



Helping Honey Bees Deal with Varroa Mites

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Russ Killingsworth

president@metrobeekeepers.net

Overview

- **About the Varroa mite**
- **What Varroa mites do to honey bees**
- **Sampling options for the beekeeper**
- **Treatment options**

Threats to Bees

Diseases

Foulbrood
Nosema
Viruses
etc

Parasities & Pests

Varroa Mites
Small Hive Beetle
Wax Moths
etc



Poor Nutrition

Not enough nectar & pollen
Flowerless landscapes
Mono agriculture
Herbicides

Pesticides

Neonicotinoids
Pyrethroids
Fungicides
Herbicides
etc

Animals

Small Mammals (skunks, mice)
Large Mammals (livestock, bears)
Birds
People

- **Varroa is the biggest single threat to bees**
- **Combined threats compound individual harmful effects**



5/8"

18 mm

1/16"
1.7 mm



**Mature
Female**



Varroa Destructor Mites

**Recently Matured
Female**



**Mature
Female**



**Immature
Female**



**Mature
Males**

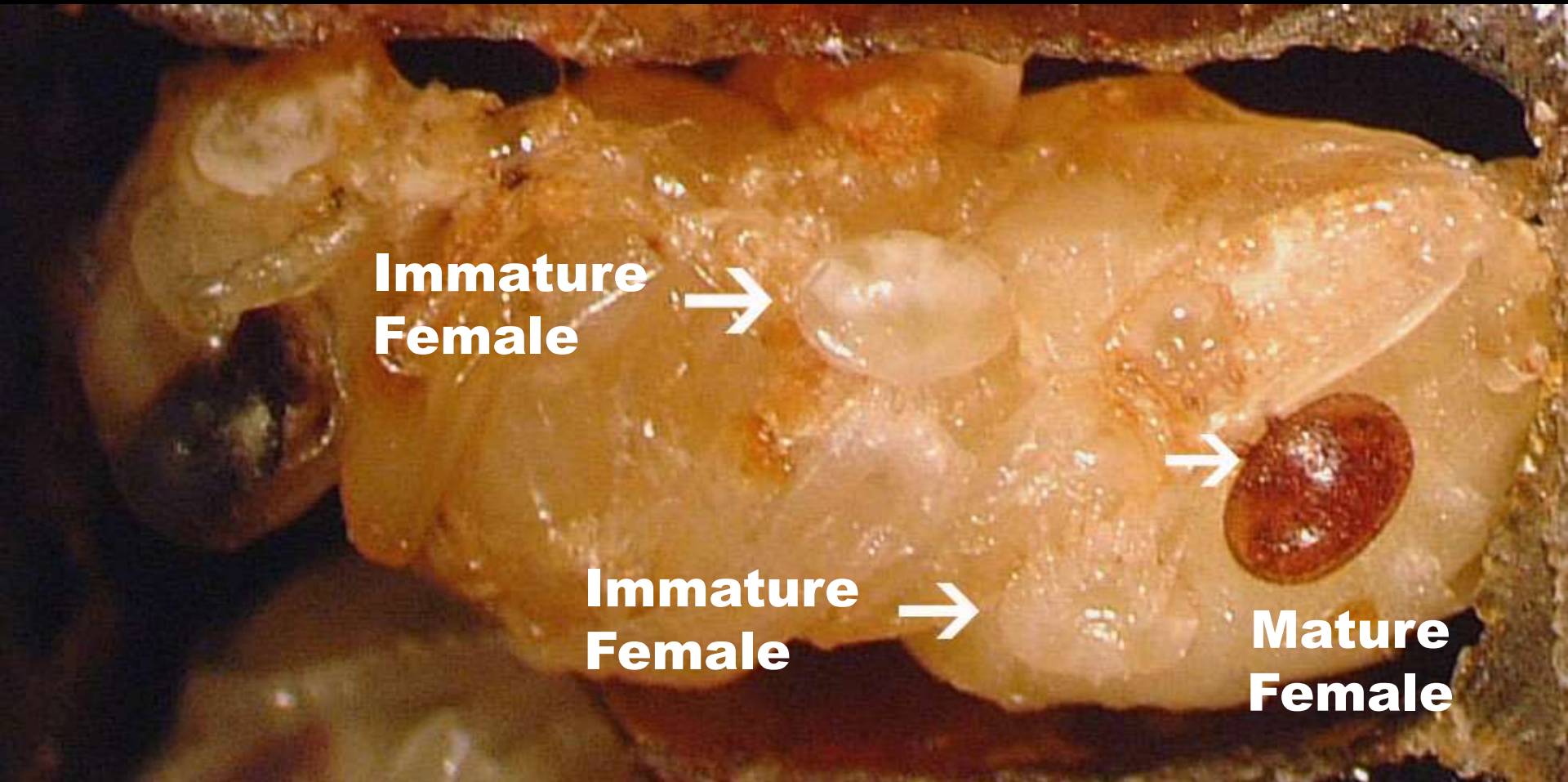


Drone Brood Check



Varroa are much more common on drone brood
(more on this later)

- Immature mites are hard to see on brood



<https://bee-health.extension.org/honey-bee-viruses-the-deadly-varroa-mite-associates/>

Not easy to see on adult bees

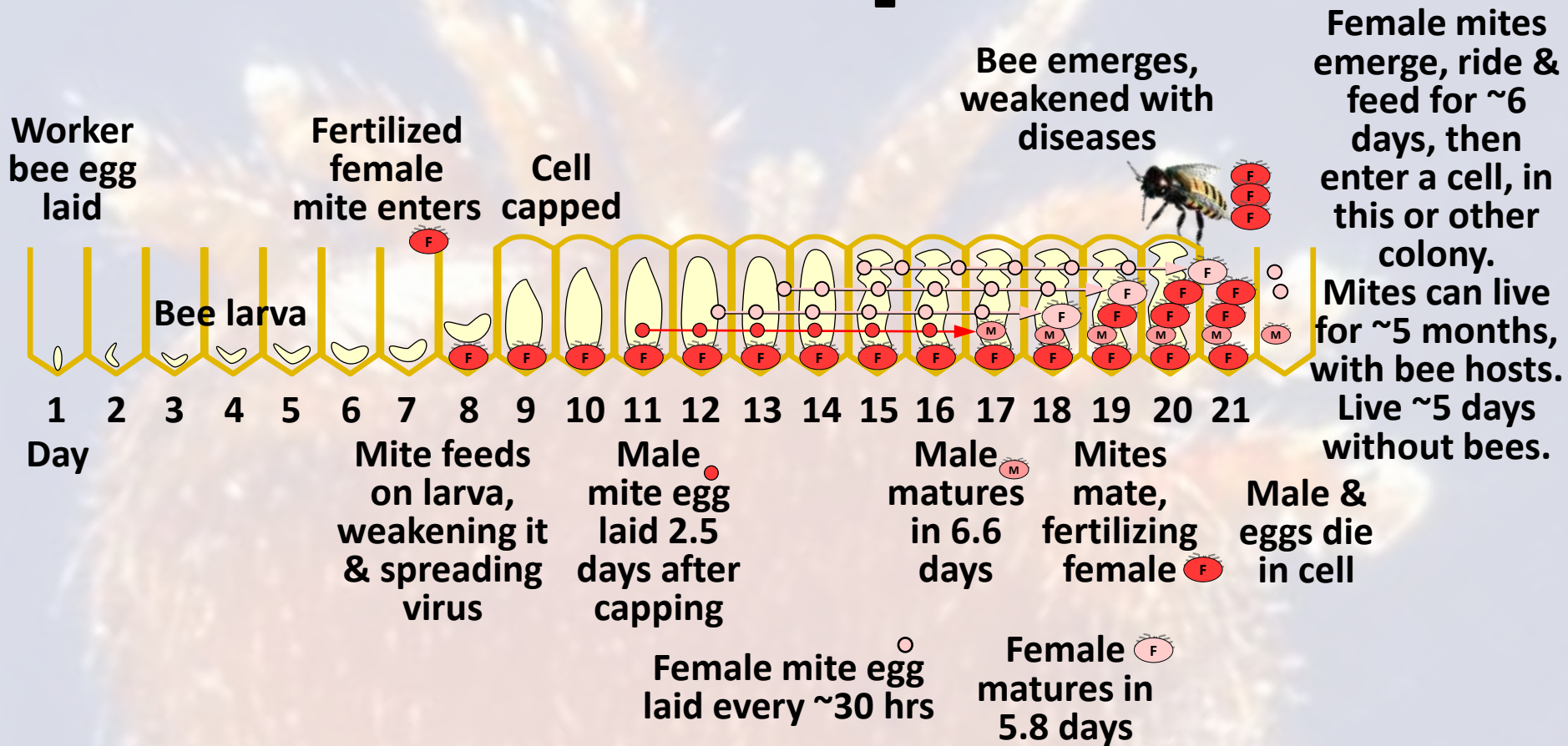


Photo by Kathy Keatley Garvey

Agriculture and Natural Resources, University of California

https://ucanr.edu/blogs/bugsquad//blogfiles/62719_original.jpg

Varroa Mite Reproduction



All the female mites feed off the bee pupa

- **Worker cell: 1.2 fertilized mites (varies temp, humidity)**
- **Drone cell: 2.2 fertilized mites, cap day ~11, emerge day ~24**
- **Understanding the cycle helps beekeepers interfere**

