TOOLS FOR VARROA MANAGEMENT

A GUIDE TO EFFECTIVE VARROA SAMPLING & CONTROL

HEALTHY BEES · HEALTHY PEOPLE · HEALTHY PLANET™

HONEY BEE HEALTH COALITION™

Ninth Edition - June 11, 2026

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ABOUT THE HONEY BEE HEALTH COALITION

The Honey Bee Health Coalition was formed in 2014 as a cross-sector effort to promote collaborative solutions to honey bee health challenges. The Coalition brings together diverse stakeholders including representatives of beekeeping industry, growers, academia, government, agribusinesses, conservation groups, manufacturers, companies, and other key partners dedicated to improving the health of honey bees and other pollinators. The Coalition's mission is to collaboratively implement solutions that will help to restore and enhance the health of honey bees while also supporting the health of native and managed pollinators in the context of productive agricultural systems and thriving ecosystems.

A major tenet and founding principle of the Coalition is the recognition that declines in overall honey bee health is a multi-factorial problem, and all stakeholders have a role to play in managing bee health issues. The Coalition focuses on accelerating improvement of honey bee health in four key areas: forage and nutrition, hive management, crop pest management, and outreach, education and communications. As part of the hive management focus area, the Coalition has developed "Tools for Varroa Management" as a guide for beekeepers to select options to more effectively control the varroa mite (*Varroa destructor*) in managed hives.

For more information on the Coalition and its key focus areas/products, please visit: *http://honeybeehealthcoalition.org/*. To access the Honey Bee Health Coalition's full varroa resources, scan the QR code below.

Access the Honey Bee Health Coalition's full Varroa resources here.

INTRODUCTION

Every honey bee colony in the continental United States and Canada is susceptible to infestations of *Varroa destructor* mites (varroa). Varroa infestation is one of the greatest threats to honey bee health, honey production, and pollination services. Untreated colonies or colonies with poorly managed mite populations can fail, causing economic losses to beekeepers and ultimately impacting agricultural food production through the loss of pollination services. Colonies infested with varroa spread mites and diseases to other colonies and apiaries through drifting, robbing, and absconding. Management actions such as introducing nucleus colonies (nucs), brood frames, packaged bees, swarms, external splits, or full-size colonies to apiaries can further contribute to the spread of varroa.

All beekeepers should remain vigilant in monitoring for varroa levels and be prepared to take timely action to reduce mite populations. Effective varroa control will reduce colony losses and avoid spread of infectious diseases among colonies.

This Guide will explain practical, effective methods that beekeepers can use to measure varroa infestations in their colonies and select appropriate control methods. The Honey Bee Health Coalition offers this Guide free of charge and asks that you please reference the Coalition if distributing.

This Guide represents the current state of the science regarding varroa mites. It will be updated as new products or information become available. Check cover page to be sure you have the latest edition.

ABOUT VARROA MITES

Varroa destructor (varroa), is a parasitic mite that lives on the outside of its host, such as the western (European) honey bees, *Apis mellifera*. The mite feeds on the brood and adults of its host. Varroa reduce overall colony vigor and transmit and worsen honey bee viral infections. When left untreated, colonies with high levels of these mites may die within months. Varroa, which is present on all continents except Antarctica, is the most damaging honey bee pest and is a major factor responsible for colony losses worldwide.

Adult varroa readily disperse within and among bee colonies. They spread through natural drift of workers and drones, robbing of weak colonies by stronger ones, swarming, absconding, and through human-aided exchange of bees and brood frames between colonies. Mites do not live longer than a few days without their host, so unoccupied bee equipment does not harbor live mites.

Even after a colony has been treated, some varroa remain and mite populations can rebound. Generally, uncontrolled mite populations can double monthly. This increase can happen more quickly if the colony has large amounts of drone brood or if varroa are transmitted from neighboring colonies. A colony's genetics play a role in how quickly varroa populations increase.

Therefore, beekeepers should have an Integrated Pest Management (IPM) plan in place to successfully manage varroa in their colonies.

Photo Credit: Ben Sallmann

Honey Bee and Varroa Mite Seasonal Development

Honey bees and their parasitic varroa mites cycle through four broadly recognizable seasonal phases (see Figure 1). In some locations, there is one cycle of these four phases per year, in other locations there can be more than one cycle.

The phases are:

- **Dormant (less active):** Bees are clustered; little or no brood in northern locations and reduced brood rearing in southern locations; all or most varroa mites are on adult worker bees; bee and mite populations are in decline because little or no reproduction is occurring within the colony.
- **Population Increase:** Seasonal colony buildup; colony brood and adult worker population increasing; varroa population usually low but increasing; pre-honey flow supering of colonies.
- **Population Peak:** Bee population (both adult and brood) at peak; mite populations increasing, nearing peak; often honey supers on colonies.
- **Population Decrease:** Post-honey harvest; bee population decreasing; colonies rearing overwintering bees. Varroa populations growing, peaking, and then declining until eventually only phoretic/dispersal mites on adult bees after colonies have little or no brood.

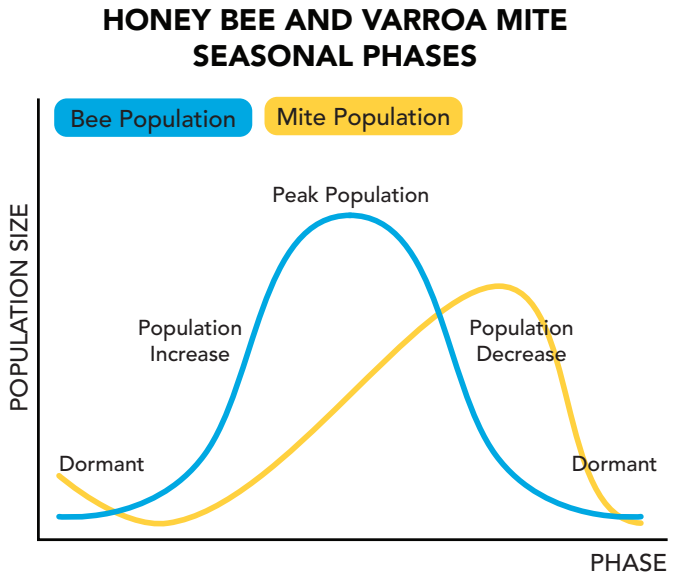


Figure 1: Varroa Mite and Honey Bee Seasonal Phases

Varroa populations increase and decrease in synchrony with the seasonal changes in colony population. When left unchecked, mite populations reach their highest levels soon after the brood and adult honey bee populations reach their peak. When the amount of bee brood declines, mite numbers can drastically increase on the adult bees. Eventually, varroa numbers decrease, along with the adult bee population (see Figure 1).

Having a low mite population at the start of bee Population Decrease phase is critical. If mite populations are high, the colony may not be healthy enough to rear bees to survive the dormant phase. During broodless periods, all mites are carried on adult bees and are referred to as dispersal (historically called "phoretic") mites. If brood is present in the hive, mites continue to reproduce.


Photo Credit:
Bee Informed Partnership

INTEGRATED PEST MANAGEMENT (IPM)

Integrated Pest Management (IPM) is a comprehensive approach to pest management that seeks to keep pests from reaching damaging levels while reducing economic costs and hazards to people and the environment. In the case of varroa management, IPM is a set of proactive monitoring and control methods that offers beekeepers a whole-systems approach to controlling varroa and slowing the development of mite resistance to control measures.

This Guide presents information about IPM techniques that integrate:

- Frequent monitoring of mite populations to determine infestation levels and to evaluate the effectiveness of controls.
- Use of cultural/mechanical practices (*e.g.*, breeding, screened bottom board, removal of drone brood, genetics) to slow mite population build-up.
- Use of mite control products to reduce mite populations when they reach treatment threshold levels.
- Use of products (miticides; sometimes referred to as acaricides) with different active ingredients and mechanisms of action to avoid the development of miticide resistance.

An IPM approach can help beekeepers maintain mite levels below where they can damage a colony. There is no single solution for varroa management. This Guide reviews the efficacy, application, advantages, and disadvantages of a wide variety of control methods. This information enables beekeepers to choose an approach suited to their individual circumstances and risk tolerance.

Doing nothing to control varroa levels is not a practical option for most beekeepers. The overwhelming majority of honey bee colonies are not capable of surviving or thriving unless the beekeeper prevents mites from reaching damaging levels.

If the beekeeper does not control varroa, a colony is likely to die and, in the process, spread mites and infections to other colonies.

Active ingredients are defined as those components of a product that affects the intended pest.Check the label to confirm which active ingredient you are using and whether there are recommended options for resistance management.

Use our Varroa IPM Tracking and Control spreadsheet located on the back page of this Guide.
Download here:
http://bit.ly/varroa-spreadsheet

Integrated Pest Management (IPM) and Varroa Mite Control

The information presented in this Guide will help beekeepers to recognize that management of varroa is achieved by understanding:

- The life cycles of both the honey bee colony and the mite.
- The number of mites present in the colony at any point in time, both on adult bees and in brood.
- How tactics to control varroa mites vary according to the seasonal phase of the bee colony and type of beekeeping operation.
- That an IPM approach discourages reliance on a single, repeating treatment; it involves timely use of appropriate tools, including chemical and cultural controls when necessary.

Successful varroa control solutions are proactive. They control varroa before the mites reach levels that threaten colony productivity and survival, rather than respond after the damage has occurred.

DESCRIBING VARROA MITE LEVELS

The most accurate way to describe varroa mite infestation is the number of mites per 100 adult bees. For brevity, this Guide expresses mite levels as a percentage.

