Integrated Hive Management for Colorado Beekeepers

Whitney Cranshaw, Colorado State University, Bugwood.org

Strategies for Identifying and Mitigating Pests and Diseases Affecting Colorado's Honey Bees

EPA United States Environmental Protection Agency

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TABLE OF CONTENTS

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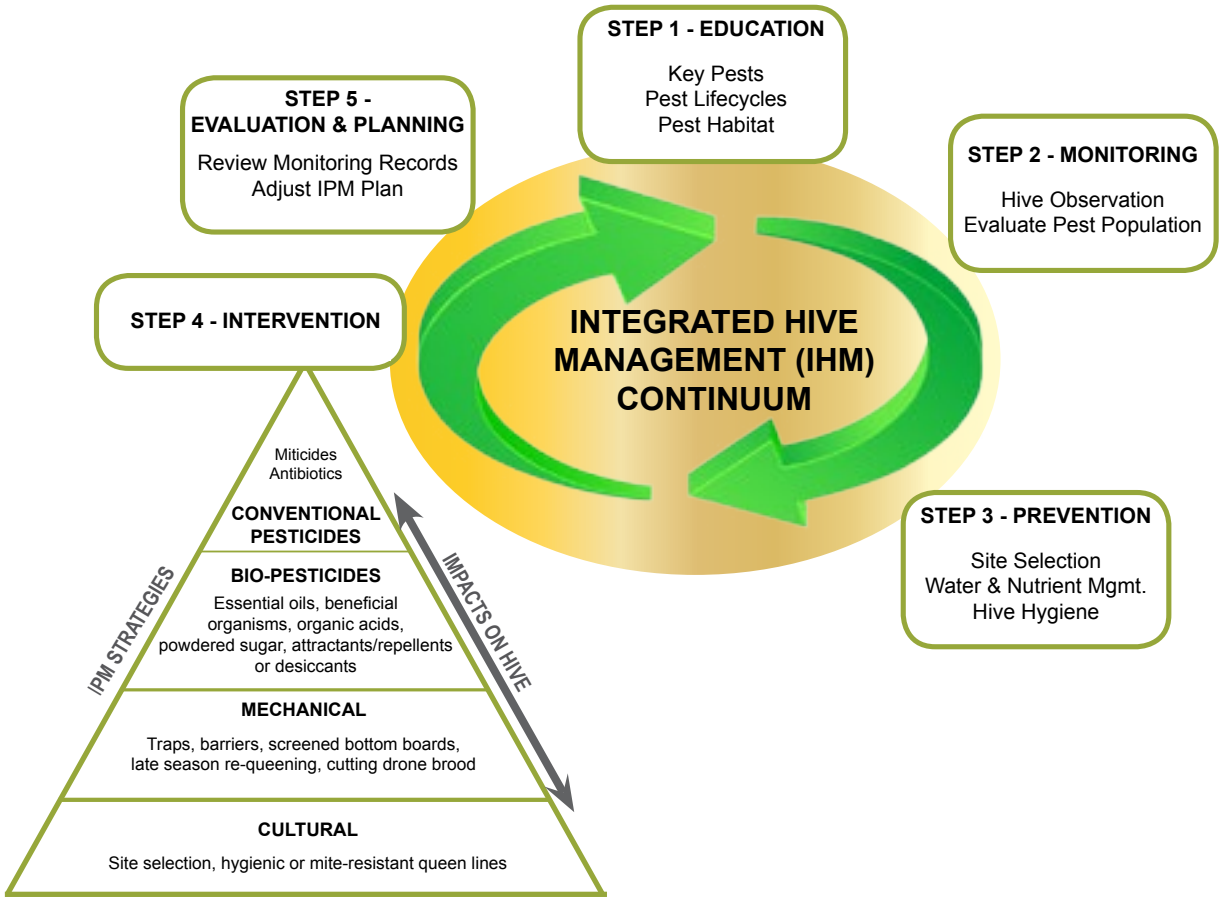
INTRODUCTION

Beekeeping is an ageless form of animal husbandry that requires an awareness of the environment and seasonal cycles. It is not simply a matter of "saving the bees". It requires a dedication for learning about the nature and behavior of bees, which involves selection of suitable hive locations and effective management practices during the different seasons. For those that stay with beekeeping, it's a portal that may raise your awareness of this highly evolved superorganism and the essential role of bees in ecosystems.

An Integrated Hive Management (IHM) program controls pests and disease by using a combination of strategies designed to be safe, effective and economical. Many IHM practices are easy to apply and are designed to manage, but not necessarily eliminate honey bee pests. The first step in an IHM program requires taking the time to familiarize yourself with the bees, the colony, and the pests. Education, monitoring, prevention, and intervention are steps on the IHM continuum. IHM intervention strategies draw from the following categories; cultural, mechanical, biological, and/or chemical controls. An effective IHM program also includes continuous evaluation and planning steps so that adjustments can be made as necessary to ensure the success of the program.

Using IHM helps beekeepers to move from a series of often disconnected acts, to an organized system of pest management that is always in search of new ways to support healthy colonies while reducing the use of chemicals. IHM requires beekeepers to evaluate each management decision in terms of its impact on the health of their bees. IHM can help beekeepers achieve their pest management goals in the least invasive manner possible by drawing on all the strategies. If needed, IHM techniques emphasize minimal, yet optimal, use of chemicals. When properly applied, the use of chemicals should ensure there are minimal risks of residues or the development of pest resistance.

IHM will not mean the same thing for all beekeepers. Some techniques are compatible with small to mid-sized operations, but not with larger operations. Different beekeepers will adopt different IHM programs, which are flexible by design, allowing beekeepers to customize their programs to achieve optimal results.



The first step in any IHM program is to properly diagnose the pest and/or disease that may be present in your hive. The USDA Bee Research Laboratory provides free authoritative diagnosis of bee diseases and pests for Federal and State regulatory agencies and beekeepers on a worldwide basis. For more information about the lab and how to submit samples, go to: http://www.ars.usda.gov/main/site_main.htm?modecode=80-42-05-40

Pest Monitoring Calendar

This calendar shows approximate times to monitor for bee pests and diseases in Colorado.

Pests*	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
				ACTIVE BEEKEEPING SEASON IN COLORADO								
PRIMARY												
Varroa mite												
Nosema ceranae												
Nosema apis												
American Foulbrood												
European Foulbrood												
SECONDARY												
Tracheal Mites												
Chalkbrood												
Wax Moths												
Viruses vectored by Varroa												
Deformed Wing Virus												
Chronic Bee Paralysis Virus												
Acute Bee Paralysis Virus												
Israeli Acute Paralysis Virus												
Viruses vectored by Nosema												
Black Queen Cell Virus												
Sacbrood												
Small Hive Beetle												
Bears												
Mice												
Skunks & Raccoons												

*Pests are listed in descending order of most serious to least serious.

MONITORING

Consistent evaluation, monitoring, and record keeping are essential components of any successful IHM program. The following guide suggests methods for use by beekeepers.

Assessing Honey Bee Colonies

Successful beekeeping requires a proactive approach. It is important to assess hives several times throughout a season. Recognize that colonies will look different during different times of the year. Recent weather, time of day, precipitation, and warm/cold spells influence colony activity during different times of the year. The following is a representative example of a late spring/early summer situation before adding honey supers. These assessments will help beekeepers develop an environmental awareness of overall conditions
impacting their hives.

MONITORING

Assessing Honey Bee Colonies — continued

Upon entering the yard:

- Look for potential floral/pollen sources (remember bees can easily forage up to 3 miles from the hive).
- Note what direction bees are flying (this may give you clues about where the bees are foraging).
- Note the activity level & mood of the yard.

Approaching the hive:

- Observe flight and activity level adjacent to the hive and front entrance.
- Note any dead or dying bees in front of the hive.
- Note any defecation on the front of hives. Excessive spotting from defecation, especially on the front of hives, may be indication of *Nosema apis* or dysentery.