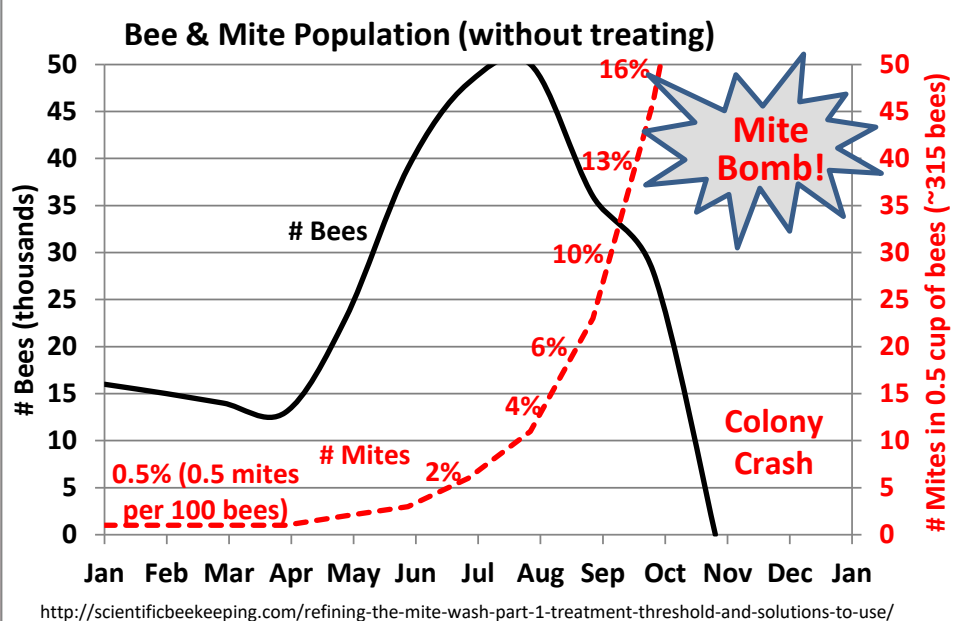
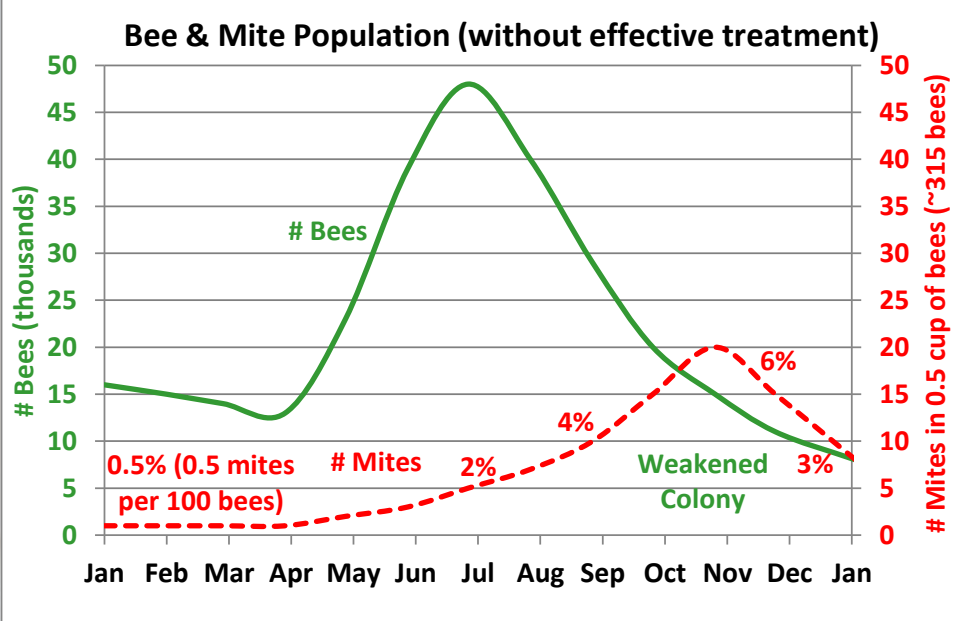
Info from beeculture.com/a-closer-look-varroa-mite-reproduction and

Graphic by Russ K <https://bee-health.extension.org/honey-bee-viruses-the-deadly-varroa-mite-associates/> www.honeybeesuite.com/outwitting-the-mites

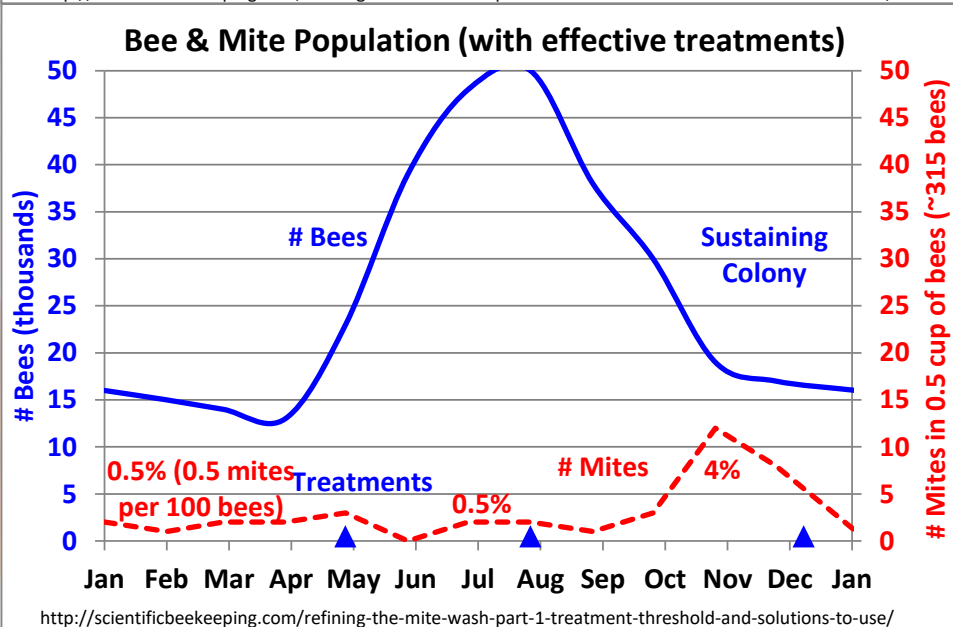
How Varroa Spread to Other Colonies

Swarms	Mites spread in both colonies
Drones	Wander in multiple colonies
Absconding bees	Due to weakening colony or less desirable conditions
Drifting bees	Lost their way home
Robber bees	Visit multiple colonies
Beekeepers	Move frames, tools, equipment
Flowers	Maybe rare, but possible

