Diseases and pests of honey bees

- Management of diseases and pests has long been recognized as an integral part of beekeeping

- Pesticides used to control plant and animal pests (including pests within a beehive) can have adverse impacts on bees

- Diagnosis of problems should begin when entering the apiary and continue into the hive and conclude when leaving
Diseases and pests of honey bees

The beekeeper is always the first line of defense against diseases

Montana Department of Agriculture does provide inspection services to look for pests and diseases

Some pests and diseases are regulated by law and must be reported

Integrated Pest Management

**FOA Definition IPM:** The careful consideration of all available pest control techniques and subsequent integration of appropriate measures that discourage the development of pest populations and keep pesticides and other interventions to levels that are economically justified and reduce or minimize risks to human health and the environment.

- IPM is a process that seeks to integrate more than a single (chemical) approach to pest control
- Does not seek total elimination of pest, but rather a method to keep the pest population below the economic threshold
- Focuses on long-term prevention of pests or their damage by managing the ecosystem

IPM ≠TREATMENT FREE
Integrated Pest Management

- The status of a pest within an ecosystem is not fixed.
- Factors that modify the status of a pest include:
  a. Organisms involved
  b. The crop
  c. The environment
  d. Time

As time increases, pest populations could grow exponentially (\(\approx\)epidemic).
Integrated Pest Management

Economic injury level

- Unacceptable loss
- Acceptable loss
- No economic loss

Economic injury level
Economic threshold
Statistical threshold

Regulated Pests in Montana

- Small Hive Beetle (*Aethina tumida*)
- American Foulbrood (*Paenibacillus larvae*)
- Tropilaelaps Mites (*Tropilaelaps spp.*)
- Cape Bees (*Apis mellifera capensis*)
- Africanized Bees (*Apis mellifera scutellata*)
Regulated Pests in Montana

Small Hive Beetle (*Aethina tumida*)

- SHB adults are positively phototactic
- SHB females can lay up to 1,000 eggs in her lifetime
- Larvae are attracted to protein (pollen patties)
- Larvae defecate in honey causing fermentation (issues with extraction)
- SHB is mainly an issue in southern states

Control Methods:
- Keep healthy colony
- Traps
- Pollen patties (must monitor frequently)
- Freezing equipment

Regulated Pests in Montana

American Foulbrood (*Paenibacillus larvae*)

- Bacterium that spreads via equipment, comb, honey, in-hive tools, and out-of-hive tools
- Spores can be viable for 50+ years
- Symptoms include:
  - Ropey brood
  - Distinct sour odor
  - Scale
- Prevention*
  - Terramycin
  - Tylan
  - VFD required
- Only “treatment” is to destroy equipment
**Regulated Pests in Montana**

**Tropilaelaps Mites** (*Tropilaelaps spp.*)

- External parasite
- 1/3 the size of varroa
- Not documented in the US but is in parts of Asia
- Are visible during inspections
- Some studies have shown that there can be 25 TrM to every varroa mite in a colony
- Contact state inspector immediately if you suspect TrM is present in your colony(s)

**Cape Bees** (*Apis mellifera capensis*)

Sounds harmless, but…

*genetic bottleneoding

* Am capensis x Am scutellata
Regulated Pests in Montana

Africanized Bees
(\textit{Apis mellifera scutellata})

- Defend their hive more rapidly than the European honeybee
- Usually sting in greater numbers
- Are less selective about where they nest
- Swarm more often than European honeybees

Non-Regulated Pests in Montana

Varroa Mites (\textit{Varroa destructor})

Tracheal Mites (\textit{Acarapis woodi})

European Foulbrood
(\textit{Melissococcus pluton})

Nosema (\textit{N. apis} or \textit{N. ceranae})

Yellow jackets (\textit{Vespula spp.} or \textit{Dolichovespula spp.})
Varroa Mites (*Varroa destructor*)

- Reddish-brown, Large-bodied mite (1.0 mm long x 1.4 mm wide)
- Are active on adult bees, but fluctuates with population
- Mites can differentiate and prefer drone brood to worker brood, probably using brood pheromones to find the preferred male brood host
- Sampling Varroa may be done by looking at brood, adult bee bodies, or by estimating the number of mites in the whole colony (there are several ways to do this)

Symptoms:
- Visible on adult bees
- Deformed Wing Virus (DWV) and other pathogens present

Non-Regulated Pests in Montana
Varroa Mites (Varroa destructor)

Non-Regulated Pests in Montana

Sampling methods

Sample BEFORE and AFTER treatment!

