Mite Keeping 101

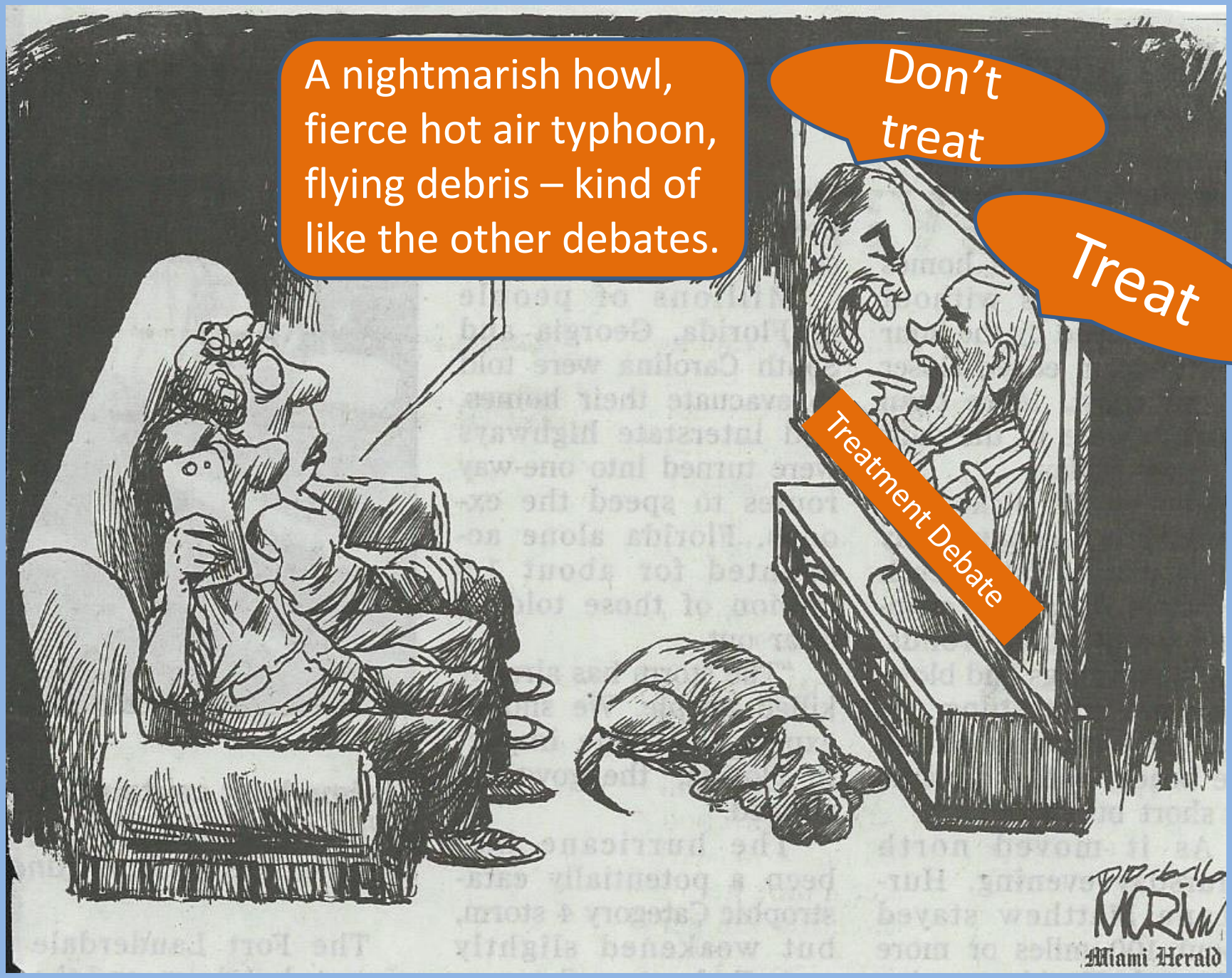
Then

“Maybe if we procrastinate long enough, they’ll just go away.”

Now

“Maybe if we procrastinate long enough, the Varroa mites will just go away.”

Result of procrastination

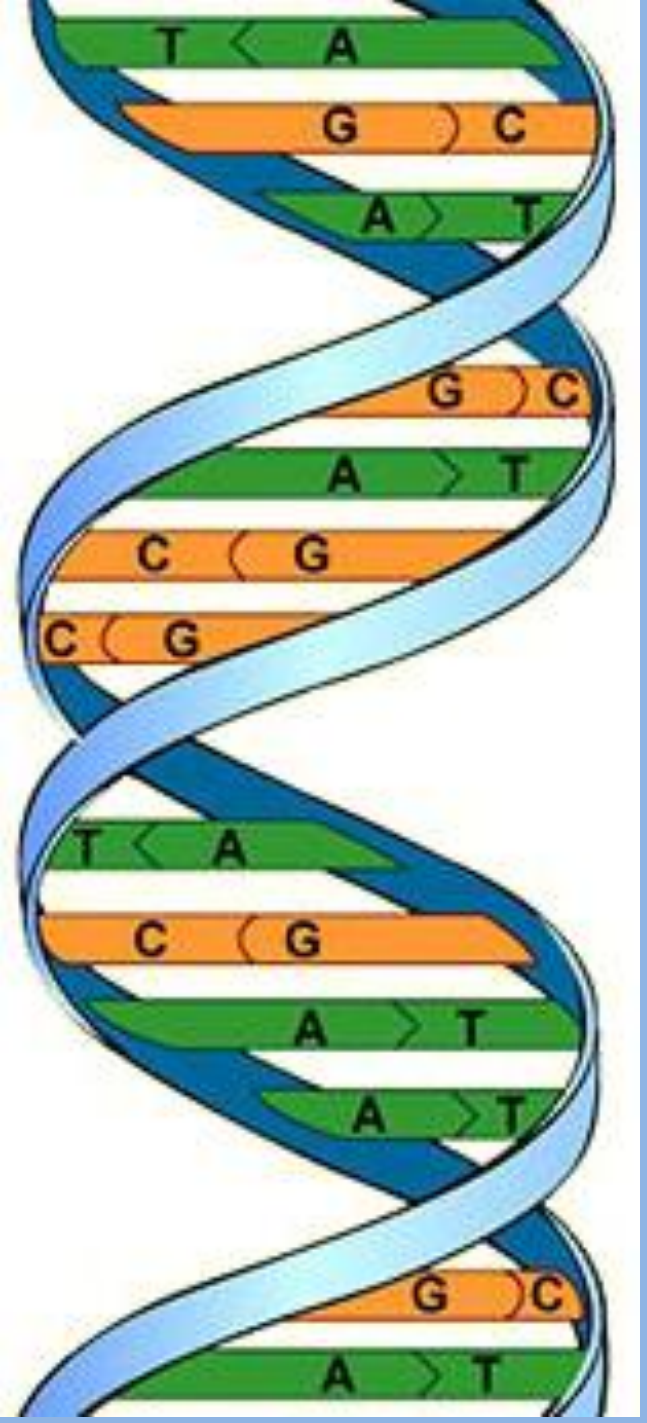

A nightmarish howl, fierce hot air typhoon, flying debris – kind of like the other debates.
Don't treat
Treat
Treatment Debate
Miami Herald

Chemicals in my hives!
Are you serious?

“James Bond” Method

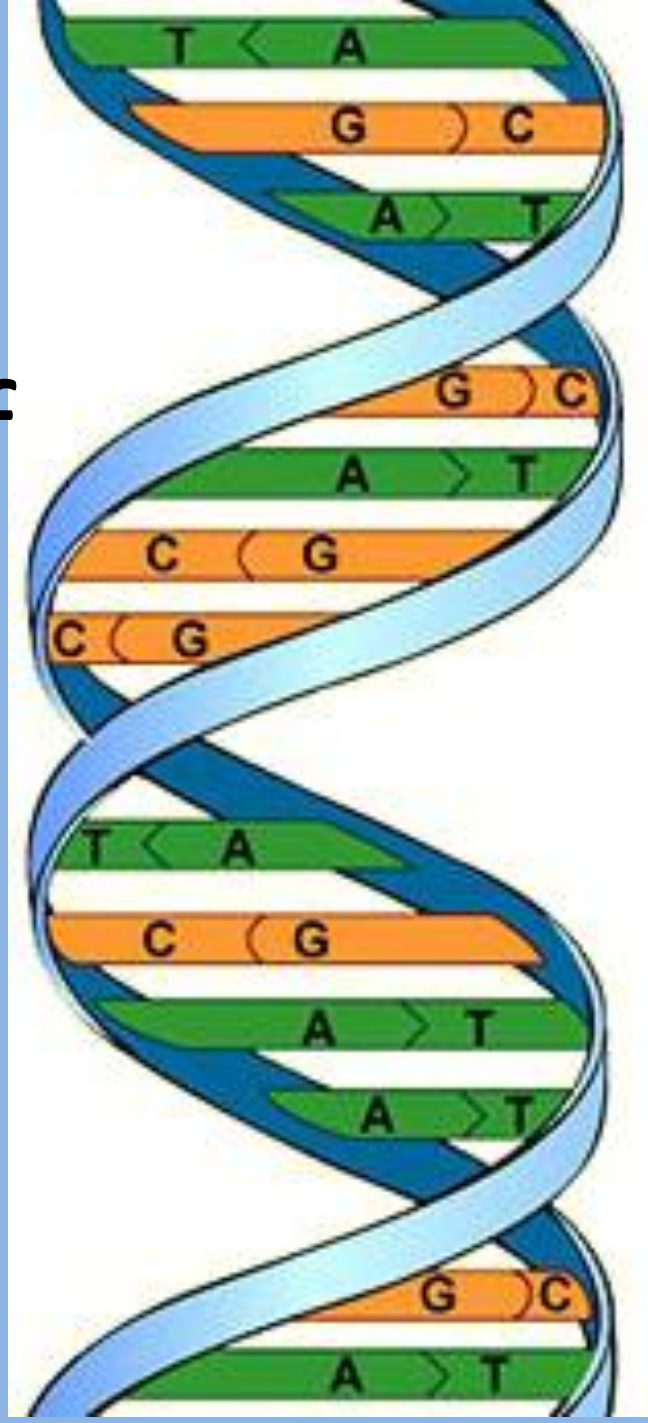
Treatment Free beekeeping is the ultimate goal

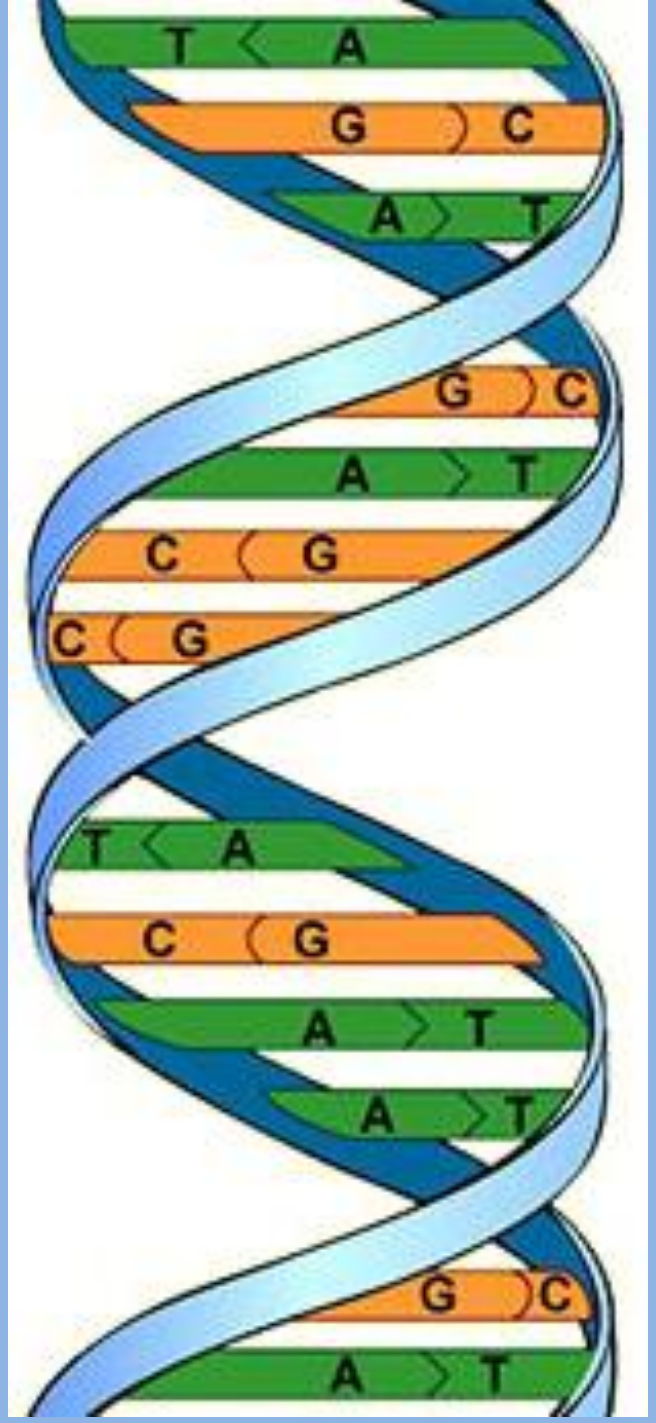
Genetics is the vehicle that gets you there..