For example, in this Guide, "3 mites per 100 adult bees" is written as "3 percent."

For more information, watch our video on IPM and varroa mite control: *http://bit.ly/varroaipm*

MONITORING VARROA MITE POPULATIONS

Bee colonies can tolerate a low number of varroa mites. As mite numbers increase, colonies become susceptible to other stressors, dwindle, and eventually die. Monitoring varroa levels in colonies (via sampling) enables a beekeeper to estimate mite infestation level. Accurately assessing the varroa mite population to determine if treatment is necessary and effective forms the basis of an IPM control strategy.

Unfortunately, monitoring may not be reliable when brood is present in the colony, particularly drone brood. Mites are frequently in capped brood cells, making them impossible to detect without opening brood cells.

Even if sampling shows 0% mites, it does not mean there are no mites in the colony. Mites may be present elsewhere, such as in capped brood cells or on adult bees that were not sampled. Waiting too long to confirm elevated mite population is risky. A delay in treatment can reduce a colony's likelihood of survival and contribute to spreading mites to other colonies.

Beekeepers can assess varroa mite populations during any of the phases of bee/mite population cycles.

Generally, a beekeeper should perform varroa monitoring assessments monthly beginning with the Population Increase phase, or at least 4 times from Population Peak to Decline.

During the bee Population Decrease phase, check mite levels more frequently to confirm that infestation levels are low going into the Dormant phase. Sampling during the Dormant phase is less important because mite production is reduced and it may be too cold to safely sample bees during this time. It is best to wait until milder conditions permit sampling.

Always repeat sampling after treatment to confirm the effectiveness of the treatment that was performed.

Immediately treat colonies when sampling results warrant (*i.e.*, mite numbers exceed the 1 - 2% threshold). These recommended thresholds can vary based on region. Please consult with your state, province, territory, Tribal, or university extension apiculturist for more details.

Recommended Sampling Methods

For more information and a demonstration of both sampling methods, please watch our video: http://bit.ly/sampling-methods

Sampling methods involve removing mites from the bodies of adult bees then counting the mites to establish a standard percentage measure of mite numbers and provide the best estimates of mite infestation.

Two methods that sample mites in this manner are the alcohol/soap wash and powdered sugar shake. **The alcohol/soap wash method is a more reliable method than the powdered sugar shake. Practice improves accuracy with both methods.**

This section also evaluates other less reliable sampling methods (see Table 2). These alternative methods should only be used as a secondary confirmation of the varroa levels indicated by more accurate methods.

See the ***References and Additional Resources*** section for journal articles on sampling methods.

Photo Credit: Judy Griesedieck

EQUIPMENT NEEDED:

Note: You can purchase sampling kits and follow the manufacturer's instructions or utilize the equipment listed below to build your own.

- Large container, such as a plastic pail or dishwashing tub.
- Wide-mouth jar, such as quart Mason canning jar with a two-part lid.
- ½ cup measuring cup or juice box holder with a drawn line indicating ½ cup.
- #8 screen mesh cut to fit inside rim of canning lid.
- **One** of the following:
  - Ethanol (ethyl alcohol), minimum 70% alcohol
  - Isopropyl (rubbing) alcohol, minimum 70% alcohol
  - Methanol (methyl hydrate), minimum 70% alcohol
  - Non- or low-sudsing soap solution (*e.g.*, low-sudsing laundry detergent, plant-based soaps, solution of alcohol and soap).
  - Automotive windshield washer fluid, minimum 40% alcohol.
- *For powdered sugar shake,* use powdered sugar and water mister (to dissolve powdered sugar).
- White tray, dishwashing tub, or similar device. For powdered sugar shake, paper boards, plates, or sheets can be used.

COLLECTING THE SAMPLE (BOTH METHODS)

Collect a sample of approximately 300 adult bees from one to three brood-nest combs (avoiding the queen). 300 bees are equivalent to about ½ cup of lightly packed bees. Using fewer than 300 bees will not give you an accurate sample.

1. Select one to three brood frames. Look for the queen on each frame. If she is present, set the frame aside or move her to another frame.
2. For alcohol or soap wash method only, add enough alcohol, low-sudsing soap solution, or winter windshield washer fluid to the wide-mouth jar to completely cover 300 bees by a couple inches.
3. Shake bees directly from one to three brood frames into the larger collecting container (plastic pail or dishpan). Wait briefly to allow older-age adult bees to fly out.
4. Scoop ½ cup of remaining bees and quickly pour them into the wide-mouth jar.

Alternatively, mark the wide-mouth jar or juice box holder with a ½ cup bee-equivalent line. Collect adult bees directly into the collection jar from a brood frame by moving the collection jar downward over the adult bees on the frame, so they fall backwards into the jar.

Experiment with your collection technique to consistently obtain a 300-bee sample. This means counting the number of bees you collected from time to time.

SAMPLING: ALCOHOL OR SOAP WASH METHOD

Perform the alcohol or soap wash away from the smoker.

1. Swirl the jar with bees and alcohol/soap vigorously for at least one minute to dislodge the mites from the bees.
2. After swirling, empty the liquid contents into the shallow tray or dishwashing tub through a mesh screen that traps the adult bees while allowing the mites to fall through.
3. Refresh the alcohol, soap, or windshield wiper fluid to the wide-mouth jar to cover the same sample of bees by a couple inches.
4. Repeat steps 1-2 and empty the new mites and alcohol into the same tray or tub. This increases the accuracy of the count.
5. Count the mites (see "Counting the Mites" below).

SAMPLING: POWDERED (ICING) SUGAR SHAKE METHOD

This method relies on skill developed through practice and is more prone to error than the alcohol or soap wash methods. Avoid performing the powdered sugar method in high humidity or during a strong nectar flow (when bees may have nectar in their honey stomachs) as dampness will cause the sugar and mites to adhere to the bees. If the shaken bees are not coated in a dusting of dry powdered sugar when you put them back into their colony, the test is invalid.

1. Add approximately two tablespoons of powdered sugar to the jar containing 300 bees. For best results, sift the powdered sugar through a flour sifter to ensure a fine texture.
2. Vigorously shake the jar for approximately one minute to cover the bees in sugar and dislodge the mites from the bees.
3. Set the jar down in the shade and wait three to five minutes. Rushing this step increases the likelihood of undercounting the mites.
4. Briefly shake again, then invert the jar over the white or light-colored plate or dishwashing tub, and shake it like a salt-shaker. The sugar and mites will fall onto the plate or tub. Shake the inverted jar until sugar and mites stop falling out. Shaking the bees too lightly will result in underestimating mite numbers.
5. Repeat steps 1-4 with the same sample of bees to improve the accuracy of the count. Add new mites and sugar to the previously collected mites and sugar.
6. Spray the powdered sugar deposit in the plate or pan with a water mist to dissolve the sugar.
7. Count the mites (see "Counting the Mites" below).
8. Sampled bees can be released back into the top of their colony or at the colony entrance. Sampled bees may or may not survive the testing procedure.

COUNTING THE MITES (BOTH METHODS)

The goal of mite assessment is to determine the number of varroa per 100 adult bees, expressed as the percent infestation.

Counting steps:

1. Count the total number of mites collected.
2. Divide that number by 300 (or the number of bees in the sample).
3. Multiply by 100 to yield a percentage.

Example:

A beekeeper samples 300 adult bees and counts 12 mites in the pan.

12 mites ÷ 300 bees = 0.04 mites per bee

0.04 X 100 = 4% (4 mites per 100 adult bees)

To increase the accuracy of the assessment, count the actual number of bees in each sample. As you gain experience with sampling, your sample sizes should become more consistent to the 300 mark.

How many colonies to sample for Varroa mites?

If an apiary has fewer than ten colonies or the colonies are in a breeding program, sample each colony. For larger apiaries, take one sample per colony from a minimum of 8 randomly selected colonies in each apiary (or a minimum of 10% of the total colonies within multiple apiaries). If possible, include colonies from the center as well as the outer edges of the bee yard and hives of varying strength.

Following an IPM approach calls for sampling each colony, treating colonies that exceed the seasonal mite threshold, and not treating colonies with mite levels below threshold.

If you cannot sample all colonies in an apiary, treat the entire yard if any colony's mite levels exceed the seasonal threshold.

Interpreting Sample Findings

When using the alcohol/soap wash (recommended) or powdered sugar shake, we suggest using the following conservative estimates for treatment thresholds (see Table 1). These thresholds are based on published research, beekeeping best practices, and reports from beekeepers and bee health researchers from many regions. Mite thresholds are an evolving science and are often situationally and regionally specific. When possible, consult your local apiary inspector or extension service for advice.

Table 1: Varroa Mite Treatment Thresholds by Colony Phase (%=Number of mites/100 adult bees)

Colony Phase	% Immediate control not needed	% Promptly control
Dormant*	<1%	≥1%
Population Increase	<1%	≥1%
Peak Population	<2%	≥2%
Population Decrease	<2%	≥2%

*Note: Sample just prior to clustering to determine whether bees are healthy going into dormancy.

When mite levels are below the threshold, the infestation is considered acceptably low, so immediate control may not be needed at that time. Re-sample mite levels monthly beginning with the Population Increase phase, or at least 4 times from Population Peak to Population Decline. When sampling is done after treatment, the low level may mean that the treatment was successful in reducing the mites below potentially damaging levels.

When mite levels are above the threshold, apply mite control immediately, using a registered, effective, seasonally appropriate treatment method according to label directions (see Table 3: Control Options by Seasonal Phase). If post-treatment tests show that mite numbers remain above the threshold after treatment, apply another suitable control method without delay.