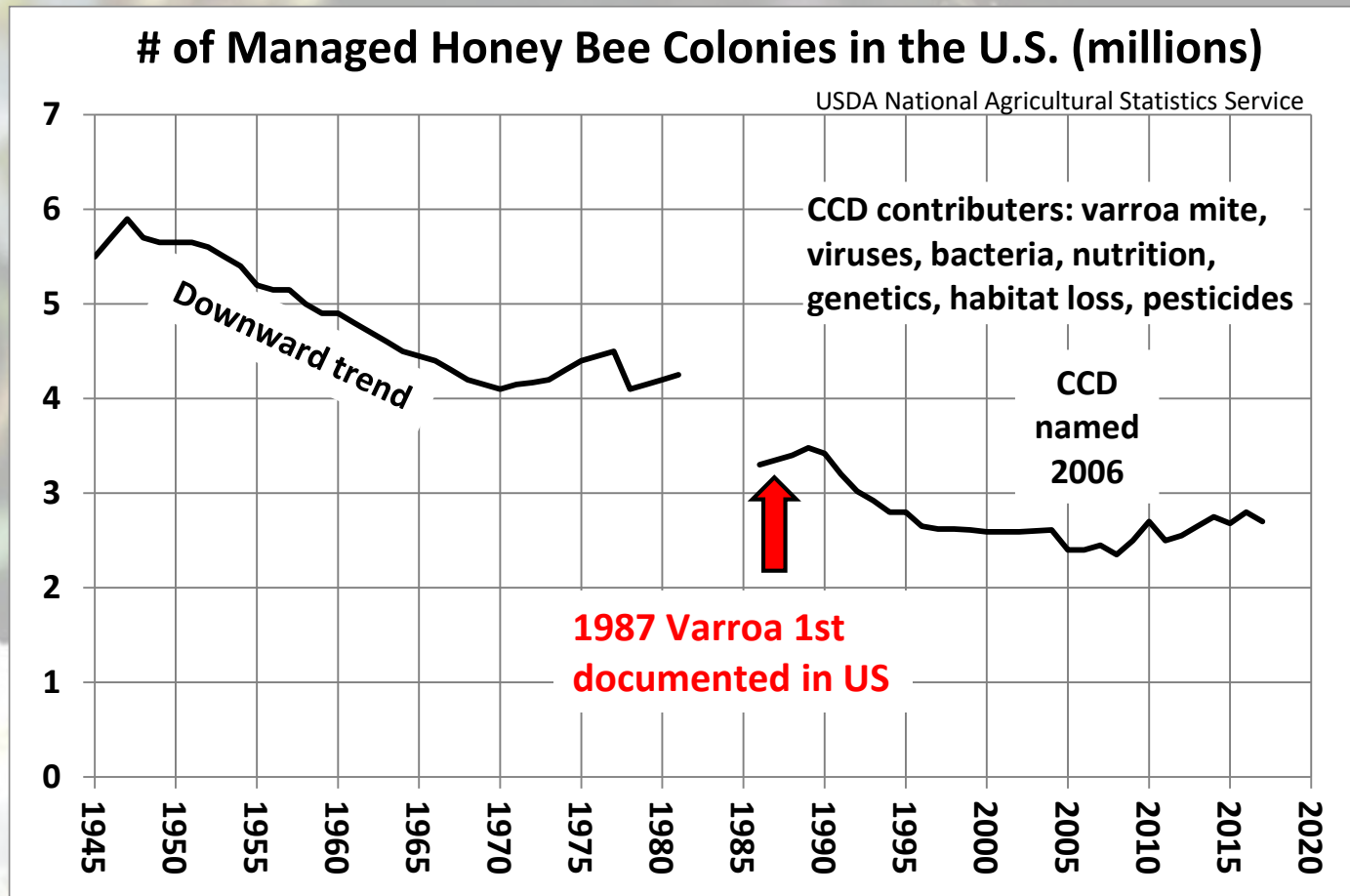
Varroa Weaken & Kill Bee Colonies ¹¹



- **Bees are weakened from mites feeding on larvae/pupae & adults**
- **Diseased bees**
- **Fewer productive bees**
- **Spreads to more colonies**



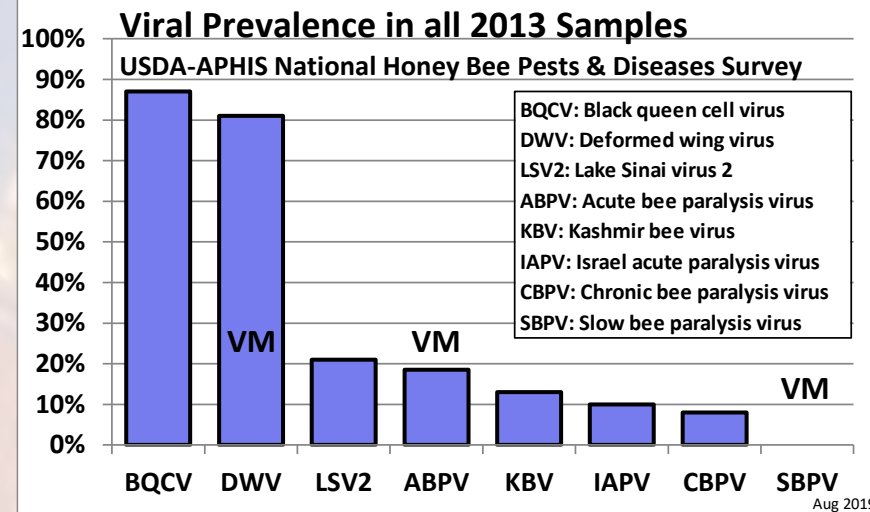
Varroa Arrived in US in ~1987



- **Improving the downward trend requires work**
 - **More splits**
 - **Treatments**
 - **Research**
 - **More beekeeping work**
 - **Reduced/safer pesticides**
 - **Improving habitat**

Viruses in Honey Bees

- **~20 honey bee viruses have been discovered**
- **Most viruses are associated with Varroa**
- **Deformed Wing Virus is the most common**



Reducing Varroa populations will reduce viruses & diseases

Honey Bee Health Coalition



- **“If you keep bees & do nothing to manage varroa mites, your bees will die.”** Danielle Downy, Executive Director of Project APIS m (research for honey bee health & crop production, www.projectapism.org)

- **“Controlling varroa mites is part of being a responsible beekeeper.”** Mark Dykes, President of Apiary Inspectors of America, helped develop Texas Master Beekeeper Program

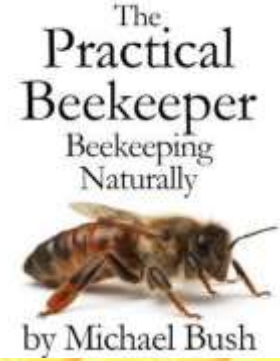


- **Follow guidelines in “Tools for Varroa Management” from www.HoneyBeeHealthCoalition.org/varroa**



Treatment-Free, Michael Bush

There is no hope of coming up with bees who can survive without treating until we stop treating



- **Treating breeds super-mites & weak bees**
- **Treating kills beneficial organisms**
 - **A bee colony is a superorganism, 8k micro-organisms, many kinds of beneficial mites, many kinds of insects, fungus, yeast, bacteria**
 - **Treatment disrupts balance of superorganism**
 - **Essential oils kill microbes, yeasts, good bacteria**
 - **Organic acids shift Ph, changing who lives**
 - **Acids & Oils damage bees smell & communication**
 - **Antibiotics kill beneficial bacteria**
- **Treatments build up in wax, poisoning bees**

Randy Oliver, ScientificBeekeeping.com

- **My goal is to develop bees that require no treatment for varroa**
- **I kept bees “treatment-free” before varroa**
- **I support breeding bees to resist varroa**
- **I’m working on my own breeding program**
- **I adamantly do not recommend “treatment-free” beekeeping for beginners**
- **Most lines of honey bees today will die from varroa/virus within 2 years, unless beekeepers reduce the mite population**
- **Not controlling mites is inexcusable, & spreads mites & viruses to neighboring bees & pollinators**
- **PLEASE MANAGE MITE LEVELS IN YOUR HIVES AND DO NOT ALLOW COLONIES TO COLLAPSE FROM VARROA**
- **There are several easy & effective natural treatments that will not contaminate your combs or honey, as well as methods such as drone brood trapping and queen caging**

