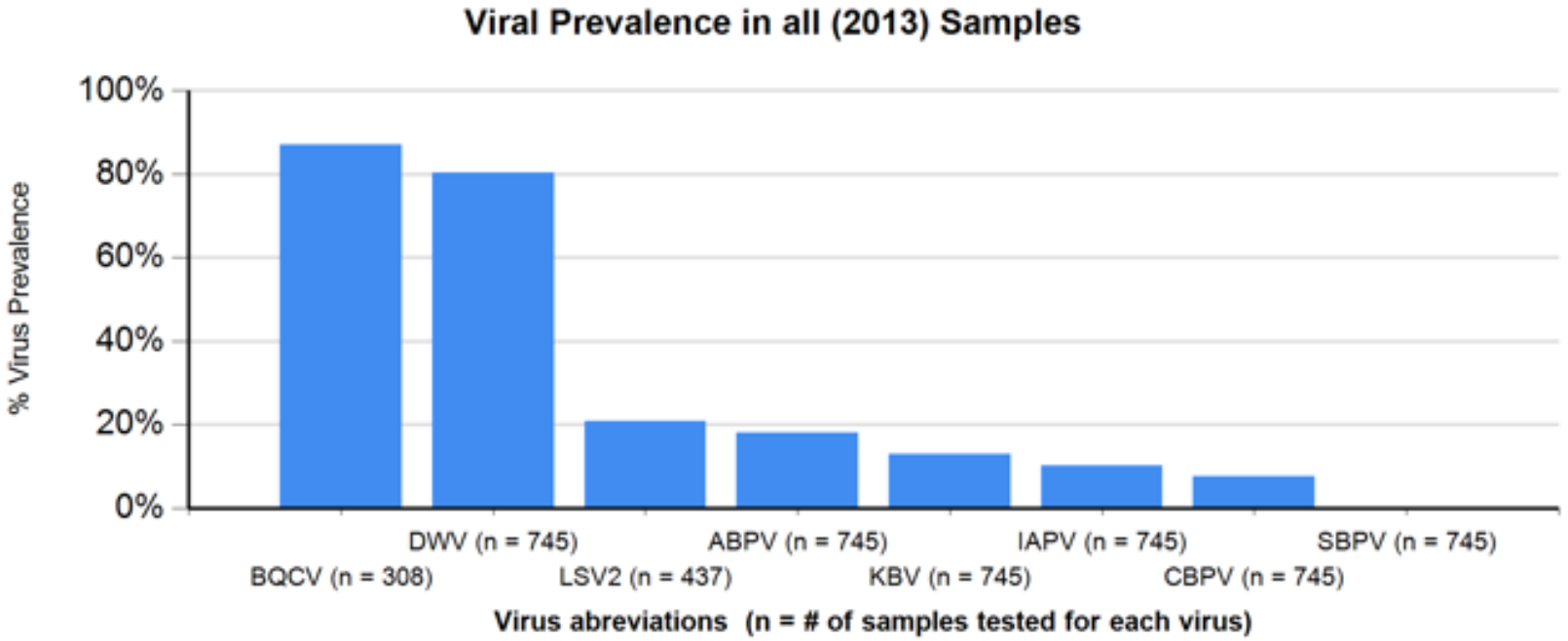
1.1.13. Apis iridescent virus



From: COLOSS Honey Bee Research Association

http://www.coloss.org/beebook/II/virus/1/1

Viral Prevalence in U.S. Hives
USDA-APHIS Survey 2013



BQCV – Black queen cell v., DWV – Deformed wing v., LSV2 – Lake Sinai v.2, ABPV-Acute bee paralysis v., KBV-Kashmir bee v., IAPV-Israel acute paralysis v., CBPV-Chronic bee paralysis v., SBPV-Slow bee paralysis v.

http://articles.extension.org/pages/71172/honey-bee-viruses-the-deadly-varroa-mite-associates

Black Queen Cell Virus

- Largely asymptomatic in workers and brood
- Queen pupae die and darken after death
- Wall of queen cell turns dark brown to black
- Associated with Nosema