Beekeepers should stay current with recommendations based on new research findings.

USE CAUTION WHEN INTERPRETING SAMPLING RESULTS

- Use repeated sampling to monitor and continuously assess that your management plan is working, rather than to decide whether or not to manage varroa.
- Sampling results are an estimate of the infestation and may not accurately represent the total mite population of the colony, especially since mite thresholds are low.
- Mite infestations can vary from one colony to the next even in the same apiary and when colonies are managed the same.
- Sample results will vary throughout the year. Sampling during the Population Increase phase is more likely to underestimate overall mite numbers and the risk to the colony.
- Inexperience with sampling procedures can affect results.
- Losses can be caused by other stressors influencing colony health (*i.e.* colony strength, diseases, pesticides, poor nutrition, queen health, weather).

TIPS

Sampling recommendations:

- Sample monthly beginning with the Population Increase phase, or at least 4 times from Population Peak to Population Decline.
- It is important to sample after treatment to assess control effectiveness and determine if another treatment is needed.
    - Generally, post-treatment sampling should reveal numbers under 2% when sampling adult workers using alcohol wash.
    - A sticky bottom board can be used for a "quick check" post-treatment sample. If more than a few mites are found on the sticky board, use an alcohol wash to determine if another treatment is needed.

Factors that can affect mite levels:

- High worker and drone brood production, leading to higher mite levels.
- Decreased brood production, leading to a higher number of mites on adult bees.
- Mite migration on bees from other colonies.
- Colony genetics.

A single sample may not detect rapid changes in mite numbers on bees when these factors are present. A good rule is to resample if you are in doubt.

Alternate Sampling Methods for Varroa Assessment

The two most accurate ways to monitor varroa infestation levels in a honey bee colony are the alcohol or soap wash method and the powdered sugar shake method. However, some beekeepers continue to use methods that are not fully tested, are less efficient, or less accurate. **The Honey Bee Health Coalition does not recommend relying on the methods identified in Table 2.**

Table 2: Less Reliable Sampling Methods for Assessing the Number of Varroa Mites in Bee Colonies

Less Reliable Sampling Methods	
Method	**Concern**
Assessing Mites in Drone Brood	▪ Drone brood is not always present in a hive. ▪ Difficult to interpret results as a percent of brood infested.
CO_2 Sampling	▪ Use of CO_2 may be less accurate during honey flow. ▪ Must check accuracy by comparing with alcohol/soap wash or powdered sugar shake method.
Ether Roll	▪ Likely to dramatically under-detect mites on sampled adult bees. ▪ Material is highly flammable and can be dangerous to inhale.
Sticky (debris) Board	▪ **Useful to check mite population trends or as quick check to confirm treatment effectiveness.** ▪ Ants or other scavengers might remove mite bodies and interfere with estimates. ▪ Difficult to interpret number of mites as an estimate of mite population, since it is a whole-colony measure and not a per-bee measure.
Visual Inspection of Mites on Adults	▪ Unless mites are on thorax or top of abdomen of adult bees, mites are difficult to see on bees. ▪ Finding mites on adult bees usually indicates that a mite population well over treatment threshold already exists. ▪ Least reliable method.

SELECTING CONTROL METHODS

There is no "one- size-fits- all" solution to varroa management. Colonies should be monitored throughout the active season (see Figure 1). If mites exceed threshold, then a treatment should be administered.

It is important to alternate methods and not simply rely on one method of control. Relying on a single tool (for example, one active ingredient or family of active ingredients) for treatment may hasten development of miticide-resistant varroa populations and limit the number of options you will have to effectively control mites in the future.

Mite levels should be managed even in newly established colonies (nucs, package bees, swarms).

If sampling results indicate high mite levels in one colony within an apiary, do not delay treatment. Delay increases the risk of harm to the colony and the spread of varroa to other colonies.

Note:

- Beekeepers should ensure that all control products are legal (*i.e.*, registered) for use to control varroa. Read the entire product label and follow all label directions for use, storage, advisory statements, and precautions. Besides being potentially dangerous and ineffective, using any registered product in a manner inconsistent with its labelling is a violation of federal laws (it is illegal).
- Using any product past its expiration date is not recommended.
- Legal restrictions can change among provinces and states. Contact your state or province pesticide enforcement agency for more details.
- Additional guidance on legal restrictions and registered products can be found on the Environmental Protection Agency (EPA) website (United States) and Pest Management Regulatory Agency (PMRA) website (Canada) (see Additional Resources).
- The efficacy of various treatments identified in the tables and product descriptions below are based on published studies, current label instructions, and the collective professional judgment of the principal drafting committee.

Science is ever evolving and information presented in this Guide, including the tables below, is based on the best available science at the date of publication. It should not be construed as an endorsement or recommendation of any product or treatment.

Summary of Controls Discussed in this Guide

CHEMICAL CONTROLS		
Synthetic Chemicals	**Active Ingredient**	**Page**
Apivar® and Apivar® 2.0	Amitraz	See page 20
Amiflex® (Amitraz)	Amitraz	See page 21
Apistan®	Tau-fluvalinate	See page 22
CheckMite+®	Coumaphos	See page 23
Biopesticides	**Active Ingredient**	Note
Essential Oils		
Apiguard® (U.S.)	Thymol	See page 24
Thymovar® (CAN)	Thymol	See page 25
ApiLife Var®	Thymol	See page 26
Organic Acids		
Formic Pro®	Formic acid	See page 27
Formic Acid 65% (CAN)	Formic acid	See page 28
EZ-OX Tablets	Oxalic acid dihydrate	See page 29
Api-Bioxal Powder	Oxalic acid dihydrate	See page 30
Api-Bioxal RTU (U.S.)	Oxalic acid	See page 31
VarroxSan®	Oxalic acid dihydrate	See page 32
HopGuard®3	Potassium salt of hops beta acids	See page 33
MBG2X5G® (U.S.)	L-glutamic acid	See page 34
OrganiShield®	Sucrose octanoate esters	See page 35
Genetic Technologies (RNAi)		
Norroa™ (U.S.)	Vadescana	See page 36

NON-CHEMICAL (CULTURAL) CONTROLS	
Screened Bottom Board	See page 37
Colony Biosecurity (sanitation/comb management)	See page 38
Drone Brood Removal	See page 39
Induced Brood Break (brood interruption)	See page 40
Requeening with Varroa-Resistant Stock	See page 41
Robber Screens	See page 42

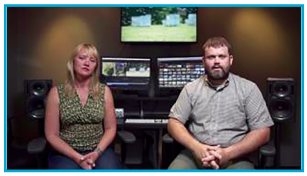
See details on each of these controls in the "Descriptions of Controls" section below.

Notes:

- **The repeated use of the same synthetic chemicals may lead to mites developing resistance to the chemical. It is important to monitor and consider using alternative registered products.**
- **In addition to being illegal under federal, state, provincial, and territorial laws, the off-label use of synthetic chemicals may lead to mites developing resistance to the chemical.**
- EPA and PMRA define a biopesticide as a pesticide that: 1) is a naturally-occurring substance or structurally-similar and functionally identical to a naturally-occurring substance; and 2) has a history of exposure to humans and the environment demonstrating minimal toxicity, or in the case of a synthetically-derived biochemical pesticides, is equivalent to a naturally-occurring substance that has such a history.

Varroa Videos

Watch our series of videos that demonstrate step-by-step application of all controls covered in this guide.



Will Varroa kill my bees?

IPM

Sampling methods

Essential oils

Apivar®

Apistan® or Checkmite+ ®

Formic acid

HopGuard®

Oxalic Acid

Sanitation, screen bottoms

Drone brood removal

Requeening

Try out the **Honey Bee Health Coalition's Varroa Management Tool**. This online decision tree tool helps beekeepers make informed varroa management and treatment decisions.

The tool will walk through a series of questions that will determine how best to manage varroa mites in an infected hive. *https://honeybeehealthcoalition.org/varroatool/*

Commonly Recommended Control Options by Seasonal Phase

Different control options are appropriate for each of the four population phases of the honey bee/varroa seasonal cycle. Table 3 summarizes options for each phase. For more information, please refer to product-specific or method-specific tables (pages 20-42).

Table 3: Control Options by Seasonal Phase

Dormant Phase	
Bees are clustered; little or no brood in northern locations and reduced brood rearing in southern locations; bee and mite populations are in decline because little or no reproduction is occurring within the colony. **Considerations:** ▪ Efficacy of a product may vary significantly in colonies that have no brood vs. low brood. ▪ Most products have temperature constraints and may not be suitable at all times of year. If there is a tight winter cluster in cold temperatures, some methods may be less effective, affect the ability of the colony to cluster, or damage the bees.	**Best options:** ▪ Api-Bioxal® or EZ-OX Oxalic acid dribble (OAD) or vaporization/sublimation (OAV) ▪ VarroxSan® ▪ HopGuard®3 ▪ Apiguard®, Thymovar® (CAN), or ApiLife Var® (check temperature requirements) ▪ Formic Pro©, 65% liquid formic acid (CAN) (check temperature requirements) **Not best for this period:** Any hive management practices that risk colony success through this phase (*e.g.*, queen caging, excessive manipulation of the hive to apply a treatment)
Population Increase	
Seasonal colony buildup; colony brood and adult worker population increasing; varroa population usually low but increasing; pre-honey flow supering of colonies. **Considerations:** ▪ Some products cannot be used for a period of time leading up to the addition of supers and/or while honey supers are in place. ▪ Consider the forecasted temperature.	**Best options:** ▪ Apivar®, Apivar® 2.0, or Amiflex® - only if no honey supers are present ▪ Apiguard®, Thymovar® (CAN), or ApiLife Var® (only if no honey supers are present) ▪ Formic Pro®, 65% liquid formic acid (CAN) ▪ VarroxSan® ▪ HopGuard®3 (US) ▪ Norroa™ **Management practices that can reduce mite growth:** ▪ Making divides/splits ▪ Requeening using mite-resistant stock ▪ Drone brood removal (2-3 times on strong colonies) ▪ Queen confinement/brood break

Population Peak

Bee population (both adult & brood) at peak; mite populations increasing, nearing peak; often honey supers on colonies.

