Integrated Hive Mangement for Colorado Beekeepers

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

COLLEGE OF AGRICULTURAL SCIENCES
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BIOAGRICULTURAL SCIENCES & PEST MANAGEMENT DEPARTMENT

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2nd Edition

Integrated Hive Management for Colorado Beekeepers: Strategies for Identifying and Mitigating Pests and Diseases Affecting Colorado Honeybees.

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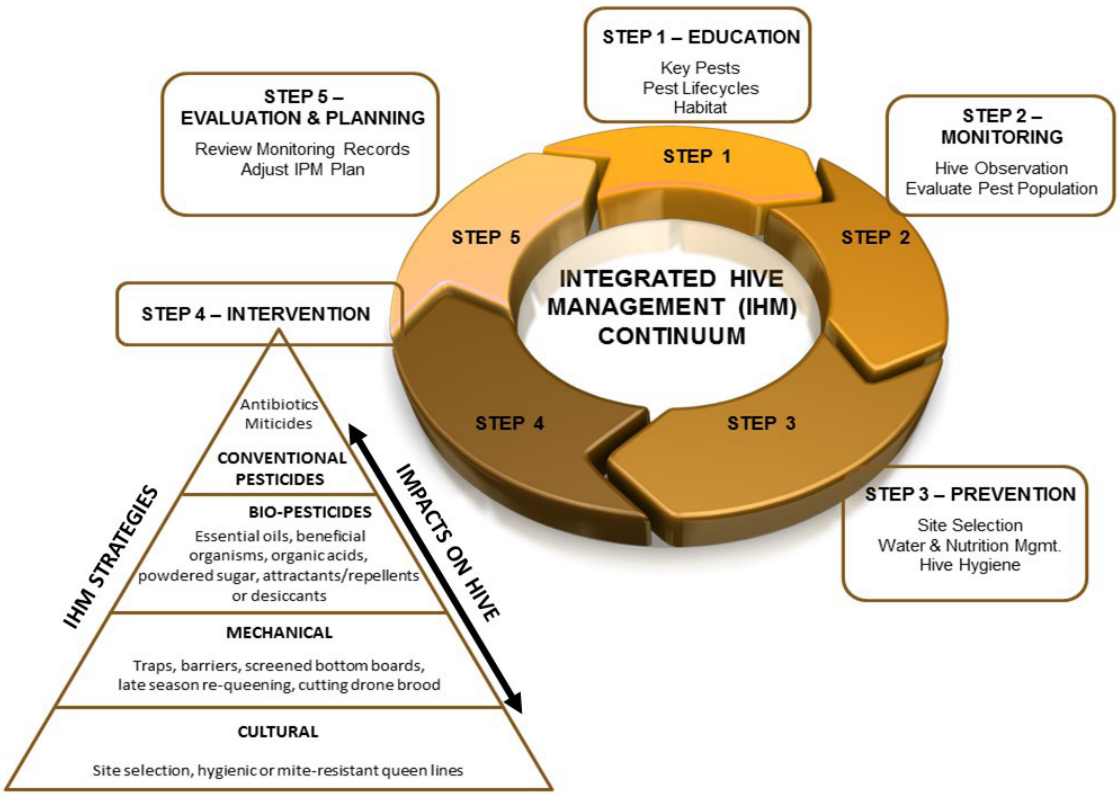
Introduction

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 in the IHM continuum (detailed below). 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. IHM strategies emphasize optimal use of chemicals when necessary as part of the IHM plan. When properly applied, the use of chemicals should ensure there are minimal risks of residues in the honey and combs, or the development of pest resistance.

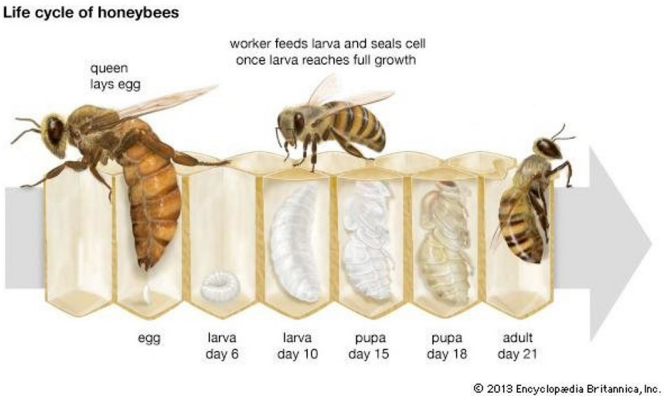
IHM will not mean the same thing for all beekeepers. Some techniques are compatible with small to mid-sized operations, but not with larger operations. Different beekeepers will adopt different IHM programs, which are flexible by design, allowing beekeepers to customize their programs to achieve optimal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



Bee Biology

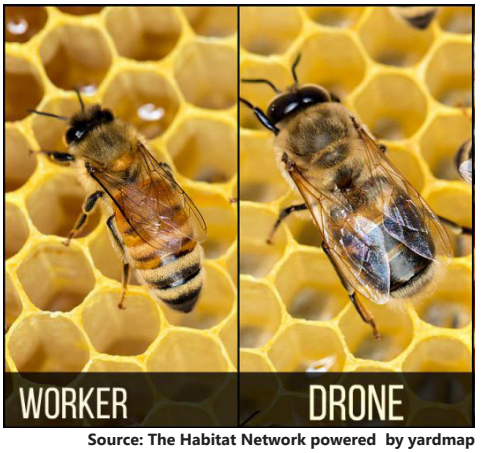
Beekeeping is an ageless form of animal husbandry that requires an awareness of the environment and seasonal cycles. It is not simply a matter of "saving the bees". It requires a dedication for learning about the biology and behavior of bees, which involves selection of suitable hive locations and effective 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 super organism and the essential role of bees in ecosystems. Understanding bee behavior and biology is key to performing beekeeping activities responsibly.

European honey bees (*Apis mellifera*), live together in large colonies with one queen, female worker bees, and seasonally produced male drone bees. Managed honey bees live in manmade hive boxes. Feral honey bee colonies occur in the wild inside hollow spaces such as tree trunks. Honey bee colonies are perennial and will live through the winter. A colony may have 20,000 to 80,000 worker bees and hundreds of drones produced seasonally.



Queens are the only ones who reproduce in the colony. **Workers** are responsible for feeding the larvae, constructing and cleaning the nest, foraging for food, and defending the nest. Worker honey bees perform different tasks on the colony depending on their age.