Before opening the hive:

- **Smoke the Entrance**. Have smoker lit and going. Give a few light puffs of smoke at the entrance.
- If the activity level seems low, it may be an indication of potential problems.
- Note the hive temperament at this point. Do they seem organized with regular coming and going's, or are they becoming aggressive and defensive?

Smoking the hive
Wendy VanDyk Evans, Bugwood.org

The Basics of Lighting the Smoker*

1. **Assemble your materials**
2. **Prepare your smoker**
3. **Add the kindling**
4. **Light the kindling**
5. **Add the final fuel**
6. **Fill the smoker ⅔ - ¾ full**
7. **Puff vigorously until smoking well**
8. **Close lid and puff occasionally to keep going**

***A detailed description of using a smoker can be found in the Appendix.**

Opening the hive:

- The key to successfully opening the hive is to enter the bees domain gently, using your smoker to facilitate a smooth entry, without agitating or alarming the bees. After smoking the entrance, then **ease** the outer cover up, as jarring and loud popping sounds will agitate the bees. Then administer a few light puffs of smoke through the communication hole in the inner cover. Wait a few minutes,then gently open the inner cover and administer a few light puffs of smoke on the bees themselves.

MONITORING

Assessing Honey Bee Colonies — continued

Opening the hive:

- Inside the hive check for signs of American Foulbrood or other diseases. Signs of American Foulbrood include: sunken cells, pinholes in cappings, putrefied larvae (decomposed larvae has the consistency of snot) and has a pungent odor (like an old garbage pail).
- Preliminary signs of dysentery or *Nosema apis* include: bee poop on frames or on inner surfaces of hive.

Look for Signs of Healthy Hive

- Do the bees look active and numerous?
- Is there fresh white comb on the frames?
- Are the bees actively foraging?
- Is there honey and pollen in the frames?

Examining bees:

- How many frames do bees cover?
- Determine if there are eggs, larva, and sealed brood. If these 3 stages of development are present, it's an indication that things are going pretty well.
- Are there mites on the bees?
- Look for k-wing or deformed wings on the bees.
- During active brood rearing season, uncap a few brood cells and look for mites in drone pupae.
- In a healthy hive, most drone cells will be found at the bottom of frame and make up no more than 20% of cells on the frame. (Scattered or bullet shaped cappings on drone cells throughout the frame may indicate an issue with queen, i.e. laying workers or failing queen).

Assessing the Queen:

- Does her abdomen appear big, long and fat? This indicates that she's laying eggs.
- Is she laying eggs in a uniform pattern (capped cells) with minimal missed cells? Missed cells, with a "shotgun" or a salt/pepper pattern could indicate disease.

Harvest Season Checking for Varroa — Monitoring & Treatment

Remember Varroa's reproductive cycle is related to bee's reproductive cycle.

Varroa Monitoring & Treatment:

- Early summer (June): Do a mite check in order to get any infestations under control.
- Early August - September: Harvest time is a critical time to check and treat for Varroa mites. (**It is critical to monitor and treat, if necessary, before the end of August in Colorado.** The most damage from Varroa usually occurs in late summer and is the primary reason colonies don't overwinter successfully).
- Remember - bees must have at least one brood cycle with reduced Varroa pressure to have healthy bees for overwintering. It is important to note that successful overwintering requires a high bee population with a low Varroa count. Depending solely on the number of bees you see in the hive in the fall, does not guarantee successful overwintering.

Fall Check — Check Nectar & Pollen Store

- In Colorado, it is extremely important to check the pollen stores because pollen resources are limited. There should be several frames containing pollen, in addition to honey. If there are not several frames with pollen, supplemental pollen must be provided.
- In Colorado, bees are overwintered in 2 deep supers. The lower box is for bees and the top box should be full of pollen and honey. For Colorado beekeepers, the top box should weigh about 75-90 lbs. to provide enough food for overwintering.
- Check in September/October - if the colony is light, supplemental feeding should be provided.

MONITORING - FOR VARROA MITE

The following information contains treatment guidelines which are only suggested levels. Treatment levels will vary depending on colony strength, temperatures, geographic location, presence of other pests/pathogens, and hive management. Beekeepers should sample at least twice a year, in mid-spring and late summer, as mite numbers will increase during the season. If colonies appear stressed and weak, a sample can be collected mid-summer. Beekeepers might also consider taking samples before and after a treatment to determine if the treatment was effective at reducing mite populations. Several colonies from each beeyard should be sampled.

Remember...it is critical that Varroa be monitored and treated, if necessary, BEFORE the end of August in Colorado to reduce mite pressure before overwintering. If fall sampling indicates a mite treatment is necessary, honey supers should be removed as soon as possible before treatment to avoid contaminating or affecting honey quality.

SCREEN BOTTOM WITH STICKY BOARD (Mite Census)

The sticky board is a passive, non-lethal method to monitor Varroa mite population levels within the hive. The best time to use sticky boards is during active brood rearing, which is approximately early May through August in Colorado.

Materials:

#8-mesh (⅛" mesh) hardware cloth that will retain the bees while letting mites fall through.

A stiff piece of white poster board or self-stick shelf liner (sticky side-up) that is sufficiently large enough to cover the hive bottom board.

Aerosol cooking spray, vaseline or Tanglefoot® if using the poster board.

Directions:

Sticky-boards can be purchased from a bee-supply dealer or made from adhesive covered poster-board placed underneath #8-mesh hardware cloth. If using self-stick shelf liner, place the sticky side up. The sticky-board is placed between the screen and the hive bottom board. The screen separates the mites from the bees while preventing the bees from becoming entrapped in the sticky board. As mites transfer between the adult bees and brood, some fall off through the screen and adhere to the sticky paper on the bottom board.

The sticky-board should be placed in the hive and removed after 24-36 hours and examined for numbers of mites. Counts from 10-20 mites on the sticky board indicates that the colony should be treated for Varroa.

The sticky-board method is a more reliable method of monitoring Varroa mite levels than simply sampling brood during active brood rearing season.

ALCOHOL ROLL

The alcohol roll, while lethal to sampled bees, is considered a more accurate method for monitoring Varroa mite levels than the ether roll.

Materials:

A wide-mouth mason jar with a tight fitting lid.

Rubbing alcohol.

Kitchen strainer and 2nd jar or bowl.

Directions:

1. Place 1" of alcohol in the mason jar.
2. Brush or shake approximately 300 worker bees, or about 1/2 cup loose bees, collected from near the middle of the brood nest into the wide-mouth mason jar. It is extremely important to collect "house bees" (those found in the middle of the hive) rather than the forager/worker bees because house bees are where Varroa are most prevalent.
   Be certain that the queen remains in the hive.
3. Place the lid on the jar of collected bees and shake a few minutes to ensure that all of the bees are covered.
4. Pour all of the jar contents through the kitchen strainer into another jar or bowl.
5. Pour off the alcohol through cloth or a paper towel.
6. Spread out the cloth or paper towel and count the mites.
7. If you count from 6 to 9 mites, treat for Varroa. This represents a 2-3% threshold. Hobby beekeepers may be able to tolerate slightly higher infestation levels.

MONITORING - FOR VARROA MITE

ETHER ROLL

The ether roll is a lethal method but an easier method than the alcohol roll for monitoring Varroa mites but results tend to be less consistent than alcohol roll.

Materials:

A wide-mouth mason jar with a tight fitting lid.
Commercial aerosol diesel engine starter fluid.