Considerations:

- Some products cannot be used for a period of time leading up to the addition of supers and/or while honey supers are in place.Consider the forecasted temperature.

Best options:

- Formic Pro®, 65% liquid formic acid (CAN)
- VarroxSan® if separated from honey supers by one chamber
- Apivar®, Apivar® 2.0, or Amiflex® (only if no honey supers are present)
- Apiguard®, Thymovar® (CAN), or ApiLife Var® (only if no honey supers are present)

Management practices that can reduce mite growth:

- Requeening with mite-resistant stock
- Making divides/splits
- Drone brood removal (if colonies produce enough drone brood)

Not best for this period:

- HopGuard®3
- Api-Bioxal® or EZ-OX Oxalic acid drip (OAD) or vaporization/sublimation (OAV).
- Apistan® or CheckMite+®

Population Decrease

Post-honey harvest; bee population decreasing; colonies rearing overwintering bees. Varroa populations growing, peaking, and then declining until eventually only phoretic/dispersal mites on adult bees after colonies have little or no brood.

Considerations:

- Treating early in the Population Decrease phase is important. Late control when mite numbers are high may be insufficient to protect colonies from the consequences (*e.g.*, viruses, bee weakness, mortality) of high mite infestations.
- Consider the forecasted temperature.

Best options:

- Formic Pro®, 65% liquid formic acid (CAN)
- Apivar®, Apivar® 2.0, or Amiflex® (only if no honey supers are present)
- Apiguard®, Thymovar® (CAN), or ApiLife Var® (only if no honey supers are present)
- VarroxSan®
- HopGuard®3
- Api-Bioxal® or EZ-OX oxalic acid dribble (OAD) or vaporization/sublimation (OAV)

Management practices that can reduce mite growth:

- Requeening with mite-resistant stock

Not best for this period:

- Apistan® or CheckMite+®

NON-RELIABLE, NON-TESTED METHODS AND UNREGISTERED (ILLEGAL) CHEMICALS

Several treatments are ineffective, **lack independent verification, are currently inaccessible, or are unregistered** for varroa control, including:

- Mineral oils
- Unregistered acids (such as lactic or acetic acid)
- Food stimulants and supplements
- Powdered sugar
- Small cell, "natural" comb for the rearing of smaller bees
- Heat/cold treatments
- Unregistered essential oils

Beekeepers should never use an unregistered chemical nor use a registered chemical in a manner inconsistent with label directions to control mites. Such use may violate federal, state, provincial, and territorial laws and may result in consequences to the colony, beekeeper, and/or their employees.

Treatments not described in this guide should be avoided unless they are adequately evaluated and registered for varroa control.

DESCRIPTIONS OF VARROA CONTROL OPTIONS

READ THIS FIRST!

This information does not replace label information. Make sure to read the label on each product before use.

For answers to questions, contact your state, province, territory, Tribal, or university extension apiculturist.

On the following pages you will find tables that provide detailed information on varroa controls. Next to each product name is the name of the technical registrant (*i.e.* the company which owns the label).

Flag icons indicate U.S. and/or Canadian registration.

Symbols (gloves, eyewear protection (goggles) and respirator) shown to the left are included with varroa controls to help guide in choosing personal protective equipment.

Personal Protective Equipment

- **Check Label:** Always check the label before use of chemicals and direct employees to do likewise. Make certain you and anyone applying those chemicals understand and follow the instructions on the label. Follow the label if specific protective clothing or equipment is required.
- **Clothing:** Use shirts with long sleeves, pants and sturdy footwear when using chemicals.
- **Gloves:** Use chemical-resistant gloves when handling miticide products.
- **Eye protection:** As a general rule, eye protection should be used when working with any chemical. Do not rub eyes or nose after using any chemicals until after thorough washing of hands. Use of a face shield or goggles is required when mixing oxalic acid into sugar water and for all application methods of oxalic acid.
- **Respirator:** Please note that there are many styles and models of respirators on the market. Some labels require specific respirators.

For additional and simplified protection, use a full-face respirator with appropriate cartridge type.

Managing Resistance

Varroa develop rapidly through their life cycle. When repeatedly exposed to the same active ingredient, mite populations are likely to develop resistance to the active ingredient. Increasing dosage or use of more frequent applications may hasten the development of resistance and reduce the number of options available to effectively control mites. Rotating active ingredients *(i.e.*, practicing IPM) during the year will help slow development of mite resistance.

Initial indications of mite resistance may be a "treatment failure" and/or need for more treatments. A treatment failure could be due to improper application or dosage, use of outdated (expired) product, improper storage of miticides, or other factors. For the synthetic miticides (*i.e.*, Apistan®, Apivar®, and Amiflex®) your state, provincial, territorial, Tribal, or university extension apiculturists may help identify if a treatment failure or less effective mite kill could be due to increased mite resistance against the applied active ingredient.

Note on Efficacy: *HBHC has not independently verified effectiveness claims made by the registrant, manufacturer, or brand.

Chemical Controls

SYNTHETIC CHEMICALS

Apivar® & Apivar 2.0® (Véto-Pharma)	
Active Ingredient	Amitraz
Label Information	For updated label information, please visit *https://honeybeehealthcoalition.org/varroaguidetables/*
Formulation	Formulated as slow-release blended and extruded polymer strip
Route of Exposure	Contact
Application	Place 1 Apivar® strip per 5 frames of bees. Place strips near the bee cluster or – in case brood is present – in the center of the brood nest. 42 to 56 days, then remove strips. Keep a minimum distance of 2 frames between strips. Treat all hives in apiary at same time. Do not treat more than 2x/year. Apivar 2.0®: treatment duration is 6-10 weeks. 10-week option is recommended when brood is still present in the colony. 6-week duration is recommended for broodless treatment. Do not treat more than 2x/year.
Time of Year	**Population Increase:** Only if colonies will NOT be supered within 8 weeks; **Population Decrease:** Immediately following peak population once honey harvested.
Brand-reported Effectiveness*	Up to 95% effective. Please note that this reported efficacy depends on mite resistance and on the extent of prior use. See label for mite resistance management.
Conditions for Use	**Capped Brood:** Product is designed to kill successive generations of varroa mites. **Colony Size:** No conditions noted. **Temperature:** No conditions noted. **Honey Supers:** Can not be used when colonies are supered for honey. Apivar®: must be removed 2 weeks before colonies are supered. Apivar 2.0®: okay to super immediately after removing strips.
Advantages	Effective unless there is mite resistance or the cluster moves away from contact with strips.
Disadvantages	Contamination of beeswax and pollen in brood nest; evidence of mite resistance to amitraz; Apivar® is a long-term treatment that does not provide immediate mite knockdown.
Consideration	The only legally permissible (*i.e.*, registered for use in bee colonies) amitraz products are Apivar®, Apivar 2.0® and Amiflex®; do not reuse strips; store unopened packages at room temperature; use opened packages immediately; perform resistance test (if possible before use) and monitor mite levels following use to confirm control effectiveness; see Resources for information on resistance testing. Chemical is controlled release so mite knock down may not occur immediately.

Amiflex® (Véto-Pharma)

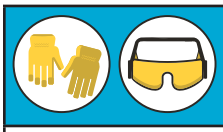
Active Ingredient	Amitraz
Label Information	For updated label information, please visit https://honeybeehealthcoalition.org/varroaguidetables/
Formulation	A premixed gel applied with a dosing gun to a wooden strip.
Route of Exposure	Contact
Application	Two 3-milliliters doses per brood box. Place wooden strips in the center of the brood area or in the center of the bee cluster, leaving a minimum of one frame free of gel between two frames with gel. Scrape frames clear of wax before application. Can apply 7 days before a long action treatment to obtain a knockdown effect. Do not use more than four times per year. **Low infestation:** Apply once. Remove any remaining product at 7 days. **High infestation:** Day 1: Apply the first treatment. Day 7: remove any remaining product Day 14: apply the second treatment. Day 21: remove any remaining product from the second treatment.
Time of Year	**Population increase:** Must remove product before adding supers. **Population decrease:** Apply following peak population once honey supers are removed.
Brand-Reported Effectiveness*	**Colonies with brood:** A single treatment removes 56% of varroa on average. Two treatments removes an average of 81 to 83%. **Colonies without brood:** A single treatment removes 98 to 100% of varroa.
Conditions for Use	**Capped brood:** May be effective if multiple treatments are used. **Colony size:** Do not use on sparsely populated or inactive colonies. **Temperature:** No temperature restriction, but avoid treatment during times of the year when bees are not actively foraging (*e.g.*, winter). **Honey supers:** Do not use when honey supers are present. Remove any remaining product before adding supers. Do not apply Amiflex® more than two times in a row before a honey flow. Rotate with other products including different active ingredients.
Advantages	Effective unless there is mite resistance.
Disadvantages	Contamination (breakdown products/metabolite byproducts) of beeswax and pollen in brood nest; evidence of mites resistant to Amitraz; some beekeepers report bees absconding.
Considerations	Amiflex® was formerly registered as a **Restricted Use Pesticide**; check product label to ensure that product is updated formulation without Restricted Use Pesticide designation.