Treat for Nosema

Deformed Wing Virus

- Closely associated with varroa
- Control of DWV is usually achieved by treatment against varroa

Sacbrood Virus

- Appears before nectar flow or during prolonged dearth of nectar (when bees stressed)
- Larvae die shortly after capping and become a fluid filled sac
- Infected larvae are yellow to brown-black
- Discolored, sunken, or perforated cappings
- Larva dies with head raised in a banana shape toward the top of the cell
- Larval remains aren't "ropey" like AFB, EFB

http://www.planthealthaustralia.com.au/wp-content/uploads/2016/02/Sacbrood-virus-FS.pdf

Rob Snyder, www.beeinformed.org

Larva affected by sacbrood virus with its head raised in a banana shape and stretched out on its back in the cell, with healthy larvae around

Food and Environment Research Agency (Fera), Crown Copyright

Infected larva in cell showing the change in colour and the mouthparts turning black and pointing upwards

Sacbrood Treatment

- Sanitation – remove infected larvae
- Requeen with hygienic stock
- Provide food and add worker bees to strengthen hive

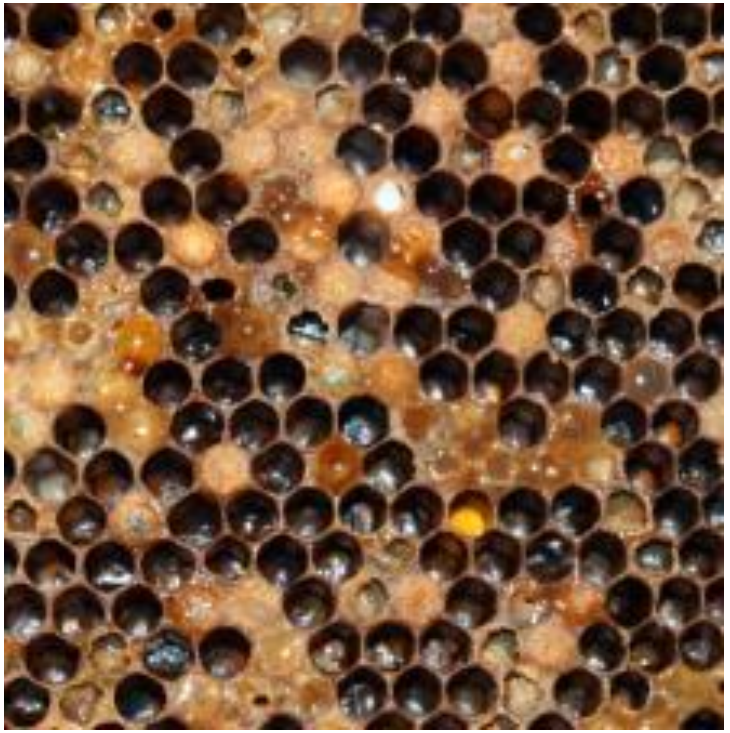
Food and Environment Research Agency (Fera), Crown Copyright

Body of a sacbrood virus affected larva that has become a fluid filled sac

Bacterial Diseases

American Foulbrood

- Most widespread and destructive disease
- Bacteria: *Paenibacillus larvae* spp. *larvae*
- Primary means of spread – beekeepers and robbing
- 2.6 billion spores can be produced in one infected larva
- Only takes 6 spores to infect a larva
- Spores can last decades!