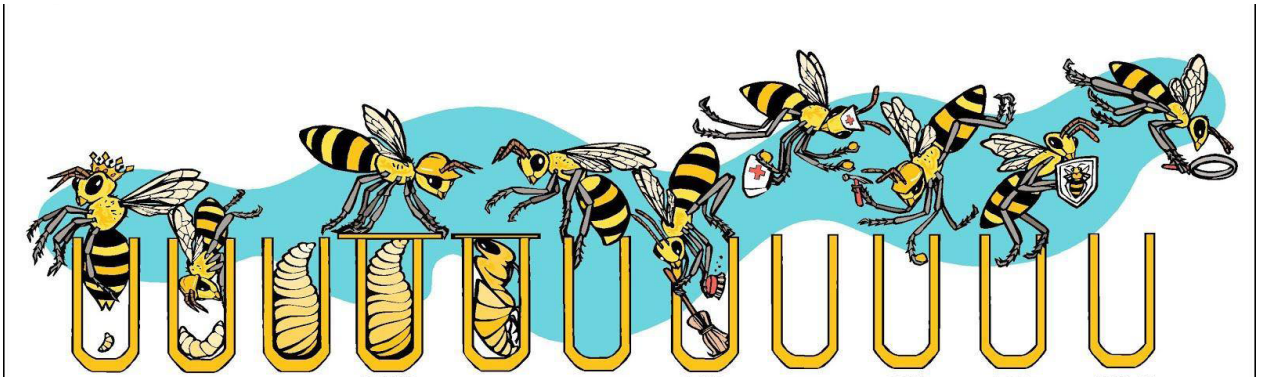
Healthy Queen. **(Photo: Colton O'Brien)**



Source: The Habitat Network powered by yardmap

Drones are male bees produced from unfertilized eggs whose sole responsibility is to reproduce with queens from surrounding hives. They are only produced when the hive is growing. Drones die once they reproduce.

Age-based Division of Labor in Honey Bees



DAY 1	DAY 4	DAY 10	about DAY 20	about DAY 30-40	about DAY 41 onward
egg laid	egg hatches	**Worker** caps cell with wax and larva spins cocoon	**Adult** bee joins colony	**Nurses** feed brood and **Builders** produce wax to cap cells and build honeycomb	**Guards** protect hive and **Foragers** search for pollen and nectar

Modified from westernbeekeepers.com

A newly emerged worker bee (0 to 11 days old) is a nurse bee and will secrete brood food and feed larvae. A middle-aged bee (11 - 21 days old) is a builder bee. With her wax glands developed, she will secrete beeswax and add new cells and repair old ones. Middle-aged bees may also perform hygienic tasks– a behavior where in adult bees inspect pupal cells for disease. Hygienic bees will uncap pupal cells and, if disease is detected, they will remove the diseased pupae and throw them out of the colony, thus cleaning the hive of disease. Worker bees older than 21 days can perform a variety of tasks including foraging, storing food reserves, or undertaking. A bee that becomes an undertaker focuses on removing dead bees and does not perform any other hive related task.

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HIVE MONITORING

Assessing Honey Bee Colonies

Successful beekeeping requires a proactive approach. It is important to assess hives every three weeks or *at least* once a month. 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.

Hive 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			■	■	■	■	■	■	■	■	■	
American Foulbrood			■	■	■	■	■	■	■	■		
Nosema ceranae			■	■	■	■	■	■				
Nosema apis		■	■	■								
European Foulbrood			■	■	■							
Viruses vectored by *Varroa*												
Deformed Wing Virus			■	■	■	■	■	■	■	■		
Chronic Bee Paralysis Virus			■	■	■	■	■	■	■			
Acute Bee Paralysis Virus			■	■	■	■	■	■	■			
Israeli Acute Paralysis Virus			■	■	■	■	■	■	■			
Lake Sinai Virus			■	■	■	■	■	■	■			
Kashmir Bee Virus			■	■	■	■	■	■	■			
****Black Queen Cell Virus**			■	■	■	■	■	■	■			
SECONDARY												
Chalkbrood			■	■	■							
Wax Moths					■	■	■	■	■	■		
Tracheal Mites			■	■	■							
Sacbrood			■	■								
Small Hive Beetle				■	■	■	■	■	■			
Bears				■	■	■	■	■	■	■		
Mice									■	■	■	■
Skunks & Raccoons					■	■	■	■	■			

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

Calendar updated 2019

**Research ongoing-More information found at: https://beeinformed.org/

The first step in any IHM program is to properly diagnose the pest and/or disease that may be present in your hive. 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

GUIDELINES FOR MONITORING HIVES

Upon entering the yard:

- Look for potential floral/pollen sources (remember bees can easily forage up to 3 miles from the hives, further if necessary).
- 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. More information on using smokers found in Appendix.
- 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.
(Photo: 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 2/3 - 3/4 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:

- Inside the hive, check for signs of American Foulbrood or other diseases. Signs of American foulbrood include: sunken cells, pinholes in capping, putrefied larvae (decomposed larvae has the consistency of snot) and 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.

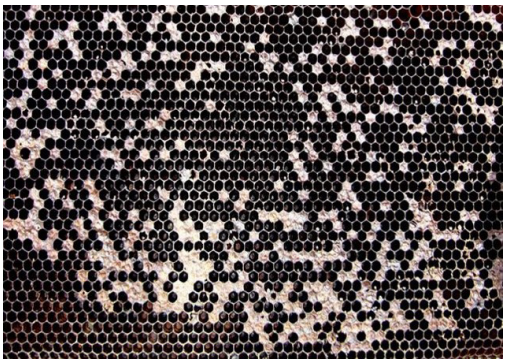
Signs of Healthy Hives:

Healthy Frame with Active Bees, Capped Brood, Pollen and Honey Cells.
(Photo: Colton O'Brien)

- Two deep boxes beginning mid-May to September.
- Solid section of capped brood on 3 to 4 frames in the hive.
- Presence of eggs and larvae of different sizes in 3 to 4 other frames. Larvae are pearly white and c-shaped in the bottom of the cell.
- Honey and pollen stored at the corners on brood frames in addition to 3 to 4 full honey frames.
- Active, healthy queen - Try to spot the queen during every other hive inspection.
- Lots and lots of active bees on frames and flying in and out of the hive.

Signs of Unhealthy Hives:

- Spotty brood or 'shotgun' brood pattern - absence of the solid section of capped brood in a frame. Very few frames with larvae of different sizes.
- Multiple eggs in each cell and/or empty cells.
- Lack of honey and pollen in the corners of brood frames.
- Presence of emergency queen cells which indicates the colony is preparing to swarm due to overcrowding.
- Presence of Varroa mites on adult bees, bees with deformed wings.
- Signs of pests and/or diseases - Wax moths, hive beetles, foulbrood, Nosema.



Spotty Brood or 'Shotgun' Brood Pattern.
(Source: scientiuficbeekeeping.com.)

Examine 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, especially in drone pupae.

Hive Showing Several Emergency Queen Cells.
(Source: scientificbeekeeping.com)

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 capping on drone cells throughout the frame may indicate an issue with queen, i.e. laying workers or failing queen.

Assess the Queen:

Healthy Queen. **(Photo: Colton O'Brien)**

- Is the Queen present?
- Is there more than one Queen?
- Does her abdomen appear big, long and fat? This indicates that she's laying eggs.
- Is the Queen 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 or hygienic behavior in response to a disease or pest.

Check for Varroa —

- Remember, Varroa's reproductive cycle is related to bee's reproductive cycle. **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.
- Mid-spring (late March-early April): Do a mite check to determine whether Varroa is present and what level of infestation is present. Treat if it exceeds thresholds.
- Early summer (June): Do another 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. **NOTE:** Either harvest honey before treating, or treat and then harvest after the preharvest interval has expired, based on the product label.

