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Important honey bee pests/parasites

- *Varroa destructor – varroa mite*
- *Nosema spp.*
- *Aethina tumida – small hive beetle*

Extension.org. Photo by W. – F. Huang

Chris Maltzahn | Oregon Department of Agriculture

What can a beekeeper do about *Varroa*?

What is an Integrated Pest Management Approach?

- Decision-making process based on understanding the host and pest biology and host-pest interactions
- Action based on thresholds
- Uses multiple tactics
  - Safe, profitable and environmentally friendly

Important honey bee pests/parasites

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Some background

- *Varroa jacobsoni* was named in 1904
  - Original host is *Apis cerana* – the Asian honey bee
  - Evolved together and not as harmful as on *Apis mellifera*
- First reported on *A. mellifera in 1962*
- Found in the US in 1987 (Florida and Wisconsin)

Is varroa on *A. mellifera* the same?

- *Varroa jacobsoni* was found not be able to reproduce on *A. mellifera* in the far East
- Anderson and Trueman (2000) determined that *Varroa* is at least a 2-species complex of 18 haplotypes
  - The species that causes all the damage was renamed to *Varroa destructor* (Anderson and Trueman)

Why is *Varroa* so devastating?

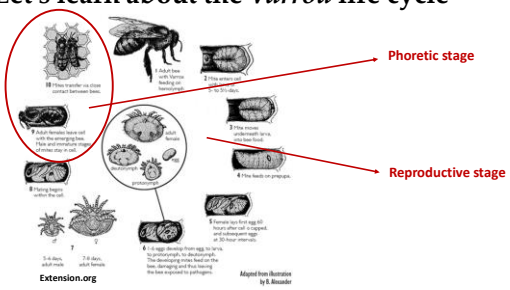
Varroa destructor

- Feed on hemolymph
  - Both adults and brood
- Suppresses immune response of bees and reduces survivorship (Yang and Cox-Foster 2005, 2006)
- Reduces drone quality (e.g., Duay et al. 2002; Zdzislaw and Jarozs 1984; Weinberg and Madel 1985)
- Vectors viruses (e.g., De Miranda et al. 2009)

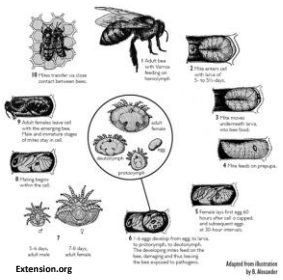
Viruses

- Deformed wing virus
  - Highly associated with varroa mites
- Paralysis viruses
  - Acute bee paralysis virus (APV)
  - Chronic bee paralysis virus (CPV)
  - Israeli acute paralysis virus (IAPV)

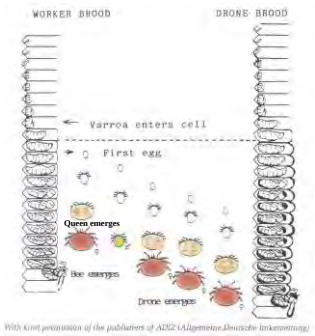
Let's learn about the *Varroa* life cycle



Let's learn about the *Varroa* life cycle



- Gravid female mite enters the cell right before it is capped
  - Starts feeding on larva/prepupa
  - Lays a first male egg
  - Lays multiple female eggs at 30-hour intervals

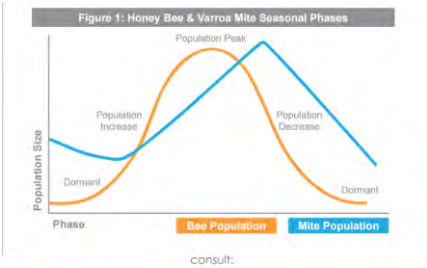


With kind permission of the publishers of ADIZ (Allgemeine Deutsche Imkerzeitung)

Varroa prefers drones

- Number produced depends on length of pupal stage
  - Queen is pupa for 8 days (0.0 mites)
  - Worker is pupa for 12 days (1.3 mites)
  - Drone is pupa for 14 days (3 or 4 mites)
- Male mates with sisters
  - Sperm matures in females
- Mites released with emerging bee
  - Male mite dies

Adapted from Eric Mussen



consult:
www.extension.org/pages/65450/varroa-mite-reproductive-biology

Monitoring Mite Levels

- Alcohol wash
- Sugar shake

Varroa mite monitoring

- **Collect ~ 300 (1/2 cup) bees from brood nest area combs**
- **Place in a wide-neck jar and close with a mesh lid**
- **Add 2 tablespoons of powdered sugar or add enough alcohol to cover the bee sample**
- **Shake jar for one minute, wait another few minutes**
- **Shake the powdered sugar or alcohol into a container**
- **Count mites and calculate the percentage** **e.g. 9 mites /300 bees = 0.03*100 = 3%**

Video https://www.facebook.com/elninolab/videos/874430566019896/

When to treat?