"Genetics will work if you have about 500 years."

Jerry Hayes
American Bee Journal





Why 500 years?

- Drifting
- Can't control the drones the queen mates with
- Flowers previously visited by Varroa infected bees

The hidden danger of pollination

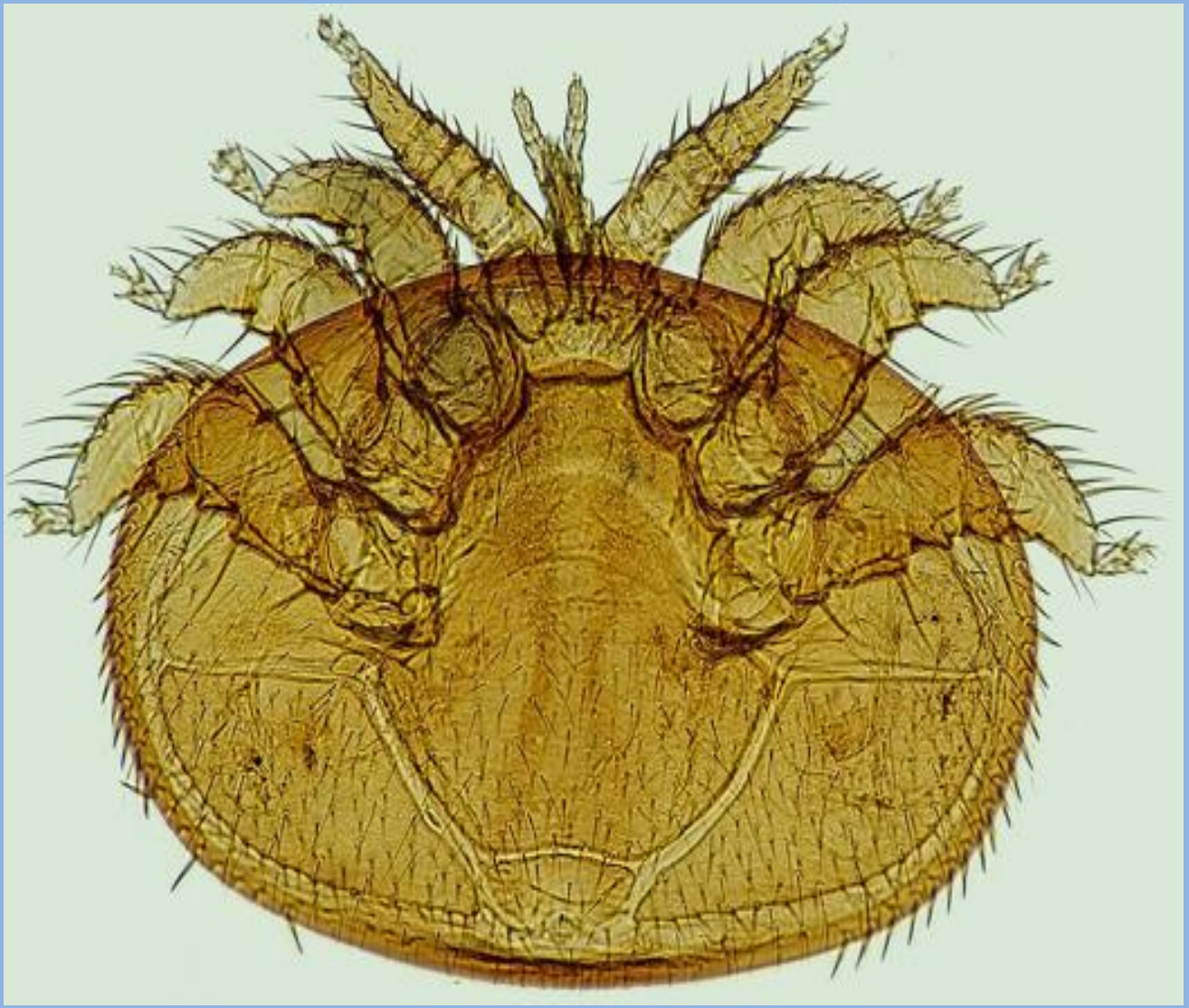
Treatment Free is the ultimate goal

This is what you can do now…

- Know your numbers
- Treat only if needed
- Verify efficacy of treatment
- Have a treatment back up plan

This program will tell you what you need to know about Varroa mites and how to use this information to keep your bees healthy

So what is a mite?



Varroa Mites are related to ticks

Tick

Mites are everywhere

Varroa mites on honey bee

Getting to know Varroa

Varroa mites are found two ways in bee colonies

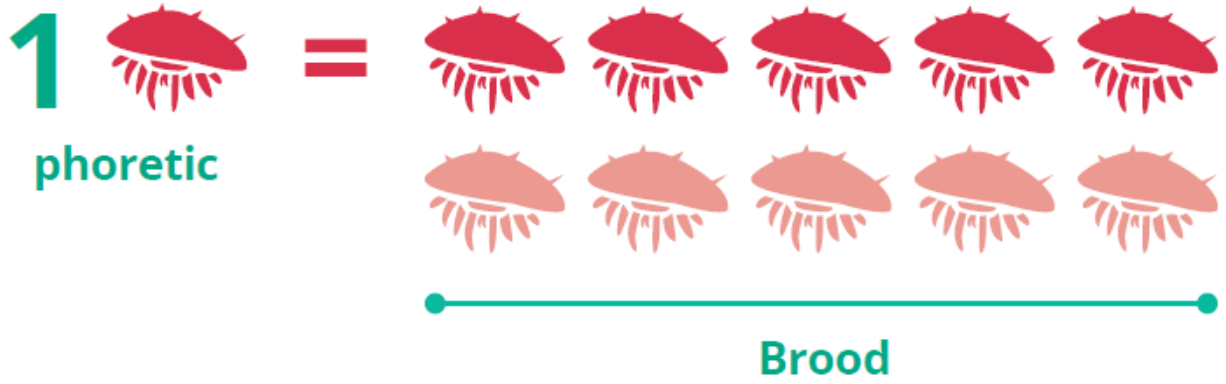
1. **Phoretic** Varroa mites are found on adult bees

Varroa mites are found two ways in bee colonies

2. **Reproductive** Varroa mites in capped brood cells

Majority of Varroa mites in a hive are protected under capped brood

1 Varroa mite visible on one bee (phoretic)
= 5 to 10 Varroa mites present in the brood (reproductive)

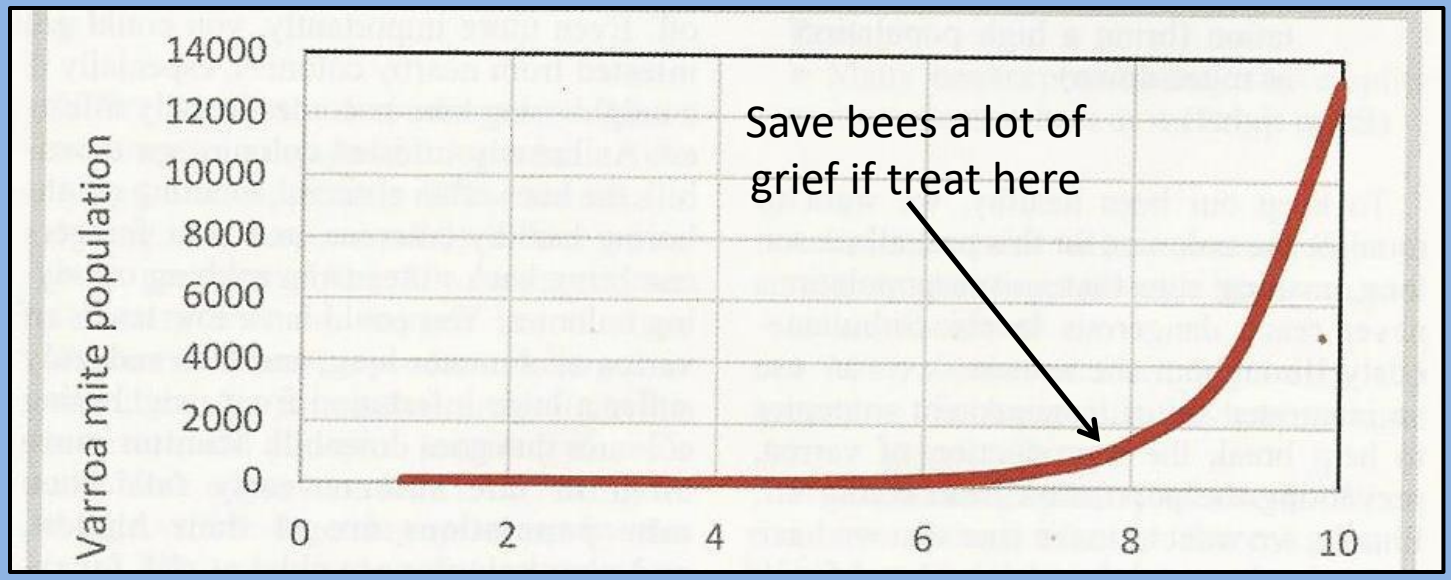


What do Varroa mites and Tribbles (think Star Trek) have in common?

They multiply astronomically

- At least **1.45 new female mites in worker (female) brood**
- At least **2.2 new female mites in drone (male) bee brood**

Varroa exponential growth



Brood cycles
(24 days for drones)

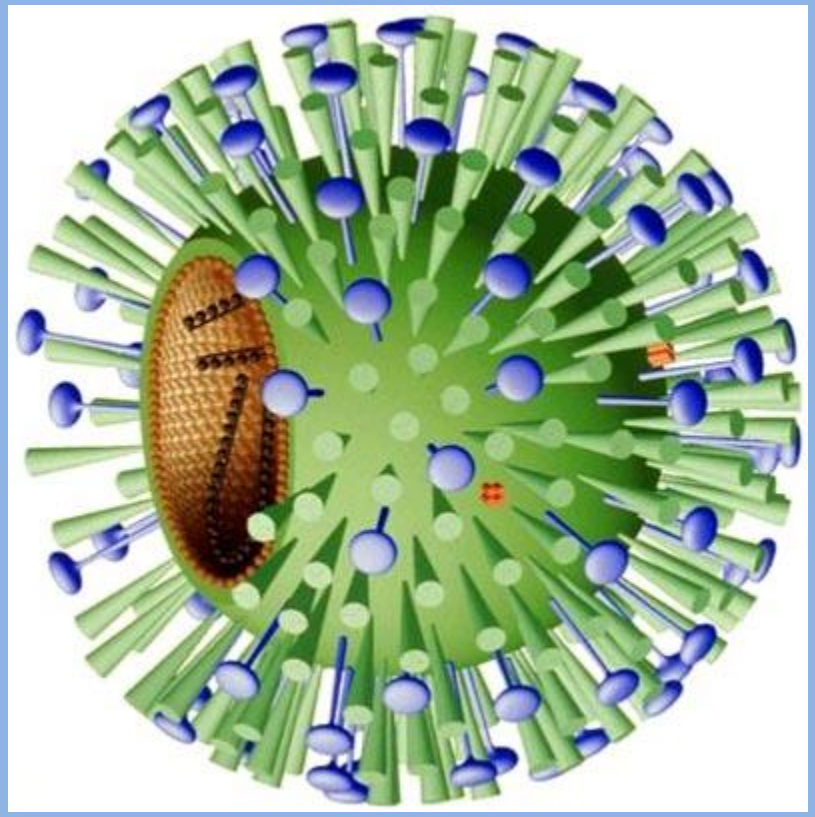
Meghan Milbrath

Why be concerned about Varroa?

Biggest Concerns

- Varroa vector viruses
- Varroa can inhibit bees' ability to overwinter

Varroa vectors viruses



Vector at Work

Humans get viruses (flu)

So do bees

Viruses

- A virus needs a host; can't live without a bee
- The virus "hijacks" their host's DNA and inserts their own instructions
- Virus compromises the bees' immune system; makes them susceptible to a variety of problems
- Varroa mites carry the viruses and pass them on to the bees

Rewriting genetic instructions

Examples of Viruses: Deformed wings

K-wing

DWS = deformed wing syndrome

Another example
Acute Bee Paralysis aka Hairless Black

Normal bee

- Caused by a virus vectored by Varroa mites
- Bee tremble and can not fly
- No treatment except varroa control

Interferes with overwintering (Raising Fat Winter Bees)

Varroa mites interfere with the bees' ability to produce long-lived "fat" bees necessary to overwinter

What is a “fat” winter bee?