https://beeinformed.org/2013/10/21/american-foulbrood-afb/

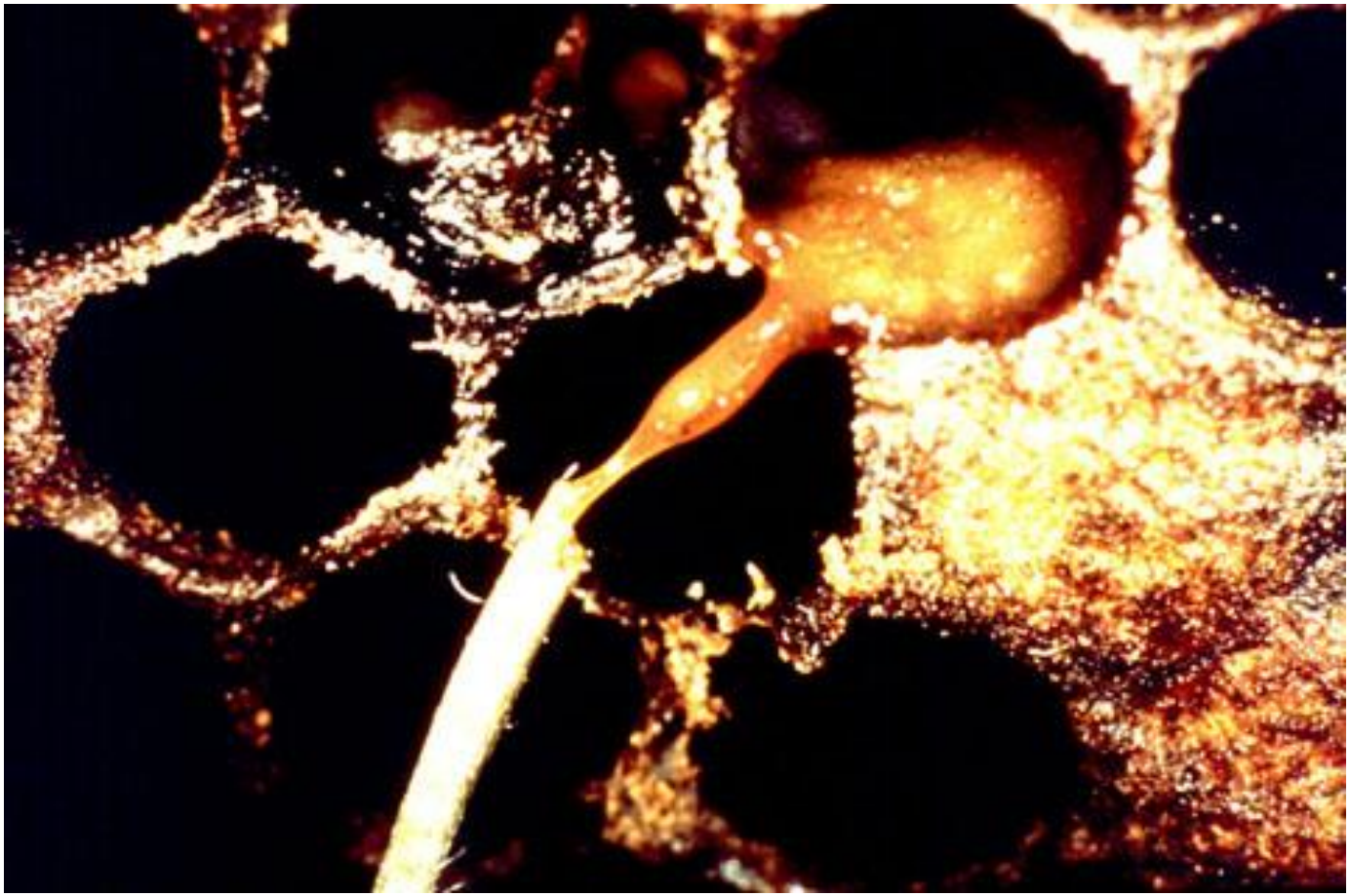
http://www.dpi.nsw.gov.au/__data/assets/pdf_file/0011/558434/managing-afb.pdf

American Foulbrood Symptoms

- Odd brood cell with soft, brown decayed brood among healthy brood
- Scattered, spotty brood pattern
- Cappings sunken and discolored
- Cappings may be chewed or perforated by nurse bees
- Unpleasant sharp, foul smell (rotting meat, sulfurous chicken house)
- Stick inserted into decayed brood ropes out (1-2”)
- Dead pupae may have tongue extended up to the roof of the cell (rare)