- When above threshold

Figure 2: Treatment Thresholds by Phase;(%=Number of mites/100 adult bees)

Colony Phase	Acceptable Further control not needed	Caution Control may be warranted	Danger Control promptly
Dormant with brood	<1%	1-2%	>2%
Dormant without brood	<1%	<2-3%	>3%
Population Increase	<1%	<2-3%	>3%
Peak Population	<2%	<3-5%	>5%
Population Decrease	<2%	<2-3%	>3%

Acceptable: *Current mite populations are not an immediate threat.*

Caution: *Mite population is reaching levels that may soon cause damage; non-chemical control might be employed while chemical control may be needed within a month; continue to sample and be prepared to intervene.*

Danger: *Colony loss is likely unless the beekeeper controls Varroa immediately.*

What can a beekeeper do about it?

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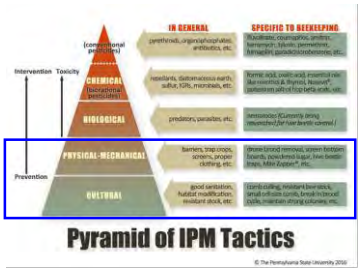


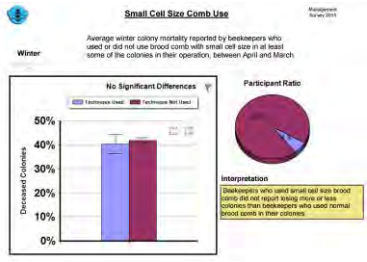
Cultural control: Resistant bee stock

- **Usually hygienic honey bee stocks**
  - **Nurse bees can detect and remove diseased and *Varroa*-infested brood**
  - **Several stocks available for purchase**
    - **Minnesota Hygienic**
    - **Varroa Sensitive Hygiene**
    - **Russian Bees**
    - **Or you can breed your own**

control bees: (33 percent of uncapped cells were infested with Varroa mites)

VSH bees: (90 percent of uncapped cells were infested)

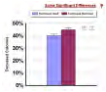
Cultural Control: Small Cell Size



Physical/mechanical control

- Breaking the brood cycle , caging the queen, splitting colonies
- Drone comb removal
  - Done in Spring, doesn't seem to have a lasting effect (Wantuch and Tarpy 2009)
  - Once drone comb capped remove and freeze
- Powdered sugar dusting
  - ½ cup/1-2 deeps
  - Not proven effective (Ellis et al. 2009)
    - Every 2 weeks for 11 months
- Screened bottom boards
  - Prevents mites from crawling up
  - Really a monitoring tool
- Use a combination

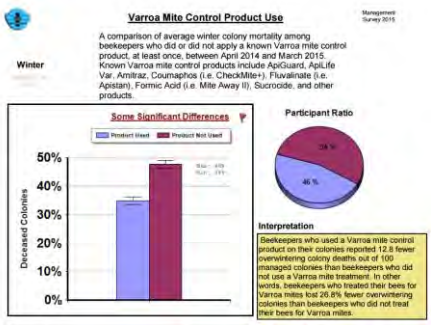



What can a beekeeper do about it?

Chemical control

	Pest/Pathogen	Active Ingredient	Formulation/Trade Name	Warning
Soft chemicals	Varroa mites	formic acid	Mite pads (Mite away II) and wipes	Brood toxicity
		thymol	Apilife Var, Apiguard	Brood toxicity; loss of queens
		oxalic acid ***	Drip and vapor	Mixed reviews
		Hop beta acids	Hopguard II	Messy
Hard Chemicals		coumaphos	Checkmite+	Neg. effects on queens, brood; development of resistance
		fluvalinate	Apistan, Mavrik	
		amitraz	Apivar	Resistance recorded in other countries



What is my lab doing about it?

- **Provide additional options for varroa mite management**
  - **The IR-4 Project:** Efficacy and honey bee safety of several novel biopesticides

Tricia Bohls

Bernardo Niño

Leonard and Linda Pankratz

Improving existing miticides (thymol)

- **Vapors do not kill mites inside the brood**
- **Delivering the miticide directly to larvae would be more effective**
- **Make thymol water-soluble for uptake by bees**

Dr. Bill Collins
Ft. Lewis College, Durango, CO

Use what best suits your situation

- You might have to experiment with a few different approaches until you find out what works for you
- Monitor regularly AND make sure your techniques are working
- USE MULTIPLE TECHNIQUES!
  - Especially when it comes to chemicals to prevent resistance development

http://honeybeehealthcoalition.org/varroa/

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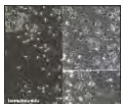
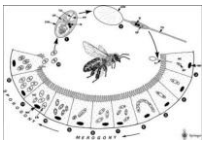
Nosema parasite



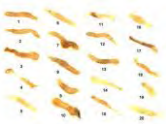
- *Nosema apis* and *Nosema ceranae*
  - Workers, drones, queens
- Gut microsporidian
  - Punctures gut cell wall
  - Causes diarrhea
  - "Starves" the bees (Holt personal comm.)