For the soapy water/alcohol and sugar shake sampling method, a little bit of math is needed

Divide the number of mites by the number of bees in the sample
ex) If you find 9 mites in a 300-adult-bee sample

\[
\frac{9}{300} = 0.03 \times 100 = 3\%
\]

Results anywhere from 2-5% requires treatment for mites

Figure 1. Simplified bee and mite population growth curves for a temperate climate. The mite growth curve lags behind the bee curve. Note how the number of mites per hundred bees greatly increases in fall. A colony is unlikely to survive a fall infestation rate this high.
Varroa Mites (Varroa destructor)

Treatment methods

1. **Miticides**: synthetic and natural chemical compounds
   - One of the earliest control strategies
   - Specifically targets mites without causing apparent harm to the bees or hive
   Ex) Apistan®, Mavrik®, Checkmite+, Apivar®

2. **Organic acid chemicals**: Have been shown to provide varroa control but are not as convenient to use because they are temperature dependent and maybe have negative side effects.

   Ex) Formic Acid (Mite Away Quick Strips (MAQS®))
   - Impregnated sugar pad with formic acid
   - Eliminates need to reenter colony to remove strips
   - MAQS targets mites within brood cells and is permitted when honey is still on the colony being treated
   - MAQS caused moderate queen death during initial season of use

2. **Organic acid chemicals:**
   Ex) Oxalic Acid (wood bleach)
   - Is not permitted when honey is still on colony
   - Applied in fall/early spring when little brood is present
   - Outside temperature must be at least 37º F
   - Can be applied in 3 ways:
     1. In sugar solution as a spray to packages
     2. In sugar solution trickled between frames
     3. Vapor treatment

Resource:
https://www.dadant.com/
Oxalic Aid Vaporization: Questions and Answers
3. **Essential Oils:** Many essential oil extracts have been tested as miticides and several have confirmed activity.
   
   *Ex* Thymol (Apiguard®, Api-Life VAR®)
   - **Apiguard®:** slow-release gel
   - **Api-Life VAR®:** wafer application
   - Both also control for tracheal mites and some control of chalkbrood (fungus)
   - Negative side effects:
     - brood removal when applied at higher temperatures
     - queen mortality
   - Work poorly under lower temperatures and can cause bee mortality at higher temperatures

4. **Others?**

   Lithium chloride effectively kills the honey bee parasite Varroa destructor by a systemic mode of action.
Non-Regulated Pests in Montana

Varroa Mites (Varroa destructor)

Microscopic and Visual Report
The microscopic and visual report summarizes the colony sample size, the mite sample count, the mite species count, and any Apis cerana and Trigona sp. mites found.

<table>
<thead>
<tr>
<th>Target</th>
<th>Number</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Varroa mites counted</td>
<td>0</td>
<td>Total number of Varroa mites counted in entire sample</td>
</tr>
<tr>
<td>Varroa mites per 100 bees</td>
<td>0</td>
<td>Average number of Varroa mites per 100 bees</td>
</tr>
<tr>
<td>Apis cerana</td>
<td>0</td>
<td>A. cerana is native to Asia, not known to be in the U.S.</td>
</tr>
<tr>
<td>Trigona sp.</td>
<td>0</td>
<td>Trigona are native to Asia, not known to be in the U.S.</td>
</tr>
</tbody>
</table>
| Note: Based on analysis of samples since Jan 01, 2016, Varroa mites were present in 98% of samples. According to APHIS, 4% of samples (microscopy analysis only).

Figure 1 below indicates sample results inclusive of all data collected from Jan 01, 2016 to present. It illustrates the percentage (prevalence) of the samples that tested positive for the indicated mite count out of 2016 samples.