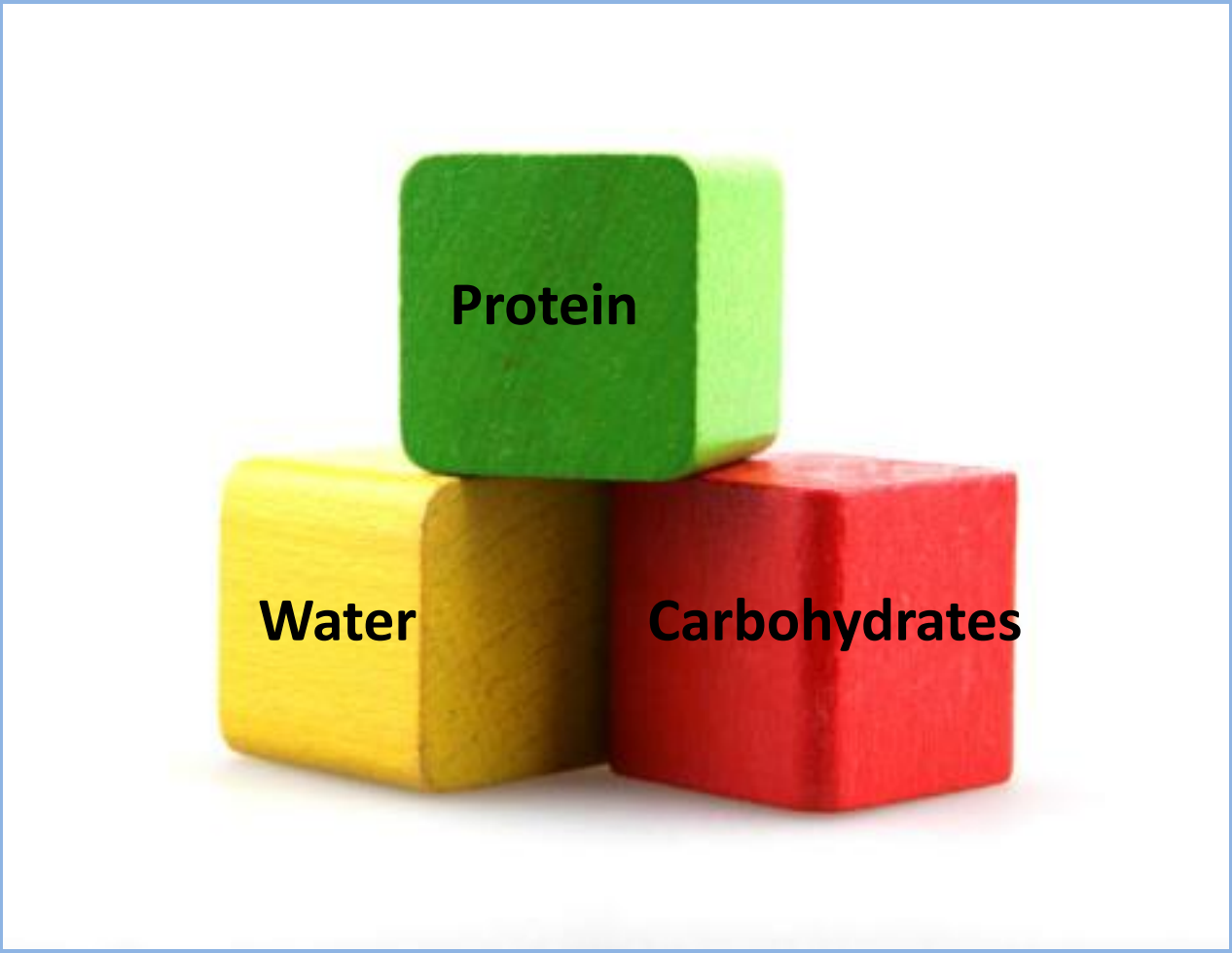
- Fat winter bees have lots of Vitellogenin

- Vitellogenin = molecule the bees make consisting of proteins, fats and carbohydrates

- It is a food storage reservoir in bees’ bodies

- Makes it possible for the winter bees to come out of metabolic retirement

Building blocks for making Vitellogenin



When you think Vitellogenin – think about chickens and egg yolks

Chicken

Yolk

Non-winter and winter Bees

Non-winter Bee: few fat bodies

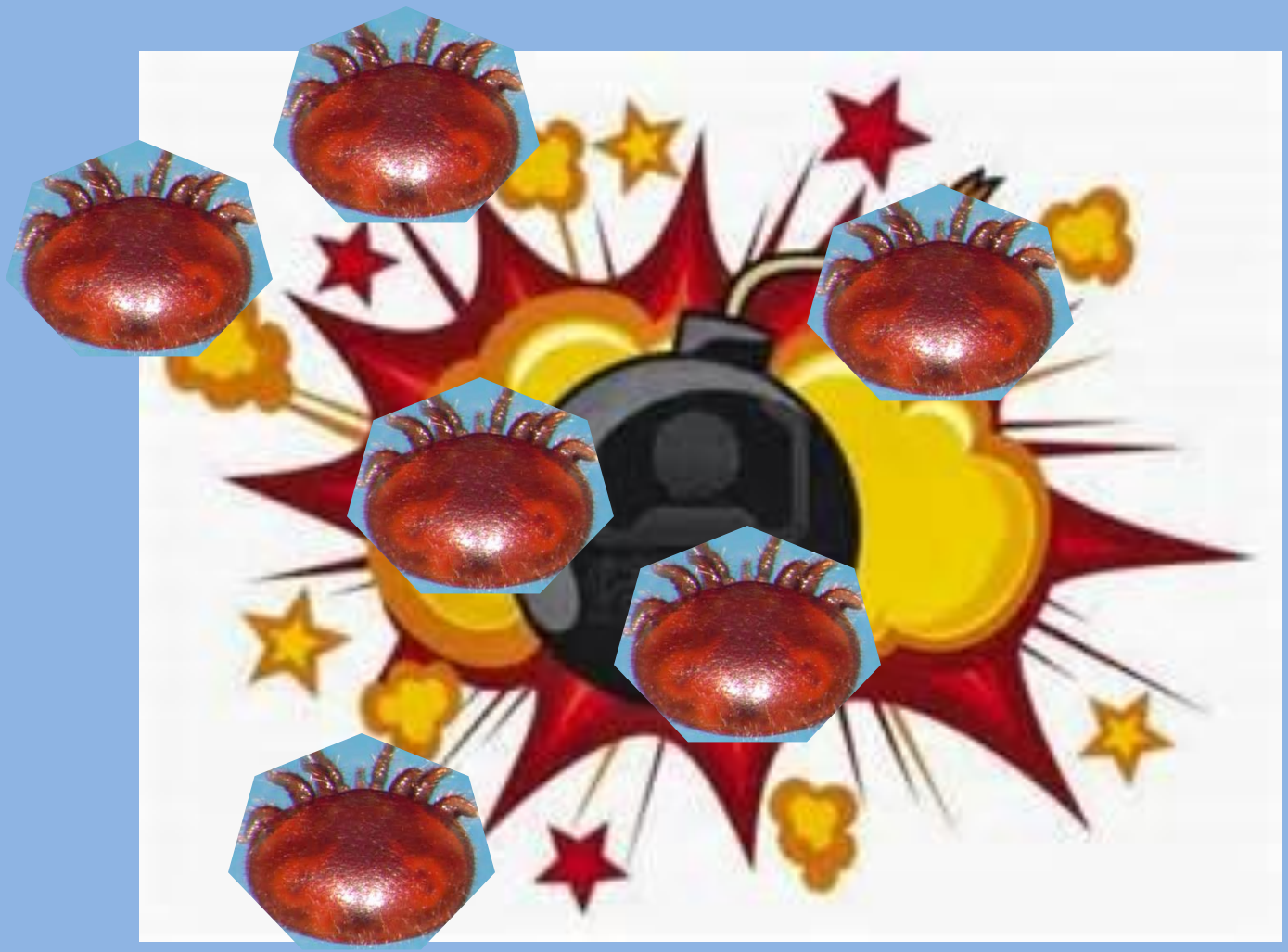
Winter “fat” Bee: lots of fat bodies

Vitellogenin = “fountain of youth” that prolongs bee lifespan so the colony can overwinter

- Vitellogenin allows winter bees to survive for months rather than weeks

- Winter bees have to be able to switch roles back to nurse bees again to raise the next generation coming out of winter

You create a Varroa bomb



Bees with Varroa mites drift to neighboring hives

Low Population = robbing

You have to replace your bees

- We’ve talked about the problem: Varroa mites

- Now let’s talk about what you can do

The only way the Varroa mite can sneak up on you is if you are not watching

How to avoid a sneak attack

Know the signs of Varroa

- Determine your mite numbers

- Make a treatment decision based on the numbers/trends

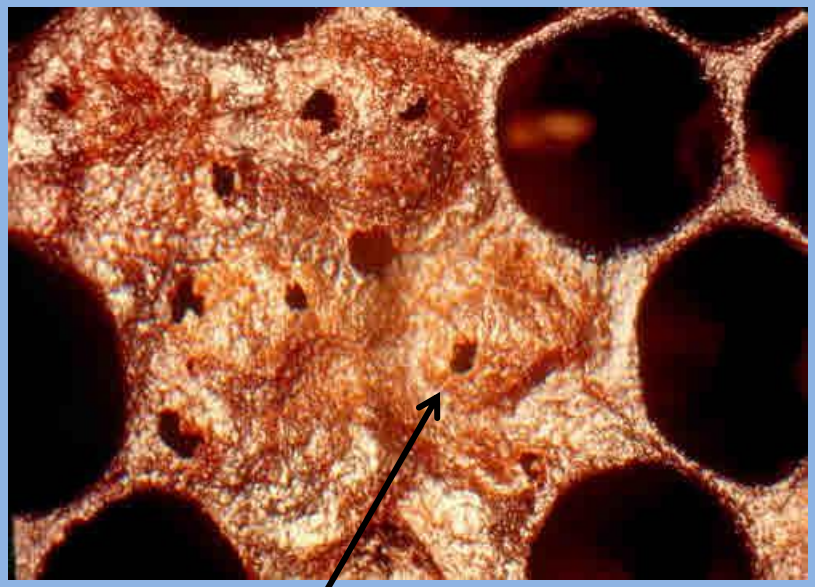
What are the indicators that the Varroa mites are sneaking up on you and your bees?

Bees crawling on the ground in front of the hive

Varroa mites on sticky board

Perforated caps

Infested capped brood



Perforated cap

Normal capped brood

Varroa mites visible on pupae

Varroa on drone pupa

Spotty brood pattern

Normal Brood Pattern

Spotty Brood Pattern

Indicators of viruses: deformed wings

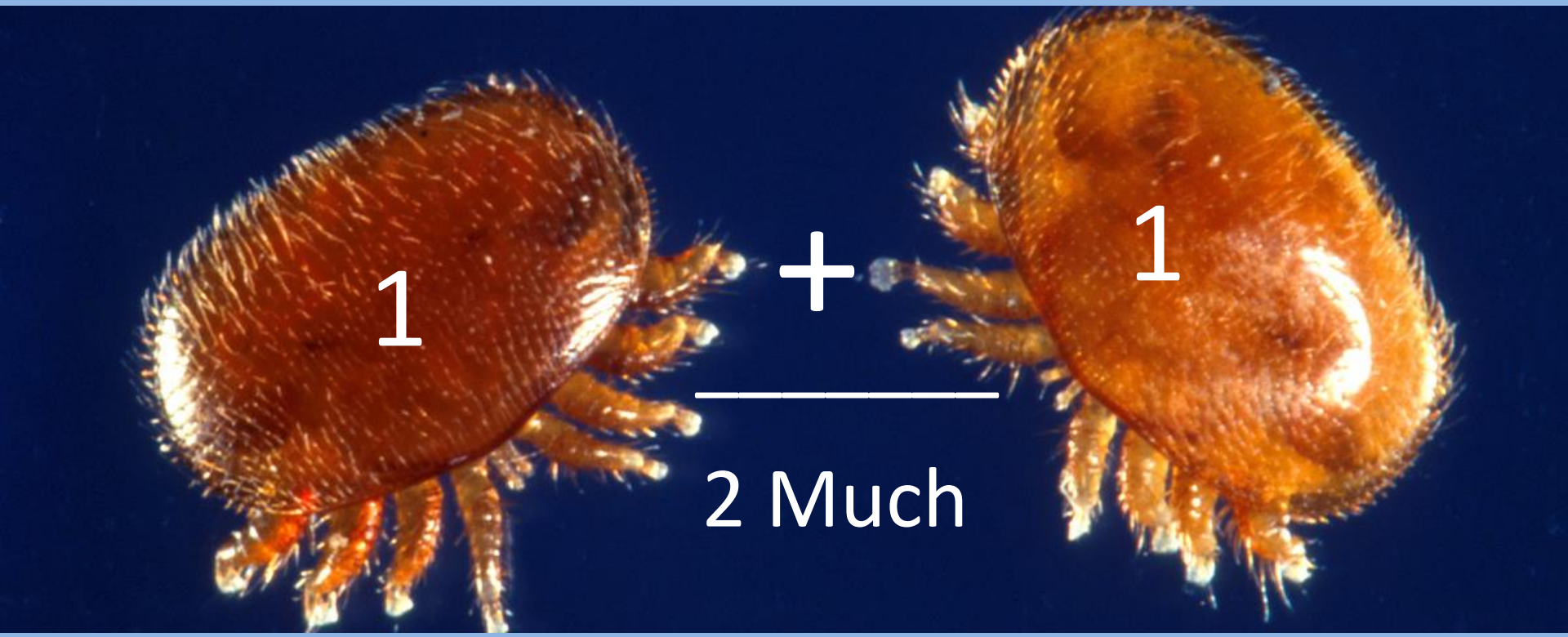
The only way the Varroa mite can sneak up on you is if you are not watching

How to avoid a sneak attack

- Know the signs of Varroa

Determine your mite numbers

- Make a treatment decision based on the numbers/trends


1
+
1
2 Much

How do you confirm your colony's mite load?