Directions:

1. Brush or shake approximately 300 worker bees, or 1/2 cup loose bees, collected from near the brood nest into the wide-mouth mason jar. It is extremely important to collect “house bees” (those found in the middle of the hive) rather than the forager/worker because house bees are where Varroa are most prevalent. **Be certain that the queen remains in the hive.**
2. Place the lid on the jar of collected bees and spray a short burst (about one second) of engine starter fluid into the jar. After about one minute, gently roll the jar from side to side to coat all of the bees with the ether.
3. If Varroa mites are present, they will fall off of the bees and adhere to the sides of the jar where they can be counted.
4. If you count from 6 to 9 mites, treat for Varroa. Hobby beekeepers may be able to tolerate slightly higher infestation levels.

POWDERED SUGAR ROLL

Another method used to monitor for Varroa mites is the powdered sugar roll. This method has the advantage of not sacrificing bees while checking for mites.

Materials:

A wide-mouth mason jar with a two-piece lid. Remove the center portion of the lid and replace with #8-mesh screen.
#8-mesh (⅛” mesh) hardware cloth that will retain the bees while letting mites pass through.
Tablespoon measure.
Powdered sugar.
Cheesecloth.

Directions:

1. Brush or shake approximately 300 worker bees, or 1/2 cup loose bees, collected from near the brood nest into the wide-mouth mason jar.
   It is extremely important to collect “house bees” (those found in the middle of the hive) rather than the forager/worker bees because house bees are where Varroa are most prevalent. **Be certain that the queen remains in the hive.**
2. Replace the modified lid and add a heaping tablespoon of powdered sugar through the mesh screen.
3. Roll the jar from side to side to distribute sugar over all of the bees. Wait a few minutes and roll the jar again.
4. Pour the sugar and dislodged mites through the screen onto cheesecloth.
5. Separate the mites from the sugar by sifting the sugar through the cloth, leaving the mites on the cloth surface for counting.
6. The bees can then be returned to the colony where their hive mates will groom them clean because the sugar stimulates the bees’ grooming behavior. The powdered sugar makes it dffiicult for the mites to adhere to their host, causing the mites to fall off the bees.
7. Spread out the cloth and count the mites.
8. Estimate the number of mites/ 100 bees. If there is brood in the colony, double the number to factor in mites in worker brood. If you count over 6-9 mites/ 100 bees, consider treating for Varroa. Hobby beekeepers may be able to tolerate slightly higher infestation levels.

Example of lids used for sugar roll.
Rob Snyder, beeinformed.org

Additional Resources for sampling:

Poster - Powder Sugar Roll For Varroa Mites on Honey Bees: http://www.beelab.umn.edu/prod/groups/cfans/@pub/@cfans/@bees/documents/asset/cfans_asset_317466.pdf

Mite Monitoring Methods at ScientificBeekeeping.com: http://scientificbeekeeping.com/varroa-management/mite-monitoring-methods/

Varroa Sampling at Extension.org: http://www.extension.org/pages/31539/varroa-sampling#.VRwGhPnF98E

IHM INTERVENTION STRATEGIES

There is an abundance of information (especially over the Internet) regarding different methods of beekeeping. As with all animal husbandry, there are basic principles and methods of beekeeping that have proven successful over the years. After beekeepers have developed a solid foundation of beekeeping principles, then different methods can be explored and applied more successfully.

CULTURAL & MECHANICAL CONTROL:

A key to protecting bees from pests like wasps and hornets, wax moths, or robbing bees, is to have a strong colony that can defend itself. Requeening is an important cultural control: when done in the spring, vigorously laying queens are an effective tool for disease mitigation. In fall, requeening can be done to address failing queens, aggressive bees, or to ensure overwintering success. Whenever aggressive hives are found, they should be immediately requeened with gentle queens from known sources (especially important in urban environments). Other cultural and mechanical controls include ensuring that the bees have a diversity of pollen and nectar resources and access to a fresh water supply; locating hives in sunny areas rather than shade to reduce humidity in the hive. Another effective and important practice is to rotate and replace approximately 20% of brood combs annually. Colorado beekeepers have not routinely rotated their brood combs in the past, but modern conditions nowadays essentially require it.

The following replacement and rotation schedule for brood combs is recommended for a standard 10 frame hive. During spring inspections, move dark combs to the outside of the brood box. The inside combs are then evenly spaced with frames of foundation. It is important to leave *all combs with brood together* in the center of the brood nest. All 9 or 10 frames should be rotated and replaced over a 5 year period. This practice is a very effective way to control brood diseases. It also helps to remove accumulated pesticide residues and reduces exposure of the bees to chemicals used within the hive or, if used on crops, where bees have been foraging.

Mechanical and physical methods are capable of killing pests directly or making the environment unsuitable for them to live or reproduce. Because they do not involve the use of chemicals, these methods can be applied when bees are collecting nectar, pollen, and producing honey. However, mechanical/physical controls may involve more labor and equipment, and often are more effective when combined with other controls. Mechanical/physical control methods include the use of traps, barriers, screened bottom boards, drone brood removal, burning, and freezing.

FREEZING & BURNING

Freezing and Burning are cultural methods used to eliminate pests and diseases such as Greater wax moths, American Foulbrood (AFB) and European Foulbrood (EFB).

Freezing:

Freezing is a method often used to eliminate Greater wax moth infestations. Freezing comb is a simple and effective way to rid a comb of all stages of wax moths. Freezing the comb at 20^0 F for a minimum of 4.5 hours or 5^0 F for 2 hours is recommended. Placing individual combs in freezers may be appropriate for small beekeepers. Larger beekeepers can store entire supers of comb over the winter in non-heated areas that are subject to freezing temperatures. After freezing, the comb needs to be stored where no adult wax moths can get to it.

IHM INTERVENTION STRATEGIES

FREEZING & BURNING

Freezing and Burning are cultural methods used to eliminate pests and diseases such as Greater wax moths, American Foulbrood (AFB) and European Foulbrood (EFB).

Burning:

Burning is a method used to control brood diseases, especially AFB and occassionally for EFB. Hives infected with these diseases must be destroyed or sterilized in order to prevent further spread of the disease.

Burning an American Foulbrood infected hive.
Photo credit: John Skinner

DRONE BROOD REMOVAL

Drone brood removal is a mechanical/physical strategy for reducing *Varroa* mites. It uses drone comb to 'trap' mites. *Varroa* prefer to feed on drone larvae rather than worker larvae and infested capped drone brood can be removed and discarded.

Steps for successfully removing infested drone brood:

1. Insert a drone brood frame and foundation adjacent to brood nest:

Using a drone brood frame will encourage the queen to lay in it rather than in worker combs during the drone season.

2. Wait:

No more than 20 days or until drone cells are capped. This gives the bees time to draw out comb (or clean out dead drone brood), the queen to lay eggs and the drone brood to develop.

3. Get rid of the drone brood:

You can dispose of the capped drone pupae and accompanying Varroa mites in one of three ways; scraping, cutting comb into the trash, or freezing. Remember if drone brood emerges from the comb before removal you have significantly increased rather than decreased the Varroa population.

4. Repeat:

Continue removing the drone brood until late August/September or when brood rearing in the hive has significantly decreased at the end of the season.

IHM INTERVENTION STRATEGIES

BIOLOGICAL CONTROL:

Biological control is the application of various biological controls and/or organisms to reduce or eliminate honey bee diseases. This strategy relies on using other living organisms to control pests. Examples include using *Bacillus thuringiensis* Berliner, a natural control sold under the trade name Certan®, for controlling wax moths. While bio-control is used in many aspects of agriculture, effective bio-agents for beekeeping are not widely available and approval for their use varies state by state. Any bio-control product that is used in bee hives must be registered by the state.

CHEMICAL CONTROL:

Chemical controls are used where established pest and disease thresholds have been reached after cultural, mechanical/physical and biological methods have not been effective. Proper chemical use must include selecting a registered chemical and applying it according to label directions including: applying the proper dose, at the correct time, by the proper method and removing chemical treatments at the required intervals. Pesticide products should be alternated regularly to prevent or reduce the likelihood of developing pest resistance. Chemical treatments often require that treatment be completed within a specific amount of time before supers are added. Chemical treatments that are temperature-dependent should be used with caution. Some products such as formic acid and oxalic acid are sensitive to high temperatures and must be used within the temperature range indicated or bee death will occur.