Tracheal Mites (Acarapis woodi)

- Microscopic, internal mites of the honeybee respiratory system
- Enters through thoracic spiracles
- Feeds on haemolymph of honeybee
- Infection affects the honeybees’ capacity to breathe and opens the tracheal surface to pathogens and reduces air flow to muscles (flight)
- Mites infections combined with other stressors can lead to colony death
  - Strong, populous bee colonies with abundant resources tend to have lower levels of infestation
  - Causes minor annual loss and is not a major pest

Non-Regulated Pests in Montana

Treatment vs. Non-treatment

Insecticides for Varroa control may be beneficial for beekeepers in states with high levels of Varroa infestation and low colony populations.

Insecticides for tracheal mite control may be beneficial for beekeepers in states with high levels of tracheal mite infestation and low colony populations.

Non-Regulated Pests in Montana

Tracheal Mites (Acarapis woodi)
Non-Regulated Pests in Montana

Tracheal Mites (*Acarapis woodi*)

**Control methods:**
- Re-queening colonies
- Crisco® patties
- Menthol/grease patties

**Symptoms:**
- Dwindling populations
- Weak bees crawling in front of hive
- K-wing adults
- Non-specific

Can submit samples to the USDA lab in Beltsville, MD or call Sam Abban if you have questions regarding TM:

BEE DISEASE DIAGNOSIS
BEE RESEARCH LAB
10300 BALTIMORE AVE BARC – EAST
BLDG 306 ROOM 316
BELTSVILLE AGRICULTURAL RESEARCH CENTER – EAST
BELTSVILLE, MD 20705

Non-Regulated Pests in Montana

European Foulbrood (*Melissococcus pluton*)

- Bacterial disease that effect larvae before capping
- Classic symptoms of EFB: larvae curled upward, flaccid, deflated with tracheal system prominent, and brown or yellowish
- Caused by mites and ingesting contaminated food
Non-Regulated Pests in Montana

European Foulbrood
(Melissococcus pluton)

- Can be slightlyropy with threads less than 1.5cm, but usually not roped.
- Odor: sour or none
- Scale: brown to black, rubbery
- Shape of brood before capped
- Appearance: twisted, dull to yellow to dark brown, tracheal tubes often visible

American Foulbrood
- Golf color, roped with a fine thread about 2.5cm
- Odor: sulfurous, “chicken house
- Scale: brown to black, brittle
- Shape of brood after capped
- Appearance: chocolate brown to black, perforated cappings

Nosema (N. apis or N. ceranae)

- Microsporidium (can only reproduce in cell of their host), unicellular parasite
- Labs usually only testing for level of Nosema, not distinguishing between the two
  - Historically, N. apis was the only form found present in the US but N. ceranae has become the more common form

Symptoms:
- less productive hives
- lower populations
- increased winter loss
- Dead and wandering bees in front of hive
- K-wing
- Dysentery is not a symptom, but is often correlated
Non-Regulated Pests in Montana

Nosema (\textit{N. apis} or \textit{N. ceranae})

Spread and control
- Nosema is spread from colony to colony via drifting and robbing bees that come in contact with contaminated fecal matter.
- Water collection sites also act as a repository.
- Spore-contaminated comb is greatest source.
  - Always make sure great care is taken before swapping frames from hive to hive.
  - Spores can remain viable for over a year.
- Fumagilin-B is currently only chemical treatment for disease.
  - Threshold is 1 million spores/bee.
  - Debate over whether chemical treatment is necessary.
  - FB no longer available for purchase.

Testing is available for FREE in MT!
Send samples to:
MT Dept of Ag
c/o State Entomologist
302 N Roberts St
Helena, MT 59601

Non-Regulated Pests in Montana

Yellow jackets (\textit{Vespula} spp.)

- Wasps collect protein in early spring/summer to feed to brood and collect sugary secretions later in the summer.
- Queens can lay thousands of eggs throughout the growing season.

Highly aggressive in the fall:
- Nests are super-sized in the fall.
- Nests reach max size in fall (usually around 5,000 individuals).
- Highly defensive of nest.
- Food sources are scarce in fall and yellowjackets can become desperate.
- Workers are searching for sugar (energy) later in the year.
- Focused on survival.
- Queen dies at end of year and new queens emerge and look for mates.
What can you do?
- Narrow hive entrance
- Set traps and set them early
  - Killing a queen early on will knock down populations
- Baited cat food/other forms of protein
- Keep hive strong and healthy
- Robbing screen

QUESTIONS?