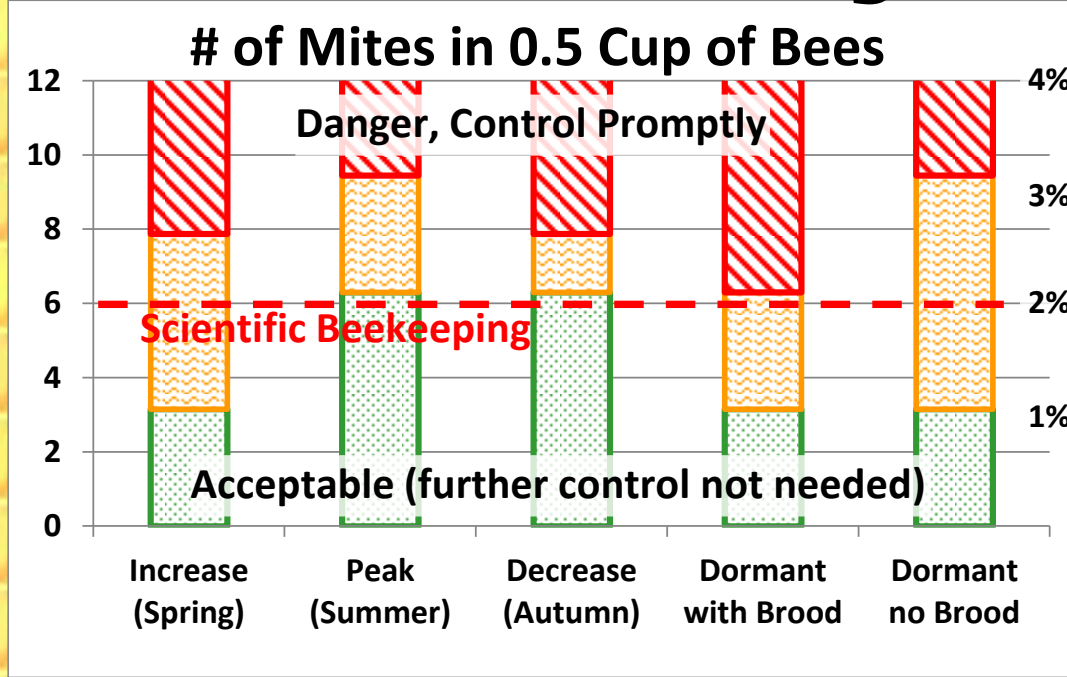


Opinions vs Expert Judgment

- **If you ask 5 beekeepers a question, you get 6 different answers**
 - **That joke is sometimes interpreted as dismissing all opinions**
- **In my opinion,**
 - **There are various ways to do beekeeping, with legitimate pros & cons**
 - **We can learn from different approaches**
 - **Not all opinions have equal weight**
 - **Those quoted in previous charts have successfully kept bees for decades**

How Many Mites is too Many?

- **Randy Oliver**
 - **No more than 6 mites in 0.5 cup (~315 bees)**
 - **2% (2 mites in 100 bees)**
- **Honey Bee Health**
 - **1% in Spring**
 - **3% at Peak**
- **Some sources: 5%**



Colony Phase	Acceptable Further control not needed	Danger Control Promptly
Population Increase	< 1%	> 2 to 3%
Peak Population	< 2%	> 3%
Population Decrease	< 2%	> 2 to 3%
Dormant with Brood	< 1%	> 2%
Dormant w/o Brood	< 1%	> 3%

www.honeybeehealthcoalition.org/varroa

Max: 6 mites in 0.5 cup = 2 mites in 100 bees (2%)

How do I know if I have more than 6 mites in a half cup of bees?

- **Accurate sampling options**
 - **Powdered sugar roll (my preference)**
 - **Alcohol or soapy water wash**
- **Less accurate sampling options**
 - **Mite drop count on sticky board**
 - **Mite drop after powdered sugar dusting**
- **Some beeks don't sample, they just treat**
 - **They check for dead varroa on the tray**

Shake the bees
into a tub

Gather Bees

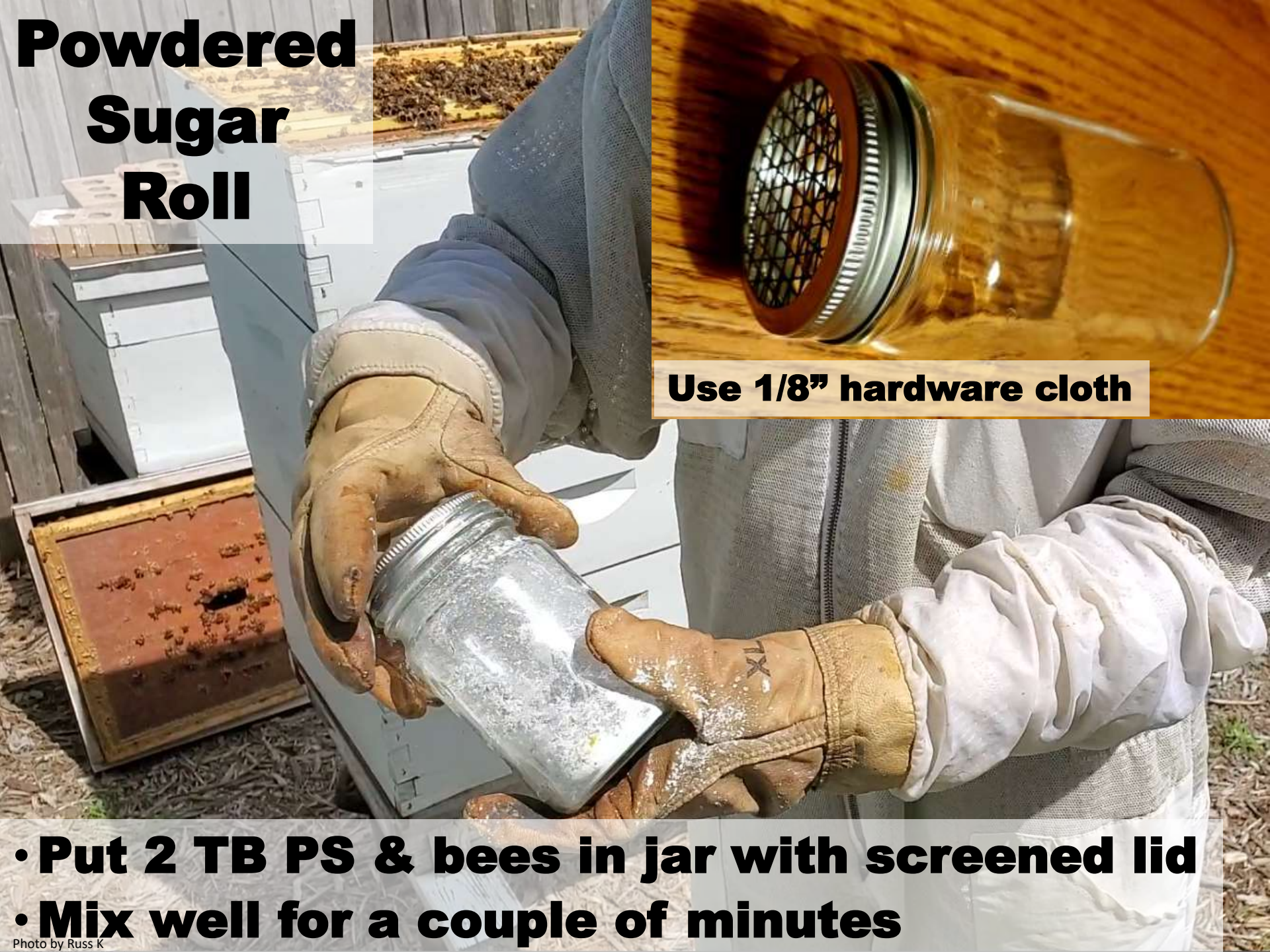
- **Select a frame of nurse bees**
- **Shake them into tub**



- **Field bees fly off**
- **Check for queen**
- **Get ½ cup bees (~315 bees)**



Powdered Sugar Roll



Use 1/8" hardware cloth

- Put 2 TB PS & bees in jar with screened lid**
- Mix well for a couple of minutes**

- **Shake sugar & mites thru screened lid onto white tray, spray soapy water, kills mites, dissolves sugar**
- **Open lid & return sugared bees to hive**
- **Count mites**



- **Sugar roll is a little less accurate than alcohol**
- **Not as many mites are dislodged (maybe ~10%)**
- **You can't count bees**



Varroa Count w/ Alcohol Wash

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- **Make a double cup with mesh**
- **Cut bottom off a cup**
- **Nest with uncut cup, with mesh between**
- **Add rubbing alcohol**