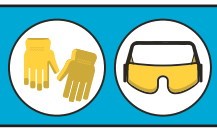
Apistan® (Vita Bee Health)

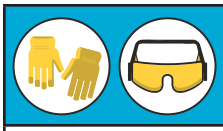
Active Ingredient	*Tau*-fluvalinate
Label Information	For updated label information, please visit https://honeybeehealthcoalition.org/varroaguidetables/
Formulation	Formulated as slow-release impregnated flexible polymer strip.
Route of Exposure	Contact
Application	Use 1 strip for each 5 combs of bees or less. Hang strips on brood combs. Treat all hives in apiary at the same time. **Treatment duration:** 42 to 56 days.
Time of Year	**Population Increase:** Before honey flow if 7 weeks or more until supering. **Population Decrease:** Following honey harvest.
Brand-reported Effectiveness*	95 to 99% but ONLY if no mite resistance; however, resistance has been widely documented.
Conditions for Use	**Capped Brood:** Product is designed to kill successive generations of varroa mites. **Colony Size:** No conditions noted. **Temperatures:** > 50°F (10°C); do not use during nectar flow. **Honey Supers:** Do not use when colonies are supered for honey.
Advantages	Highly effective with susceptible mite populations (*Note: mite resistance to amitraz has been well documented*).
Disadvantages	Widespread mite resistance; contamination of hive components (*e.g.,* elevated fluvalinate residues in wax and comb pollen); continuous use may affect brood development; interaction with other pesticides can occur and jeopardize colony health.
Considerations	May adversely affect queen and drone reproductive health; wear chemically resistant gloves; perform resistance test before use and/or monitor mite levels following use to confirm control effectiveness. (See Bibliography & Resources for information on resistance testing.)

CheckMite+® (Elanco Healthcare)

Active Ingredient	Coumaphos
Label Information	For updated label information, please visit https://honeybeehealthcoalition.org/varroaguidetables/
Formulation	Formulated as slow-release impregnated rigid polymer strip.
Route of Exposure	Contact
Application	One strip for each five combs of bees in each brood chamber. **Treatment length:** 42 to 45 days.
Time of Year	**Population Increase:** Only if colonies will NOT be supered within 6 weeks. **Population Decrease:** After honey harvest.
Brand-reported Effectiveness*	85 to 99% if no mite resistance; however, mite resistance has been widely reported. Effective against small hive beetles (*Aethina tumida*), but application method is different than for mite control.
Conditions for Use	**Capped Brood:** Treatment is most effective when brood rearing is lowest. **Colony Size:** No conditions noted. **Temperature:** No conditions noted. **Honey Supers:** Do not use with honey supers, wait two weeks after use before supering.
Advantages	Effective when mite populations are susceptible (*Note: mite resistance to amitraz has been well documented*); can be used to control the small hive beetle (applied in different manner).
Disadvantages	Mite resistance; organophosphate pesticide; persists in beeswax and pollen in brood nest; greater additive effects when combined with other products; adversely affects reproductive health of queens & drones (sperm production).
Consideration	Perform resistance test and monitor mite levels following use to confirm control effectiveness. (See Resources for information on resistance testing.)

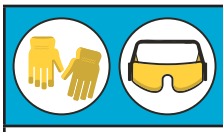
 Apiguard® (USA Vita BeeHealth) 	
Active Ingredient	Thymol
Label Information	For updated label information, please visit https://honeybeehealthcoalition.org/varroaguidetables/
Formulation	Individual hive dose or bulk tub
Route of Exposure	Contact and fumigant
Application	Twice at 2-week intervals, apply individual dosage tray or 50 gm per double box hive (remove or spread remaining gel over frame top bars at end of 4th week). At temperatures above 77°F, a lower dosage of 25-26 mL (approximately 0.88 oz/25g) of Apiguard gel can be used effectively. Repeat dose applications may be applied at intervals of 1-2 weeks, as needed for up to 4 applications of 25-26 mL (approximately 0.88 oz/25g) where mite infestations persist. Small and over-wintering bee colonies and nuclei see "Conditions for Use" below. Apiguard gel (depending on the colony or nucleus size) left in place until the product disappears from the tray.
Time of Year	**Population Increase:** Only if colonies will not be supered within 6 weeks. **Population Peak:** Only if bees are not storing honey for human consumption. **Population Decrease:** Post-honey harvest or approaching dormancy.
Brand-reported Effectiveness*	74 to 95% (more effective with warmer temperatures)
Conditions for Use	Ensure that there is a free space of at least ¼ inch between the top of the tray and the hive cover to ensure that bees have adequate access (*e.g.*, an empty super or shim on top of the brood box). **Capped Brood:** No conditions noted. **Colony Size:** Small and wintering bee colonies and nuclei require only one dose of 12-13 mL (approximately 0.44 oz/12.5g) to 25-26 mL (approximately 0.88 oz/25g); combine weak colonies before treatment. **Temperature:** Between 60°F and 105°F (15 to 40°C); do not apply when the colony activity is very low. **Honey Supers:** Do not use when colonies are supered for honey.
Advantages	Naturally derived; no known varroa resistance to thymol.
Disadvantages	May reduce queen egg-laying activity; may increase adult and young larvae mortality; works best under warmer temps; may cause bees to beard in hot weather; human skin irritant; taints honey taste if used improperly.
Consideration	Effectiveness reduced for light mite infestations; requires solid bottom board or closed screened bottom board; product occupies a ¼-inch space above brood nest; avoid opening treated colonies for 48 hours after dosing.

 THYMOVAR® (Andermatt-Canada) 	
Active Ingredient	Thymol
Label Information	For updated label information, please visit https://honeybeehealthcoalition.org/varroaguidetables/
Formulation	Impregnated strip
Route of Exposure	Contact and fumigant
Application	Twice at 3 to 4 week intervals, 1 strip for single brood chamber and 2 for double box hive, remove excess materials at end of 2nd application.
Time of Year	**Population Increase:** Only if colonies will not be supered within 6 weeks. **Population Peak:** Only if bees are not storing honey. **Population Decrease:** Post-honey harvest or approaching dormancy, within temperature considerations
Brand-reported Effectiveness*	74 to 95% (more effective with warmer temperatures)
Conditions for Use	**Capped Brood:** No conditions noted. **Temperature:** Between 60°F and 85°F (15 to 30°C) **Honey Supers:** Do not use when colonies are supered for honey.
Advantages	Naturally derived; no known varroa resistance to thymol.
Disadvantages	May reduce queen egg-laying activity; may increase adult and young larvae mortality; works best under warmer temps; may cause bees to beard in hot weather; human skin irritant; taints honey taste if used improperly.
Consideration	Effectiveness reduced for light mite infestations; requires closed screened bottom board; requires a ¼-inch space above brood nest; cannot enter treated areas for 48 hours after dosing.



ApiLife Var® (Chemicals Laif S.P.A.)

Active Ingredient	Thymol, Eucalyptus oil, Menthol
Label Information	For updated label information, please visit https://honeybeehealthcoalition.org/varroaguidetables/
Formulation	Tablet (wafer)
Route of Exposure	Fumigant
Application	3 tablets for 7-10 days each (leave 3rd tablet in hive for 12 days). Divide tablet (wafer) into 4 pieces and place each piece in a corner of the hive on the top bars. Repeat or combine with another product, if heavy mite numbers. Do not treat more than 2x/year. Apply during the coolest time of the day either in the early morning or evening.
Time of Year	**Population Increase:** Less effective. **Population Peak:** If honey supers are not present. **Population Decrease:** After nectar flow, with temperature considerations.
Brand-reported Effectiveness*	70 to 90%
Conditions for Use	**Sealed Brood:** Most effective when little to no sealed brood is present. **Colony Size:** For best results, the colony should be as compact as possible during treatment; combine weak colonies before treatment. **Temperature:** 64-95°F (18-35°C); lower efficacy if average daily temperatures are below 54°F (12°C) degrees. **Honey Supers:** Do not use when colonies are supered for honey; remove treatment at least 1 month before harvesting honey.
Advantages	Naturally derived, no known resistance to essential oils mix.
Disadvantages	High temperatures may cause bees to exit hives and/or adult/brood death; taints honey taste if used improperly; may melt some plastic hive parts.
Consideration	Requires solid bottom board or closed screened bottom board; reduce entrances and any other openings that exist.

 Formic Pro® (NOD Apiary Products) 	
Active Ingredient	Formic acid
Label Information	For updated label information, please visit https://honeybeehealthcoalition.org/varroaguidetables/
Formulation	Saccharide gel strip in a laminated paper wrap; 42.25% formic acid.
Route of Exposure	Fumigant
Application	**Option 1:** 2 strips for 14 days. **Option 2:** 1st strip for 10 days, then remove and replace with 2nd strip for an additional 10 days. Suitable for a single or double brood-chamber of standard Langstroth equipment. There should be a strip touching each top bar containing brood.
Time of Year	**Population Increase/Population Peak:** Can be used with honey supers present. **Population Decrease:** Following harvest if not too warm and when bees are still flying regularly.
Brand-reported Effectiveness*	83 to 97%
Conditions for Use	**Capped Brood:** Effective when capped brood is present. **Colony Size:** Colony cluster should cover a minimum of 6 frames. **Temperature:** Use when outside day temperature 50-85°F (10-29.5°C). **Honey Supers:** Can use with honey supers. **Feeding:** Colonies should not be fed during treatment.
Advantages	Application Option 1 enables killing mites under cappings; formic acid is naturally found in hives; not required to immediately remove strips following treatment; OMRI listed for use in organic agriculture.
Disadvantages	Potential for bee brood mortality and queen loss; recommended to not disturb colony during treatment period (except for addition of second single strip); check if colony is queenright after treatment is finished.
Consideration	Requires solid bottom board or closed screened bottom board, bottom hive entrance open; do not remove paper packaging; may see bee bearding in first couple of days following treatment.