- How many are there?
- Are there too many?

Varroa Management Concept #1

It’s not about knocking mite levels down- the trick is to never allow them to get high in the first place.

Randy Oliver Scientific Beekeeping

TOOLS FOR VARROA MANAGEMENT

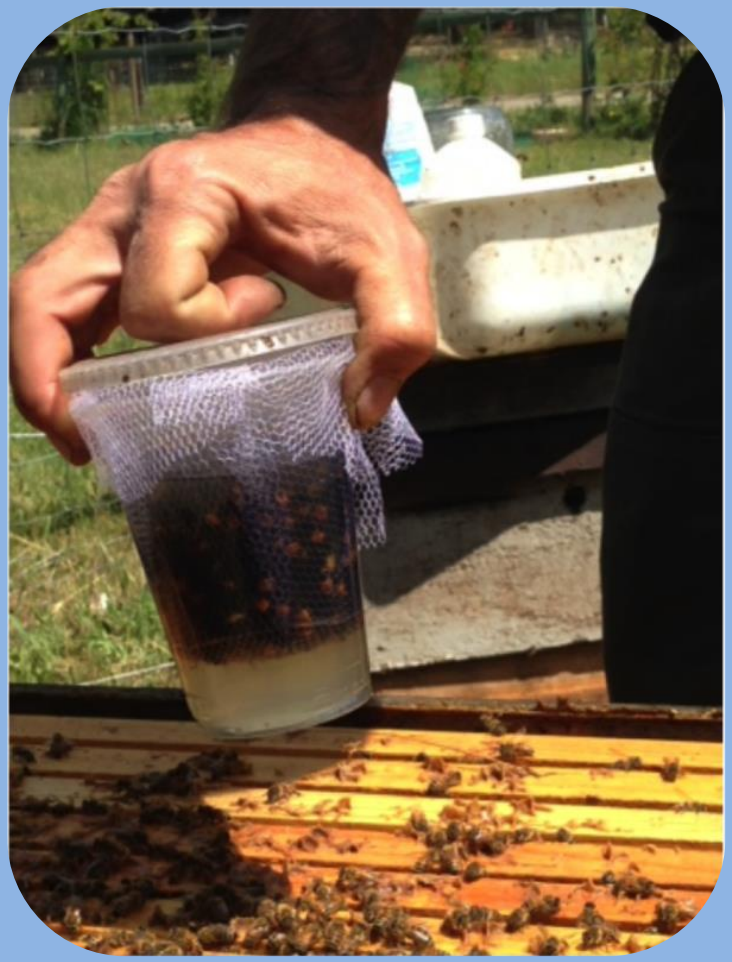
A GUIDE TO EFFECTIVE VARROA SAMPLING & CONTROL

HEALTHY BEES · HEALTHY PEOPLE · HEALTHY PLANET™

http://honeybeehealthcoalition/org/varroa

HONEY BEE HEALTH COALITION™

Alcohol wash = Gold Standard
Goal =Between 1 – 3%



Fall 1-3%

Spring 1%

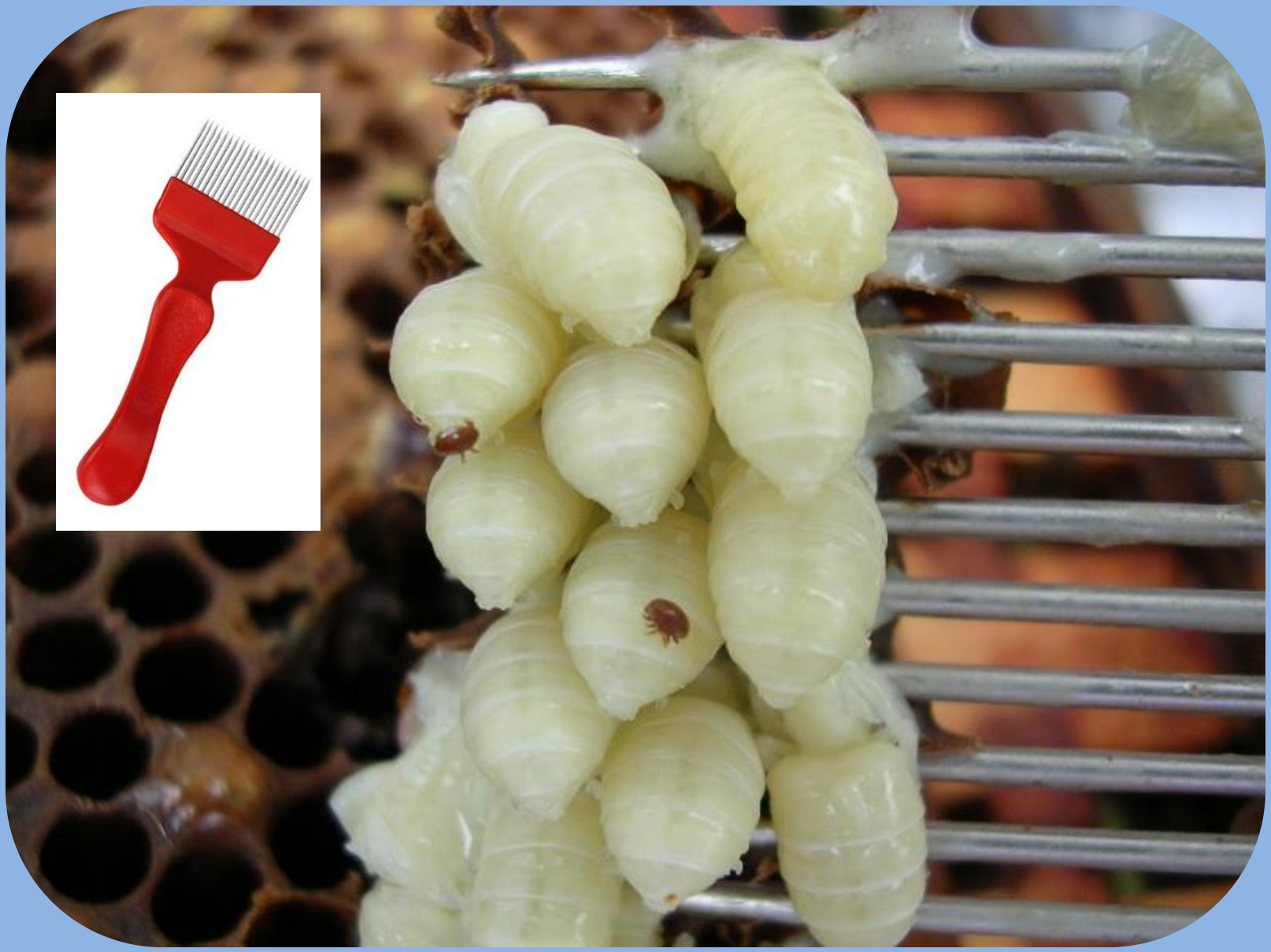
Randy Oliver Scientificbeekeeping.com

Gold standard: Sugar Shake

Ether Roll

Randy Oliver at Scientific Beekeeping

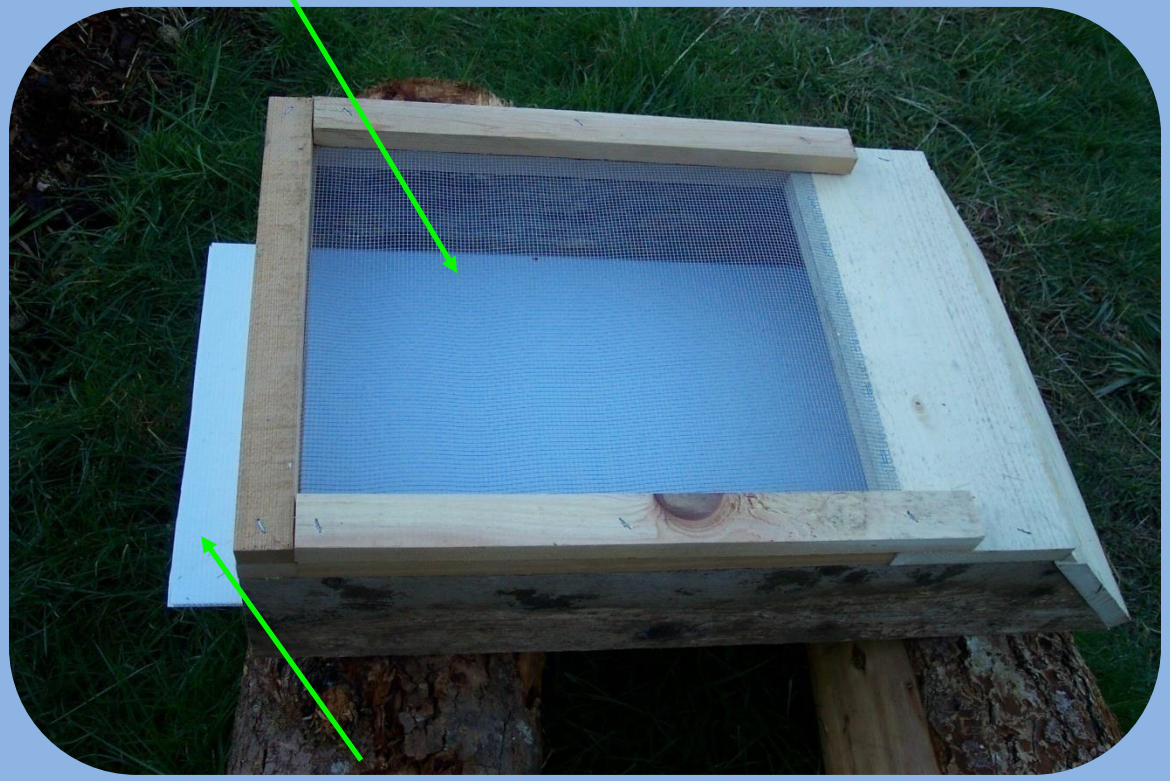
Brood Sampling



Sticky board: 24-hour natural drop

Least accurate tool; only gives you trend not numbers

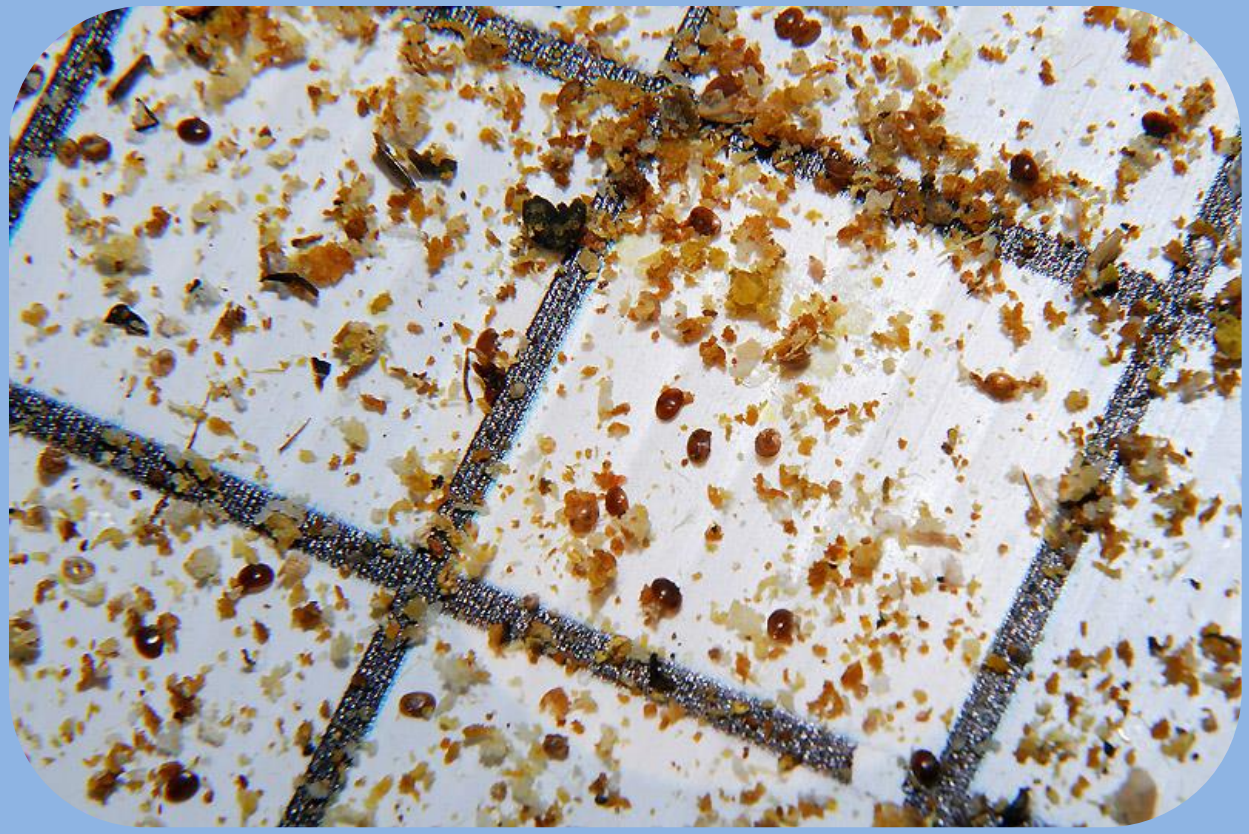
Leave the Screened Bottom Board in place year round



Sticky Board in place only when sampling or treating

How are your mite numbers trending?