The Hard Part

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- **Pour the bees in the alcohol & add cap**
- **Swirl for 45 seconds**
- **While holding your breath**

Count the Mites

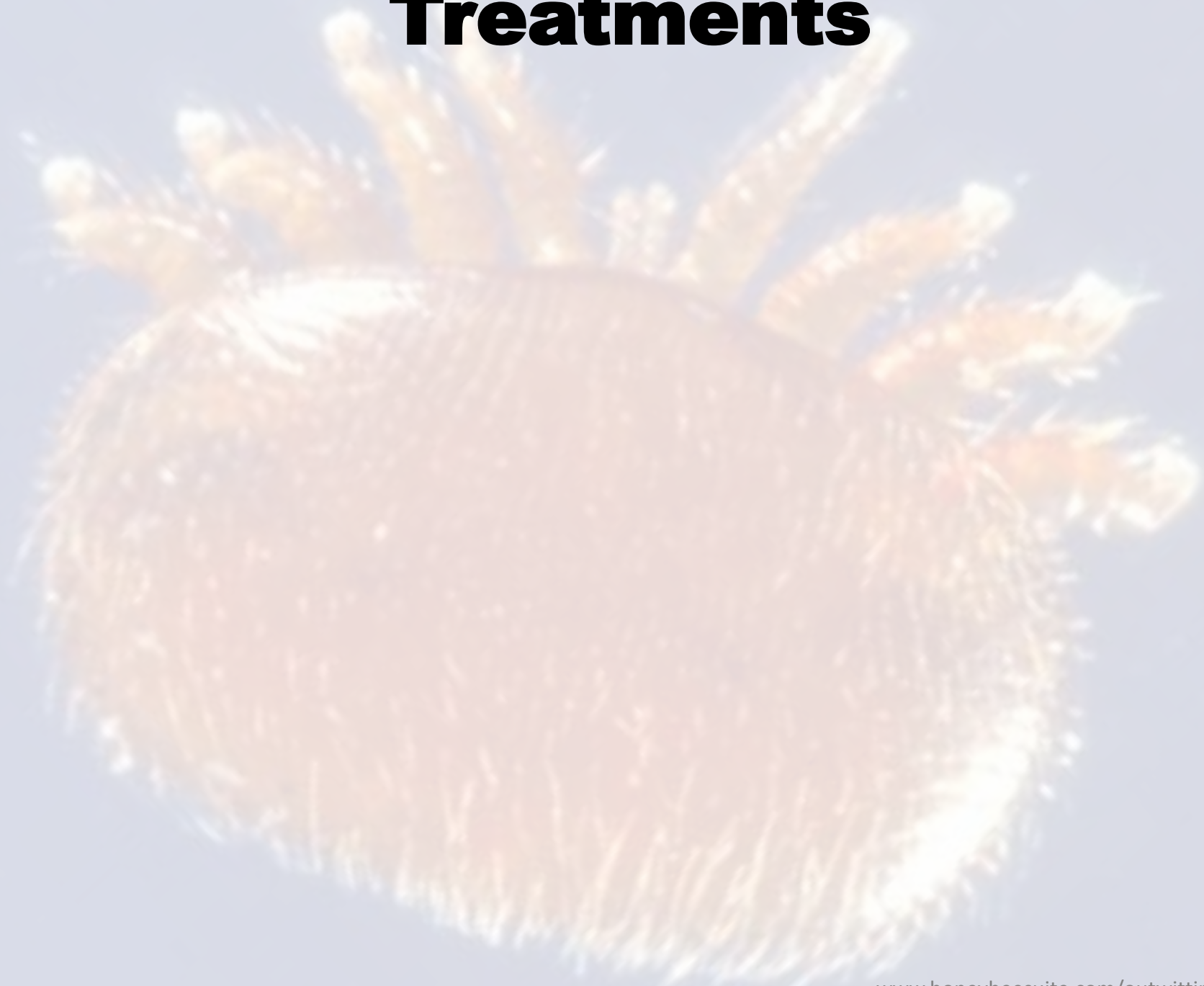
• **Breathe again**

• **Or stop breathing**



- **Also count the bees for more accurate % mite load**
- **Take appropriate action**
- **Record results & your actions, to help you decide when to check again**

Treatments



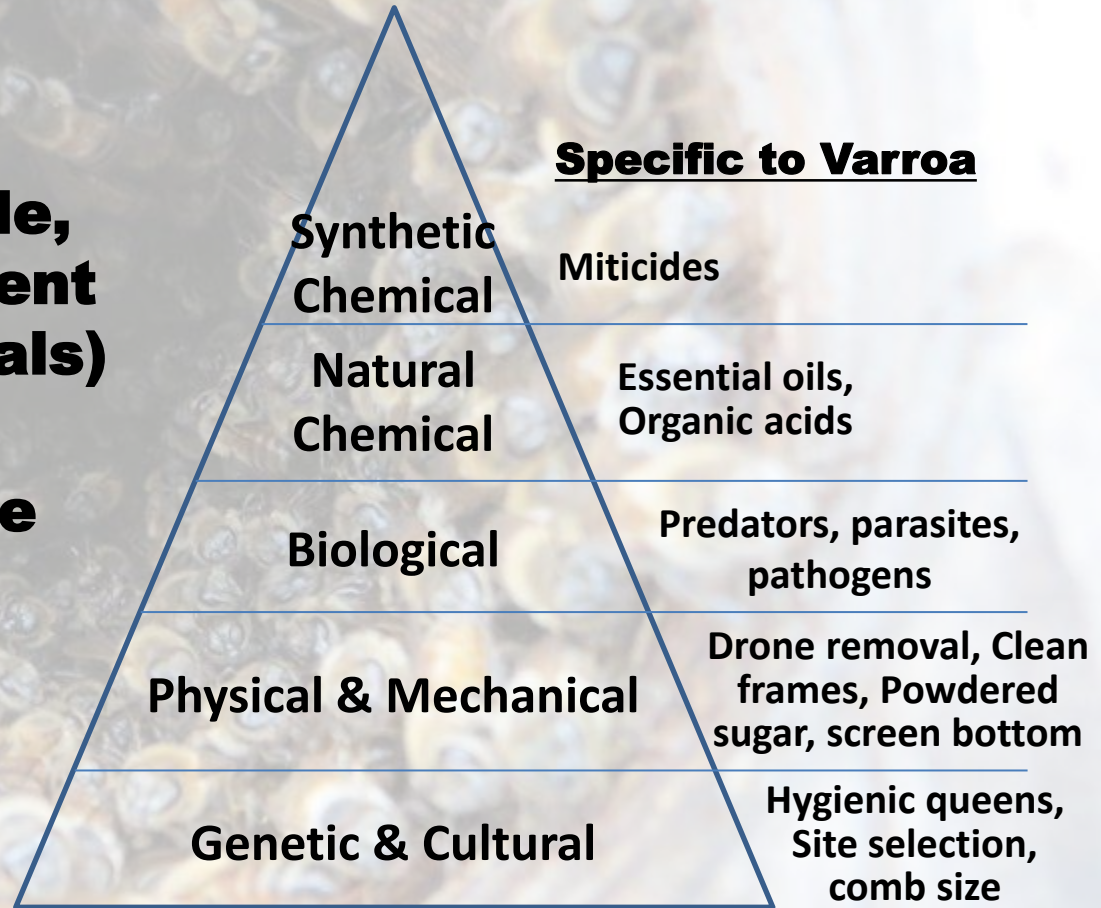
Integrated Pest Management

• Objectives:

- Solve pest problem
- Reduce risks to people, property, & environment (less harmful chemicals)
- Reduce costs
- Long-term sustainable

• Principles:

