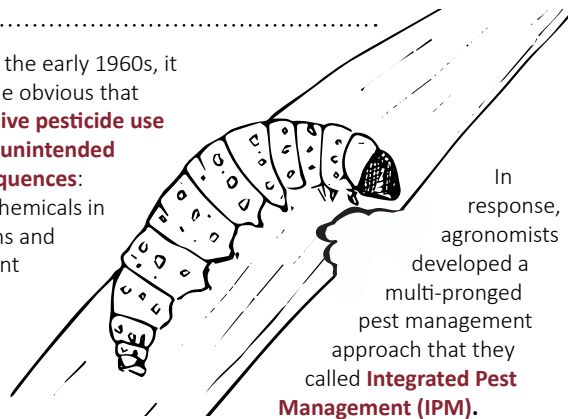


Smart *Varroa* Control Using Integrated Pest Management (IPM)

IPM is a strategy for controlling pests while minimizing pesticide use

Insect pests are a perennial problem for farmers because they damage crops. Synthetic pesticides were invented in the 1930s and were commonly used after WWII. At first, farmers applied the same chemicals every year, whether or not pests were present (the "calendar method").

But by the early 1960s, it became obvious that **excessive pesticide use led to unintended consequences:** toxic chemicals in streams and resistant pests



The goal of IPM is to **keep pest levels low using minimal pesticides**. Today, it is widely used by farmers and gardeners. These farmers (and gardeners):

- *Use non-chemical practices* like crop rotation to reduce pest build-up
- *Scout for pests* to determine whether chemical intervention is necessary
- *Rotate chemicals* so that pests do not become resistant

Experts now recommend that **beekeepers** use IPM to manage **Varroa mites**!

IPM FOR VARROA MITES

1 PREVENT Pest Build-up using Non-Chemical Practices

Regardless of mite level, use mite-curbing management practices to inhibit mite growth and support hive health!



2 SAMPLE Regularly

Use monthly alcohol washes to track mite population levels



3 INTERVENE with Pesticides when Mite Levels are High

Alternate miticides to reduce the chance that mites develop resistance.



REMEMBER: no management practice or miticide is a silver bullet; a good IPM plan combines multiple tools to manage pests effectively

1

PREVENT Pest Build-up using Non-Chemical Practices

Regardless of mite level, use these practices to deter mites and support hive health

SUPPORT OVERALL HEALTH

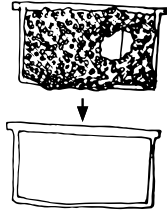
Maintain Good Genetics

Obtain **local queens** and/or queens bred for **Varroa tolerance** (Russian, VSH, Ankle-biter, etc.)



Replace Old Frames

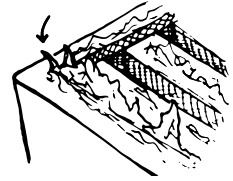
This helps to reduce disease and pesticide build-up in wax.



Protect Propolis

You can encourage propolis production by stapling propolis traps (or creating grooves) on the inner walls of the brood box.

Studies show that propolis positively affects bee immune function.²

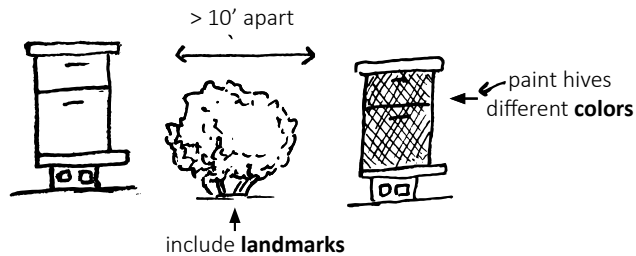


REDUCE MITE TRANSMISSION

Mites spread via both drifting and robbing.

A recent study found that clustered hives have higher mite populations than dispersed hives, due

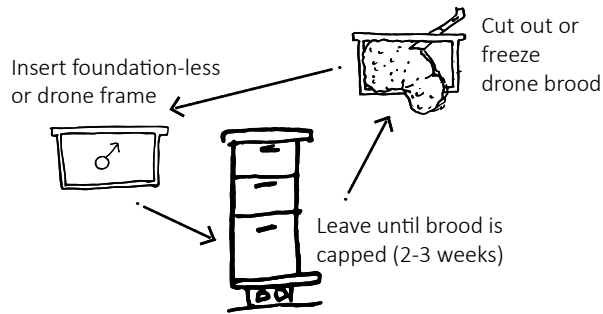
to increased mite transmission.³ To reduce drift, place hives >10' apart, paint hives different colors, and/or separate with landmarks.