Nosema diagnosis

- Diarrhea – but can test neg for *Nosema* (Tom Webster)

- Field test
  - Pull gut out of a bee
  - Midgut supposedly lighter and swollen in *Nosema*
  - *However…*



http://www.beeccdcap.uga.edu/documents/CAPArticle6.html

Tom Webster

Testing for *Nosema*

- Requires specialized equipment
  - Microscope
  - Counting chamber
  - Mortar and pestle
  - Pipettes
  - Forceps

Testing for *Nosema*

- **Collect 30-60 bees from your colony (entrance)**
- **Crush abdomens of 25-50 bees**
  - **Add 0.1 ml / bee**
- **Put a drop of sample on counting chamber**
  - **Microscope at 400X**
  - **Count 10 random squares and divide by 40 to get millions of spores**

http://articles.extension.org/sites/default/files/w/b/be/nosema_spore_count_spermcounter.pdf

Testing for *Nosema*

- **Molecular tests available**
  - **Expensive, specialized equipment and expertise necessary**
- **Development of a diagnostic kit by Kate Aronstein (USDA)**
- **USDA Honey Bee Lab, Beltsville, MD**
  - **https://www.ars.usda.gov/Services/docs.htm?docid=7473**
- **Bee Informed Partnership**
  - **https://beeinformed.org/programs/emergency-response-kits-2/**
- **Ramesh Sagili, Oregon State University**

Nosema treatment

- Fumagilin-B fed in sugar syrup
  - Established colonies
    - Fall treatment
  - Packages
    - Spring treatment
- Keep colonies strong and well fed
- Potential for resistant stocks

Cultural control: Sanitation

- **Minimize pest/pathogen transfer**
  - **Practice good hygiene while working**
    - **Use different equipment in different apiaries**
    - **Clean equipment often (with 10% bleach)**
    - **Wash protective clothing**

  - **If reusing equipment**
    - **Do NOT use if don't know the history**
    - **Do NOT use if known incidence of AFB**
    - **Wash equipment (10% bleach; Nosema)**
    - **Heat treatment (24hrs @ 49°C; Nosema)**
    - **UV light (Nosema)**
    - **Comb culling or comb scrapping (dirty/damaged comb, pesticides)**
    - **Freezing frames (48hrs @ -20°C; wax moth)**
    - **Gamma irradiation (pesticides, viruses)**

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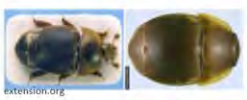
- ***Aethina tumida – small hive beetle***

Chris Hoblosky, Oregon Department of Agriculture

Small Hive Beetle - *Aethina tumida*

- Native to Africa, found in the US in 1990s
- Adults are good flyers
  - –Attracted to hives (weak hives)
  - –May also have aggregation pheromone
- Lay eggs in colonies (in mass)
- Larvae feed on pollen, eggs and brood
- Leave colonies to pupate in the soil and emerge as adults



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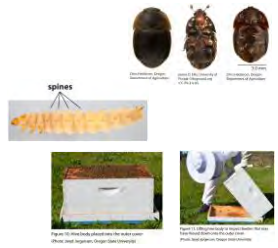
SHB diagnostics

- **Adults:**
  - **Black to brown**
  - **Oval in shape and stout**
  - **About ¼ inch**
  - **Hang out in crevices in the hive**
    - **Like dark places**
- **Larvae:**
  - **White grubs**
  - **Have spines on the "back"**



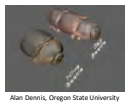
https://catalog.extension.oregonstate.edu/sites/catalog/files/project/pdf/em9150_2.pdf

Oregon State University Extension

SHB diagnostics

- **Larvae can be confused with wax moth larvae**

- **Or other adult beetles**
  - **E.g., rove beetle, sap beetle**



Alan Dennis, Oregon State University

https://catalog.extension.oregonstate.edu/sites/catalog/files/project/pdf/em9143_3.pdf

Small Hive Beetle Management

- Prevention
  - Keep hives strong
  - Keep yards and honey kitchens clean
    - Don't leave pollen patties lying around

- Mechanical Control
  - Numerous traps
- Chemical
  - Checkmite+ (AI - Coumaphos)

- Always follow label instructions
  - Correct dosage
  - Colony strength
  - Appropriate time of the season
  - Appropriate temp for application
- Check to see if your treatment worked
- Rotate/combine trt to avoid resistance