Fall 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 100 lbs. to provide enough food for overwintering.
- In September/October, if the colony is light, supplemental feeding should be provided. For more information, see CSU Fact Sheet on Feeding Honey Bees in Colorado (see Resources.)

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.

NUTRITION:

A healthy hive requires access to food which, for honey bees, is pollen, nectar and water. It is important for the beekeeper to make note of what plants are flowering around the apiary and when in the season these plants are in bloom. This helps determine if bees need supplemental nutrition. For a healthy hive, the bees need access to over 3 acres of flowering habitat throughout the season. In Colorado, there are very few areas where bees can have access to natural habitat that is flowering from April through September, the active bee season. Therefore, it is important for the beekeeper to provide supplemental nutrition.

Pollen from flowers is the primary source of protein for developing larvae. Pollen shortage results in bees foraging earlier in the life span and reduces their longevity as adults. Pollen is also an important ingredient in bee bread, which the bees use throughout their active and inactive seasons. To ensure that bee bread is present in the hive, introduce pollen patties or other pollen substitutes in surplus for colonies to feed on. Though honey bees prefer fresh pollen, protein substitutes and supplements provide nutrients during periods of pollen shortage. Pollen is supplemented to colonies only during the warmer season when the colonies are growing in size but the colonies need an adequate supply of nectar throughout the year.

Sugar Feeders in Front of the Hive. (Photo: Arathi Seshadri)

SPRING:
Feed bees with sugar solution (1 sugar : 1 water). Use lukewarm water to dissolve sugar. DO NOT BOIL and DO NOT use corn syrup. As bees are getting ready to expand their colonies in the warmer weather, spring feeding gets them to start foraging. Feeding bees with sugar syrup in the spring also helps to stimulate their wax glands which helps bees to build comb and expanding space in the colony for the queen to lay eggs.

EARLY FALL:
Colonies are supplemented with sugar solution (2 sugar : 1 water), giving bees enough time to ferment the syrup and turn it into honey reserves for the winter. In Colorado, this is very important because the winters tend to be harsh and there are no flowers in the winter to provide foraging bees with nectar.

Honey bees rely on floral diversity to provide different beneficial phytochemicals. As a responsible beekeeper and for an attractive apiary, establish a pollinator habitat within the apiary that includes a diverse mixture of native flowering plants. Make sure to pick a variety of different bloom times, so that at anytime in the season there are flowers in the yard. Maintaining a pollinator habitat is a wonderful way to support all pollinators in Colorado, in addition to the honey bees in the hives.

Refer to the CSU fact sheets on 'Feeding Honey Bees in Colorado', 'Creating Pollinator Habitat' and 'Attracting Native Bees to Your Landscape' (see Resources).

CULTURAL STRATEGIES:

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 practice when done in the spring, as vigorously laying queens are also an effective tool for disease mitigation.

Requeening:

Queen in a Queen-Cage
(Source :www.thehivelife.com.)

Requeening can be done in the spring to address failing queens, aggressive bees or, to ensure overwintering success, in early fall. DO NOT REQUEEN IN WINTER! Whenever aggressive hives are found, they should be immediately requeened with gentle queens from known sources (especially important in urban environments). To maintain healthy colonies year after year, it is important to requeen so that there is a healthy laying queen in the colony. Requeening also minimizes colonies raising new queens to replace old and weak queens. When colonies raise their own new queens, the old queen will swarm taking with her a group of worker bees, leaving the old colony with fewer workers. In order to maintain strong growing colonies, requeening is recommended at least every 2 to 3 years.

Comb Replacement:

Another effective and important practice is to rotate and replace approximately 20% of brood combs annually. It helps to control brood diseases, remove accumulated pesticide residues, and reduces exposure of the bees to chemicals if used within the hive or used on crops where bees have been foraging. Colorado beekeepers have not routinely rotated their brood combs in the past, but modern conditions 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 bees to chemicals that may have been used in the hive or used on crops where bees have been foraging.

MECHANICAL STRATEGIES:

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 IHM strategies. Mechanical/physical control methods include the use of traps, barriers, screened bottom boards, drone brood removal, burning, and freezing.

Moving Hives:

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 will reduce humidity in the hive. Hives are best moved later in the fall when the temperatures have dropped, and bees have clustered. This minimizes loss of foragers returning to the older hive locations. If you must move hives during the middle of the summer, then the following protocol can minimize loss of adult bees.

- ***Moving to a nearby area:*** This can be done gradually, moving the hive a little each day in the direction of the hive's final destination. Bees will orient to the new location each day.
- ***Moving to distant locations:*** Prepare the new location for hive placement. At the old location, close the entrance to the hive using wire mesh or screening after late afternoon before the move. This will allow for most of the foragers to return to the hive and prevent them from leaving the hive at dawn the next day. Tie down the hives using ratchet straps to ensure that the hive boxes do not separate, releasing the bees during the move. Load the hive on a truck bed, secure the hive to the truck and move the hive to the new location. If you need to leave the hive entrance closed for a day or two to minimize the chance of foragers returning to the old location, use a moving screen or net at the top of the hive to allow for ventilation. Keeping the hive closed in the new location for 1-2 days minimizes the loss of bees. A pickup truck where the truck bed is separated from the passengers, is advisable while moving hives, in order to keep safe from escaping bees.

Storing Unused Frames:

To avoid infestation by wax moths, unused frames should be stored in cold and dry conditions, preferably in a freezer.

Reusing Frames:

To minimize pest and disease incidence, use a propane torch to sanitize insides of hive boxes and other wooden parts of the hive before reusing equipment in the spring. Do not use on wax and foundation as they will melt. Use recommended precautions while operating a propane torch.

Freezing & Burning:

Freezing and burning are methods used to eliminate pests and diseases such as wax moths, American foulbrood (AFB) and European foulbrood (EFB).

- ***Freezing:***

  Freezing is a method often used to eliminate 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°F (- 7°C) for a minimum of 4.5 hours or 5°F (- 15°C)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 need to be double bagged and stored.

- ***Burning:***

  Burning is a method used to control brood diseases, especially AFB and occasionally, 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: John Skinner)

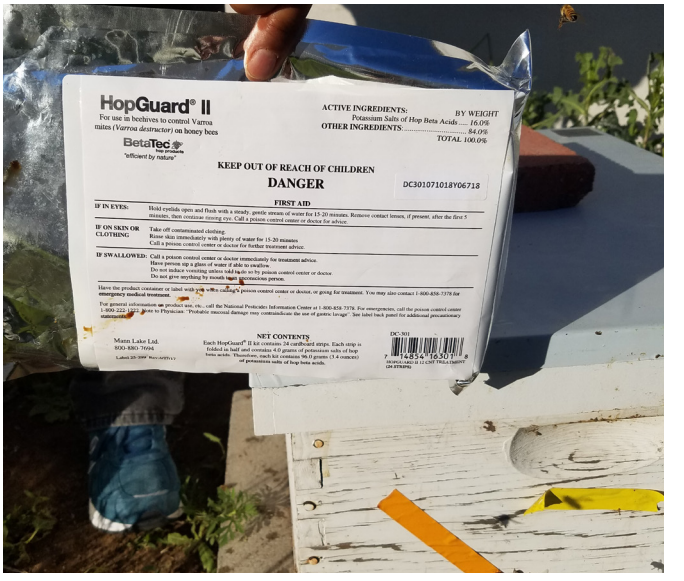
BIOLOGICAL CONTROL:

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. While biocontrol is used in many aspects of agriculture, effective biological agents for beekeeping are not widely available and approval for their use varies state by state. Any biocontrol product that is used in bee hives must be registered by the state.