Biopesticides are naturally occurring substances that control pests. They include pesticides that contain essential oils (thymol, eucalyptol, and menthol), products derived from plants (sucrose octanoate from tobacco), organic acids (formic acid), and 'diatomaceous earth' (silica oxide). Although biopesticides are derived from 'naturally occurring' sources, they can be *as toxic or more toxic* than synthetic pesticides since they are more oncentrated than what is found in nature. This is a common misconception held by some "pesticide-free" advocates.

Synthetic pesticides are manufactured products and contain properties that *may or may not* be found in nature. The most commonly used synthetic pesticides used in hives include antibiotics, Terramycin®,Tylosin® tartrate, Fumagillin, fluvalinate (pyrethroid), and coumaphos (organophosphate).

Regardless of whether you choose to use a biopesticide or a synthetic pesticide, continuous use of the same pesticide product or products containing the same active ingredient can result in the development of pesticide resistance by the target pest. From an evolutionary perspective, many organisms have the ability to adapt and become resistant to a pesticide as a way to survive. In order to avoid resistance, pesticides should only be used when other pest management methods have not provided adequate control and must always be used according to label directions.

IMPORTANT NOTE:
To maintain viability of any chemical and avoid the development of chemical resistance in pests and disease **DO NOT** use chemicals prophylactically.

Varroa Mite *Varroa destructor*

Significance

The Varroa mite is considered to be one of the most serious pests facing honey bees today. They can kill a colony in two to three years if preventive measures are not taken. Varroa mites are known to vector serious viral diseases.

Varroa mites on drone pupae.
(Denise Ellsworth, Ohio State University, Bugwood.org)

Description / Identification

Female mites are brown to reddish brown in color, approximately the size of a pinhead. Male Varroa mites are light tan in color and smaller.

These parasites feed on the hemolymph* of immature bees (preferably drone brood), but they will also feed on adults. Developing drones are much more attractive to Varroa mites then worker brood.

Female mites infiltrate cells before they are capped and feed on developing larvae and pupae.

They bury/hide themselves in the brood food until the cells are capped and continue to produce new eggs approximately every 30 hours.

Immature mites develop on bee larvae and pupae and take about a week to mature.

Varroa mites also vector viral diseases including Deformed Wing Virus (DWV), Chronic bee paralysis virus (CBPV) and Acute bee paralysis virus (ABPV), which are often more damaging than feeding on the bee's blood.

Spotty brood patterns (like shotgun) may indicate a Varroa mite infestation, particularly if associated with DWV, however, accurate mite monitoring is the only way to determine damaging levels of infestation.

Adult female Varroa mite feeding on developing bee pupa.
(Scott Bauer, USDA Agricultural Research Service, Bugwood.org)

* The circulatory fluid, analogous to blood and lymph in humans.

Varroa Mite *Varroa destructor*

IPM Recommendations

Monitoring:

1) Mite drop/sticky-board method
2) Ether/alcohol method
3) Sugar roll method

Capped pupae, especially drones, can be examined directly by opening the cells with an uncapping tool and looking for mites.

A screened bottom board with white sticky paper inserted on the bottom board is the easiest and fastest method to determine damaging mite levels.

Cultural:

- Mite levels can be reduced as much as 25% by using screened bottom boards. Specially made drone comb foundation or removal of excess drone cells can reduce mite-loads, although these techniques usually have to be used in conjunction with other methods.
- Requeen, or cage the old queen for a week or so (to break the reproductive cycle of the bees and Varroa mites) and/or, requeen with Varroa tolerant lines of bees.
- Use of a Bee gate/Varroa gate (see additional resources).

Chemical:

- Treat with coumaphos, fluvalinate, formic acid, sucrose octanoate, Api Life VAR, or Apiguard.
- When using these products, label directions and application rates must be followed.

Varroa mite attached to female worker bee.
(Rob Snyder, beeinformed.org)

Spotty brood patterns (shotgun pattern) may indicate a Varroa mite infestation.
(Rob Snyder, beeinformed.org)

Nosema ceranae
Nosema apis

Significance

Nosema is one of the most prevalent adult honey bee diseases and is caused by two species of microsporidia, *Nosema ceranae* and *Nosema apis*. *Nosema ceranae* is more prevalaent in Colorado and is the more virulent strain. It can affect colonies rapidly, causing a noticeable reduction in the bee colony. This disease can cause a bee colony to die within as little as eight days of infection.

Hives lost to *Nosema apis* have symptoms of acute dysentery. Often there is excessive bee excrement at the front of the hive near the entrance(s). *(Clemson University - USDA Cooperative Extension, Bugwood.org)*

Description / Identification

Nosema spp. invade the digestive tracts of honey bee workers, queens, and drones.

Adult bees ingest Nosema spores when they are eating contaminated food and when they are cleaning up in the hive, especially fecal material from infected bees.

The spores germinate and multiply within the lining of the bee's midgut.

Other symptoms may include severe dysentery (defecation within the hive - primarily with *N. apis*); weak, crawling bees; spotty brood patterns similar to shotgunning (mainly with *N. cerana*), and poor buildup in the spring.

Nosema ceranae may be present throughout the year, but tends to be more virulent in spring and summer.

An infection by *Nosema ceranae* is generally without overt symptoms, however, brood production tends to dwindle—the older field bees may simply "disappear."

Bees must be dissected and examined microscopically to confirm the presence of Nosema. Once a beekeeper gains experience and has received confirmation of Nosema, visual inspections may be enough to determine a Nosema problem.

***Nosema apis*, excessive bee excrement with a handful of bees remaining that appear bloated and wet.** *(photo: D. Israel)*

Nosema ceranae
Nosema apis

IPM Recommendations

Monitoring:

By being alert to the signs and symptoms and utilizing effective monitoring practices (such as those outlined in the "Assessing Honey Bee Colonies" section under Monitoring) beekeepers should be able to identify, intervene and mitigate when signs of disease and pests are evident.

Cultural:

- Keep bees strong and healthy.
- Use good management and bee-husbandry techniques to reduce stress.
- To avoid spreading Nosema among colonies, always maintain clean equipment. Rotate and replace any brood comb from colonies that have had problems with Nosema.

Chemical:

- Use Fumagillin (Fumidil-B) during an active infection. Fumidil-B is very effective against *Nosema ceranae* and *Nosema apis.* *Nosema ceranae* may require treatment during the spring and summer. *Nosema apis* is a cold-weather disease. This is the most commonly used treatment among both commercial and hobby beekeepers using IPM.
- An alternative natural product is Nozevit, a product which is a mixture of essential oils which is then combined with syrup. Typically, Nozevit is not as effective as Fumagillin, an antibiotic.
- When using these products, label directions and application rates must be followed.

Shotgun pattern typical of a *Nosema ceranae* infection. *(Randy Oliver, ScientificBeekeeping.com)*

Colonies collapsing with a high rate of *Nosema ceranae* infection. *(Randy Oliver, ScientificBeekeeping.com)*

American Foulbrood (AFB)

Significance

Prior to the introduction of Varroa mites, American Foulbrood (AFB) was considered the most serious disease beekeepers had to contend with. AFB is a bacterial disease and is still a serious honey bee brood disease. AFB spores are transmitted to young larvae (less than two days old) while being fed by nurse bees. Immature bees die from this bacterial disease in the late larval or pupal stage and putrify in their cells. AFB is also spread by housekeeper bees and by beekeepers using or swapping contaminated equipment. Once a colony is weakened by AFB, robber bees may infiltrate the hive, steal infected honey, and bring it back to their own brood, thus spreading the disease. AFB spores remain viable indefinitely.