The trend is what is important



http://honeybeehealthcoalition/org/varroa

Varroa Videos

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

Will Varroa kill my bes?

IPM

Sampling methods

Essential oils

Apivar

Apistan or Checkmite+

Formic acid

HopGuard

Oxalic Acid

Sanitation, screen bottoms

Drone brood removal

Requeening

How many mites =Treatment threshold

- Point at which the level of infestation is too high and it is time to treat
  - Alcohol Wash = 1-3% (I use 1%)
  - Sticky Board = What is the trend?

- The goal is to keep the numbers below the treatment threshold

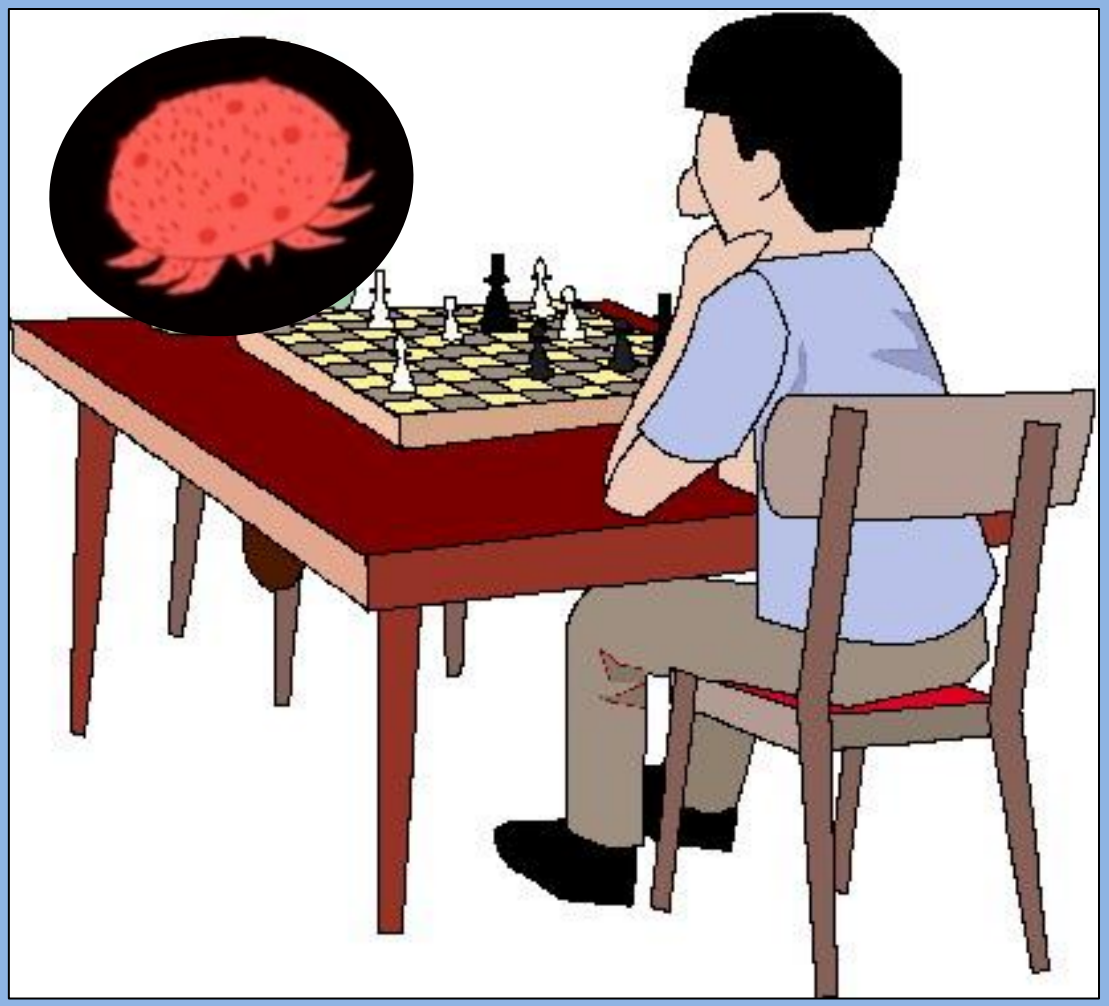
The only way the Varroa mite can sneak up on you is if you are not watching

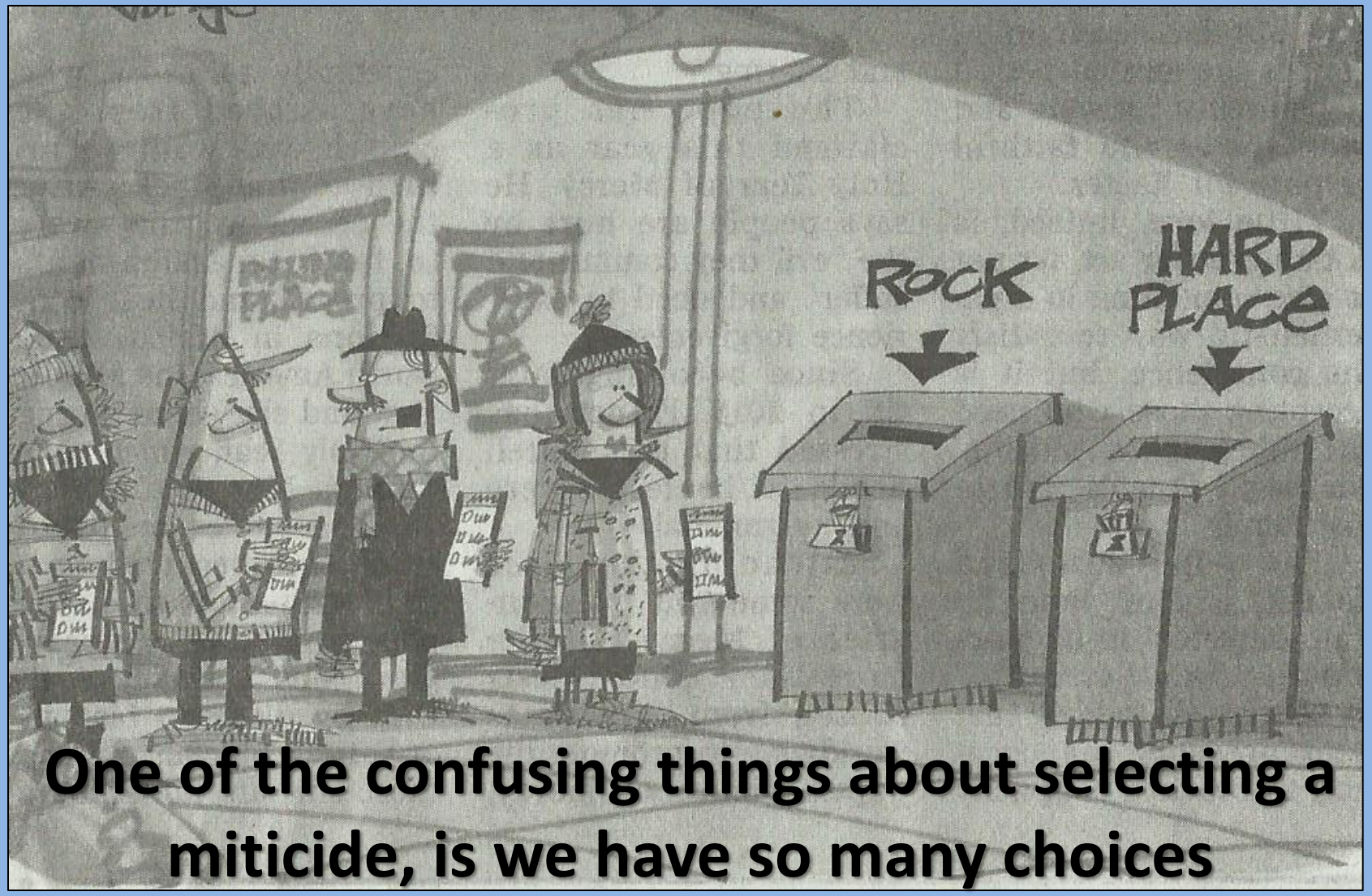
How to avoid a sneak attack

- Know the signs of Varroa
- Determine your mite numbers

Make a treatment decision based on numbers/trends

Have a treatment strategy





One of the confusing things about selecting a miticide, is we have so many choices

TOOLS FOR VARROA MANAGEMENT

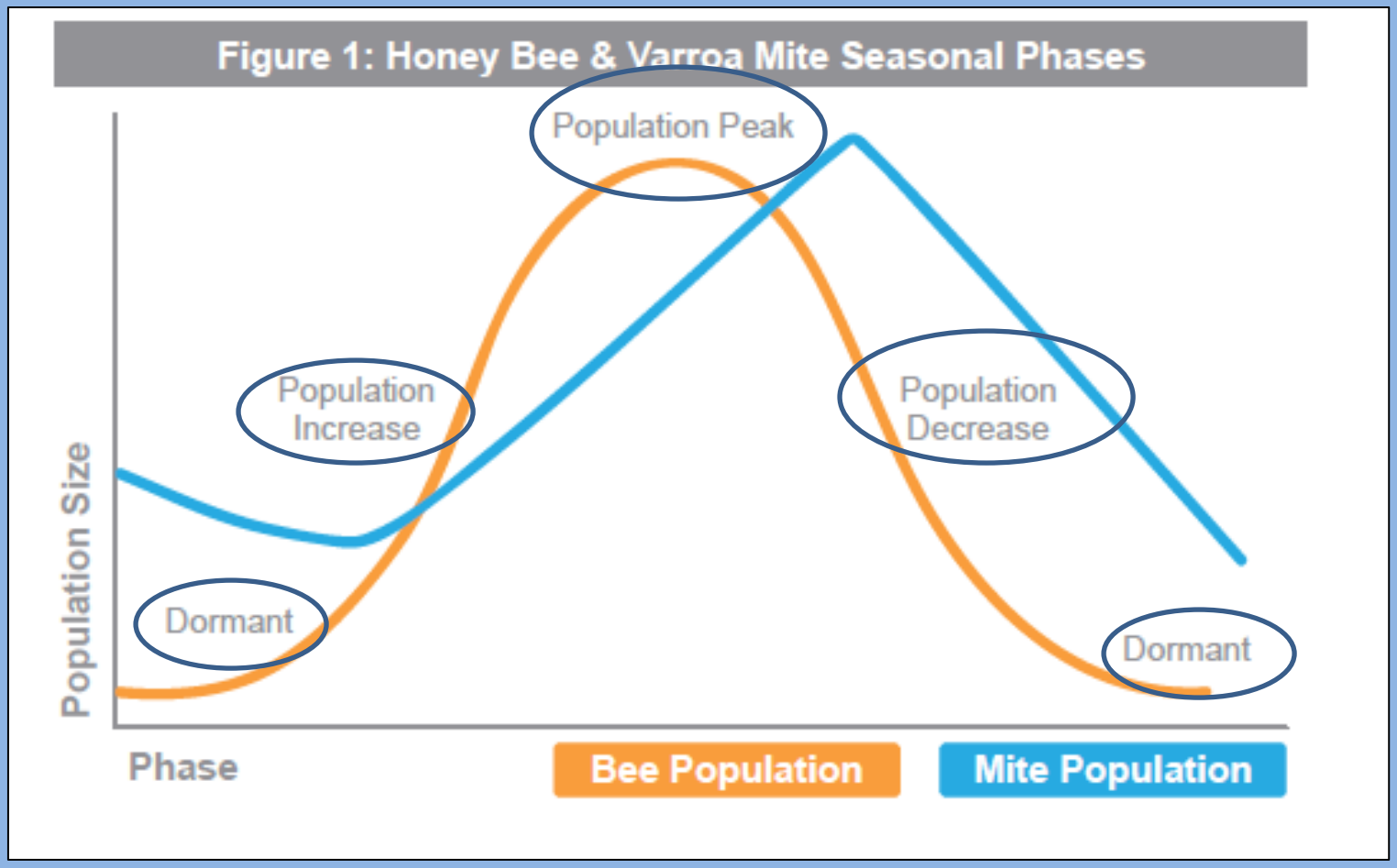
A GUIDE TO EFFECTIVE VARROA SAMPLING & CONTROL