CHEMICAL CONTROL: READ THE LABEL BEFORE USING!

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 pesticide 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.



Hopguard II Label. **(Photo: Arathi Seshadri)**

IMPORTANT NOTE:

TO MAINTAIN VIABILITY OF ANY CHEMICAL AND AVOID THE DEVELOPMENT OF CHEMICAL RESISTANCE IN PESTS AND DISEASE, DO NOT USE CHEMICALS PROPHYLACTICALLY.

Pesticide products should be alternated regularly to prevent or reduce the likelihood of developing pest resistance. Pesticides often require that treatment be completed within a specific amount of time before supers are added. Pesticides 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 of 70-90°F (21-32°C) as indicated on the label, 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 concentrated 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:

- Antimicrobials: oxytetracycline (e.g. trade names: Terramycin®, Pennox 50®), tylosin (e.g. trade names: Tylosin® Tartrate, Tylan), lincomycin hydrochloride and Fumagillin (e.g. trade name: Fumidil-B)
- A formamidine insecticide/miticide, amitraz (e.g. trade name Apivar®)
- A pyrethoid insecticide, fluvalinate (e.g. trade name Apistan®)
- An organophosphate insecticide, coumaphos (e.g. trade name Checkmite+™)

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 in 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.

PROTECTING POLLINATORS FROM PESTICIDE USE:

All pollinators, not just honey bees, are facing threats to their populations from complex interacting factors. Managed honey bees face threats from increased disease and mite parasites, lack of genetic diversity, habitat loss due to expansion of urban landscapes and crop monoculture, stress due to transporting commercial hives to other states for pollination services and environmental toxins, including pesticides.

Managed Pollinator Protection Plans (MP3s):

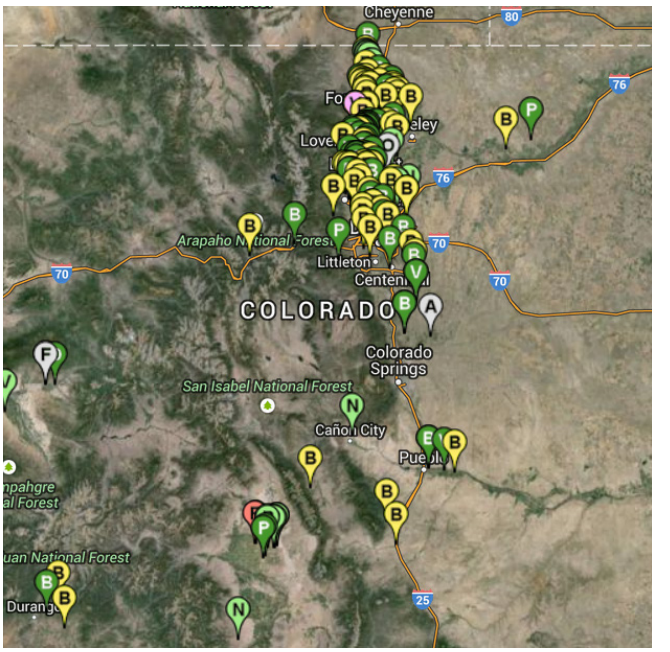
EPA is encouraging state and tribal agencies to develop and implement local pollinator protection plans, known as Managed Pollinator Protection Plans (MP3). These plans are intended to reduce pesticide exposure to bees through timely communication and coordination among key stakeholders including beekeepers, growers, pesticide applicators and landowners.

Pesticide exposure can be minimized if pesticide applicators and beekeepers communicate prior to pesticide applications to coordinate activities which will allow crop protection products to be used without unreasonable adverse effects to managed pollinators. It is the intent that such open communication will lead to practices that both mitigate potential pesticide exposure to bees and allow for the management of pests. This could involve collaboration on a change to the application timing, or an opportunity for beekeepers to move or cover their hives prior to a pesticide application, thereby reducing the chance that managed bees are found in the treatment area.

Each state approaches the MP3 differently depending on each state's agriculture, urban floral aesthetics, the local beekeeping industry, state pesticide and apiary laws, and other factors. Colorado's MP3 was developed through the Colorado Department of Agriculture (CDA) working with the Colorado Pollinator Workgroup. The Colorado Pollinator Workgroup consists of representation from commercial pesticide applicators, beekeepers, county land managers, Colorado State University, pesticide registrants, Environmental Protection Agency (EPA), CDA and other interested stakeholders. The website for the CDA MP3s can be found in the Resources section of this publication.

Colorado DriftWatch™, BeeCheck™ and FieldCheck™

While pesticides are important tools to control insects, weeds and diseases on farms and in urban landscapes, they are often used in areas shared by pollinators attracted to blooming flowers and weeds for pollen and nectar. Cooperation, communication and collaboration between growers, applicators and beekeepers can increase the likelihood of protecting pollinators, their hives and habitats from the more toxic pesticides that may harm them. In Colorado, DriftWatch™ can facilitate this communication by allowing viewers to obtain contact information to collaborate on protecting pollinators before a pesticide application.



Colorado DriftWatch™ Map (June 2019)

Colorado DriftWatch™, BeeCheck™ and FieldCheck™ serve as voluntary communication and mapping tools that allow growers, beekeepers and pesticide applicators to work together to protect specialty crops and apiaries. DriftWatch™ allows specialty crop producers to register and locate specialty crop fields of ½ acre or more. BeeCheck™ allows beekeepers to locate a single hive or entire apiaries. Single hives or apiaries registered through BeeCheck™ may be marked 'private' so only registered applicators can view them and receive contact information. FieldCheck™ allows pesticide applicators to register to view all sensitive sites located on the map, including apiaries marked 'private'. This map is Google™-based so viewers can zoom into a street level view for precise location of the sensitive site. Although participation is voluntary, these three tools are becoming increasingly popular among beekeepers, growers and applicators. The website for more information, or to register apiaries or specialty crops, can be found in the Resources section of this publication.

Primary Diseases & Pests of Honey Bees

VARROA MITE - *Varroa destructor*

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 test **at least** twice a year, in June and August/September, as mite numbers will increase during the season. If colonies appear stressed and weak, a test can be conducted mid-summer. Beekeepers might also consider testing before and after a treatment to determine if the treatment was effective at reducing mite populations. Several colonies from each bee yard should be tested.

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.