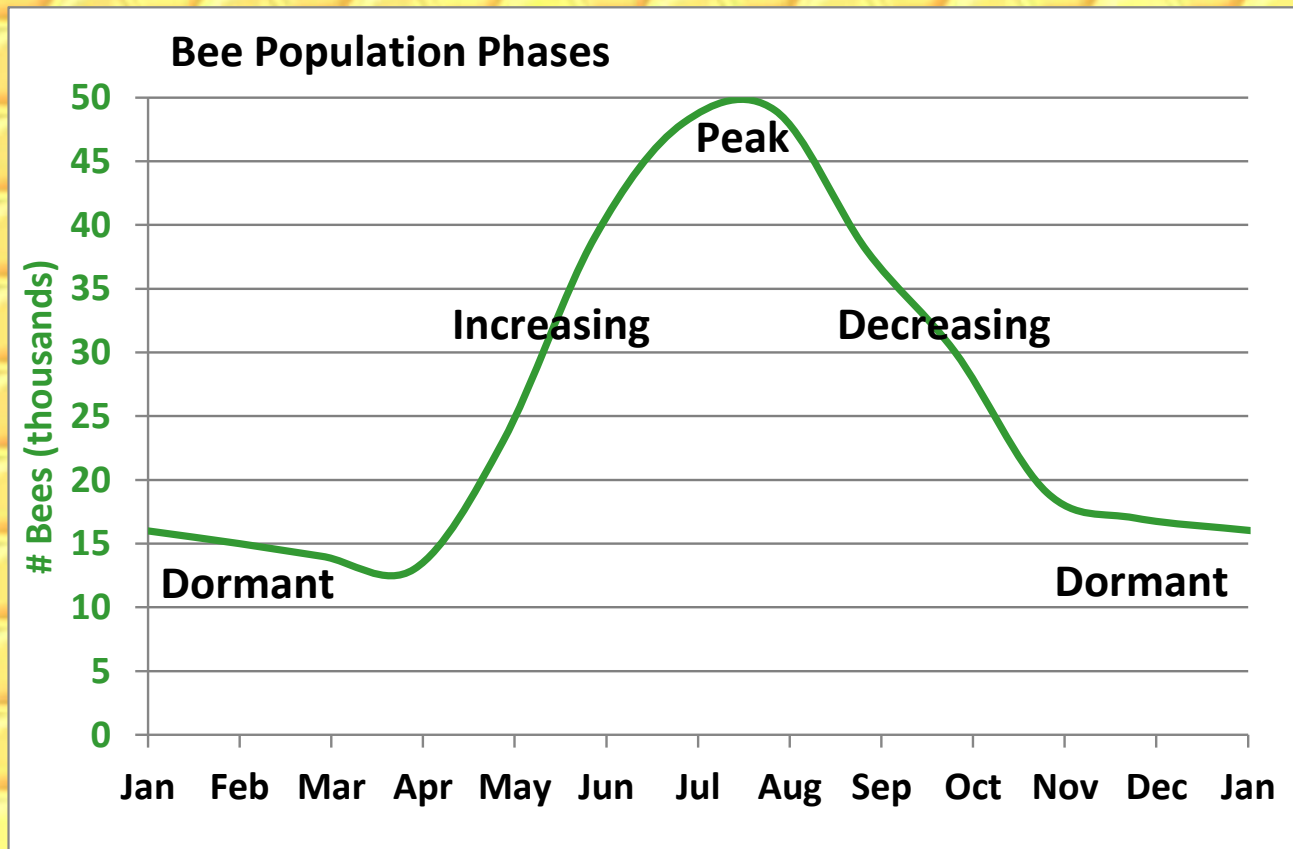
- Minimal intervention (move up the triangle with caution)
- Monitor & test for effectiveness
- Adapt & adjust



Rotate treatment methods to reduce resistance

Treatment Options Vary by Colony Population Phase

Definitions



When Mite Count is Below Threshold

- **Continue sustainable Integrated Pest Management to try to keep mite count low**

Treatment	Ess Oil	Org Acid	Synth Chem	Non-Chem	Mite kill	Improved Losses	Residues	Incr	Peak	Decr	Dorm
Drone brood removal				Y		10%	No	H	L	L	
Brood interruption				Y			No				H
Divide colony				Y			No	M	M	M	
Requeen hygienic				Y			No	M	M	M	
Basic Sanitation				Y			No	M		L	
Screen bottom board				Y	<10%	3%	No	L	L	L	L
Powdered sugar				Y	10-30%	?	No	L			

Key
H = Highly Effective
M = Moderately Effective
L = Least Effective

- **Combine powder sugar dust + drone brood removal**
- **Sanitation: cull old brood comb, space out colonies, sunny area w good drainage, clean tools btn colonies, freeze frames**

Drone Brood Frames



<http://scientificbeekeeping.com/fighting-varroa-biotechnical-tactics-ii/>

- **Drone brood frames have larger cell sizes & are green**
- **Put in middle of brood box (wax coat)**
- **Workers draw out wax**
- **Queen fills frame with drone brood**

- **After capping:**
 - **Mites are in cells**
 - **Remove frame & freeze it to kill mites (& drones)**
- **Uncap cells & return frame to colony**
- **Repeat 2 to 3 times**

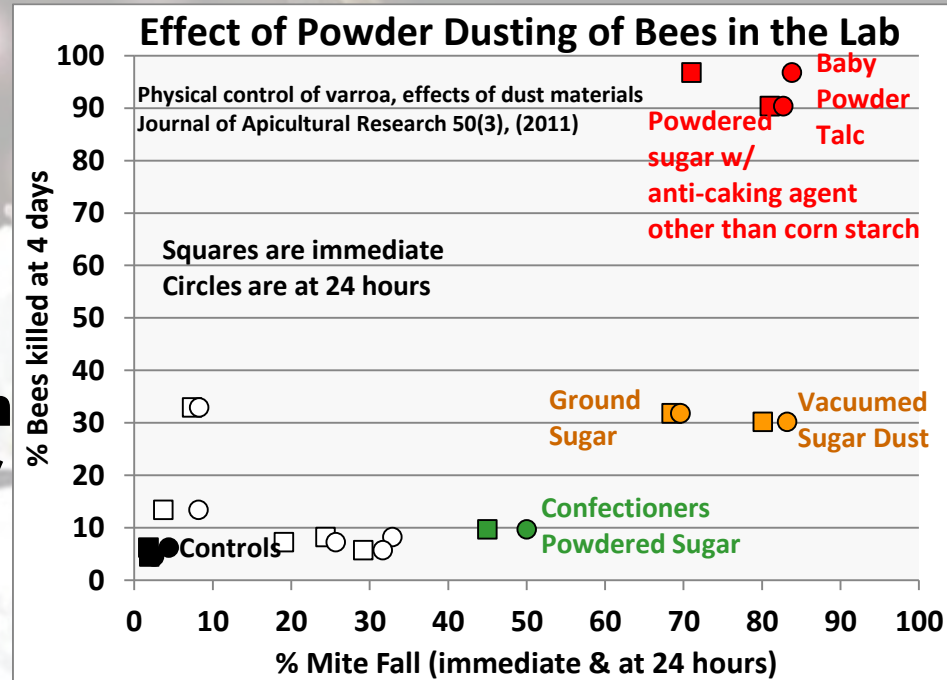


www.lincolnlandbeekeepers.org/www.lincolnlandbeekeepersorg/blog---around-the-hive/previous/2.html

Powdered Sugar Dusting

- **Range in effectiveness**
 - **10% to 30% drop in mites**
 - **Long term not much help**
- **Agreement**
 - **50% of mites fall off adult bees who are sugared**
 - **Mites lose grip & bees groom**
 - **No effect on mites in cells or on bees in the field**
 - **Good for pkgs & swarms**
 - **Not effective humid days**
 - **Use screened bottom board (or mites crawl back up)**
 - **Used widely in Europe**

Combine w/ drone brood removal for larger benefit



- **Some beeks have done daily PS dusting in Autumn to drop mite count for winter**
- **Honey Bee Health (2016): PS dusting < 10% effective.**
 - **Author: I'd use PS dusting; research will likely catch up**

Screened Bottom Board



- Reduces mite load by up to ~10%
- Use with powdered sugar dusting increases benefit

When Mite Count is Above Threshold

- Move up the IPM triangle

Treatment	Ess Oil	Org Acid	Synth Chem	Non-Chem	Mite kill	Improved Losses	Residues	Temp, °F	With supers				No Brood							
									No supers				With Brood							
									Incr	Peak	Decr	Dorm	Incr	Peak	Decr	Dorm	Incr	Peak	Decr	Dorm
Formic acid <small>(MAQS, Formic Pro)</small>		Y			80%	24%	No	50°-85°	H	H	H	M	H	H	H	M	H	H	H	M
Oxalic dribble	(This section of the table is obscured by a blue box)																			
Thymol <small>(Apiguard, Apilife var)</small>																				
Amitraz <small>(Apivar, Taktic)</small>																				
Oxalic acid fume																				
Hops beta acid <small>(Hopguard 2)</small>																				
Fluvalinate <small>(Apistan)</small>																				
Coumaphos <small>(Checkmite)</small>	(This section of the table is obscured by a blue box)																			