HEALTHY BEES · HEALTHY PEOPLE · HEALTHY PLANET™

http://honeybeehealthcoalition/org/varroa

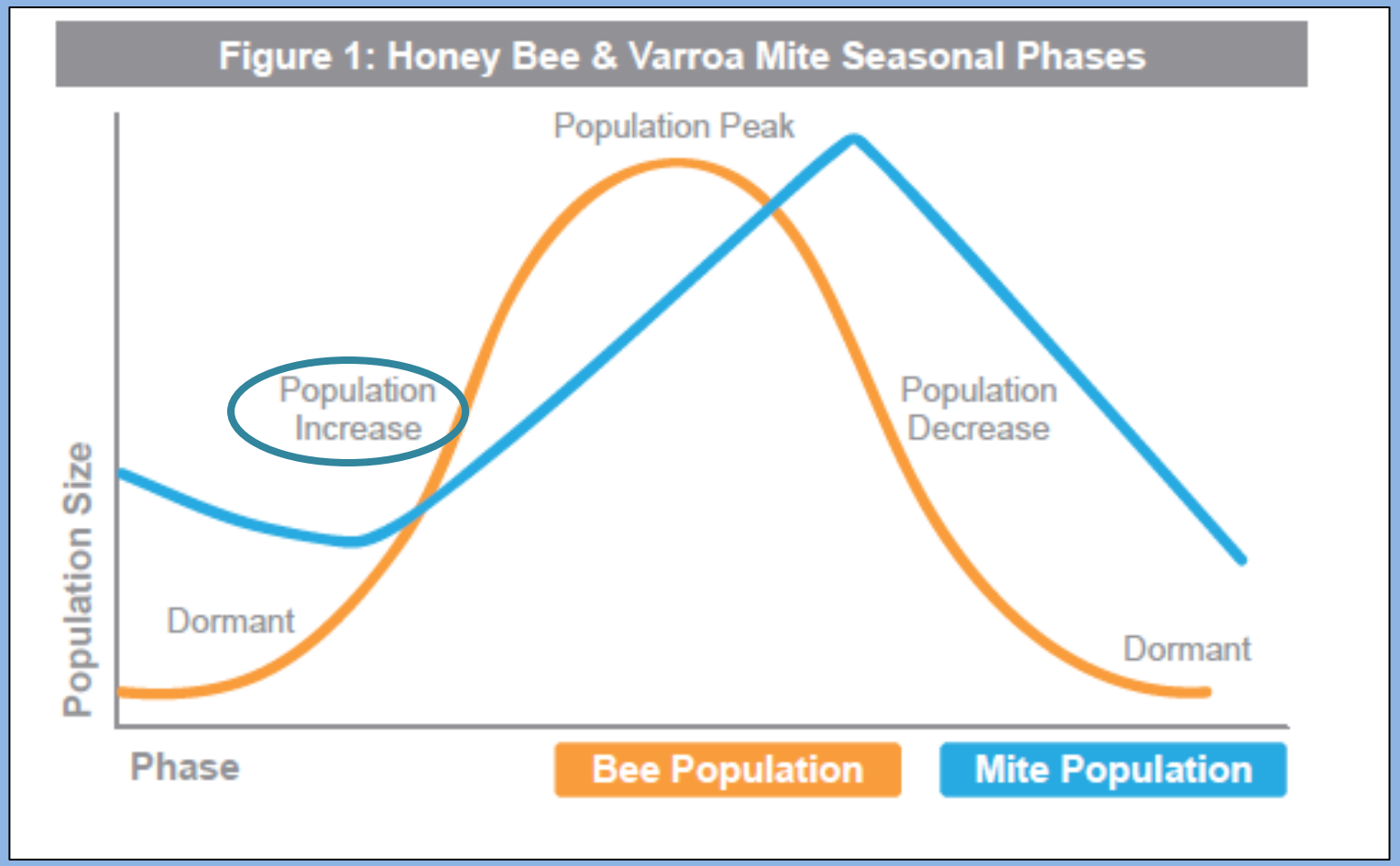
HONEY BEE HEALTH COALITION™

The 4 four population phases of the honey bee/Varroa mite seasonal cycle



Population Increase Phase (spring)

- Bee population growing and expanding
- Mite population usually low but increasing



If I’m getting a package of bees, do I need to be concerned about treating for Varroa?

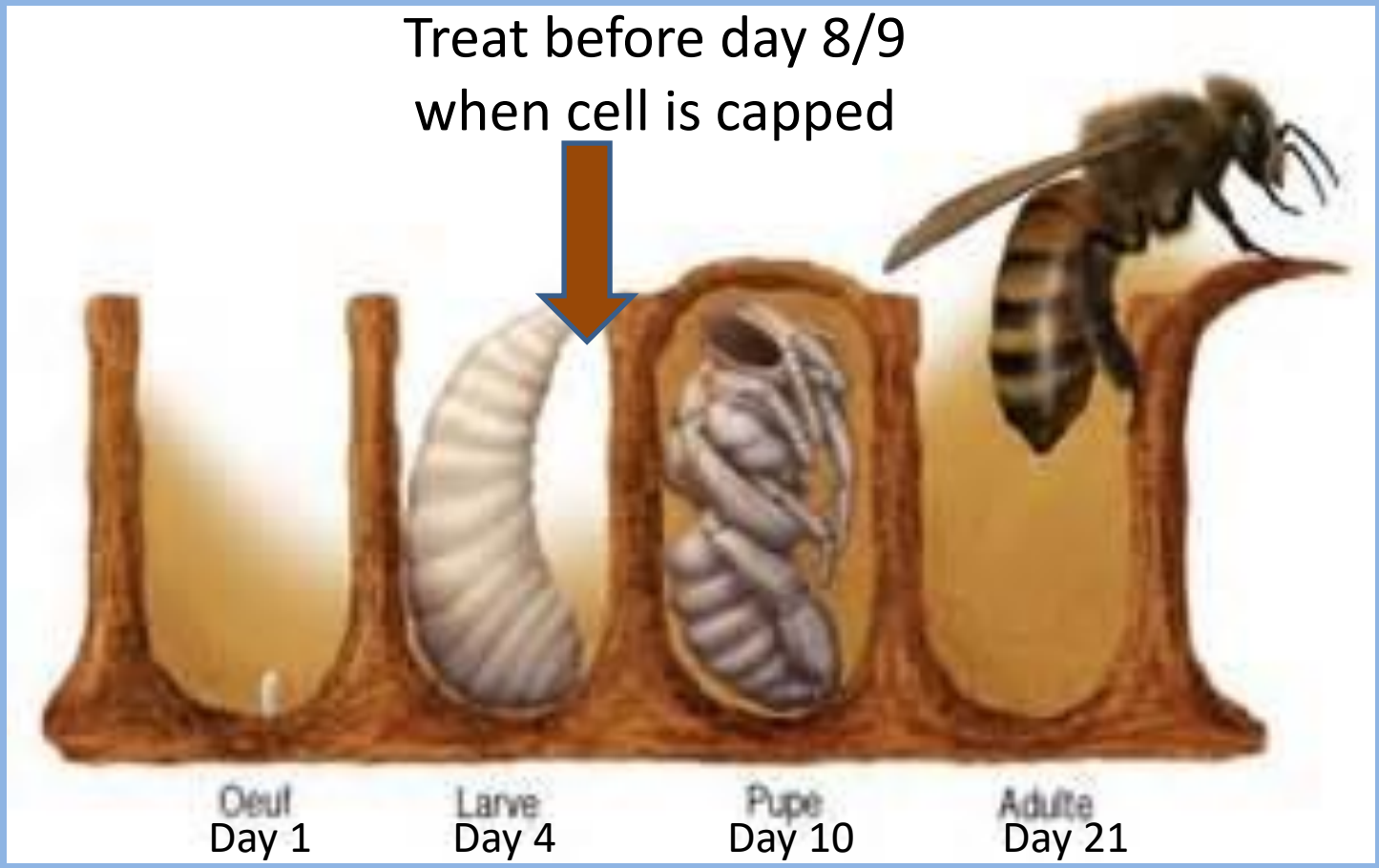
Spring: Where bee and mite biology meet

- Colonies are broodless when they are in a package or a swarm (population increase)
- Mites' strategy for survival is to reproduce and hide in capped brood
- Just about any of the mite control methods are appropriate now

Do I need to treat?

- Existing hive: do a count to determine %
  - Do a count for a package or swarm

Remember the opportunity to treat mites in a swarm or package is limited



Spring

Population Increase	
Seasonal colony buildup; colony brood population growing rapidly and adult worker population increasing; Varroa mite population usually low but increasing; pre-honey flow supering of colonies.	
Highly Effective Options: ▪ Apivar® ▪ Apiguard®, Thymovar®, or ApiLife Var® ▪ MAQS® (formic acid) ▪ Drone brood removal	Notes: ▪ Apivar® must be terminated after a 42- to 56-day treatment period, two weeks prior to adding supers ▪ Apiguard® treatment must be terminated prior to adding supers. ▪ ApiLife Var® must be terminated after 2 or 3 treatments (7-10 days each). Remove ApiLife Var® tablets from the hive at least one month before harvesting honey. (If colonies are not used in honey production, use would be OK.) ▪ MAQS™ use is legally permitted when colonies are supered. ▪ Drone brood removal may be used 2-3 times on strong, populous colonies.
Moderately Effective Options: ▪ HopGuard® II ▪ Colony division ▪ Requeening using hygienic stock ▪ Basic sanitation	Notes: ▪ Hopguard® II effective on smaller colonies during buildup or following almond pollination service. It may help keep mites reduced during buildup but effectiveness needs to be confirmed. ▪ Dividing the colony during the Population Increase phase will most likely negatively affect surplus honey production. ▪ Hygienic queens are not always available. ▪ Basic sanitation may help reduce other stressors.
Least Effective Options: ▪ Screen bottom board ▪ Powdered sugar ▪ Mineral oil ▪ Failure to perform managements	Notes: ▪ A screen bottom board is marginally effective. ▪ There is little evidence that powdered sugar or mineral oil has any effect on mite populations.

Api Life Var® (thymol + eucalyptol, menthol, and camphor.)	
Name	Api Life Var®
Active Ingredient	Thymol + camphor, menthol and eucalyptol oil (essential oils)
Form	Tablet: divide into ¼ strips, place on top of brood box at corners
[illegible]	Fumigant
Treatment time	2 or 3X for 7-10 days each (leave 3rd treatment in for 12 days); Repeat or combine with another treatment if heavy mite numbers.
Time of Year	**Population Increase:** Less effective but better during early season buildup or low mite numbers; **Population Peak:** If honey supers are not present **Population Decrease:** After nectar flow, with temperature considerations
Effectiveness	70 to 90%
BIP Results	24.5 to 40% fewer overwintering colony losses with use in 4 consecutive survey years
Restrictions and Considerations	Use between 65 to 85°F (18-30°C); ineffective below 45°F (8°C).
	Do not use more than 2x/year; do not use when colonies are supered for honey; wait one month before harvesting honey following removal of strips
Advantages	Naturally derived.
Disadvantages	Temperature considerations: may run bees out of hive if temperature is 80°F or above; increase in bee adult irritability; honey taste tainting.
Considerations	Wear gloves; high temps may cause bees to exit hives and/or adult/brood deaths; may melt plastic hive parts; not available in CA or HI.

Api Life Var

If you treat one colony, treat them all

- Varroa mites are like cigarette smoke
- Both can kill and
- Both spread by drifting

Was the treatment effective?

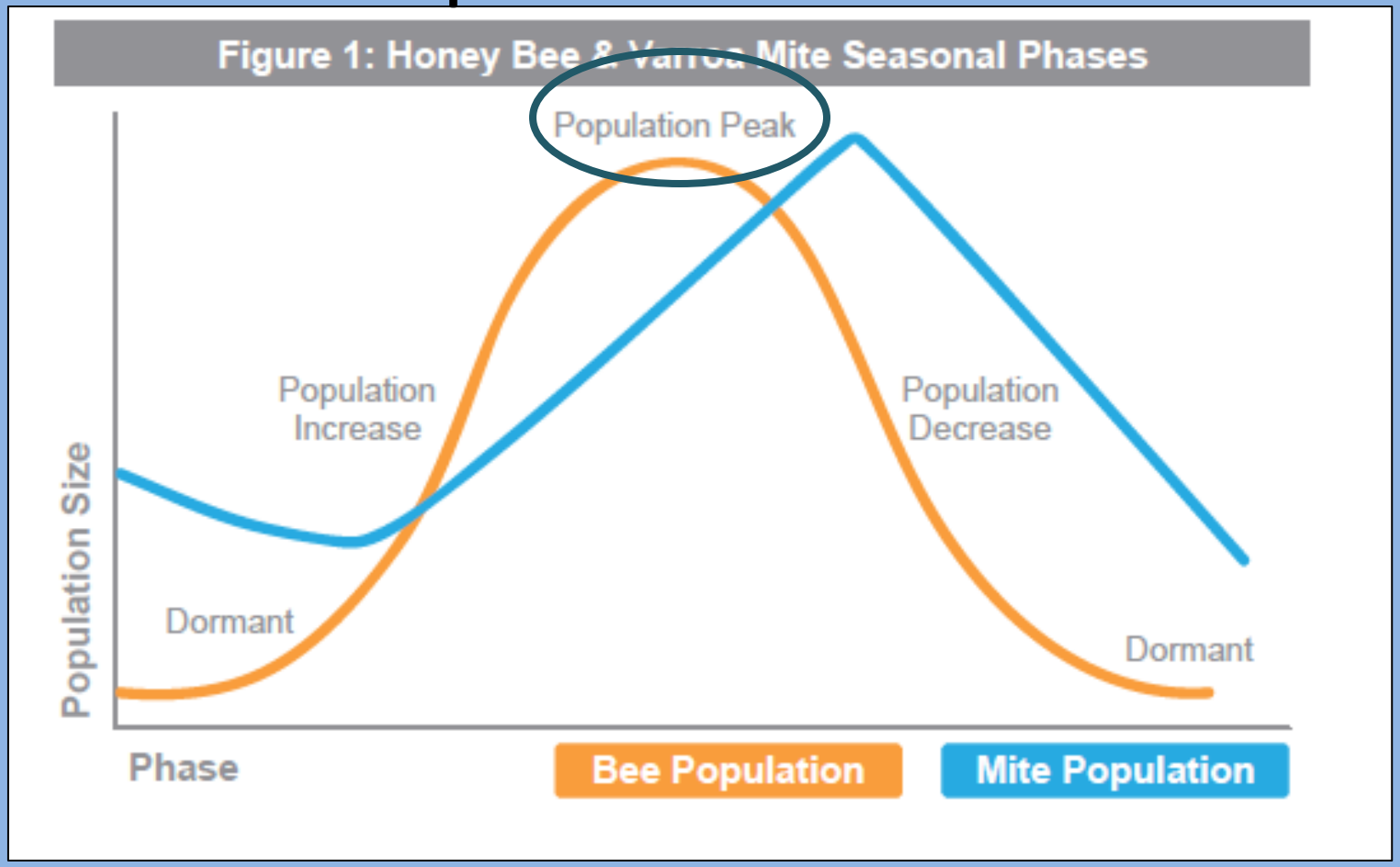
What are your post treatment numbers?