Bob Snyder 2005-2013

American Foul Brood
Paenibacillus larvae spp. larvae



Dead larvae are sticky and “ropey” (drawn out)

American Foulbrood Treatment

- Don’t try to cure it. Call the state bee inspector ASAP
- Hive and equipment may have to be burned and totally destroyed!
- WHY?
- The spores can remain active for 70+ years!
- With billions of dormant spores on your equipment, do not try “cure” your problem with antibiotics.
- *Your fellow local beekeepers will thank you for complete and total eradication!*

European Foulbrood

- Bacteria: *Melissococcus plutonius*
- Spotty “shotgun” brood pattern
- Larvae are tan or brown, melted appearance
- Larvae usually die before cell is capped
- Capped cell may be sunken and perforated, but “roping” is not observed
- Sour odor

http://articles.extension.org/pages/23693/european-foulbrood:-a-bacterial-disease-affecting-honey-bee-brood

European Foulbrood

Fig.1: A classic symptom of European foulbrood is a curled upwards, flaccid, and brown or yellowish dead larva in it's cell, pictured above.

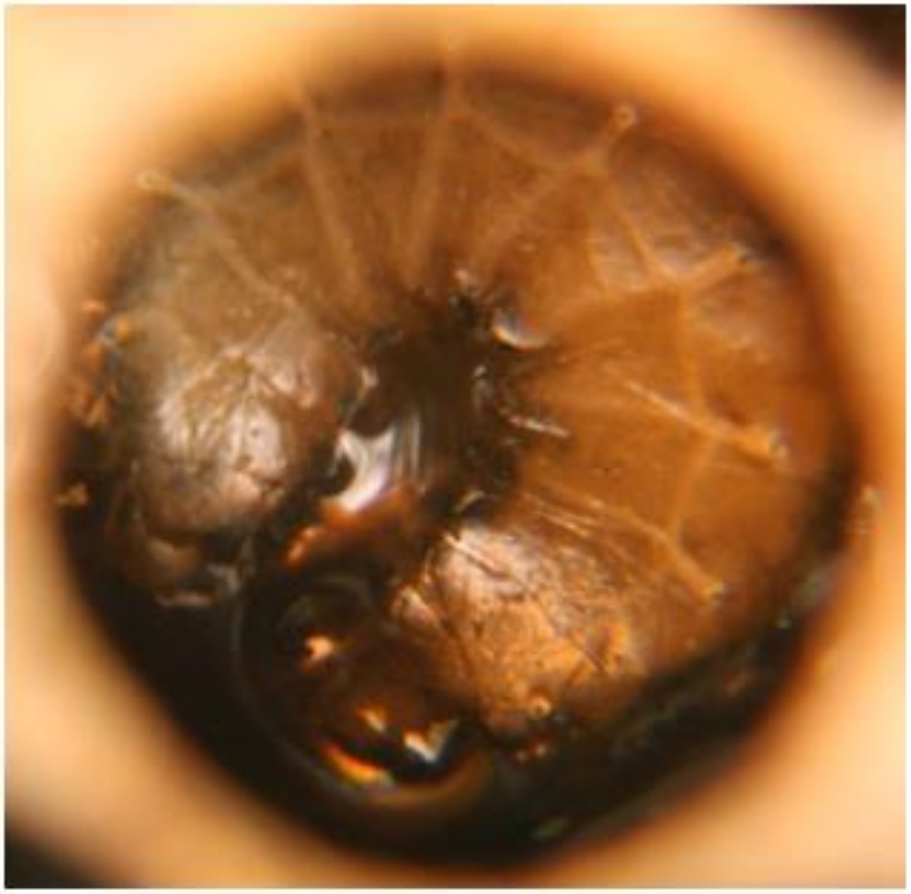


Fig.2: Larvae infected with *M, plutonius* can appear deflated with their tracheal system more defined.