Formic Acid 65% (Vita Bee Health)

Active Ingredient	Formic acid 65%
Label Information	For updated label information, please visit https://honeybeehealthcoalition.org/varroaguidetables/
Formulation	Liquid 65% formic acid In Canada, 65% formic acid liquid is permitted to be applied in soaked absorbing (dri loc) pads or MiteGone pads.
Route of Exposure	Fumigant
Application	**Option 1:** Using absorbing (dri loc) pad, 21 to 30 day application; 30-40 mL per 2 story hive; up to 6 applications: one every 10 days. **Option 2:** Using MiteGone® pad; 20 day application (1x every 10 days); 120-125 g formic acid 65% per pad, 2x per year.
Time of Year	**Population Increase:** Application must be removed 2 weeks prior to adding supers for honey collection. **Population Decrease:** Post-honey harvest.
Brand-reported Effectiveness*	60 to 93% effective within **temperature range** of 50 to 86°F (10 to 30°C).
Conditions for Use	**Sealed Brood:** Effective when sealed brood is present. **Colony Size:** Minimum 5 frames of bees. **Temperature:** Use when outside temperatures are between 50 to 86 °F (10°C to 30°C) and leave hive entrances fully open. Temperatures above or below the recommended range can lead to colony damage and impacts efficacy. **Honey Supers:** Do not use when colonies are supered for honey.
Advantages	Can kill mites underneath cappings; formic acid is naturally found in hives; no known mite resistance to formic acid; the Organic Materials Review Institute (OMRI) listed for use in organic agriculture.
Disadvantages	Potential for bee brood mortality and queen loss if applied under higher temperature; check if colonies are queenright after treatment is finished.
Consideration	Formic acid liquid and fumes can be dangerous to applicators.

EZ-OX (Mike's Bees, LLC)

Active Ingredient	Oxalic acid dihydrate
Label Information	For updated label information, please visit https://honeybeehealthcoalition.org/varroaguidetables/
Formulation	**Option 1:** Sugar syrup drip with syringe or drenching applicator. **Option 2:** Vaporization (fumigation or sublimation). **Option 3:** Spray application for caged (package) bees. Product comes in powder or 1-gram tablets (tablets for vaporization only).
Route of Exposure	Contact
Application	**Sugar solution method (dribble):** Mix 35 grams (approximately 2.3 tablespoons) into 1 liter of 1:1 sugar syrup. With syringe, trickle 5 mL of this solution directly onto the bees in each occupied bee space between frames in each brood box; maximum dose is 50 mL per colony. **Vaporizer method:** 4 grams per brood box. Follow vaporizer directions. **Spray application:** Approved for caged (package) bee use. Spray untreated sugar syrup to engorge bees before applying. Prepare the solution as above Apply 0.1 fl oz (3.0 mL) of 2.8% EZ-OX solution per 1,000 bees using a pump sprayer or battery powered sprayer.
Time of Year	**Dormant Phase:** Best used during Dormant Phase when sealed brood is not present. Early **Population Increase** and late **Population Decrease** when brood rearing is reduced. May be used when honey supers are on colony.
Brand-reported Effectiveness*	82 to 99% when brood not present.
Conditions for Use	**Capped Brood:** Less effective in colonies with capped brood. **Colony Size:** No restrictions. **Temperature:** None, but risks when opening hive below 40°F/4°C. May not be as effective if tight cluster is present. **Honey Supers:** Can be used with honey supers.
Advantages	Kills/damages varroa on adult bees; can be used in alternate types of hives; OMRI listed for use in organic agriculture.
Disadvantages	Corrosive; vaporizer application is extremely dangerous to applicator health - follow label precautionary directions for handling; when applying, need to use proper protective equipment (respirator, goggles, long pants, long sleeves); orientation upwind is recommended; vapors quickly recrystallize.

Api-Bioxal® Powder (Chemicals Laif S.P.A)

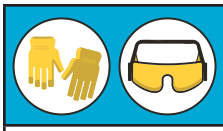
Active Ingredient	Oxalic acid dihydrate
Label Information	For updated label information, please visit https://honeybeehealthcoalition.org/varroaguidetables/
Formulation	White crystalline powder
Route of Exposure	Contact
Application	**Sugar solution method (dribble):** Mix 35 grams (approximately 2.3 tablespoons) into 1 liter of 1:1 sugar syrup. With syringe, trickle 5 mL of this solution directly onto the bees in each occupied bee space between frames in each brood box; maximum dose is 50 mL per colony. **Vaporizer method:** 4 grams per brood box. Follow vaporizer directions. **Spray application:** Approved for caged (package) bee use. Spray untreated sugar syrup to engorge bees before applying. Prepare the solution as above Apply 0.1 fl oz (3.0 mL) of 2.8% Api-Bioxal® solution per 1,000 bees using a pump sprayer or battery powered sprayer.
Time of Year	**Dormant Phase:** Best used during Dormant Phase when sealed brood is not present. Early **Population Increase** and late **Population Decrease** when brood rearing is reduced. May be used when honey supers are on colony.
Brand-reported Effectiveness*	82 to 99% when brood not present.
Conditions for Use	**Capped Brood:** Less effective in colonies with capped brood. **Colony Size:** No restrictions. **Temperature:** None, but risks when opening hive below 40°F/4°C. May not be as effective if tight cluster is present. **Honey Supers:** Can be used with honey supers.
Advantages	Kills/damages varroa on adult bees; can be used in alternate types of hives; OMRI listed for use in organic agriculture.
Disadvantages	Corrosive; vaporizer application is extremely dangerous to applicator health - follow label precautionary directions for handling; when applying, need to use proper protective equipment (respirator, goggles, long pants, long sleeves); orientation upwind is recommended; vapors quickly recrystallize.

Api-Bioxal RTU® (Chemicals Laif S.P.A.)

Active Ingredient	Oxalic acid
Label Information	For updated label information, please visit https://honeybeehealthcoalition.org/varroaguidetables/
Formulation	Ready-To-Use (RTU) liquid formulation
Route of Exposure	Contact
Application	Smoke bees down from the top bars. With a syringe or an applicator, trickle 5 mL (1 teaspoon) of premixed solution directly onto the bees in each seam (space between frames) occupied with bees, in each brood box. Dose is 5mL (1 teaspoon) per seam occupied with bees, no matter colony size. Treatment can be repeated up to 4 times, 7 to 10 days apart when sealed brood is present.
Time of Year	**Dormant Phase:** Most effective when colony has minimal capped brood. **Population increase; Population peak; Population decrease:** Less effective when capped brood present.
Brand-reported Effectiveness*	Effectiveness ranges from 70 to 99% depending on the number of repetitions or presence/absence of brood.
Conditions for Use	**Capped brood:** Best used when capped brood is absent or minimal. Does not penetrate cappings and could harm open brood. Can be repeatedly applied when capped brood present. **Colony size:** Colonies of any size can be treated. Very weak colonies may have detectable bee mortality. **Temperature:** No temperature restrictions. **Honey supers:** Can be used with honey supers on the hive. **Wintering colonies:** Cannot use in enclosed overwintering areas.
Advantages	Premixed formulation saves time and prevents math and mixing errors; contains no sugar, so bees are not tempted to consume treatment; safe to use at any ambient temperature, any colony size, and whether or not supers are in place; no maximum per-hive dose (calculate dose based on occupied seams); stored solution does not develop toxic hydroxymethylfurfurol (HMF).
Disadvantages	Each box must be exposed to treat space between each frame.
Considerations	Api-Bioxal RTU® is formulated with a higher dose of oxalic acid than allowed in homemade dribble solutions made with other registered oxalic acid miticides.

VarroxSan® (Vita Bee Health Limited)

Active Ingredient	Oxalic acid dihydrate
Label Information	For updated label information, please visit https://honeybeehealthcoalition.org/varroaguidetables/
Formulation	Slow-release fiberboard strips
Route of Exposure	Contact
Application	Use up to 4 strips per brood chamber per application (1 strip per 2.5 frames of bees). Leave strips in for a 42 to 56 day treatment period. Fold each strip in half and hang over 1 frame in the brood area or bee cluster, slightly away from the comb surface. Maintain a distance (space) of 2 frames between strips (*i.e.,* place on frames in positions 2, 4, 6, 8). Reposition any strip not in contact with the bees to be closer to the cluster. Leave the strips inside the hive for 42 to 56 days, then remove.
Time of Year	Effective during early **Population Increase, Population Peak,** and **Population Decrease**.
Brand-reported Effectiveness*	92 to 98%, with an average of 96%.
Conditions for Use	**Capped Brood:** Long-acting treatment to kill several successive generations of varroa mites. **Colony size:** No conditions noted. **Temperature:** No restrictions. **Honey supers:** Approved for use when honey supers are in place.
Advantages	Can suppress mite population growth while honey supers are in place.
Disadvantages	Strips can be challenging to insert into the hive without disrupting the bees on the comb and hang properly between frames; difficult to remove from hive; expect brood removal behind strips.
Considerations	May be more effective when the external temperature is 60°F (15°C) or above and the colony is active; ensure that the strips are in the cluster of bees; can be used in combination with a knockdown treatment to provide additional control of mite populations.