AFB — A colony heavily infected with AFB will have moisture on the sealed brood. Brood is also oozing from perforated cells at this stage.
(Rob Snyder, beeinformed.org)

Description / Identification

Dead larvae change color from tan to dark brown, putrify and become "ropy" (stretch-out in "strings" when pulled out of the cell with a toothpick).

Dehydrated larvae form "scales" in the bottom of cells that are hard to remove. The putrified larvae or pupae may be found with remnants of extruded tongues stuck to the tops of cells.

Cell cappings usually appear sunken and dark in color with multiple perforations and, in advanced cases there is a characteristic odor similar to rotting garbage.

There is often a spotty brood pattern ("shotgun") of infected and uninfected cells.

AFB —"Ropy" symptom.
(Clemson University - USDA Cooperative Extension, Bugwood.org)

AFB — Deadout with spotty brood pattern.
(Rob Snyder, beeinformed.org)

AFB infected brood may exhibit a syndrome called 'pupal tongue' where the tongue protrudes to the top of the cell.
(University of Georgia, http://www.ent.uga.edu/bees/disorders/bacterial.html)

American Foulbrood (AFB)

IPM Recommendations

Monitoring:

Effective monitoring practices (such as those outlined in the "Assessing Honey Bee Colonies" section) and maintaining clean equipment and combs are the best way to avoid AFB infection. There are few viable options other than destroying the bees and hive, once AFB has taken hold.

Cultural:

- To prevent AFB, maintain good management and sanitation practices.
- If AFB is identified in a colony, all infected combs (mainly brood combs) must be removed and destroyed, usually by burning. All other parts of the hive must be sterilized by cleaning and scorching, boiling or gamma irradiation (unavailable in many parts of the country).
- Bees in infected colonies should be killed, but if not, must be shaken into clean equipment with clean frames of foundation and must be treated with a regimen of Terramycin® or Tylan/Tylosin® tartrate.
- Heavily diseased colonies (more than a frame of infected brood), or small bee populations, must be destroyed and burned. AFB is not a disease to play with! Beekeepers have a responsibility to not spread the disease to other bees and beekeepers.

Chemical:

- No antibiotics eradicate AFB spores. Terramycin® or Tylan/Tylosin® are used to prevent or control *active stages* of AFB when reintroducing bees into clean frames.
- When using these products, label directions and application rates must be followed. Otherwise, contamination of honey and other products may result.

European Foulbrood (EFB)

Significance

Along with Nosema, sacbrood, and chalkbrood, European foulbrood (EFB) is considered a stress-related disease of honey bees. It is aggravated by conditions such as cool temperatures, high humidity, and/or food shortages. EFB is commonly seen with increased brood rearing in the spring.

Description / Identification

It is caused by a *non-spore-forming bacterium* that is transferred throughout the colony via housekeeper bees as they remove dead larvae.

European Foulbrood (EFB)

Description / Identification (continued)

EFB may also be spread by robber bees and beekeepers using contaminated equipment.

Young larvae ingest EFB bacteria and die within four days of egg hatch.

Larvae infested by EFB usually *die in the coiled stage* and do not become "ropy" (like AFB).

Larvae change from yellow to brown, sometimes with a silvery cross pattern caused by tracheal discoloration.

Dry scales—the remainder of the larvae—are easily removed from their cells, unlike AFB scales, which are difficult to remove. Therefore, EFB is somewhat reversible by applying hygienic behaviors in strong colonies.

A sour odor (like fermented fruit) may be present, but odor is not a defining symptom of EFB.

EFB larvae turning and decomposing (two cells with contaminated brood food). *(Rob Snyder, beeinformed.org)*

Larvae with early stages of EFB. One larvae displaying "stomach ache" (starting to contort in the cell) position. *(Rob Snyder, beeinformed.org)*

IPM Recommendations

Monitoring:
By utilizing effective monitoring practices (such as those outlined in the "Assessing Honey Bee Colonies" section) and recognizing early signs, beekeepers can address EFB before it decimates a colony.

Cultural:

- For light infections, reduce stress by improving nutrition (supplemental feeding) and/or relocating hives to a more favorable (sunny, warm) location.
- For moderate infections, reduce stress and requeen with a young, vigorous queen.
- For severe infections, treat with Terramycin® or Tylan/Tylosin® tartrate and requeen.

Chemical:

- Terramycin® or Tylan/Tylosin® tartrate are the only approved controls recommended for severe infections (see cultural practices above).
- When using these products, label directions and application rates must be followed.

EFB larvae with sunken trachea visible (silvery lines on side). *(Rob Snyder, beeinformed.org)*

Tracheal Mites

Significance

Tracheal mites are parasites of the respiratory system of adult bees.

Mites inside tracheal tube.
(Pest and Diseases Image Library, Bugwood.org)

Description / Identification

Tracheal mites are usually more severe in areas with high humidity and colder winters. Mite populations are usually highest and most destructive during the winter when heavy infestations can contribute to the death of an entire bee colony.

These mites infest the respiratory-breathing tubes of the adult bees, usually in the first thoracic segment, although they may invade the air sacs as well.

These parasites feed on the hemolymph-blood of adult bees. Mites feed by puncturing tracheal walls and ingesting the bee's blood.

Tracheal mites are transmitted by bee-to-bee contact and may also be introduced into colonies from package bees, new queens, and bees from colonies collapsing from tracheal mite infestation.

Female mites lay their eggs in the tracheal tubes of honey bees where they complete development in as little as two weeks.

Infested bees become physiologically stressed, often lethargic and may have damaged flight muscles, and are seen crawling rather than flying in front of the hive.

IPM Recommendations

Monitoring:

These mites are usually easier to detect during the fall and late winter. Sick bees can be collected from around the hive entrance, dissected and the trachea examined under a microscope, or stored in 70% ethanol until they can be examined.

Cultural:

- Use resistant honey bee stock. Several genetic lines have shown established resistance: Buckfast, Russian, Minnesota Hygienic, and possibly New World Carniolan.
- Grease patties, made from a mixture of sugar and vegetable shortening, can be given to the bees and may be somewhat effective, but using *genetic honey bee lines with established resistance is the best control*.

Chemical:

Menthol crystals in pre-measured packets are one of the more effective natural controls for tracheal mites (applied according to directions). Synthetic pesticides are usually not necessary, and carry the additional risk of gradual contamination of the brood comb.

Chalkbrood

Significance

Chalkbrood is a fungal disease that infects three-to-four day-old larvae, usually in stressed or weak bee colonies. It is most commonly seen in the spring, or any time there is high humidity and cooler weather. Chalkbrood does not usually kill a colony, but it may result in fewer developing bees or less honey production during nectar flows. Spores can persist for years in infected and old brood combs.

Chalkbrood mummies just outside the entrance of the hive entrance. *(Rob Snyder, beeinformed.org)*

Description / Identification

Nurse bees spread the fungal spores while feeding immature bees.

The spores germinate in the gut of the larva and mycelia grow, causing the appearance of white or grey mummified larvae, first seen in the cells and then, as the house bees clean them out, on the bottom board and in front of the hive.

Larvae usually die in an upright, stretched-out position.

The infected larvae are usually removed from their cells by nurse bees.

Chalkbrood taking over a drone larvae. *(Rob Snyder, beeinformed.org)*

Dried mummies will turn dark gray to black; eventually all these colors of mummies can be found in brood frames and on the bottom board or in front of the hive.

IPM Recommendations

Cultural:

- Reduce stress by moving hives to sunny locations, with plenty of air ventilation and dry conditions.
- Remove heavily infected combs and discard or burn them; replace with new frames or foundation.
- Requeen if disease is severe, especially with hygienic queen lines. Honey bee lines have shown differences in susceptibility to chalkbrood, which is largely related to hygiene.