Questions to ask yourself if you didn't get the result you wanted

- Did I follow the directions exactly? Example

- If I did what the directions ask, try another highly effective option

Population Peak phase (summer) Corresponds to nectar flow



Bee population at peak; mite population increasing

What if you need to treat during the population peak?

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.

Summer treatment option

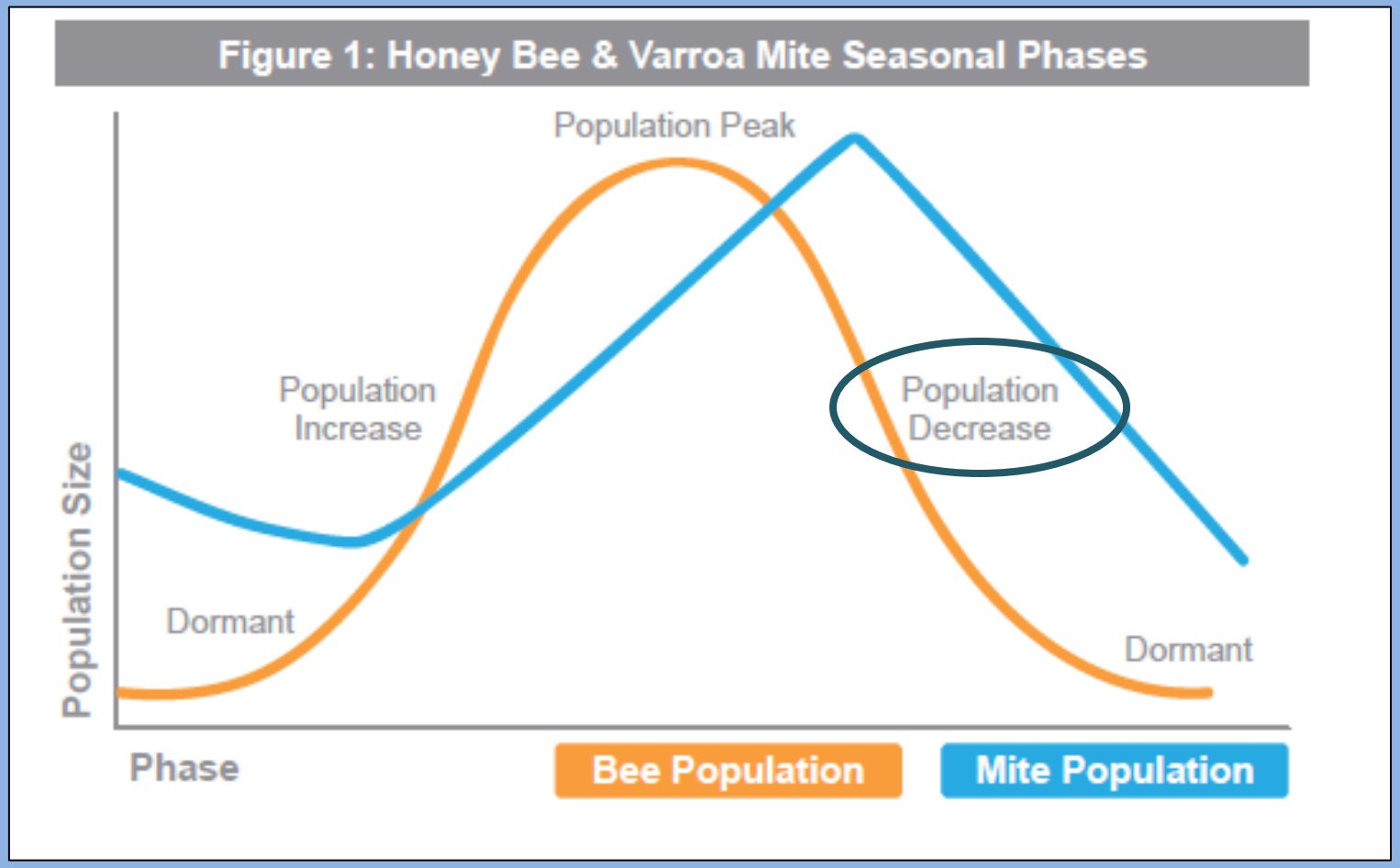
	Mite-Away Quick Strips® (MAQS®) (formic acid)
Name	Mite-Away Quick Strips® (MAQS®)
Active Ingredient	Formic acid (organic acid)
Form	MAQS®: legal formulation-impregnated biodegradable strip
Mode of Action	Fumigant
Treatment Time/ Use	Treatment time 7 days, not necessary to remove strips.
Time of Year	**Population Increase/Population Peak**: Unique chemical that can be used while honey supers present **Population Decrease**: Following harvest if not too warm
Effectiveness	61 to 98% under temperature limitations; if too warm (>95°F) less effective
BIP Results	16 to 31% fewer overwintering colony losses with use in four consecutive survey years.
[illegible]	Two strips placed on top bars of brood chamber
Restrictions	Use between 50 to 85°F (10 to 30°C) remove if temperature >90°F.
Advantages	Natural product; OK to use while bees storing honey (taste tainting possible); able to kill mites under cappings.
Disadvantages	Potential for bee brood mortality and queen losses.
Considerations	Use acid-resistant gloves, protective eyewear and clothing, including respirator; post "72-hour restricted" re-entry signs in apiary; leave screen bottom board (if used) open and add empty hive body or spacer frame above brood chamber; may see bee bearding first couple of days; use permitted during nectar flow.

MAQS (formic acid)

- Naturally occurring
- Effective on phoretic mites and those under capped brood
- Can use when honey supers present
- Temperature dependent
- Many cautions with use; follow application directions

What do you do when your mite numbers are too high and you have honey supers in place?

Bees' Fall starts after nectar flow



Post honey harvest bee population decreasing; raising winter bees

Mite population growing, peaking then dwindling to phoretic when colony broodless

Why is the best time to treat after the honey harvest?

We want to start raising “winter bees” after honey harvest

- Food resources dwindling and Varroa mites are increasing

- Bees need time to store energy (honey) and protein (Vitellogenin) for winter

- The bees need to raise multiple generations of bees with Vitellogenin to become “fat” winter bees (21 days per worker brood cycle)

Non-winter and winter Bees

Non-winter Bee: few fat bodies

Winter “fat” Bee: lots of fat bodies

Think Multiple generations

“So what we want to do here is take care of the bees that take care of the bees that go into winter.” Kim Flottum

Vitellogenin allows bees to be young again: come out of metabolic retirement

- Raise Babies
- Care for Queen
- Maintain Hive
- Build Comb

- Protect Hive as Guard Bee

- Collect Nectar
- Collect Pollen
- Work Until Their Wings Wear Out

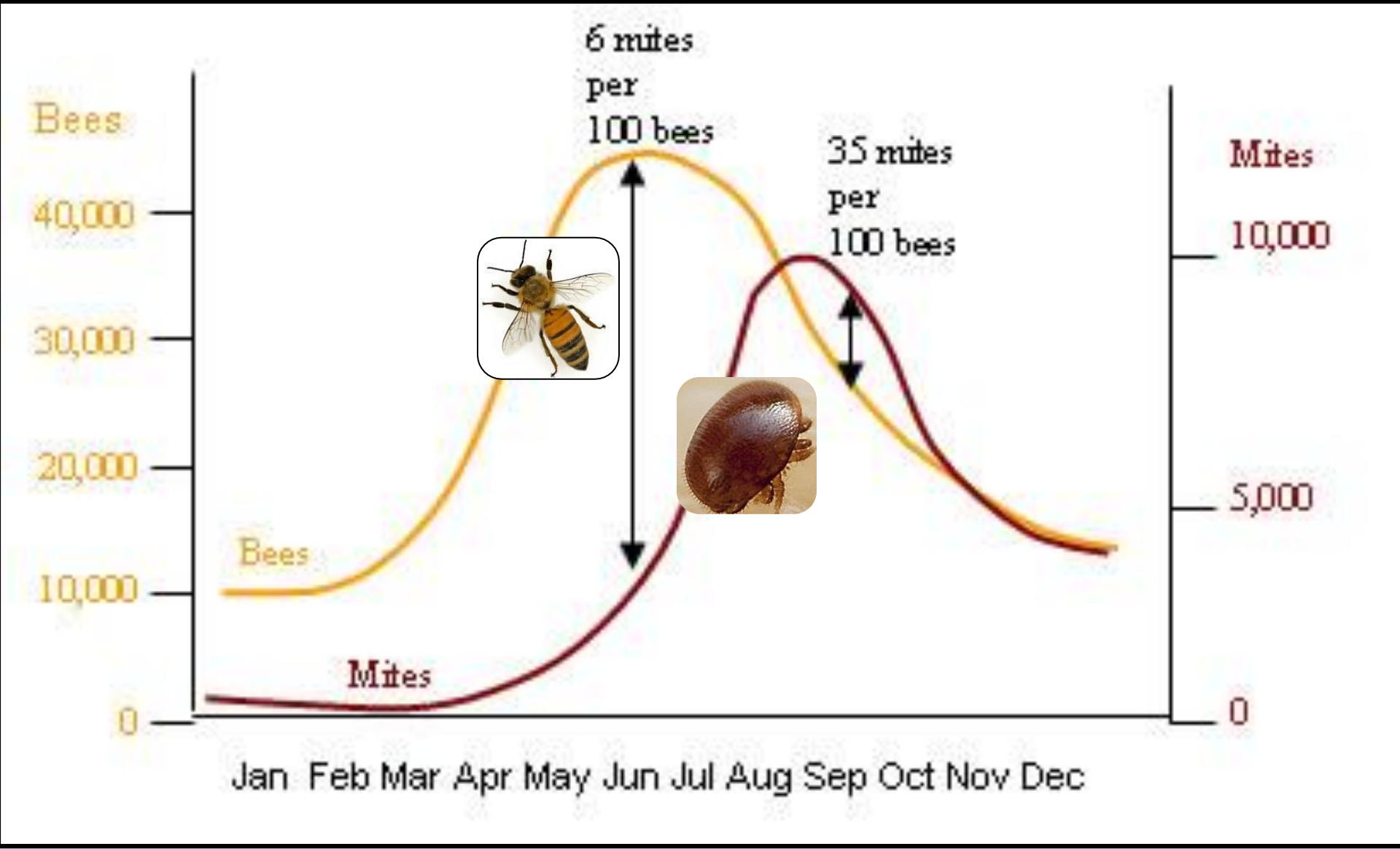
What interferes with the bees' ability to produce "fat" winter bees?

Fall can be precursor of winter losses or spring success

"The parasitic mite *Varroa destructor* remains the single most detrimental pest of honey bees, and is closely associated with overwintering colony declines."

Report on the National Stakeholders Conference on Honeybee Health

Population Decrease (fall) A perfect storm: skyrocketing ratio of mites to bees



How does this perfect storm affect the rearing of “fat” winter bees?