European foulbrood	American foulbrood
	
• Can be slightly ropey with threads less than 1.5cm, but usually not ropey. • Odor: sour or none • Scale: brown to black, rubbery • Stage of Brood: before capped • Appearance: twisted, dull to yellow to dark brown, tracheal tubes often visible	• Coffee color, ropey with a fine thread about 2.5cm • Odor: sulfurous, "chicken house" • Scale: brown to black, brittle • Stage of Brood: after capped • Appearance: chocolate brown to black, perforated cappings

Fig.3: Table from Shimanuki and Knox (2000) and Delaplane (1998), Ropey length from Shimanuki (1997), American foulbrood photo by Williams, USDA.

http://articles.extension.org/pages/23693/european-foulbrood:-a-bacterial-disease-affecting-honey-bee-brood

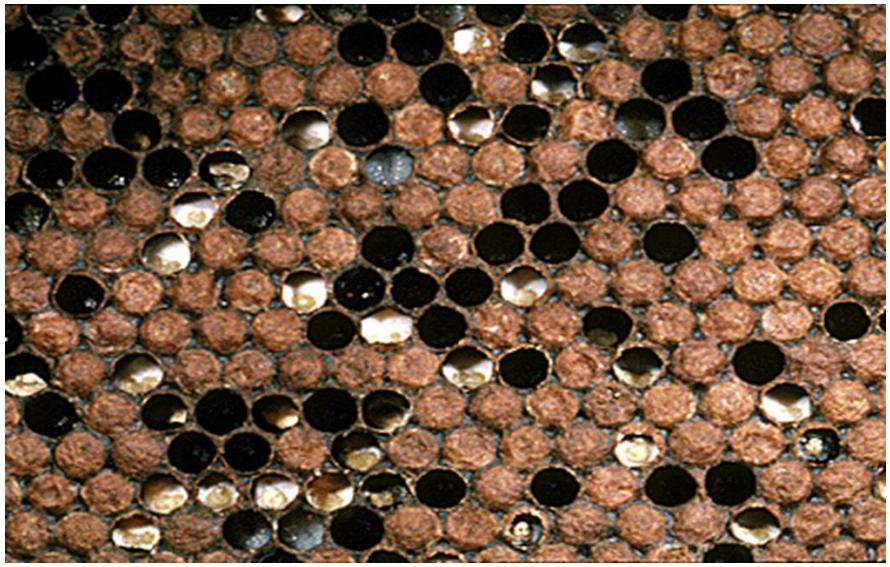
European Foulbrood - Treatment

- Requeen to break the brood cycle and allow the colony to remove infected/dead larvae
- Help your bees by removing infected larvae with a tweezers
- (Treat with antibiotic, e.g. Tylan, Terramycin)
- Replace all of the frames and comb every few years
  - Minimizes spread of disease
  - Old wax can contain residual medication. This builds resistance to antibiotics

Fungal Diseases

Chalkbrood

- *Ascosphaera apis*
- The most common fungal disease affecting bee larvae
- Damp conditions in early spring



Chalkbrood

Uncapped mummies

Chalkbrood 'mummies' being deposited at the hive entrance. Rob Snyder, www.beeinformed.org

Chalkbrood Treatment

- A healthy colony will recover on its own
- Help your bees by removing mummified carcasses from around the hive, and remove heavily infected frames (usually only one)
- Consider moving the hive to a well ventilated, dry area, facing the sun

http://beeaware.org.au/archive-pest/chalkbrood/#ad-image-0

Stonebrood

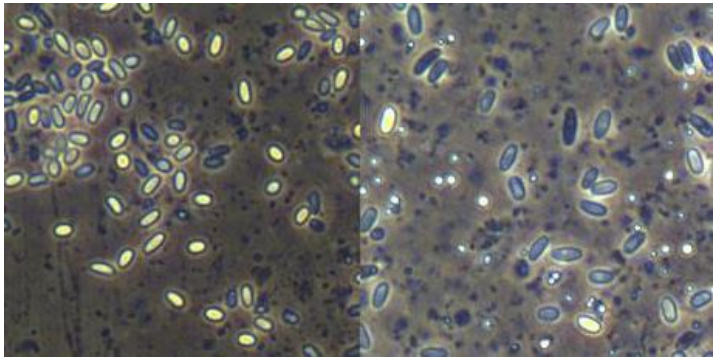
- Aspergillus species
- Too much moisture in the hive
- Infected larvae are hard
- Greenish spores and mycelium