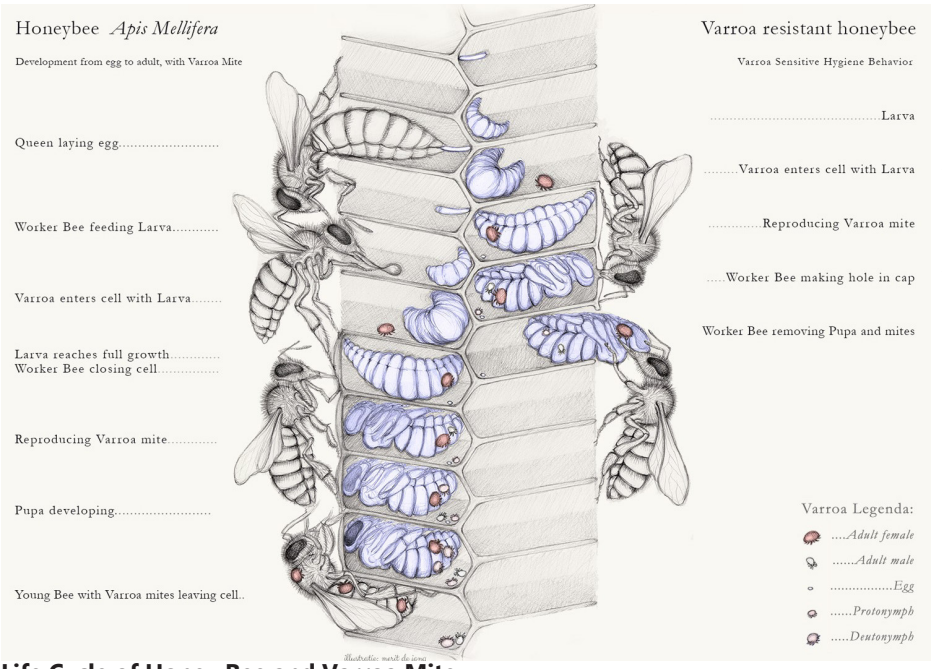
Varroa Mites on Drone Pupae.
(Photo: Denise Ellsworth, Ohio State University, Bugwood.org)

Significance

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

Description / Identification

The 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.



Life Cycle of Honey Bee and Varroa Mite **(Source: Encyclopedia Britannica)**

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

- These parasites feed on the hemolymph* of immature bees (preferring 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.
- Female mites 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, taking 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.

IHM RECOMMENDATIONS

Monitoring Options:

1) Screen bottom with sticky-board method.
2) Alcohol wash and Ether roll method.
3) Powdered Sugar roll method.

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

Adult Female Varroa mite Feeding on Developing Bee Pupa.
(Photo: Scott Bauer, USDA Agricultural Research Service, Bugwood.org)

Varroa Mite Attached to Female Worker Bee.
(Photo: Rob Snyder, beeinformed.org)

MONITORING FOR VARROA MITES

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. The sticky board should be placed in the hive and removed after 24 to 36 hours to examine for mite counts. Counts of more than 3 mites on the sticky board indicates that the colony should be treated for Varroa. While this is the easiest method, it is not very reliable unless you check it after 24-36 hours.

Materials:

- #8-mesh (1/8" 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:

1. 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.
2. The sticky board should be placed in the hive and removed after 24-36 hours and examined for numbers of mites. Counts of 3 or more mites on the sticky board indicates that the colony should be treated for Varroa.
3. The sticky board method is a more reliable method of monitoring Varroa mite levels than simply sampling brood during active brood rearing season.

ALCOHOL WASH

The alcohol wash, while lethal to sampled bees, is considered a more accurate method for monitoring* Varroa *mite levels than the ether roll. If you count more that 2 mites per 100 bees, treat for* Varroa*. This threshold may be reduced in the future, based on new guidelines, to 1 mite per 100 bees.

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, (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 more than 6 mites per 300 bees, treat for Varroa. This represents a 2% threshold.

ETHER ROLL

***The ether roll is a lethal method and easier for monitoring* Varroa *mites than the alcohol roll, however, it is not very accurate. If you count more than 3 mites in your sample of 300 bees or if you count more than 1 mite per 100 bees, treat for* Varroa.**

Materials:

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

Directions:

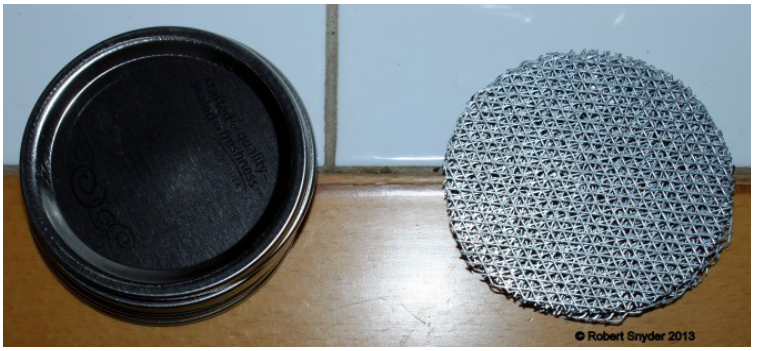
1. Brush or shake approximately 300 worker bees (1/2 cup loose bees) collected from near the brood nest into the wide-mouth mason jar. It is extremely important to collect "house bees" (those found in the middle of the hive) rather than the forager/worker because house bees are where Varroa are most prevalent. Be certain that the queen remains in the hive.
2. Spray a short burst (about one second) of engine starter fluid into the jar and place the lid on the jar of collected bees. 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 the bees and adhere to the sides of the jar where they can be counted.
4. If you count 3 mites per 300 bees, treat for Varroa.

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. If you count more that 2 mites per 100 bees, consider treating for* Varroa.**

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 (1/8" mesh) hardware cloth that will retain the bees while letting mites pass through.
- Tablespoon measure.
- Powdered sugar.
- Cheesecloth.



Example of Lids used for Powered Sugar Roll.
(Photo: Rob Snyder, beeinformed.org)

Directions:

1. Brush or shake approximately 300 worker bees (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. The powdered sugar makes it difficult for the mites to adhere to their host, causing the mites to fall off the bees.
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.
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 mites/ 300 bees, treat for Varroa.

IHM RECOMMENDATIONS

Cultural and Mechanical Strategies:

- 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 when available.
- Use a bee gate/Varroa gate (see Resources).
- Follow the procedure for Drone Brood removal below.

Drone Brood Removal

Drone brood removal is a mechanical/physical strategy for reducing* Varroa *mite. 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:** Dispose of the capped drone pupae and accompanying Varroa mites in one of three ways; scraping, cutting comb into a trash bag, 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.

Chemical:

- Treat with Oxalic acid fumigation, Hopguard II (more information in References), formic acid coumaphos, fluvalinate, Apivar, Apiguard. Rotate between chemicals with different active ingredients when treating to avoid developing mite resistance to the chemicals.
- Treat only when temperatures are between 70-90°F (21-32°C). Oxalic acid fumigation is preferably conducted early in the spring or late fall. It is not recommended when there is brood in the colony.
- When using these products, Federal and state laws require you to strictly follow label directions.