Wax Moths

Significance

Wax moths can be serious pests of stored wax comb. These pests typically do not directly destroy bee colonies, but they can infest stored equipment and stress colonies by forcing them to spend more time on comb maintenance.

Greater wax moth. *(Rob Snyder, beeinformed.org)*

Wax Moths

Description / Identification

The greater wax moth is the more destructive, and common, comb pest usually seen by beekeepers, while the lesser wax moth is both less prevalent and less destructive.

Signs of wax moth infestations include webbing, frass and debris, pupal cocoons, and tunnels in the combs.

Stored equipment that contains previously used brood comb is the most susceptible to wax moth infestations (due to protein in old cocoons and residual pollen).

The moths lay 300 - 600 eggs on or near wax combs each day.

Caterpillars hatch three to five days later and tunnel through the wax combs, leaving webbing, feces and debris behind.

Immature wax moths feed on pollen, cast skins, and cocoons, but they do not usually attack new wax combs or foundation because they need protein to develop. Honey supers and combs that have not been previously used for brood rearing are also less susceptible to attack.

Wax moths pupate outside of the comb and may take from one to several months to complete development. Development times are closely related to ambient temperatures.

IPM Recommendations

Cultural:

- Freezing temperatures *kill all stages of wax moths*, so combs suspected of being infested with moth eggs or larvae should be stored in a freezer while empty equipment should be stored in a dry, non-insulated room during the winter. Colorado winters, historically, have had enough freezing weather to prevent heavy wax moth damage on stored equipment. However, in recent years, damage from wax moths due to warming weather patterns indicates that beekeepers need to take additional precautions.

- Do not store supers of brood combs *together* with honey supers as that increases the chances of infestation of all the equipment.

- Store equipment in well-lit areas with good ventilation and subject to freezing temperatures. This is the best way to protect against wax moth damage in Colorado.

Frames with extensive wax moth damage.
(Rob Snyder, beeinformed.org)

Biological:

- Natural enemies include parasitic wasps, but they are not consistently available or effective.

- *Bacillus thuringiensis* Berliner is a natural control, sold under the trade name Certan®, but it is not widely available in the U.S.

Wax Moths

***IPM Recommendations* (continued)**

Chemical:

- Paradichlorobenzene (PDB) crystals sold as Para-Moth, must only be used to protect stored brood comb (not honey supers). Any supers used for honey production will be contaminated and the subsequent honey contaminated by exposing them to PDB.
- When fumigating using PDB, supers should be treated in stacks of five for maximum effectiveness.
- When using these products, label directions and application rates must be followed.

Viruses Vectored by Varroa

Varroa mites transmit several viruses to honey bees. These viruses include: Deformed Wing Virus (DWV), Chronic Bee Paralysis Virus (CBPV), Acute Bee Paralysis Virus (ABPV) and Israeli Acute Paralysis Virus (IAPV). *Controlling Varroa is the most important method for eliminating these viruses.*

Deformed Wing Virus (DWV)

Significance

Deformed wing virus (DWV) is associated with heavy Varroa mite infestations. DWV was once thought to be a result of mite feeding. Further studies have shown that Varroa mites actually transmit DWV when feeding.

Deformed Wing Virus - The virus multiplies slowly which permits the infected bee to survive to adulthood. The newly-emerged adult has misshapen wings and dies.

(http://www.ent.uga.edu, University of Georgia College of Ag & Envirn. Science)

Description / Identification

DWV causes bees to develop misshaped wings during pupation that are incapable of flight.

Deformed wing bees may die off naturally as they approach foraging age, or are sometimes actively removed from the colony by house bees.

IPM Recommendations

Cultural:

- Maintaining Varroa levels below damaging levels/thresholds (refer to monitoring section for information about thresholds) is the key to prevention of DWV.
- Keep Varroa levels down and colonies strong and healthy.
- Regular comb replacement, and periodic requeening are typical practices that can help prevent or control many types of viral infections.

Viruses Vectored by Varroa

Chronic Bee Paralysis Virus
Acute Bee Paralysis Virus
Israeli Acute Paralysis Virus

Chronic Bee Paralysis Virus - CBPV infected bee, bald and deformed wings.

("Creative Commons CBPV" by Crown copyright is licensed under CC BY 2.0 UK)

Significance

Chronic bee paralysis virus (CBPV), Acute bee paralysis virus (ABPV), and Israeli acute paralysis virus (IAPV) are vectored by Varroa mites.

Description / Identification-CBPV, ABPV & IAPV

Bees in infected hives are often found isolated, motionless and/or quivering on the top bars.

Abdomens may also be distended and the wings dislocated.

These viral diseases may also be passed on in the hive or to other hives via robbing infected hives.

Paralysis viruses render bees unable to fly and cause them to quiver uncontrollably.

Bees afflicted with some viruses may lose their hair and become dark and shiny (looking like robber bees) but are usually weakened.

Sick bees are usually seen trying to crawl up or falling down from the front of the hive.

VIRUS	TIME OF PEAK INFECTION
CBPV	Spring & summer
ABPV	Parallels Varroa infestation level, so peaks are generally in late summer and fall
IAPV	Unknown, but is genetically similar to ABPV

IPM Recommendations

Cultural:

- Monitor and control Varroa mites, which vector these viruses.
- Use good management practices to reduce stress.
- Requeen using a Varroa-resistant honey bee strain.
- Add a frame of sealed brood from a healthy colony to boost the numbers of healthy bees.

Chronic Bee Paralysis Virus - three bees with typical CBPV "shiny appearance".

("Creative Commons CBPV" by Crown copyright is licensed under CC BY 2.0 UK)

Viruses Associated with Nosema

Black Queen Cell Virus

Significance

Black Queen Cell Virus (BQCV) is a virus that results from heavy levels of Nosema infection. BQCV only affects queen larvae. BQCV is not as prevalent or usually as serious a threat as viruses affecting worker bees.

Description / Identification - BQCV

Larvae/pupae turn pale yellow with tough skin at first, similar to Sacbrood Virus, but in queen larvae only.

Larvae/pupae then darken from brown to black. At this stage the exterior of the cell wall will appear to be dark.

The immature larvae dies and turns black after its cell is sealed.

VIRUS	TIME OF PEAK INFECTION
BQCV	Parallels Nosema infection levels

Black Queen Cell Virus - A queen with BQCV. *(Rob Snyder, beeinformed.org)*

IPM Recommendations

Cultural:

- Requeening.
- Use hygienic bee stock.
- Implement good sanitation practices.
- Regular comb replacement may help.

Chemical:

- No chemical controls are currently recommended, although treating Nosema infections with Fumadil-B or Nozevit may help curtail this virus.
- When using these products, label directions and application rates must be followed.

Sacbrood

Significance

Sacbrood is a viral disease brought on by stress. The disease is most likely to occur in spring and early summer during stressful conditions such as cool temperatures, high humidity, and malnutrition. Sacbrood tends to disappear after conditions improve and especially after the main nectar flow has started.

The black larvae is sometimes said to look like a "Chinese Slipper". *(Rob Snyder, beeinformed.org)*

Sacbrood

Description / Identification

Sacbrood virus has been identified in healthy larvae and adults as well as sick bees.

Two-day-old larvae are more susceptible to this disease.

Immature bees turn from yellow-gray to black, with head blackening first.

Black-headed larvae are bent toward cell center.

The dark cappings of the brood cells appear punctured or partially removed (not to be confused with the appearance of AFB).

Larvae die in an *upright position* after their cells have been sealed.

Sacbrood under a perforated cap.
(Rob Snyder, beeinformed.org)

Dead larvae resemble fluid-filled sacs and *can be removed from the cell intact.*

The decomposed larval scale are dry, brittle, and easily removed from cell.