Varroa infestation

- Bees make Vitellogenin just like they make royal jelly
- Worker bees infected with Varroa mites DO NOT MAKE Vitellogenin
- Without Vitellogenin the colony does not overwinter well if at all =
  - No winter bees
  - No colony survival

Fall: Population Decrease

Population Decrease	
Post-honey harvest; bee population decreasing; colonies rearing overwintering bees. Varroa mite populations growing, peaking, and then declining until eventually only phoretic mites on adult bees after colonies become broodless.	
Highly Effective Options: ▪ Apivar® ▪ MAQS® ▪ Apiguard®, Thymovar®, or ApiLife Var® ▪ HopGuard® II	Notes: ▪ Apivar® should not be used until surplus honey is removed. ▪ MAQS®, Apiguard®, Thymovar®, 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. ▪ HopGuard® II limited test data support its effectiveness. Confirm control effectiveness following use.
Moderately Effective Options: ▪ Requeening with hygienic bees ▪ Dividing colonies ▪ Oxalic acid drip	Notes: ▪ Hygienic stock is not widely available. ▪ Requeening and dividing colonies may be difficult. ▪ Oxalic acid is most effective if there is little to no capped brood present.
Least Effective Options: ▪ Apistan® or CheckMite+® ▪ Drone brood removal ▪ Screen bottom board ▪ Sanitation	Notes: ▪ Mite resistance to Apistan® and CheckMite+® is well documented. ▪ Colonies are unlikely to raise drones during this phase. ▪ Basic sanitation may help relieve stress.

Fall

Apiguard® / Thymovar®	
Name	Apiguard® (USA) and 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)
Considerations	26 to 31% fewer overwintering colony losses with use in 4 consecuti
	Temperatures >59°F and <105°F (15 to 40°C)
Restrictions	Do Not use when colonies are supered for honey.
Advantages	Naturally derived; no known Varroa resistance to Thymol, easy to us
	May reduce queen egg-laying activity; may increase adult and young under warmer temps; may cause bees to beard in hot weather; huma
Considerations	Use Gloves; Effectiveness reduced for light mite infestations; require board; do not feed sugar syrup during treatment; consider using spac individual gel trays. (Thymovar – spacer rim is not needed)

Courtesy of Jen Holt

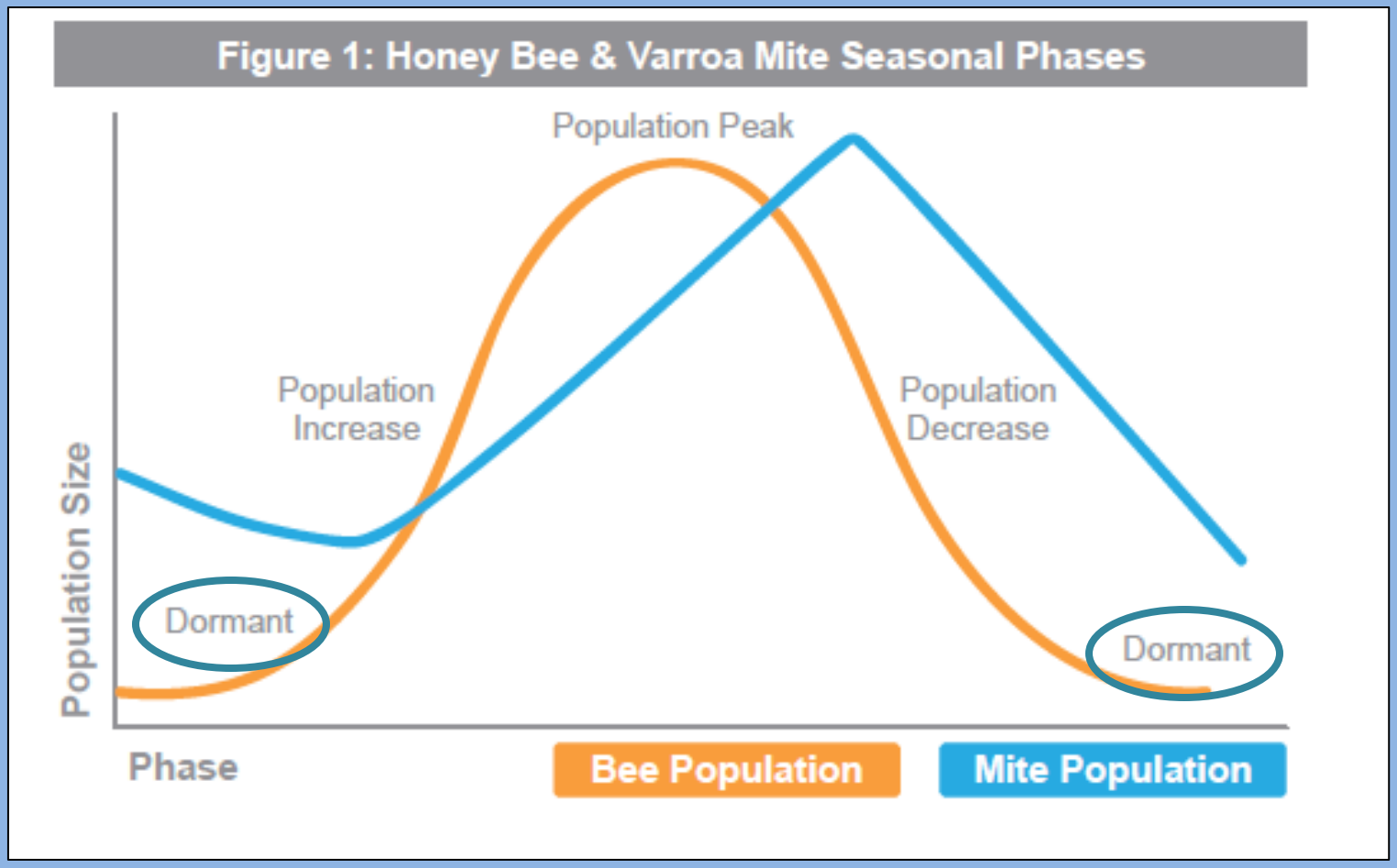

APIGUARD®
4125/08
For beehive use
50g gel containing 12.5g Thymol
Keep out of reach and sight of children.
For animal treatment only.
Withdrawal period:
Honey: Zero days.
Do not use during honeyflow.
Do not store above 30°C.
Do not freeze.
VITA
Vm 17017/4002
AVM-GSL
Read the warnings and instructions before use.
Date of application: .....
(for beekeepers use)
Marketing Authorisation Holder:
Vita (Europe) Limited, Basingstoke, Hampshire, UK
Manufactured for Vita (Europe) Ltd. by:
Laleham Healthcare Ltd., Alton, Hampshire, UK
BN 07F1254
EXP 07/2012

Why are your post treatment numbers important?

Latest start to treatment and still have time for back up treatment plan

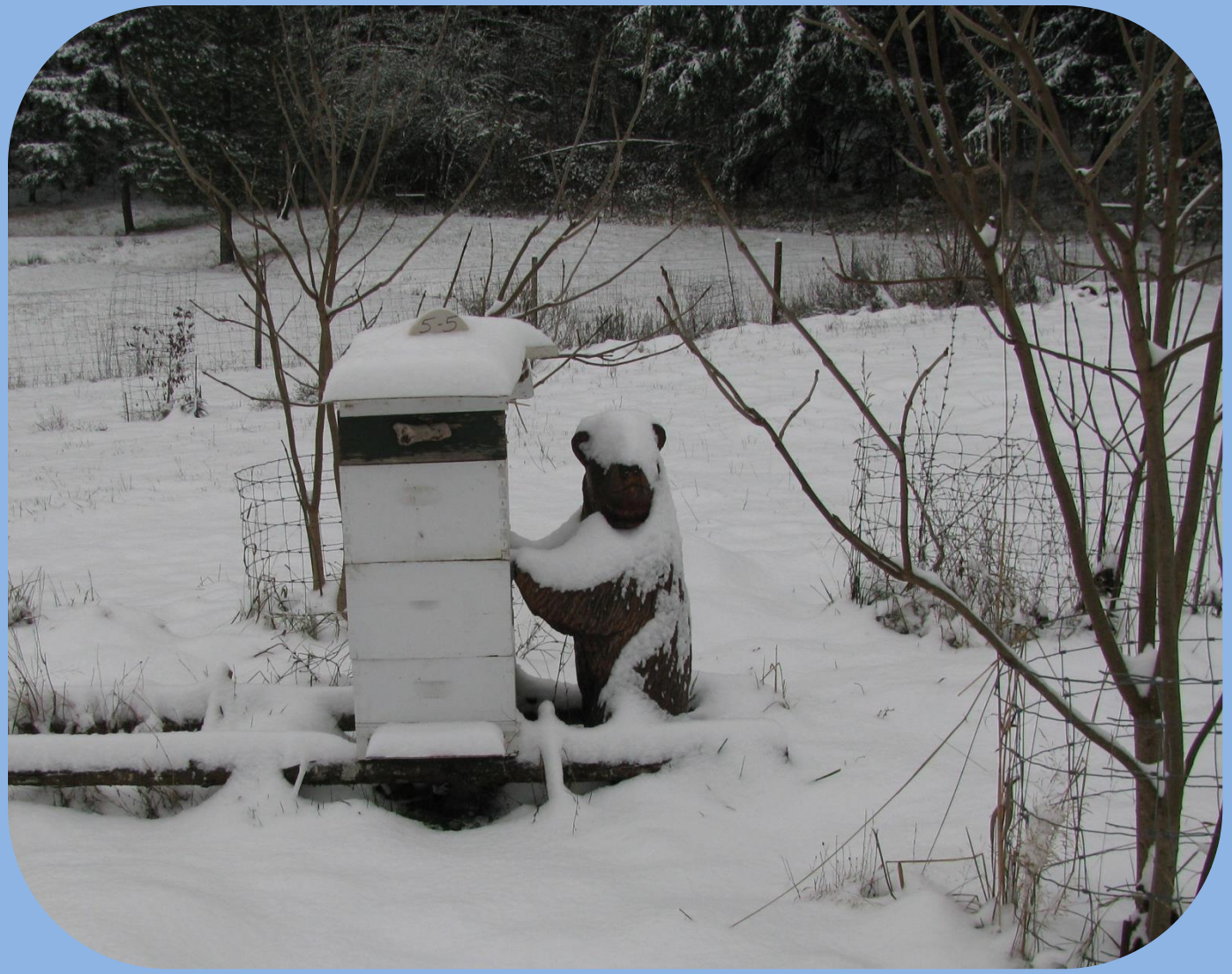
Too late!

Winter: Dormant phase



No brood and mites are phoretic

Winter: Opportunity



Winter: dormant phase

Dormant Phase	
Bees are clustered; no brood in northern locations with reduced brood rearing in southern locations; all or most Varroa mites are phoretic (*i.e.*, on adult worker bodies, as there is little to no developing brood) and both populations are in decline because there is little or no reproduction occurring within the colony.	
Highly Effective Options: ▪ Oxalic acid (fumigation method) ▪ Winter or broodless period ▪ HopGuard® II	Notes: ▪ Best utilized when no brood. ▪ Varroa mortality over extended broodless period is high. ▪ HopGuard II works best when little/no brood
Moderately Effective Options: ▪ In beekeeping regions with brood during this phase, Apiguard, Thymovar®, ApiLife Var®, formic acid, or Formic Acid Quick Strips (MAQS®) provided temperatures are within optimal ranges.	Notes: ▪ The effectiveness of Apiguard®, Thymovar®, ApiLife Var® and formic acid (MAQS®) during the dormant phase when there is no brood is largely unknown.
Least Effective Options: ▪ Anything that risks colony success through this phase ▪ Screen bottom board	Notes: ▪ Screen bottom board removes a small percentage of mites that fall from adult bodies. It is best used in combination with other techniques.

Oxalic Acid	
Name	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
Video	Watch our Oxalic Acid video: http://bit.ly/controls-oxalicacid

Dormant/Winter: Oxalic Acid

Oxalic acid, found in spinach, made Popeye strong; it can do the same for your winter bees

Why Oxalic Acid?

- Varroa mites are all phoretic which means you can get them all
- No brood for Varroa mites to hide in
- So far no resistance to it
- Inexpensive
- Last chance to control varroa mites

Oxalic Fumigation Application

- Slightly more effective
- Requires extra equipment
  - ✓ Vaporizer tool
  - ✓ Battery to power it
- Corrosive: Dangerous to lungs, eyes
- Need protective clothing and nitrile gloves
- Requires goggles, respirator
- Follow directions exactly

Solution/Dribble application (sugar syrup)

- Equipment: syringe or applicator
- Requires nitrile gloves, protective goggles
- Dangerous to eyes; wear gloves to keep hands away from face
- Follow directions exactly

Rx

There is no “one-size-fits-all” solution for Varroa management. Choose an approach that fits you.

Be Proactive: Control Varroa

Take Home Messages

- Know your mite loads whether you plan to treat or not
- Know your mite load at the time you treat & post treatment
- Follow the product directions EXACTLY
- Talk to experienced, successful beekeepers to learn what has worked for them
- Ultimately it is your decision

Don’t Give Varroa a License to Kill!

OREGON Class **K**

License to Kill

00753276 Expires NOW

Varroa destructor
Your Bee Hive
Any Place, USA

Restrictions
Untreated Hives

The End

Photo: Suzanne Jurgens

Questions?

References

- Scientificbeekeeping.com
- Randy Oliver's website

- http://honeybeehealthcoalition/org/varroa
- Tools for Varroa Management