Treatment

- Sanitation – remove dead brood, affected frames, and mummies around the entrance
- Add ventilation – allow hive to dry out; prop open inner cover

Nosema – 2 species

- Fungus-like organism (previously considered a protozoan)
- *N. apis* has been around over 100 yrs
- *N. ceranae* is spreading and associated with CCD
- *Nc* first discovered in the European honey bee in Viet Nam, but probably first got to Europe and USA in the late 1990s



Nosema ceranae *Nosema apis*

Disease weakens bees and makes them more susceptible to other stressors

- **100x more susceptible to insecticides**

http://www.extension.org/pages/60674/effects-of-nosema-on-honey-bee-behavior-and-physiology#.VEEuw85L_G8

Nosema Symptoms

Symptoms

- Infected workers do not digest food well and are not capable of producing brood food secretions
- Dysentery: inside hive – check bottom board
- Life spans reduced up to 78%
- Infected queens are superseded

Diagnosis (You won't do this at home)

- Homogenize severed abdomens, spin in a clinical centrifuge, re-suspend pellet and count spores under a microscope using a hemocytometer

http://articles.extension.org/pages/60674/effects-of-nosema-on-honey-bee-behavior-and-physiology

Nosema Treatment

- Fumagillin B®, Fumadil® B
- Use in late fall, early spring
- No honey supers on hive
- Do not feed medicated syrup immediately before, or during, honey flow

http://entomology.ucdavis.edu/files/147621.pdf

Parasites
and
Predators

Lesser Wax Moth
Achroia grisella (Pyralidae)