IPM Recommendations

Cultural:

- Requeen.
- Reduce hive stress.
- Improve living conditions (clean hive, rotate combs, strong-healthy bees).

Small Hive Beetle (SHB)

Significance

Small hive beetles (SHB) are serious pests of honey bees, especially in non-temperate climates. SHB are a tropically evolved species. Both adults and larvae can cause extensive damage to weakened honey bee colonies or honey supers. SHB is typically not a prevalent problem in Colorado as environmental conditions here are not favorable to SHB reproduction.

Small hive beetle adults.
(Jessica Lawrence, Eurofins Agroscience Services, Bugwood.org)

Description / Identification

Adults are reddish brown or black, less than ¼ inch long and can live up to six months.

Female beetles lay their eggs, which are smaller than those laid by queen bees, in crevices within a hive.

SHB larvae eat everything in the colony (pollen, brood, honey, dead adult bees and combs) causing the honey to ferment and to become repellent to the bees and other scavengers as well.

Small Hive Beetle (SHB)

Description / Identification (continued)

The affected honey can also become thin, causing it to run out of the combs, which may further cause the bees to abandon the hive.

Small hive beetles spend five to seven weeks pupating in sandy or loamy soil, around the hive, before emerging as adults. Most of the soil types found in Colorado are not conducive to SHB reproduction.

Infestations usually peak during late-summer months through the fall season in areas where beetles may be emerging from the soil.

Small hive beetle larvae. *(Rob Snyder, beeinformed.org)*

IPM Recommendations

Cultural:

- The most effective control for SHB in Colorado is to keep colonies strong and to keep all residual honey and wax cappings in closed containers and honey processing facilities clean.
- Do not store honey supers for extended lengths of time before extraction.
- Keep the supers and comb in a location with less than 50% relative humidity to keep SHB eggs from hatching.
- Do not stack infested supers onto strong colonies.
- Freeze lightly infested combs before re-using them and burn heavily infested ones.
- Use beetle traps (corrugated plastic or pit traps).

Biological:

- Fungi and nematodes have been evaluated but are not available for commercial use.

Chemical:

- Coumaphos (Checkmite+®) used in a beetle trap, or permethrin (GardStar®) used as a soil drench, control SHB (**NOT** in the hive). Caution: Permethrin is highly toxic to honey bees if they come into direct contact with it and should never be used in the hive.
- When using these products, label directions and application rates must be followed.

Bears

Significance

The black bear of North America can be a serious pest of honey bee colonies. There are no confirmed sightings of grizzly bears in Colorado. Bears eat bees, brood, and honey. They destroy hives and are very hard to control once they start attacking beehives.

Description / Identification

An individual bear that discovers bee colonies may return night after night to feast on brood and honey.

Bears pound and smash the hive equipment to get to the beeswax comb and may quickly destroy a beehive beyond repair.

Stings rarely deter bears once they have tasted the larvae and honey.

Damage to bee colonies is more likely to occur in early spring when bears come out of hibernation and in the fall before entering hibernation dens.

Evidence of a bear's visit to the beehive.
("Creative Commons Answering The Age Old Question" by mossback farms is licensed under CC BY 2.0.)

IPM Recommendations

Monitoring:

Install an electric fence with one strand of barbed wire along the top in areas suspected of being predated by bears. When bears come in contact with the barbed wire, they usually leave some hairs behind.

Cultural:

- Carefully select apiary sites to avoid foraging ranges of bears. Areas to avoid would include wildlife pathways, as well as along the edges of streams and the vegetated area in ravines and meadows.
- Establish the apiary site away from trees and overhangs to prevent bears from climbing up and dropping inside fences.
- Install an high voltage, electric fence around the bee yard. If the wires are more than 7 inches apart, the fence may not deter bears.
- Before bear damage begins, an apiary can be protected by a sturdy electric fence or the bee hives can be elevated on sturdy bear-proof platforms, usually over 8 feet high.
- Moving the hive(s) is often the only option, once a bear has found and starts preying on honey bee colonies.

Mice

Significance

Mice are one of the most common and troublesome rodent pests of honey bee colonies. They usually become a problem during fall when the evening temperatures begin to drop. Beehives may provide food (pollen, honey and bees) but the greatest attraction for mice is protection from the cold. If a mouse infestation goes unchecked, they can cause damage to the combs and equipment in addition to the odor created by mouse urine and droppings.

In the fall, mice will often try to move into accessible hives to establish a warm winter residence. *(Mouse at Hive. Source: http://www.butternutvalleyfarm.com/356/a-mouse-in-the-beehive)*

Description / Identification

Mice may try to make nests in hives during the fall and winter months, as the bees cluster.

They tend to build their nests at the bottom of the hive and in corners away from the bee cluster to avoid getting stung.

Mice destroy frames and wax comb by chewing them to provide room to build their nest.

Mouse urine is particularly smelly and may not be cleaned up well by the bees in the spring, thereby requiring the beekeeper to change out the affected equipment.

Mouse problems are more likely to occur in apiaries located near woodlots or in fields.

IPM Recommendations

Cultural:

- For active beehives: the use of an entrance reducer is standard practice to eliminate mouse entry. Entrance reducers are usually installed in early fall, when night time temperatures drop below 50° F.
- For any mice already in the hive (in the future, get entrance reducers on earlier) chase them away, destroy possible nests, and replace chewed frames so that the bees do not rebuild the comb with drone cells the following spring.
- For bee equipment in storage: cover the top and bottom of supers with queen excluders, wire screening, or tight fitting lids.

Skunks & Raccoons

Significance

Skunks and raccoons find bee colonies an easy food source. Their scratching and feeding activity causes bee colonies to become agitated, defensive and aggressive.

Description / Identification

Skunks and raccoons feed at beehive entrances at night (when bees are less likely to fly).

They feed predominantly in the spring, but also during summer and fall.

They scratch and paw at the entrance, which agitates the bees to come to defend the colony. The skunk or raccoon then swat or roll the bees with their paws to disable them and then eat them.

Digging/scratching marks in front of the hive, along with matted grass around the entrance, are common signs of skunk and raccoon problems.

Skunk feces with obvious bee parts in them is another good indication of skunk predation.

Skunk feces with bee parts in it is a good indication the skunk has been feeding on bees.
(Rob Snyder, beeinformed.org)

Chances of skunk-raccoon predation are higher when other natural food sources are scarce, or in larger apiaries.

IPM Recommendations

Monitoring:

Look for bee parts in animal scat visible on the ground near apiaries. Also, matted grass and signs of scratching and digging around hive entrances.

Cultural:

- The best control for skunk or raccoon is to make the entrance less accessible and/or to increase their vulnerability to stings, especially the face and belly areas.
- Ensure that hives are elevated off the ground, preferably a foot or more.
- A piece of chicken wire or hardware cloth can be bent into a "U" shape and slid between the bottom of the hive and the hive stand. It should extend about a foot or more in front of the hive which forces the animals to raise-up to get to the entrance, thereby exposing their more vulnerable body parts to stings.
- Place a spike board (a spike board is made using a piece of plywood about 24 inches square with nails driven-in from the bottom-spaced a few inches apart) down directly in front of the hive entrance. This "spike board" will force the animals to again raise-up or avoid approaching the entrance altogether.
- Install a fence around the bee yard, placed a foot or more below ground level, to prevent the animals from digging underneath.

EMERGING ISSUES

AFRICANIZED HONEY BEES (AHB) IN COLORADO: A DEVELOPING AWARENESS

An awareness and concern over the presence of Africanized honey bees in Colorado has developed since the Spring of 2014 when an overwintered colony in the Grand Junction area tested positive for AHB. While there have been anecdotal reports of AHB in Colorado since the late 1990's, this newest report highlights two important factors:

- Previous anecdotal accounts involved rural and less populated areas, while this last confirmed report involved a heavily populated urban area.