REMOVE DRONE BROOD

Because *Varroa* preferentially invade drone cells and produce more offspring there, **adding and removing a drone frame is an effective way to bait, trap and remove mites.**

To use: add a frame with drone-cell-foundation (or no foundation) to the edge of the brood nest and remove when pupae are capped. Kill mites by cutting out brood or freezing frame for 48 hrs.



DID YOU KNOW?
This is a common springtime practice in parts of Europe

BREAK THE BROOD CYCLE (AND KEEP HIVES SMALL)

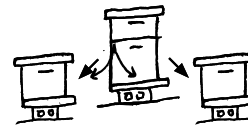
Researchers find that **small hives that swarm have lower mites than large hives that are prevented from swarming.**⁴ Swarming leads to a brood-less period, when mites are unable to reproduce. It also limits the total volume of brood in a

hive, restricting mite reproduction. In order to curb mite growth, you can (a) allow your hives to swarm or artificially create a brood break through (b) splitting, (c) re-queening or (d) caging the queen for >21 days (one brood cycle)

(a) allow hives to swarm



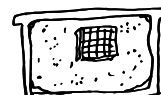
(b) split hives



(c) re-queen



(d) cage queen



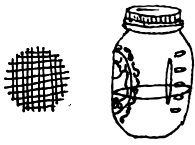
More research is needed to determine the most effective way to use these strategies to manage mites

2 SAMPLE Regularly

Use monthly alcohol washes to track mite population levels

*Email bees@mass.gov for a free kit! Watch a how-to video here: <https://honeybeehealthcoalition.org/varroa/>

1



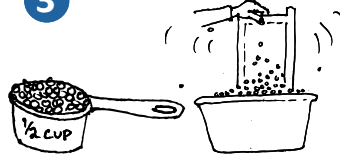
Obtain 1/8-inch hardware mesh and cut to fit mason jar lid. Pour rubbing alcohol into jar.

2



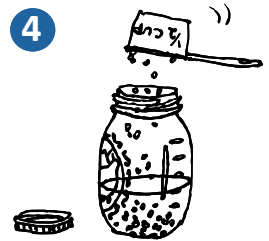
Open the hive and locate a frame with open brood

3



Shake bees off of frame into bin. Scoop up a **1/2 cup** of bees (~300 bees)

4



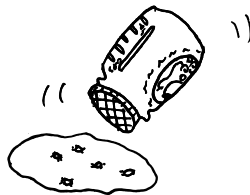
Pour bees into jar. Screw on solid lid

5



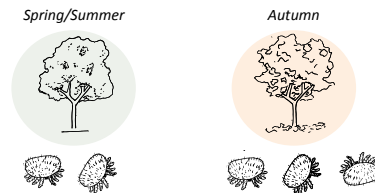
Seal jar with original solid lid (not mesh lid). Shake vigorously.

6



To isolate mites from bees, replace solid lid with mesh lid. Shake upside-down over a clean surface or container

7



Divide the number of mites by three. This is your infestation level. *If your infestation level exceeds 2 in spring/summer, or 3 in autumn, it is **time to treat**.* (Some recommend treating at an infestation level of 1!)

3 INTERVENE with Pesticides when Mite Levels are High

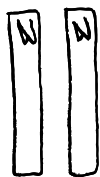
Alternate miticides to reduce the chance that mites develop resistance.

Miticides: YOUR CHOICES...

SYNTHETIC

PROS: Targeted toxicity

CONS: Last longer in the environment



Apivar
(amitraz)

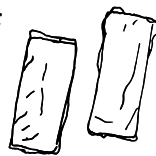
NOTE: Apistan (tau-fluvalinate) is no longer recommended due to mite resistance and residues in wax

ORGANIC

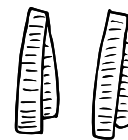
PROS: Degrade quickly

CONS: Broad-spectrum toxicity (more harmful to the beekeeper!)