- Info compiled from HBHC document & tool
- Some categories are odd (increasing w/ no brood)
- Inconsistent: moderately effective, but don't use
- Powerful info about effectiveness, pros & cons

Key
H = Highly Effective
M = Moderately Effective
L = Least Effective
HBHC Tool says Don't Use
Not Red: HBHC says Use

When Mite Count is Above Threshold

• **Move up the IPM triangle**

Treatment	Ess Oil	Org Acid	Synth Chem	Non-Chem	Mite kill	Improved Loses	Residues	Temp, °F					No Brood				With Brood			
									With supers				No supers				No supers			
									Incr	Peak	Decr	Dorm	Incr	Peak	Decr	Dorm	Incr	Peak	Decr	Dorm
Formic acid (MAQS, Formic Pro)		Y			80%	24%	No	50°-85°	H	H	H	M	H	H	H	M	H	H	H	M
Oxalic dribble		Y			90%	39%	No	Any					Y	M	M	Y	Y	M	M	Y
Thymol (Apiguard, Apilife var)	Y				83%	30%	Some	59°-105°					H	H	H	M	H	H	H	M
Amitraz (Apivar, Taktic)			Y		95%	41%	Yes	Any					H	H	H		H	H	H	
Oxalic acid fume		Y			90%	39%	No	Any					Y		Y	H	Y	Y	Y	H
Hops beta acid (Hopguard 2)		Y			85%	0%	No	>50°	M	M	H	H	M	M	H	H	M	M	H	H
Fluvalinate (Apistan)			Y		97%*	7%	Yes						Y		L		Y		L	
Coumaphos (Checkmite)			Y		92%*	6%	Yes						Y		L		Y		L	

* For non-resistant mites

- **Brood & broodless are same except for Oxalic Acid (but OA is ok to use w/ no brood at any season)**
- **Effectiveness changes (resistance, advancements)**
- **Powerful info about effectiveness, pros & cons**
- **Read the directions & choose your options**
- **Rotate treatment methods to reduce resistance**

Key
H = Highly Effective
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Thymol Apiguard Details

Apiguard® (USA) Thymovar® (Canada)



Active Ingredient	Thymol (essential oil)
Formulation	Apiguard gel - individual hive dose or bulk tub; Thymovar - individual dose as wafer
Mode of Action	Fumigant
Treatment Time/ Use Frequency	Apiguard: Twice at 2 week intervals, apply individual dosage tray or 50 gm per for double hive (remove or spread remaining gel over frame top bars at end of 4th week) Thymovar: Twice at 3-4 intervals, 1 wafer for single hive and 2 for double 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 & not during pollination rental if temps are elevated Population Decrease: Post-honey harvest or approaching dormancy
Effectiveness	74 to 95% (more effective with warmer temperatures)
BIP Results	26 to 31% fewer overwintering colony losses with use in 4 consecutive survey years
Conditions for Use	Temperatures >59°F and <105°F (15 to 40°C) BIP = Bee Informed Partnership
Restrictions	Do Not use when colonies are supered for honey.
Advantages	Naturally derived; no known Varroa resistance to Thymol, easy to use.
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.
Considerations	Use Gloves; Effectiveness reduced for light mite infestations; requires closed screen bottom board; do not feed sugar syrup during treatment; consider using spacer rim above brood nest for individual gel trays. (Thymovar - spacer rim is not needed)

- **Honey Bee Health has a page for each treatment option**
<https://honeybeehealthcoalition.org/Varroa/>

Oxalic Acid Details

Oxalic Acid



Active Ingredient	Oxalic acid dihydrate (organic acid)
Formulation	Sugar syrup drip with syringe or drenching applicator, also Sublimation (fumigation). NOTE: A mist application approved for caged (package) bee use; engorge bees before applying.
Mode of Action	Contact
Treatment Time/Use Frequency	Treatment most effective on brood less bees; Use no more than once on dormant (winter) bees but repeated uses during season considered less harmful to adult bees.
Time of Year	Early population increase and late population Decrease when brood is little and brood rearing reduced Dormant Phase: Best used when brood not present
Effectiveness	82 to 99% when brood not present
BIP Results	37 to 41% fewer overwintering colony losses with use in 2 consecutive survey years.
Conditions of Use	Mix 35 grams (approximately 2.3 Tablespoons) of oxalic acid 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 in each brood box; maximum 50ml per colony of Oxalic acid in sugar syrup; fumigation of 2 g per hive and follow label and vaporizer directions.
Restrictions	Recently registered for use in US; Permitted in Canada. Do not use in enclosed overwintering areas and when honey supers are in place
Advantages	Cleanses bee adults of mites during broodless periods.
Disadvantages	Corrosive; Liquid application may chill adult cluster. Not effective in colonies with much brood. Fumigation application is extremely dangerous to applicator health - follow label precautionary directions for handling. When applying, need to use proper clothing (long pants, long sleeves), acid resistant gloves, protective eyewear (goggles or faceshield) and respirator. Proper respirator is a half-face acid/particulate model with cartridge & particulate filter. Check that it fits properly. Orientation upwind is recommended. The vapors quickly recrystallize.
Considerations	Legalized in US in Spring 2015 http://www3.epa.gov/pesticides/chem_search/ppls/091266-00001-20150310.pdf

• **Honey Bee Health has a page for each treatment option**

<https://honeybeehealthcoalition.org/Varroa/>

Oxalic Acid Details

Population Peak

Period of nectar flow and rental of colonies for pollination services; bee population (both adult & brood) at peak; mite populations increasing, nearing peak; often honey supers on colonies.

Highly Effective Options:

- MAQS®
- Apivar®, or Apiguard® or ApiLife Var® (if no supers are present or colonies are not producing honey.)

Notes:

- MAQS®, Apiguard® and ApiLife Var® are not suitable for use in all temperatures. See the detailed descriptions of products below for temperature ranges for use of these products.
- Apivar® (amitraz) is highly effective. Be cautious about using it too often to avoid risk of developing resistance.

Moderately Effective Options:

- Requeening with hygienic stock
- Division of colonies
- HopGuard® II
- Oxalic acid drip

Notes:

- Requeening or dividing colonies may negatively affect honey production (if colonies are strong enough to produce surplus). Hygienic or locally selected stock is not widely available.
- HopGuard® II can be utilized while honey supers in place; it is important to check control effectiveness following use as there is limited field test data.
- Oxalic acid is best used when there is little or no capped brood in the colony during the Dormant Phase or because of queen replacement that interrupts brood rearing.

Least Effective Options:

- Screen bottom board
- Drone brood removal

Notes:

- A screen bottom board removes a small percentage of mites that fall from adult bodies. Use it in combination with other techniques.
- Drone brood removal is restricted in this phase by the absence of sufficient drone brood and the difficulty of accessing the brood nest beneath honey supers.

• Honey Bee Health

Follow the Directions

- It is a violation of Federal law to use this product in a manner inconsistent with its labeling
- For the Safety of you, bees, & honey consumers

• RESTRICTIONS:

- For in-hive use only.
- Do not use Apivar™ strips when honey supers are present.
- Maximum rate = 2 strips per brood chamber per application (i.e., one strip per 5
- Frames of Bees (FoB).
- Remove honey supers before application of Apivar™.
- Remove Apivar™ strips 14 days before placing honey supers.
- Strips must be removed after a maximum of 56 days.
- Do not re-use strips.
- Do not use Apivar™ more than 2 times a year, i.e., no more than once in Spring and once in Fall.

DO NOT USE APIVAR™ STRIPS WHEN HONEY SUPERS ARE PRESENT.

If mite infestation reaches treatment thresholds in Fall, remove surplus honey supers before using Apivar™.

Withholding period for honey collection:

DO NOT USE APIVAR™ STRIPS WHEN HONEY SUPERS ARE PRESENT.