Webbing and frass

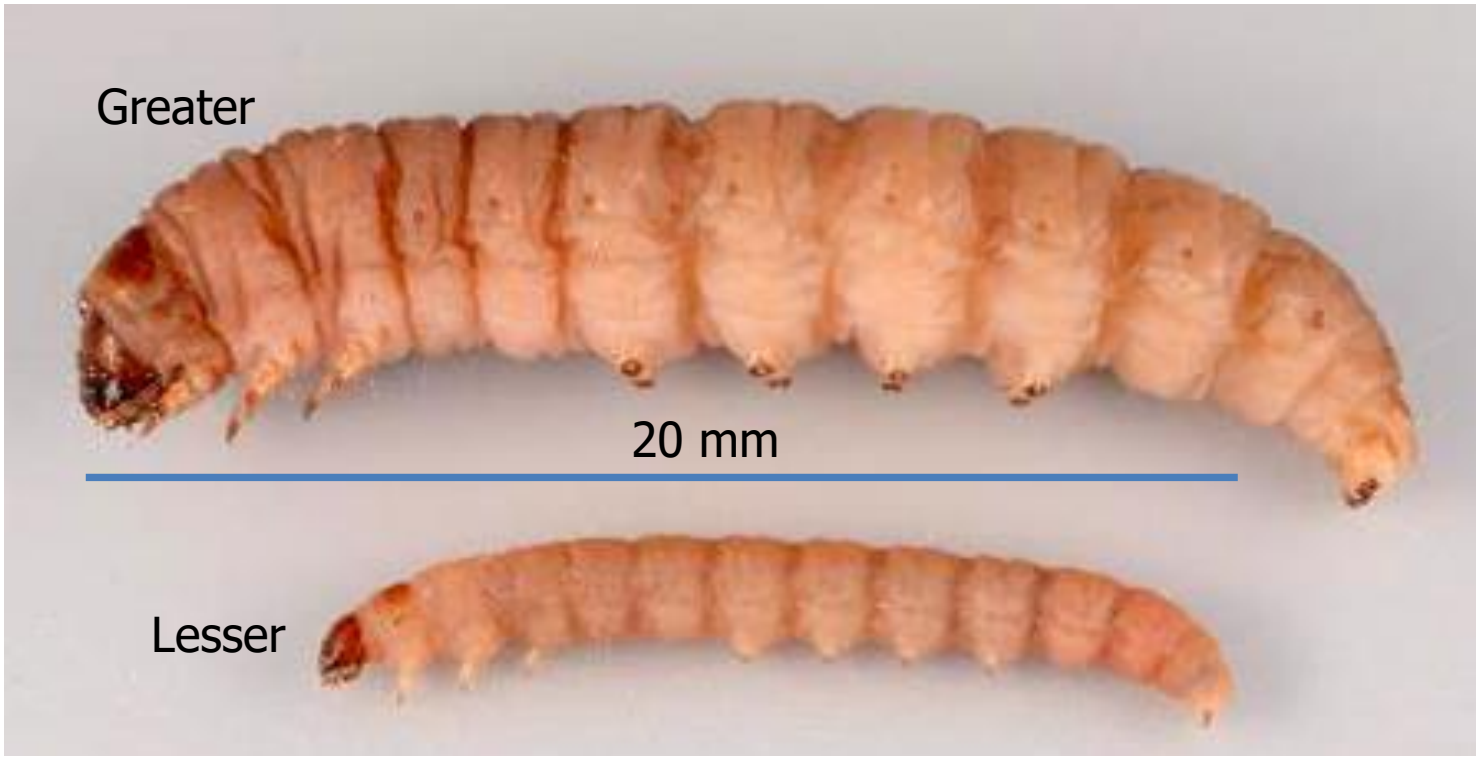
Adult Moth

Pupal cocoons

Greater Wax Moth
Galleria mellonella (Pyralidae)

- A model organism in many labs, used for toxicology testing
- When fried in oil, the larvae explode and take on a shape resembling popcorn
  - *Eating well is the best revenge!*

Size Comparison of WM Spp.



http://entnemdept.ufl.edu/creatures/MISC/BEES/Achroia_grisella.htm

“Bald Brood” Caused by wax moth

- WM larvae tunnel into capped cells
- Workers chew away the damaged cappings, exposing pupae
- Uncapped pupae may occur in a line tracing the path of the WM larva

http://entnemdept.ufl.edu/creatures/MISC/BEES/Achroia_grisella.htm

Wax Moth Damage to Wood

Fig. 8. Wax moth damage to woodenware. The larvae excavate furrows in the wood and they attach their cocoons to these furrows. Notice the boat-shaped indentations in the wall of the hive. Photograph: Ashley Mortensen, University of Florida.

Wax Moth Treatment

- Keep hive strong and healthy
  - Manage space
- Place infested comb in freezer (or over a fire ant mound)
- Remove and fumigate contaminated supers
  - Paradichlorobenzene (PDB) crystals
  - Not moth balls – don't want naphthalene

Small Hive Beetle – *Athina tumida*

Small Hive Beetle *Aethina tumida*

- Most recent pest
- Scavenger
- Not a major threat to strong colony
- Can quickly wipe out a weak colony
- Has become a major problem in SE US
- First found in NC in 1998

Small Hive Beetle

- Adult female lays
- eggs in cavity
- Larvae emerge to eat honey, brood, protein litter and grow
- **Larva is most damaging stage**
- Frames become slimy – bees repelled
- Larvae exits hive to pupate in soil