Nosema ceranae
Nosema apis

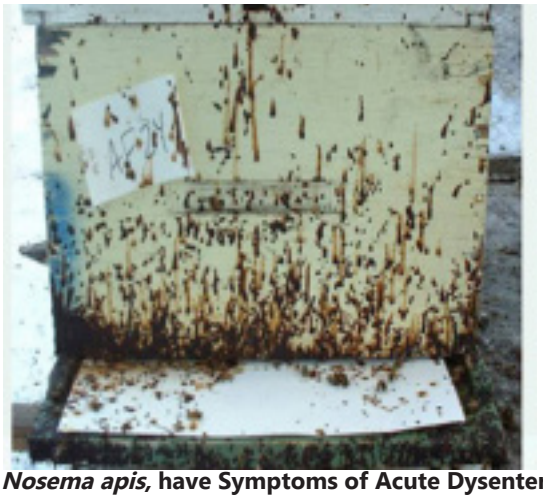
Significance

Nosema is one of the most prevalent adult honey bee diseases and is caused by two species of microsporidia, *Nosema ceranae* and *Nosema apis*. *N. ceranae* is more prevalent 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.

Colonies Collapsing with a High Rate of *Nosema ceranae* Infection. (Photo: Randy Oliver, ScientificBeekeeping.com)

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 mid-gut.
- Other symptoms may include severe dysentery (defecation within the hive, primarily seen with *N.apis)*; weak, crawling bees; spotty brood patterns similar to shotgunning (mainly with *N. ceranae)*; and poor buildup in the spring.
- *N. ceranae* may be present through the year, but tends to be more virulent in spring and summer.
- An infection by *N. ceranae* is generally without obvious symptoms, however, brood production tends to dwindle and older field bees may simply "disappear".



***Nosema apis,* have Symptoms of Acute Dysentery. Often there is Excessive Bee Excrement at the Front of the Hive Near the Entrance(s).**
(Photo: Clemson University- USDA Cooperative Extension, Bugwood.org)

Nosema ceranae & *Nosema apis*
(continued)

- 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.

IHM RECOMMENDATIONS

Monitoring:

By being alert to the signs and symptoms and utilizing effective monitoring practices (outlined in "Assessing Honey Bee Colonies" section, page 5) beekeepers should be able to identify, intervene and mitigate when signs of disease and pests are evident.

Cultural:

- Keep bees strong and healthy through supplemental feeding and provide access to fresh water.
- Use good hive management 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:

- *N. ceranae* and *N. apis* treatment may be required during the spring and summer with *N. apis* being more of a cold-weather disease. The only chemical registered for the control of the fungal disease Nosema (nosemosis) is the antibiotic fumagillin. This product is not currently available for purchase, so there is no registered anti-fungal treatment material at this time. 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.
- When using these products, Federal and state laws require you to strictly follow label directions.

American Foulbrood (AFB)

AFB"Ropy" Symptom.
(Photo: Clemson University-USDA Cooperative Extension, Bugwood.org)

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 *spore-forming bacterial disease* that affects the developing pre-pupae and pupae (collectively called the brood) and is still a serious honey bee disease. AFB spores are transmitted from adult honey bees to young larvae (less than two days old) while being fed. The adult bees can be carriers but are not affected, while the brood die from this bacterial disease in the late larval or pupal stage and putrefy in their cells.

AFB is also spread by housekeeper bees and 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 are highly contagious and the spores can remain viable in wax and honey for decades. That is why beekeepers must be diligent when re-using or swapping equipment.

Description / Identification

- Dead larvae change color from tan to dark brown, putrefy 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 putrefied 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.
- A frame heavily infected with AFB will have moisture on the sealed brood and oozing from perforated cells.
- There is often a spotty brood pattern ("shotgun") of infected and uninfected cells. Use an AFB diagnostic kit, which are available from several bee supply companies. However, this should not be the sole identification method used.

Frame Showing Heavy Infection of AFB.
(Photo: Rob Snyder, beeinformed.org)

IHM RECOMMENDATIONS

Monitoring:

Effective monitoring practices (outlined in "Assessing Honey Bee Colonies" section, page 5) 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.

- Send a sample to the USDA Bee Research diagnostic lab (see Resources). Cut out a piece of comb or coat a stick or toothpick with contents of one or more suspected cells. Remember to include return contact information.

Cultural:

- To prevent AFB, maintain good management and sanitation practices. Requeen with tolerant genetic lines such as Minnesota Hygienic bees because their behavior detects and removes infected brood.
- When AFB is confirmed, contact the CDA state apiary program to report the confirmation. The staff will advise you on the approved treatment protocol.
- When AFB is identified in a colony, all infected combs must be removed and destroyed, usually by burning. Work with state apiary officials and local fire marshals before burning the equipment. Dig a pit large enough to completely burn and bury infected colony frames. When the bees have returned to the hive (after dark), kill adult bees and burn the colony include brood, honey and adults.
- If open burning is prohibited in your area, kill bees first by pouring soapy water from the top of the hive then double bag all bees and frames in heavy-duty trash bags and send to a landfill. Larger hive bodies, covers, and/or tops can be sterilized. Scrape off any wax

American Foulbrood (AFB)
(continued)

deposits then scorch with fire or portable torch. Gamma irradiation sanitation facilities (unavailable in many parts of the country) can be used but are not cost effective and do not effectively treat honey.

- In heavily diseased colonies (more than a frame of infected brood), or small bee populations, the recommended treatment option is burn and bury. **AFB is not a disease to ignore! Beekeepers have a responsibility to not spread the disease to other bees and beekeepers.**

Chemical:

- DO NOT use antibiotics as they WILL NOT eradicate AFB spores.
- 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 regiment of Terramycin®, Tylan/Tylosin® tartrate or lincomycin. This regiment will reduce symptoms in bees but not kill spores. Obtaining these products will require a Veterinary Feed Directive (VFD).
- When using these products, Federal and state laws require you to strictly follow label directions. Otherwise, antibiotic contamination of honey and other products may result, rendering the products unmarketable.

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.

EFB Larvae Turning and Decomposing (two cells with contaminated brood food).
(Photo: Rob Snyder, beeinformed,org)

Description / Identification

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

EFB-infected Larvae with Visible Sunken Trachea (silvery lines)
(Photo: Rob Synder, beeinformed.org)

• 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.

• Use an EFB diagnostic kit and send a sample to a lab (described above for AFB). Or have the colony examined by an individual trained in disease identification.

IHM RECOMMENDATIONS

Monitoring:

By utilizing effective monitoring practices (outlined in "Assessing Honey Bee Colonies" section, page 5) and recognizing early signs, beekeepers can address EFB before it decimates a colony.

Cultural:

- Strengthen the colony by feeding sugar syrup and/or protein patties and adding adults or capped brood from a healthy colony to the diseased colony.
- For light infections, reduce stress by relocating hives to a more favorable (sunny, warm) location and/or to a site with better forage and less competition.
- If EFB persist or if the infestation is heavy, reduce stress and requeen with a young, vigorous queen before the fall season.
- For severe infections, requeen with tolerant genetic lines such as Minnesota Hygienic bees because their behavior detects and removes infected brood.

Chemical:

- Obtain a VFD to use antibiotics. This should be used only as a last resort. Terramycin® or Tylan/Tylosin® tartrate are the only approved controls recommended for severe infections (see cultural practices above). A blank VFD is available in the Appendix.
- When using these products, Federal and state laws require you to strictly follow label directions.

Secondary Diseases & Pests of Honey Bees

Tracheal Mites

Significance

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

Description / Identification

Mites Inside Tracheal Tube.
(Photo: Pest and Diseases Image Library, Bugwood.org)

- 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.