Remove honey supers before application of Apivar™.

Resistance-management:

A group of insecticides is used repeatedly on the same location. Over time, resistance mechanisms that are not linked to site of action but are specific for individual chemicals, such as enhanced metabolism, may also exist. Appropriate resistance-management strategies should be followed.

To delay miticide resistance:

Where possible, rotate the use of Apivar™ or other similar miticides with different groups that control the same pests.

Integrate use of Apivar™ with an Integrated Pest Management (IPM) program that includes cultural, biological, and other control practices.

Correctly identify the pest and ensure economic and agronomic thresholds are met.

Contact your local extension specialist or certified crop advisor for any additional pesticide resistance-management or IPM recommendations for the specific site.

For further information or to report suspected resistance, contact your local extension specialist.

Do not leave strips in colonies for greater than the designated 56 day maximum.

RESTRICTIONS:

Do not use Apivar™ strips when honey supers are present.

Maximum rate = 2 strips per brood chamber per application (i.e., one strip per 5 Frames of Bees (FoB)).

Remove honey supers before application of Apivar™.

Remove Apivar™ strips 14 days before placing honey supers.

Strips must be removed after a maximum of 56 days.

Do not re-use strips.

Do not use Apivar™ more than 2 times a year, i.e., no more than once in Spring and once in Fall.

HAZARDOUS TO HUMANS AND DOMESTIC ANIMALS

WARNING: This product contains a chemical that is swallowed or inhaled. Avoid contact with skin and eyes and wear chemical-resistant gloves when handling the strips. Wash thoroughly with soap and water after use. Do not use Apivar™ strips in the brood chamber of honey supers.

Remove Apivar™ strips 14 days before placing honey supers. Strips must be removed after a maximum of 56 days. DO NOT re-use the strips.

For terrestrial uses: This product is toxic to fish and aquatic invertebrates. Do not use Apivar™ strips in the brood chamber of honey supers.

DIRECTIONS FOR USE

It is a violation of Federal law to use this product in a manner inconsistent with its labeling.

Apivar™ strips are labeled for use against the parasitic mite (*Varroa destructor*) on honey bees.

Apivar™ strips per brood chamber (i.e., one strip per 5 Frames of Bees (FoB)).

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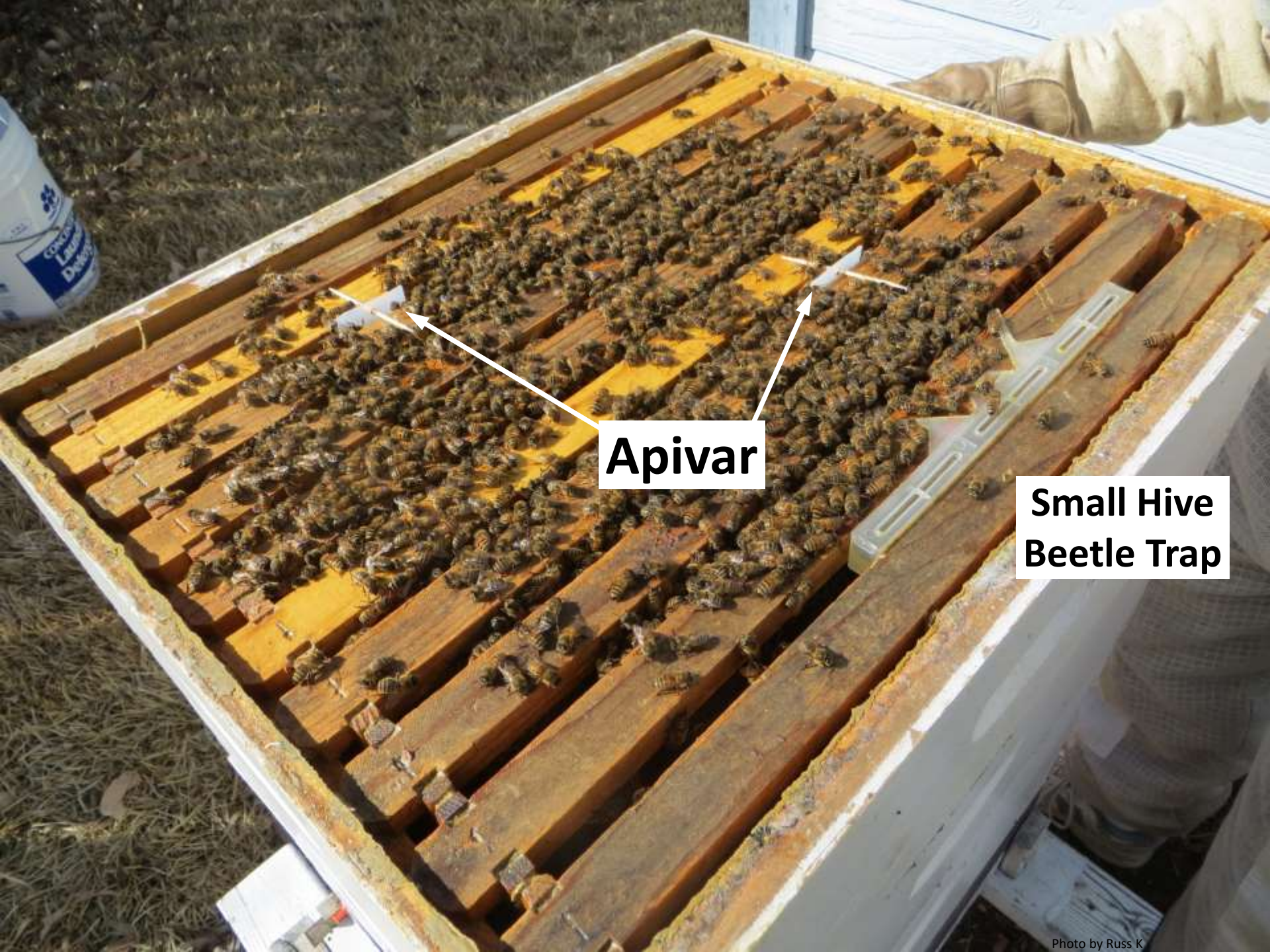
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Apivar

**Small Hive
Beetle Trap**

Pull-out Tray Under Screened Bottom Board

- Treatment resulted in hundreds of mites falling through the screen



HBHC 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](#)

Resources

- **Bee-Health**
 - <https://bee-health.extension.org/varroa-mite-reproductive-biology/>
 - <https://bee-health.extension.org/honey-bee-viruses-the-deadly-varroa-mite-associates/>
- **Randy Oliver**
 - <http://scientificbeekeeping.com/first-year-care-for-your-nuc/>
- **Honeybee Health**
 - www.honeybeehealthcoalition.org/varroa
- **Honey Bee Suite**
 - <https://www.honeybeesuite.com/varroa-mites/>
- **Bee Informed Partnership**
 - **2012-2013 Management Survey Results: Varroa Control**
<https://www.youtube.com/watch?v=4bm3Y4t1NwQ>
- **Texas AMU**
 - <https://masterbeekeeper.tamu.edu/advanced-level-modules/>
 - <https://txbeeinspection.tamu.edu/beekeepers/pests-diseases/>
- **Univ Florida**
 - <http://entnemdept.ufl.edu/honey-bee/extension/beekeeper-resources/pests-and-diseases/>
 - <http://entnemdept.ufl.edu/honey-bee/beekeeper-resources/pest-and-disease-resources/>
- **Penn State**
 - <https://extension.psu.edu/a-quick-reference-guide-to-honey-bee-parasites-pests-predators-and-diseases>
- **Bush Farms**
 - <http://bushfarms.com/beesfoursimplesteps.htm#notreatments>
 - <https://www.youtube.com/watch?v=5DFKqgWuCBA>

Summary

- **About Varroa**
 - **Pictures, reproductive cycle, spread**
- **What Varroa mites do to honey bees**
 - **Feed on larvae, pupae, & adults**
 - **Infect bees with viruses & disease**
 - **Reduce honey production**
 - **Weaken or kill colonies**
- **Please take action to avoid mite bombs**
- **Sampling options**
 - **Sample regularly**
 - **Sugar, alcohol, soap**
- **Integrated Pest Management**
- **Treatment options**
 - **Effectiveness, restrictions**
- **Questions?**