Hive Beetle - *Aethina tumida*

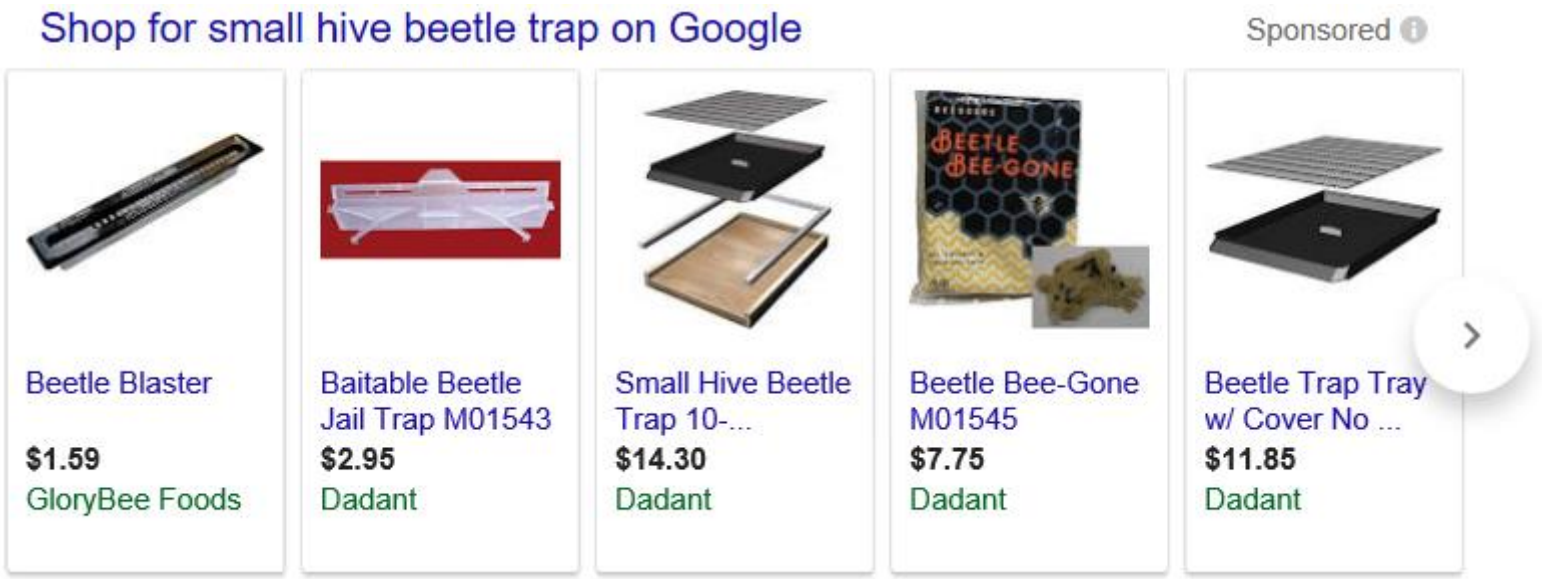
Wax Moth Larva
Compared with SHB Larva

Wax Moth Larva

SHB Larva

Control of Small Hive Beetle

- Healthy, vigorous hive
- Workers have good access to all areas of hive
- SHB traps



- Hive tool smash (Most satisfying!)

Zombie Flies and Their Control

Life Cycle of the Zombie Fly
Apocephalus borealis

Female flies find a bee.

A Female Zombie Fly

Adult flies emerge from pupae and mate.

A Honey Bee Surrounded by Zombie Fly Pupae

Maggots pupate nearby.

A Maggot Emerging from a Honey Bee

Fly larvae (maggots) eat the insides of a bee, killing it.

A Female Zombie Fly Laying Eggs inside a Honey Bee

http://www.dailymail.co.uk/sciencetech/article-2208328/Parasitic-infection-causes-bees-lurch-night-die-spreading-US.html

Ants

Plus Earwigs, Roaches, Etc.

- Usually a vigorous, healthy hive can defend against ants, but if not:
  - Cut tall weeds
  - Tanglefoot on legs of stand
  - Diatomaceous earth
  - Boric acid
  - Commercial ant bait
  - Ground cinnamon?

Mice, Skunks, Bears and Other Varmints

http://skagitvalleybeekeepers.org/101/8.html

Don’t Let ‘em In

- Straps
- Special restrictors

Bear Apocalypse for Bees!

The Peaceable Kingdom

Thanks to the Electric Fence

http://skagitvalleybeekeepers.org/101/8.html

Thanks for your interest!

Questions?

http://orderofthebee.org/