IHM 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 where available, and possibly New World Carniolan.
- Grease patties, made from a mixture of sugar and vegetable shortening, can be placed in the hive and may be somewhat effective in trapping the mites, 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 Mummies Outside Hive Entrance.
(Photo: Rob Snyder, beeinformed.org)

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.

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 gray 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 on a Drone Larvae.
(Photo: 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.

IHM 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.
- Requeening with queens from tolerant genetic lines such as Minnesota Hygienic line, which has been shown to tolerate chalkbrood through the expression of hygienic behavior that involves detecting and removing infected brood

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.

Description / Identification

- Wax moths are a common and destructive comb pest
- usually seen by beekeepers.
- 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 attracting wax moths).
- 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.

Wax Moth.
(Photo: Rob Snyder, beeinformed.org)

- 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.

IHM 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.
(Photo: 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
(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. DO NOT USE MOTH BALLS that are used for clothing storage as they are NOT registered as a pesticide and lack directions for proper use.
- When fumigating using PDB, supers should be treated in stacks of five for maximum effectiveness.
- EPA is proposing registering *Bacillus thuringiensis, subsp. aizawai* strain ABTS 1857 to prevent & control wax moths in beehives (as of January 2020).
- When using these products, Federal and state laws require you to strictly follow label directions.

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. Deformed wing was once thought to be a direct result of mite feeding. Further studies have shown that Varroa mites actually transmit DWV when feeding.

Deformed Wing Virus.
(Source: University of Georgia College of Agriculture & Environmental Science)

Description / Identification

- DWV causes bees to develop misshaped wings during pupation that are incapable of flight. The virus multiplies slowly which permits the infected bee to survive to adulthood.
- Deformed wing bees may die off naturally as they approach foraging age, or are sometimes actively removed from the colony by house bees.

IHM RECOMMENDATIONS

Cultural:

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

Other Viruses Vectored by Varroa

- Chronic Bee Paralysis Virus (CBPV)
- Acute Bee Paralysis Virus (ABPV)
- Israeli Acute Paralysis Virus (IAPV)
- Lake Sinai Virus (LSV)
- Kashmir Virus (KV)

CBPV infected paralyzed and hairless bees.
[Photo The British Animal and Plant Health Agency (APHA)]

Description / Identification-CBPV, ABPV, IAPV, LSV, and KV

- 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 hive robbing infected bees.
- 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 cuckoo 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
LSV	Research still ongoing
KV	Research still ongoing

IHM 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 which will be available in the future. (See diagram on page 16 on how hygienic bees work.)
- Add a frame of sealed brood from a healthy colony to boost the numbers of healthy bees.

CBPV Infected Bees with"Shiny Appearance".
(Photo: www.nationalbeeunit.com)

Black Queen Cell Virus (BQCV)

Significance

Black Queen Cell Virus (BQCV) is a virus with an unknown mode of transmission, but may be correlated with 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. Beekeepers raising their own queens need to be especially vigilant in managing Nosema to avoid BQCV.

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

A Queen with BQCV.
(Photo: Rob Snyder,beeinformed.org)

IHM RECOMMENDATIONS

Cultural:

- Requeen with Minnesota 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, Federal and state laws require you to strictly follow label directions.

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 mal-nutrition. Sacbrood tends to disappear after conditions improve, especially after the main nectar flow has started.

The Black Larvae is Sometimes said to Look Like a "Chinese Slipper".
(Photo: Rob Snyder, beeinformed.org)

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. Larvae turn from yellow-gray to black, with head blackening first. Black-headed larvae are bent toward cell center.
- Larvae die in an *upright position* after their cells have been sealed. 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.
- The dark capping of the brood cells appear punctured or partially removed (not to be confused with the appearance of AFB).

Sacbrood Under a Perforated Cap.
(Photo: Rob Snyder, beeinformed.org)

IHM RECOMMENDATIONS

Cultural:

- Requeen with Minnesota hygienic queens.
- Reduce hive stressors such as providing clean water and closer forage.
- Improve hive 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.

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.

Small Hive Beetle Adults.
(Photo: Jessica Lawrence, Eurofins Agroscience Services, Bugwood.org)PhPho

Small Hive Beetle (SHB)
(continued)

- SHB larvae eat everything in the colony (pollen, brood, honey, dead adult bees and comb), causing the honey to ferment and to become repellent to the bees and other scavengers as well.
- The affected honey can also become thin, causing it to run out of the combs, which may then cause the bees to abandon the hive.
- SHB 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.

Small Hive Beetle Larvae.
(Photo: Rob Snyder, beeinformed.org)

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

IHM RECOMMENDATIONS

Cultural:

- The most effective control for SHB in Colorado is to keep colonies strong and to keep all residual honey and wax capping 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) Information on pit traps can be found in the Resources.

Biological:

- Fungi and nematodes have been evaluated but have limited availability.

Chemical:

- Coumaphos (Checkmite+®) used in a beetle trap, or permethrin (GardStar®) used as a soil drench (**NOT** in the hive), control SHB. 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, Federal and state laws require you to strictly follow label directions.

Bears

Significance

The black bear of North America can be a serious threat to 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.

Evidence of a Bear's Visit to the Beehive.
(Source: Mossback Farms)

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 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.

IHM 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 which is a tell tale sign.

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.

Mouse at hive.
(Source: http://www.butternutvalleyfarm.com/356/a-mouse-in-the-hive)

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.

IHM 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 (10°C).
- 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 honey 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

Skunk Feces.
(Photo: Rob Snyder, beeinformation.org)

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

HM 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 down directly in front of the hive entrance. 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. This “spike board” will force the animals to 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:

- These bees are much more aggressive and sting more readily than regular European honey bees, posing a greater risk in urban areas.
- 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.
- 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.
    - 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. To minimize AHB introduction, avoid obtaining packages and queens from southern states where AHB is known to occur. 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.attrabeekeeping.pdf

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

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

Bee Informed - Rob Snyder
www.beeinformed.org

Univeristy of Minnesota Bee Lab
http://www.beelab.umn.edu/prod/groups/cfans/@pub/@cfans/@bees/documents/asset/cfans_asset_317466.pdf

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

Colorado State University Fact Sheets
https://extension.colostate.edu/topic-areas/insects/creating-pollinator-habitat-5-616/
https://extension.colostate.edu/topic-areas/insects/attracting-native-bees-landscape-5-615/
https://extension.colostate.edu/topic-areas/insects/feeding-honey-bees-in-colorado-5-622/

CDA Apiary Program
https://www.colorado.gov/pacific/agplants/apiary-program-page

CDA Managed Pollinator Protection Plan
https://drive.google.com/file/d/1cSt2XfqBGONvztiAgL4TyMojqE6LRGek/view

DriftWatch™
https://co.driftwatch.org/

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

Honey Bee Health Coalition
https://honey bee healthcoalition.org/wp-content/uploads/2019/01/HBHC_Hive_BMPs_v1.0_reduced.pdf

Honey Bee Veterinary Consortium
https://www.hbvc.org/

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
https://ipmdata.ipmcenters.org/documents/pmsps/MidAtlanticHoneyBeePMSP.pdf

Pitfall Trap Information
https://en.wikipedia.org/wiki/Pitfall_trap

Scientific Beekeeping
http://scientificbeekeeping.com/

The Beekeeper's Handbook. 4th Edition. 2011. Dianna Sammataro and Alphonse Avitabile. published by A.I. Root Company. Medina, Ohio

University of Georgia College of Agriculture & Environmental Science
http://www.ent.uga.edu/bees/disorders/bacterial.html

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

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

Virginia Cooperative Extension - Sampling Methods for Varroa Mites on Domesticated Honey Bees
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 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 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.