HopGuard®3 (BetaTec)

Active Ingredient	Potassium salt of hops beta acids
Label Information	For updated label information, please visit https://honeybeehealthcoalition.org/varroaguidetables/
Formulation	Folded cardboard strips
Route of Exposure	Contact
Application	Apply one strip per five frames covered with bees, spaced evenly in the cluster and at least two frames between each strip; maximum of 2 strips per brood chamber per application. 2-week treatment; to increase efficacy apply consecutive treatments according to the label; max use 4 times per year. Do not leave in colony for more than 30 days.
Time of Year	**Population Peak:** Less effective when capped brood is present. **Population Decrease:** Most effective when brood is reduced. **Dormant Phase:** Suggested to use when brood not present or brood reduced.
Brand-reported Effectiveness*	75 to 95%
Conditions for Use	**Capped Brood:** More effective with little to no brood **Colony Size:** No restrictions. **Temperature:** Above 55°F (13°C) and under 100°F (38°C.) **Honey Supers:** Can use with honey supers; honey or wax may only be harvested from honey supers, not the treated brood chambers.
Advantages	No known resistance of mites to HopGuard®3; water-based compound doesn't dissolve in wax, so little beeswax residue risk; quick knockdown of mites on adult bees; can be used in alternate types of hives.
Disadvantages	Strips are sticky and may be messy to use; expect mortality of bees and brood that touch the strip.
Consideration	Easier to apply with two people (1 to handle treatment, 1 to handle hive); use disposable gloves; strips must be wet to be effective; may stain clothing; opened packages can be stored up to two months with proper storage.

MBG2X5G® (Mite Bee Gone, LLC)	
Active Ingredient	L-Glutamic Acid
Label Information	For updated label information, please visit https://honeybeehealthcoalition.org/varroaguidetables/
Formulation	Impregnated strip
Route of Exposure	Contact
Application	**Treatment application:** Identify and count brood frames, then suspend strips between top bars of frames using a medium binder clip, one strip for every three to four frames of brood. Increase spacing between frames if possible to increase worker contact with strips. Monitor and replace when chewed below 25% of original size and reinsert new strip, typically after 42 days. **Prophylactic application:** Can insert one strip per brood box.
Time of Year	**All phases.** Recommended in **Dormant phase** into **early Population Increase phase,** with periodic reapplication throughout year.
Brand-reported Effectiveness*	Unavailable
Conditions for Use	There are **no restrictions** on use with regard to colony phase, whether or not honey supers are in use, colony size, or temperature. The product has been developed for **frequent or continuous applications throughout the year.**
Advantages	Open-ended, continuous application method provides flexibility to stay ahead of mite population growth, with no known biological stress to adult or larval honey bees.
Disadvantages	Since strips must achieve contact with mites, strip placement and bee activity around the strip can affect effectiveness.
Considerations	The benign nature of the active ingredient formulation allows for year-round use and no frequency limitation, however, as with all miticides, recommend rotating and non-continuous use of products; since strips must contact bees to work, best performance is achieved when hive box contains one fewer frames than would fit to make extra space (*e.g.*, 9 frames in a 10-frame box). The registrant of this newly developed and registered product (in 2025) is pursuing further testing and a route to market.

OrganiShield® (Applied Power Concepts, Inc.)

Active Ingredient	Sucrose octanoate esters
Label Information	For updated label information, please visit https://honeybeehealthcoalition.org/varroaguidetables/
Formulation	Formulated as a liquid
Route of Exposure	Contact
Application	Apply 1.3 fl. oz. (38 mL) to each full depth frame of bees or 3 fl. oz. per frame space to the upper frame spaces (typical 18 frame two-story colony will receive 20 – 30 fl. oz. (591 – 900 mL). Repeat applications at intervals of 7 – 10 days, up to three times per infestation. Apply using garden type pressure sprayer, backpack sprayer, or powered commercial sprayer.
Time of Year	**Population Increase:** Provided that bees are not in winter cluster or at temperatures below 55°F (13°C) **Population Peak:** Apply at temperatures at or above 55°F (13°C) **Population Decrease:** Apply at temperatures at or above 55°F (13°C)
Brand-reported Effectiveness*	None reported; product must come into contact with varroa mites to be effective.
Conditions for Use	**Capped Brood:** Product is designed to kill varroa mites emerging from brood cells. **Colony Size:** No restrictions. **Temperature:** Do not apply at temperatures below 55°F (13°C) **Honey Supers:** No restrictions.
Advantages	Effective provided that compound comes in direct contact with mite; alternative to synthetic miticides; OMRI listed for use in organic crop production.
Disadvantages	Entire frame of bees must be sprayed; product must come into contact with mite to be effective; limited residual activity.
Considerations	Causes substantial but temporary eye injury; thorough spray coverage of adult bees on frame is essential for control of mites; remove frames with adhering bees and spray both sides or leave frames in place and apply product to the frame spaces.

GENETIC TECHNOLOGIES (RNAI)

Norroa™ (GreenLight Biosciences)

Active Ingredient	Vadescana
Label Information	For updated label information, please visit *https://honeybeehealthcoalition.org/varroaguidetables/*
Formulation	Liquid pouch
Route of Exposure	Contact (mites absorb biopesticide in brood food, disrupting mite reproduction)
Application	**Option 1:** 2 pouches per brood box, remove when emptied. **Option 2:** 1 pouch per brood box, second pouch applied after 1st pouch is emptied. **Both options:** Apply pouch(es) inside brood box. Remove protective sticker and place pouch directly in hive allowing bees to feed from the pouch. Can be used twice per calendar year. Do not apply more than 2 pouches per brood chamber per treatment or 4 pouches per brood chamber per year.
Time of Year	**Population Increase:** Should be used when open brood present, mite populations are low and food resources are available for the colony. **Population Decrease:** Can be used prior to fall mite buildup.
Brand-reported Effectiveness*	Prevents foundress mite reproduction. Maintains or reduces mite levels for up to 18 weeks if applied when open brood is present and mite levels are below 3%.
Conditions for Use	**Capped brood:** Only effective when open brood present. **Colony size:** More effective on smaller colonies, <10 frames of bees. **Temperature:** No temperature restrictions. **Honey supers:** Avoid applying when supers are on, since product must be stored in brood chamber.
Advantages	Ready to use; new chemistry that can be rotated with other active ingredients; can be used on small colonies; up to 18 weeks of mite infestation reduction; no negative effects on queens or colonies.
Disadvantages	Effectiveness of product relies on bees storing product in brood cells where mites become exposed; must not be used during heavy nectar flows because product becomes diluted, or during nectar dearth (low nectar flows) because product is consumed by adult bees; not a fast knockdown mite treatment.
Considerations	Use when mite levels are low but approaching injury thresholds; if mite levels are above recommended treatment threshold, can be used in combination with a knockdown treatment to provide extended control of mite populations.

Non-Chemical/Cultural Controls

Screen Bottom Board	
Name	Screened Bottom Board
Technique	Replace solid bottom board with #8-mesh (1/8") screen surface. Falling mites drop out of colony through screen.
Route of Exposure	N/A
Treatment Time/ Use Frequency	Continuous, year-round
Time of Year	Year-round, unless in cold climate regions, it should be removed or closed.
Effectiveness	Minimal; up to 5 to 10% reduction in mite levels
Conditions for Use	Replace bottom board; recommended to leave space under the screen for mites and debris to fall ('trash' or 'garbage pit').
Restrictions	None.
Advantages	Low-tech; may be used with hive debris sticky board; can be used with sticky board as monitoring method for varroa infestation.
Disadvantages	Minimal to little control; may need to close hive bottom when fumigant control chemicals are used; may inhibit brood rearing in lower frames in spring with cool temperatures; may attract scavengers beneath hive.
Considerations	Minimally to not effective; must be used with other controls; not reliable as single control technique; works best with good hive location (sunny site, good air drainage and hive ventilation with winter protection in northern locations).
Video	Watch our Screened Bottom Board video: *http://bit.ly/controls-bottomboard*

Colony Biosecurity	
Name	Sanitation (bee biosecurity) comb management
Technique	▪ Locate hives in sunny sites with good air drainage ▪ Reduce bee adult drifting by spacing out hives in apiary and adding distinguishing color, markings, and/or visual landmarks ▪ Remove dead-outs from apiaries ▪ Store equipment inside or in covered stacks ▪ Clean hive inspection tools between hives ▪ Remove brood frames 5 years or older, or with excessive number of drone cells
Route of Exposure	Basic biosecurity practices may reduce drifting, re-infestation, and exposure to residues in comb.
Treatment Time/ Use Frequency	Continuous examination and taking actions as needed every time hives inspected. Move undesired frames to edge of box during active season, remove when broodless; possible negative effect on bee population if excessive frames removed/added at one time.
Time of Year	**Population Increase** and **Population Decrease**
Effectiveness	Unknown; considered to improve overall colony health and bee environment in the hives.
Conditions for Use	No conditions (use as necessary).
Restrictions	May reduce potential honey harvest; brood comb culling best performed under ideal comb drawing conditions (or replace with empty drawn honey combs from honey supers).
Advantages	May assist with improving overall bee colony health and performance and reduce accumulated residues of chemicals used for varroa control.
Disadvantages	None.
Considerations	Minimally to not effective if used without other controls; avoid movement of frames or bees between colonies as much as possible.
Video	Watch our Sanitation video: *http://bit.ly/controls-sanitation*