- Commonly referred to in the media as "Killer Bees", the actual risks and problems associated with Africanized Honey Bees have not changed significantly in recent years, but because of a rapid increase in urban beekeepers, the need for education and accurate information for both beekeepers and the general public has been accelerated.

What the average beekeeper needs to know about AHB's is that:

1. These bees are much more aggressive and sting more readily than regular European honey bees, posing a greater risk in urban areas.

2. Any sign that your bees or a hive is excessively aggressive, especially in urban areas, needs to be *addressed early and pro-actively*. A "hands-off" approach to managing aggressive colonies is inappropriate.

3. There are only two options when dealing with suspected AHB hives or colonies; find and kill the old queen and combine the rest of the hive with another; or find and kill the old queen and re-queen the hive with a new queen from a known gentle colony or source. Removing the old AHB queen and letting it re-queen itself obviously does not eliminate the AHB genetics!

Once true AHB colonies are established, it is much more difficult to requeen them and/or get the bees to accept a non-AHB queen. Therefore, if the beekeeper has problems getting the bees to accept a new queen, or simply in finding the old-nasty queen in the first place, the hive should be either de-queened and combined with another hive, or compassionately killed-to prevent further problems-for not only the beekeeper, but for surrounding neighbors and pets as well.

It is important to remember that Colorado's climate and ecosystems are not friendly to a long-term establishment of AHB's here. However, they can build and cause problems over the course of the regular active bee season (from about April through September). Many Colorado beekeepers establish or re-establish their hives using package bees and queens from Southern states that do have AHB's, so the possibility of introduction or re-introduction is always present. Conscientious bee management and decisive action by the beekeeper when aggressive colonies are found is the best way to reduce or eliminate future problems.

RESOURCES

Apis Molecular Systematics Laboratory, Washington State Dept. of Entomology
http://entomology.wsu.edu/apis/

ATTRA - Appropriate Technology Transfer for Rural Areas
www.attra.ncat.org.attrabeekeep-
ing.pdf

Bee Diagnostic Lab — USDA Research
http://www.ars.usda.gov/main/site_main.htm?modecode=80-42-05-40

Bee Gate — Bayer
http://beecare.bayer.com/media-center/news/news-detail/a-new-way-of-protecting-bees-against-varroa-mites

Bee Informed — Rob Snyder
www.beeinformed.org

Bee Source
http://www.beesource.com/resources/

eXtension Bee Health
http://www.extension.org/bee_health

MAAREC - Mid-Atlantic Apiculture Research & Extension Consortium
http://agdev.anr.udel.edu/maarec/

Pest Management Strategic Plan For Honey Bees In The Mid-Atlantic States
http://www.ipmcenters.org/pmsp/pdf/ MidAtlanti-
cHoneyBeePMSP.pdf

Scientific Beekeeping
http://scientificbeekeeping.com/

The Beekeeper's Handbook
by Diana Sammataro, Alphonse Avitabile and Dewey M. Caron.
2011 Cornell University Press.

University of Nebraska – Lincoln Entomology Department
http://entomology.unl.edu/

USDA Honey Bee Breeding, Genetics, and Physiology Research Lab http://www.ars.
usda.gov/Main/site_main.htm?modecode=64-13-30-00

USDA Honey Bee Research, Beltsville, MD
http://www.ars.usda.gov/main/site_main.htm?modecode=12-45-33-00

USDA Honey Bee Research, Tucson, AZ
http://www.ars.usda.gov/main/site_main.htm?modecode=53-42-03-00

Virginia Cooperative Extension —
http://pubs.ext.vt.edu/444/444-103/444-103.html

APPENDIX

Bee Smokers & Lighting Procedures

One of the most important tools that beekeepers have at their disposal, and should use regularly is the bee smoker. Especially in urban situations, and with increasing numbers of new beekeepers taking-up the craft, it is very important that the bees remain calm and manageable and not become a nuisance - or worse - a hazard to people living or working in areas adjacent to where hives are kept. The primary way to ensure that your hives and bees remain calm *proactively* is through the conscientious use of the bee smoker.

Contrary to some opinions about bee behavior – that bee smokers are unnecessary if the beekeeper is “tuned-in to the bees”– it is nonetheless a fact that once the bees have been disturbed or irritated enough to become aggressive, it is difficult, if not impossible, to get them to calm down immediately. A judicious and proactive application of smoke could avoid such a situation in the first place. Therefore, before inspecting or going into a bee hive, the use of the bee smoker should always be considered as an essential part of the procedure.

Lighting a Bee Smoker

Preliminary items

- Secure some good, dry, longer-burning material such as pine needles, pine cones, sumac pods, punk wood or cotton plugs or burlap. Some may have been treated with pesticides. Try to avoid fast burning materials such as dry grass or paper (except for initial lighting purposes). Wood pellets and/or wood chunks, charcoal briquettes tend to burn too hot so, if used, use sparingly and in combination with other materials.

- The “secret” to getting a long-burn (for an hour or more) in your smoker is to use the “wicking principle” in lighting and fueling it initially. In addition to the fuel materials mentioned above, the addition of a flammable material such as burr comb or a little lamp oil will help to keep the smoker lit for longer periods by burning like a lamp or candle. Materials such as gasoline, kerosene and other petrochemicals should be avoided as they burn too hot and produce undesirable off-gasses. Saving the burr comb from previous hive inspections is an ideal way to not only utilize it, but fuel your smoker for longer-burning.

- Ensure that your smoker is clean of excess carbon and creosote build-up before lighting. If necessary, scrape out excess residue with your hive tool and a wire brush (many commercial beekeepers clean their smokers at the end of each working day). Ensure that the grate in the bottom of the smoker is clean and clear of debris and residue, and remove and clean if necessary.

APPENDIX

Steps for Lighting (kindling method)

1. Place some quick-igniting fuel in the bottom of the smoker (newspaper, straw, etc.) – place a small piece of burr comb, or a teaspoon or two of lamp oil, on that and light. Gently work the smoker bellows to get the fire burning well.

2. After the kindling is burning well, gently tamp it down in the smoker and gradually add more of the longer burning fuel, interspersed with burr comb or a teaspoon or two of lamp oil (be careful for flare-ups if using oil). Keep gently working the bellows to ensure that the fuel continues to burn well. Keep adding fuel until the smoker is about three-quarters full. Do not fill the fuel chamber more than that, or it tends to smother the fire.

3. Initially, the fuel should be puffed continually to maintain a good burn and flame, but once that is established you can allow the flame to go out, which then should produce a heavy cloud of smoke. The smoker cover can then be closed, but the bellows needs to be squeezed periodically to ensure that the fuel is still smoldering well.

4. If the smoker will be left alone for more than a few minutes at a time (i.e. the bellows not squeezed/ worked) the top should be opened again to allow the fuel to burn and/or not smother itself.

Steps for Lighting (torch method)

This method is faster, but requires the use of an outside lighting source – such as a butane plumber's or Turner Torch.

1. Load the smoker with fuel as described before, interspersing fuel with burr comb or lamp oil. It is not necessary to use paper or kindling type fuel with this method. Ensure that the fuel is not packed or tamped-down too tightly, so that there is adequate space for air to get to it. Fill the smoker to about ½ with fuel.

2. Light the butane torch and direct the flame over the fuel in the smoker until it is thoroughly lit and flaming well. Puffing on the bellows periodically will indicate when the fuel is well lit and capable of burning on its' own.

3. Add enough additional fuel to top-off the smoker (no more than 3/4 full) puff vigorously until you are sure that all the fuel is burning well – and proceed as with the previous method.

Lighting and maintaining a well- burning smoker is not a difficult task when the basic principles are understood. The procedure becomes easier with experience and all beekeepers need to feel comfortable enough in using a bee smoker so that it becomes second nature to them. Its' use is an essential part of beekeeping proficiency and often determines whether working with bees is enjoyable or not.