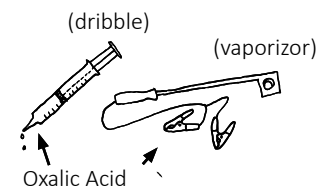
Organic Acids



Formic Pro or Mite Away Quick Strips (formic acid)



Hop Guard II (hops beta acids)



Oxalic Acid

Essential Oils



Apiguard
(thymol)



Api Life Var
(thymol, menthol and eucalyptus oil)


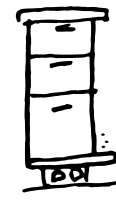
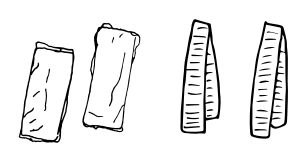



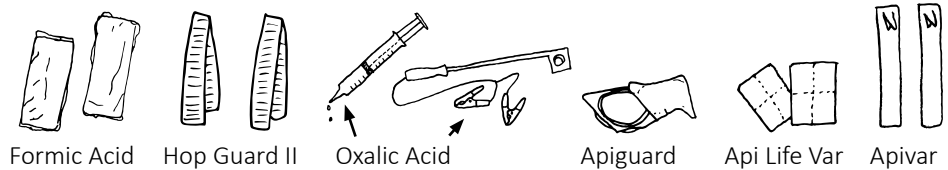


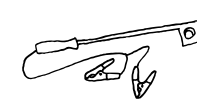
Miticides: **WHEN TO USE**

For more detailed information about temperature ranges and application methods, visit <https://honeybeehealthcoalition.org/varroa/>

HIVE PHASE

MITICIDE OPTIONS

Applies only to supers containing honey for **human consumption*

<p>Summer</p>   <p>HONEY SUPERS ON*</p>	 <p>Formic Acid (Hop Guard II)</p> <p><i>not as effective when brood is present</i></p>
<p>Spring</p>  <p>Fall</p>   <p>NO HONEY SUPERS</p>	 <p>Formic Acid Hop Guard II Oxalic Acid Apiguard Api Life Var Apivar</p>
<p>Winter</p>   <p>BEES IN CLUSTER</p>	 <p>Oxalic Acid (fumigation only)</p>






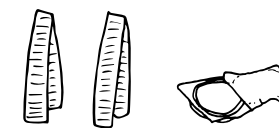
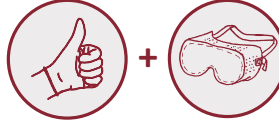
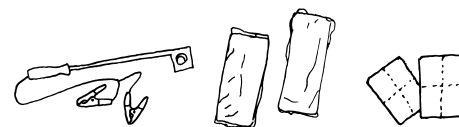

Miticides: **HOW TO APPLY SAFELY**

Miticides are toxic to people too!! It is critical to wear proper personal protective equipment (PPE).

For videos demonstrating how to safely apply miticides, visit <https://honeybeehealthcoalition.org/varroa/>

MITICIDE

PERSONAL PROTECTIVE EQUIPMENT (PPE)

 <p>Apivar</p>		<p>PPE Options:</p> <ul style="list-style-type: none">  Chemical-resistant gloves  Safety goggles  Respirator with an organic particulate filter
 <p>Hop Guard II Apiguard</p>		
 <p>Oxalic Acid Formic Acid Api Life Var</p>		

References Cited

1. The Honey Bee Health Coalition. "Tools for Varroa Management." Seventh Edition. (June 1, 2018).
2. Simone-Finstrom, Michael, Renata S. Borba, Michael Wilson, and Marla Spivak. "Propolis Counteracts Some Threats to Honey Bee Health." *Insects* 8, no. 2 (April 29, 2017).
3. Seeley, Thomas D., and Michael L. Smith. "Crowding Honeybee Colonies in Apiaries Can Increase Their Vulnerability to the Deadly Ectoparasite Varroa Destructor." *Apidologie* 46, no. 6 (November 1, 2015): 716–27.
4. Loftus, J. Carter, Michael L. Smith, and Thomas D. Seeley. 2016. "How Honey Bee Colonies Survive in the Wild: Testing the Importance of Small Nests and Frequent Swarming." *PLOS ONE* 11 (3): e0150362.