Drone Brood Removal	
Name	Drone Brood Removal (Drone Trapping Varroa)
Technique	Remove and destroy (freeze, uncap, feed to chickens, etc.) drone brood once capped. Use drone frames/foundations in brood chamber or comb with elevated number of drone brood cells.
Route of Exposure	Mites are preferentially attracted to and have greater reproduction in drone brood; removal of capped drone cells selectively removes reproducing mites.
Treatment Time/ Use Frequency	Use one or two frames devoted to drone brood when colonies rear drones.
Time of Year	**Population Increase** and **Population Peak**
Effectiveness	Not as effective as stand-alone treatment; effectiveness compounded by repeating 2 to 3x during **Population Increase**.
Conditions for Use	Need to remove capped brood in timely manner before adult drones emerge. Comb can be reused after drone brood is destroyed.
Restrictions	None.
Advantages	Non-chemical method; inexpensive and effective.
Disadvantages	Time-consuming management; if drone brood is not removed before emergence, mite population will rapidly increase; requires more colony resources than other non-chemical controls; using this method excessively can negatively impact honey production; reduces drones available for mating.
Considerations	Use drone foundation frames (*e.g.*, "green" drone frames), frames more shallow than the brood box (stimulating bees to build drone comb from bottom bar), or foundationless frames; to improve effectiveness, reduce drone brood on other brood combs and cull drone cells built between brood boxes.
Video	Watch our Drone Brood Removal video: *http://bit.ly/controls-dronebrood*

Induced Brood Break	
Name	Induced Brood Break
Technique	Interrupt egg-laying and thus brood production by: ▪ Make a split without a currently laying queen, and/or ▪ Caging queen for 1-2 weeks, and/or ▪ De-queening, and/or ▪ Moving bees to a controlled environment (*e.g.*, cold storage). May combine with other techniques like requeening, timely use of miticides.
Route of Exposure	Interrupt reproductive cycle of mite population.
Treatment Time/ Use Frequency	Treatment ideally during Population Increase or after Population Peak (during nectar flow or post- harvest). If used during Population Increase, may reduce harvest yield.
Time of Year	**Population Increase, Population Peak,** or **after Population Peak**
Effectiveness	Not a stand-alone management strategy.
Conditions for Use	Need a queen or queen cell for each split/division colony created.
Restrictions	Splitting and requeening colonies is difficult when there are limited forage resources.
Advantages	Non-chemical; potentially effective if utilized with chemical control and/or subsequent introduction of mite-resistant stock. Can be utilized with other hive managements.
Disadvantages	Requeening and/or holding original queen in cage not always successful; highly time consuming; need to purchase or raise queens to place queen in split; in short season climates it may affect honey production; research indicates that caging queens during **Population Decrease** can negatively impact hive survival.
Considerations	Effective but requires good beekeeping skills for season-long management; many treatments are more effective when there are no or few capped brood cells; potential lower honey harvest or population growth due to delay in brood production; be prepared to cull developing queen cells if caging queen; be prepared to monitor queen laying after inducing a brood break.
Video	Watch our Induced Brood Break (Brood Interruption) video: *http://bit.ly/controls-broodinterruption*

Requeening with Varroa-Resistant Stock	
Name	Requeening with varroa-resistant stock
Technique	Utilize bee stock with demonstrated hygienic or other mite-reducing mechanisms
Route of Exposure	Selected stock demonstrates slower mite population growth.
Treatment Time/ Use Frequency	Treatment during **Population Increase, Population Peak,** or **Population Decrease**. Use annually when queens are available.
Time of Year	**Population Increase, Population Peak,** or **Population Decrease**
Registrant-reported Effectiveness	Long-term solution to reduce need for chemical controls. Works well when combined with other methods.
Conditions for Use	Works with standard queen introduction methods.
Restrictions	Not always easy to introduce new queen into colony, especially when resources are not abundant. Late season queen replacement is often unsuccessful.
Advantages	Stocks selected for mite resistance or tolerance may reduce chemical miticide dependency.
Disadvantages	Cost of buying or rearing queens; requeening not always successful; overly hygienic stock can negatively impact colony growth; there can be variability in the mite resistance level of the colony; currently no standardization or labelling for "varroa-resistant" stock.
Considerations	Known stocks with potential mite population reductions: Varroa Sensitive Hygiene (VSH), Russian bees, Hilo Bees, Purdue Mite-biters, Minnesota Hygienic, Pol-line bees, Carniolan bees, Buckfast bees, and some locally derived stocks.
Video	Watch our Requeening video: *http://bit.ly/controls-requeening*

Robbing Screen

Name	Robbing Screen
Technique	▪ Install robbing screens on hive entrances, especially for weaker colonies ▪ Robbing screen reduces robbing of hive, as robber bees fail to find entrance
Route of Exposure	Reducing robbing decreases chances for mite transmission
Treatment Time/ Use Frequency	Can be used any time. Particularly helpful when robbing is prevalent (*i.e.,* in dearth) and when mite populations are highest.
Time of Year	**Population Increase, Population Peak, Population Decrease**
Registrant-reported Effectiveness	Not a standalone treatment. Reduces incoming mite pressure to a hive, but does not reduce existing mite population in a hive.
Conditions for Use	Hive equipment must accommodate design of chosen robbing screen.
Restrictions	None, but may need to be removed for some miticide treatments.
Advantages	Generally inexpensive; reduces mite transmission passively; protects honey from robbing.
Disadvantages	Very strong hives could struggle with traffic or reduced airflow when screens are installed.
Considerations	Most effective if robbing screens are placed on hives containing colonies with high mites, but a better intervention is treating or removing these colonies. In circumstances where this is impossible (*e.g.,* a neighbor's untreated colony, a colony involved in an experiment) this intervention can reduce varroa risk to other hives. Use on all colonies in an apiary can keep mites in their original colony, reducing distribution of mites to all colonies.

Disclaimer

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Precaution and legal responsibility.

Any product mentioned in this document must be used in accordance with the directions on the label. The user assumes the risk to persons or property that arises from any use of the product in a way that is inconsistent with the label.

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The views and opinions expressed in this document are those of the authors and do not necessarily reflect those of the U.S. EPA, USDA, the U.S. Government, or other affiliations.

ADDITIONAL RESOURCES

Access the Honey Bee Health Coalition's full Varroa resources, including a PDF of this document, here.

State, Tribal, Provincial, or Territorial Pesticide Regulators:

To find your State or Tribal Pesticide Regulator (US): *https://npic.orst.edu/reg/state_agencies.html*

To find your Provincial or Territorial contact for the Pesticides Compliance and Enforcement (CAN): *https://www.canada.ca/en/health-canada/services/pest-control-products/pesticides-compliance-enforcement/contact-us.html* or direct general questions to Pest Management Information Service (CAN): *https://www.canada.ca/en/health-canada/corporate/contact-us/pest-management-information-service.html*

General Information:

EPA Advisory on the Applicability of FIFRA and FFDCA for Substances used to Control Varroa Mites in Beehives (US):*https://www.epa.gov/pollinator-protection/advisory-applicability-fifra-and-ffdca-substances-used-control-varroa-mites*

EPA-registered Pesticide Products Approved for Use Against Varroa Mites in Bee Hives (US): *https://www.epa.gov/pollinator-protection/epa-registered-pesticide-products-approved-use-against-varroa-mites-bee-hives*

HBHC Hive Health BMPS (US and CAN): *https://honeybeehealthcoalition.org/resources/hive-health-best-management-practices/*

Canadian Honey Council BMPs for Honey Bee Health (CAN): *https://honeycouncil.ca/wp-content/uploads/2016/12/BMP-manual-for-honey-bee-health-Feb-2017-English.pdf*

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SAMPLING FOR VARROA TUTORIALS:

University of Minnesota Extension: https://beelab.umn.edu/varroa-mite-testing

Oregon State University Extension: https://extension.oregonstate.edu/video/sampling-varroa-mites

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Other Resources

BEE HEALTH APP

Apple Store: https://itunes.apple.com/ca/app/bee-health/id1005231410?mt=8

Google Play: https://play.google.com/store/apps/details?id=ca.ab.gov.beehealth&hl=en

Varroa Integrated Pest Management – Sampling & Control Tracking Worksheet

Inspection Date	Apiary	Colony #	# of Sampled colonies	Initial Sampling Results	Action/treatment taken	Treatment date applied	Treatment date completed	Follow-up Sampling Date	# of Sampled Colonies After Treatment Completed	Sampling Results After Treatment (was treatment effective?)	Notes (i.e. observations, batch number if chemical used, follow-up treatment if any, etc.)

The Honey Bee Health Coalition is committed to providing science-based resources, tools, and best management practices to beekeepers, growers, researchers, and stakeholders at no cost. This guide, and all HBHC educational materials, are available free of charge thanks to the support of our members, partners, and donors.

We encourage you to explore our library of resources, including:

- *Varroa management videos*
- *Varroa management decision support tool*
- *Best Management Practices for Hive Health*
- *Honey Bee Supplemental Feeding and Nutrition Guide*
- *Foulbrood Management Guide*
- *Commercial Varroa Control Guide*
- *Quick Guide to Reporting a Pesticide-Related Bee Kill Incident*
- *Pollinator educational materials for K-8 and parents and families*

If you find these resources valuable, please consider supporting the Honey Bee Health Coalition with a tax-deductible donation by scanning the QR code below. Your contribution helps us continue developing trusted educational materials, advancing collaborative solutions, and supporting honey bee health across North America.

Every gift makes a difference.

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Thank you for helping us protect and promote healthy honey bees.