Lighting a Bee Smoker

Preparing the smoker

- Secure some good, dry, longer-burning material such as pine needles, pine cones, sumac pods, punk wood or cotton plugs or burlap. Avoid sources that 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 buildup before lighting. If necessary, scrape out excess residue with your hive tool and a wire brush. Many 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.

Steps for Lighting (kindling method)

Due to Colorado's dry climate and frequent droughts, use **EXTREME CAUTION** when lighting and using smokers to avoid starting fires! Make certain that the smoker is ***completely*** extinguished before storing!

1. Place some quick-igniting fuel in the bottom of the smoker (newspaper, straw, etc.) or a small piece of burr comb, a teaspoon or two of lamp oil 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 (watch 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 ¾ 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.

VETERINARY FEED DIRECTIVE (VFD) LAWS

On Jan. 1st 2017, the Veterinary Feed Directive went into effect. All customers must have a VFD from their veterinarian to be able to purchase antibiotics for the treatment of American and European Foulbrood. A copy of the VFD must be filled out and signed by your veterinarian for the number of colonies you are wishing to treat. Your will then send a copy of the VFD to your supplier. Once the supplier is in receipt of the VFD, they can send the antibiotic to you. The VFD form can be sent via fax, mail, or email to your supplier.

To make things go as smoothly as possible we suggest building a relationship with your local veterinarian. To find a veterinarian who is familiar with bees and able to write a VFD, visit the Honey Bee Veterinary Consortium (in Resources). If they themselves are not beekeepers, you should invite them to your apiary and show them the ins and outs of the beehive. Antibiotics should only be used to treat when disease is found within a hive. Under the Food and Drug Administration (FDA) regulation, veterinarians are NOT allowed to provide antibiotics for prophylactic use. A VFD can be written for a period of up to 6 months by your local veterinarian. A copy of a VFD should be retained by the veterinarian, the beekeeper and the antibiotic supplier.

Veterinary Feed Directive

All parties must retain a copy of this VFD for 2 years after the date of issuance.

Veterinarian: Dr. John Doe
Address: ~~~~
Phone: ~~~~
Fax or email (optional): ~~~~

Client: CSU APIARIES
Address: ~~~~ (business or home)
Phone: ~~~~
Fax or email (optional): ~~~~

Drug(s) Name: Oxytetracycline Drug(s) Level: 200mg/colony ~~g/ton~~ Duration of use: 3 treatments 4-5 day intervals
Species and Production Class: Honey Bees No reorders (refills) authorized: N/A
Indication for use (as approved): Foulbrood
Caution (related to this medicated feed, if any): NOT to be used during main honey flow

USE OF FEED CONTAINING THIS VETERINARY FEED DIRECTIVE (VFD) DRUG IN A MANNER OTHER THAN AS DIRECTED ON THE LABELING (EXTRA LABEL USE) IS NOT PERMITTED.

Approximate Number of Bees/Hives:
Premises: 305 University Ave Fort Collins, CO 80523
Other Identification (e.g., age, weight) (optional):
Special Instructions (if any):

Affirmation of intent (for combination VFD Drugs) (check box)*:

☒ This VFD only authorizes the use of the VFD drug(s) cited in this order and is not intended to authorize the use of such drug(s) in combination with any other animal drugs.

☐ This VFD authorizes the use of the VFD drug(s) cited in this order in the following FDA-approved, conditionally approved or indexed combinations(s) in medicated feed that contains the VFD drug(s) as a component.

Drug(s)	Drug Level(s) and any Special Instructions
Oxytetracycline	200mg/colony 3 treatments each

☐ This VFD only authorizes the use of the VFD drug(s) cited in this order any FDA-approved, conditionally approved or indexed combinations(s) in medicated feed that contains the VFD drug(s) as a component.

Withdrawal Time (if any): This VFD Feed must be withdrawn 48 days prior to honey flow.

VFD Date of Issuance: 7/15/2019 (Month/Day/Year)
VFD Expiration Date: 1/15/2020 (Month/Day/Year)
(As specified in the approval; cannot exceed 6 months after issuance.)
Veterinarian's Signature: John Doe

Veterinary Feed Directive

All parties must retain a copy of this VFD for 2 years after the date of issuance.

Veterinarian: _____ **Client:** _____

Address: _____ **Address:** _____ (business or home)

_____ _____

Phone: _____ **Phone:** _____

Fax or email (optional): _____ **Fax or email (optional):** _____

Drug(s) Name: _____ **Drug(s) Level:** _____ **g/ton** **Duration of use:** _____

Species and Production Class: Honey Bees **No reorders (refills) authorized:** N/A

Indication for use (as approved): Foulbrood

Caution (related to this medicated feed, if any): _____

_____

USE OF FEED CONTAINING THIS VETERINARY FEED DIRECTIVE (VFD) DRUG IN A MANNER OTHER THAN AS DIRECTED ON THE LABELING (EXTRA LABEL USE) IS NOT PERMITTED.

Approximate Number of Bees/Hives: _____

Premises: _____

Other Identification (e.g., age, weight) (optional): _____

Special Instructions (if any): _____

Affirmation of intent (for combination VFD Drugs) (check box)*:

☐ **This VFD only authorizes the use of the VFD drug(s) cited in this order and is not intended to authorize the use of such drug(s) in combination with any other animal drugs.**

☐ **This VFD authorizes the use of the VFD drug(s) cited in this order in the following FDA-approved, conditionally approved or indexed combinations(s) in medicated feed that contains the VFD drug(s) as a component.**

Drug(s)	Drug Level(s) and any Special Instructions

☐ **This VFD only authorizes the use of the VFD drug(s) cited in this order any FDA-approved, conditionally approved or indexed combinations(s) in medicated feed that contains the VFD drug(s) as a component.**

Withdrawal Time (if any): This VFD Feed must be withdrawn 48 **days prior to honey flow.**

VFD Date of Issuance: _____ **(Month/Day/Year)**

VFD Expiration Date: _____ **(Month/Day/Year)**

(As specified in the approval; cannot exceed 6 months after issuance.)

Veterinarian's Signature: _____

Source: hcbees.org

Quick Resource Guide

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

DriftWatch™
https://co.driftwatch.org/

Honey Bee Health Coalition
https://honey bee healthcoalition.org/wp-content/uploads/2019/01/
HBHC_Hive_BMPs_v1.0_reduced.pdf

Honey Bee Veterinary Consortium
https://www.hbvc.org/

For more information on safe use of pesticides, visit:
Colorado Environmental Pesticide Education Program
http://cepep.agsci.colostate.edu