

# Set up

- Set up dummy alcohol wash and sticky board trap
- Bring microscope or at least hand lens

# Varroa management

For small-scale beekeepers meeting

Feb 22, 2020



# Varroa mites

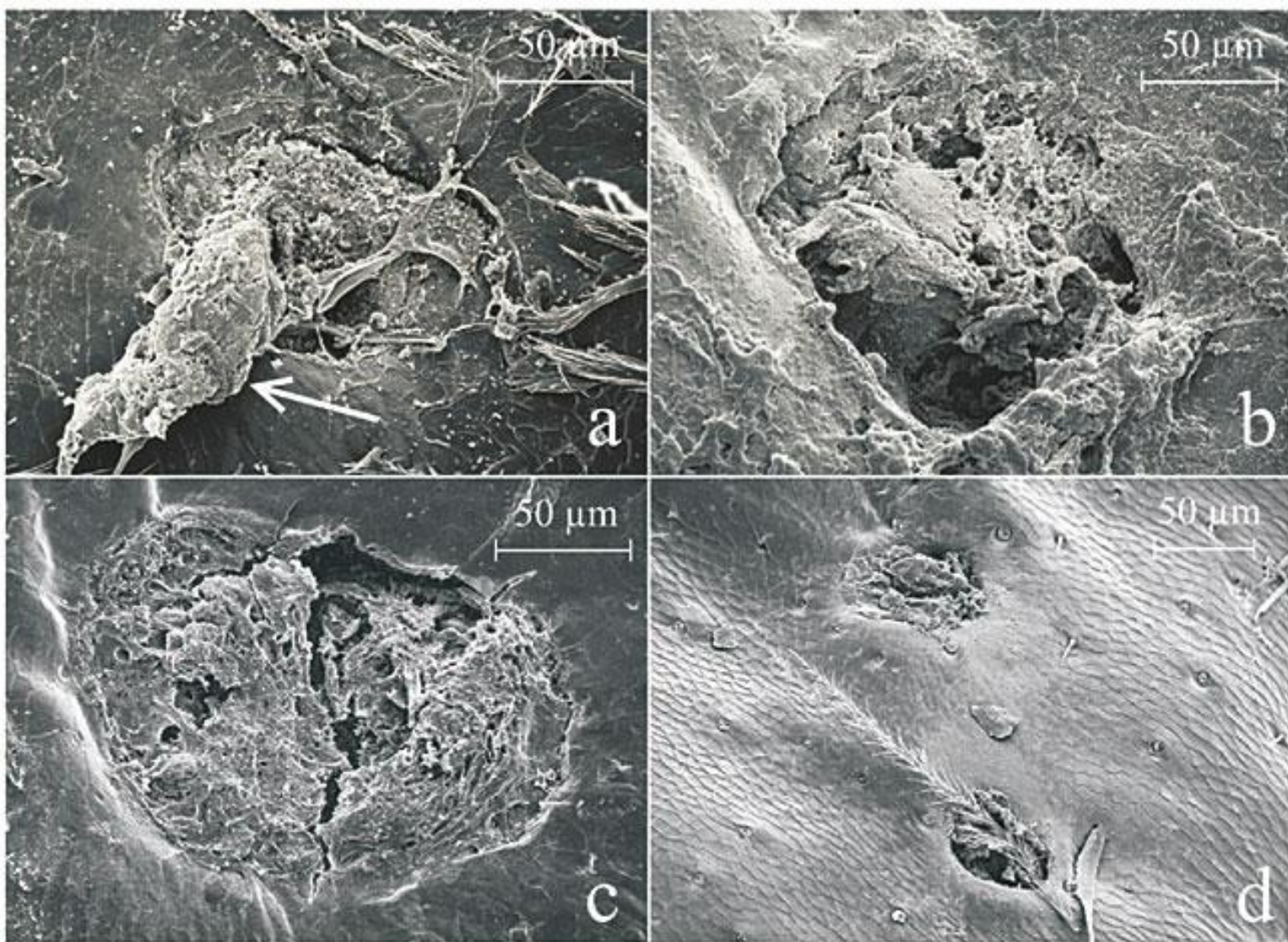
## (*Varroa destructor*)

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- Plate-sized ecto-parasite
- Feed on bee hemolymph and fat body
- Feeding punctures create open wounds on bee exoskeleton
- Vector viruses: deformed wing, BQCV, KBV, CBPV, sacbrood
  - Colony death within 2-3 years

# Damage

- Damage cuticle
- Hypoproteinemia in hemolymph
- Reduced body mass of young adults
- Shorter lifespan
- Morphological abnormalities
- ↓ Drone reproductive capacity
- Secondary infection
- ↓ immunosuppression (hemacytes, expression of antimicrobial peptides)
- ↑ susceptibility to other bee diseases



**Figure 2.** Scanning electron microscope photos of *Varroa*-made wounds in the integument of pupal honey bees. a = wound on drone pupa 21-22 days old, infested with three female mites. Hemolymph is leaking out of the perforation (arrow). b = wound on drone pupa 21-22 days old, infested with five female mites. Wound with deep holes around the margin. c = wound on worker pupa 20-21 days old, infested with four female mites. The large wound is only partly healed. d = wounds on drone pupa 21-22 days old, infested with two female mites, with two nearby perforations on the second abdominal sternite. Notice the developing hairs on the cuticular surface.

Kanbar and Engels 2005

# Viral Diseases

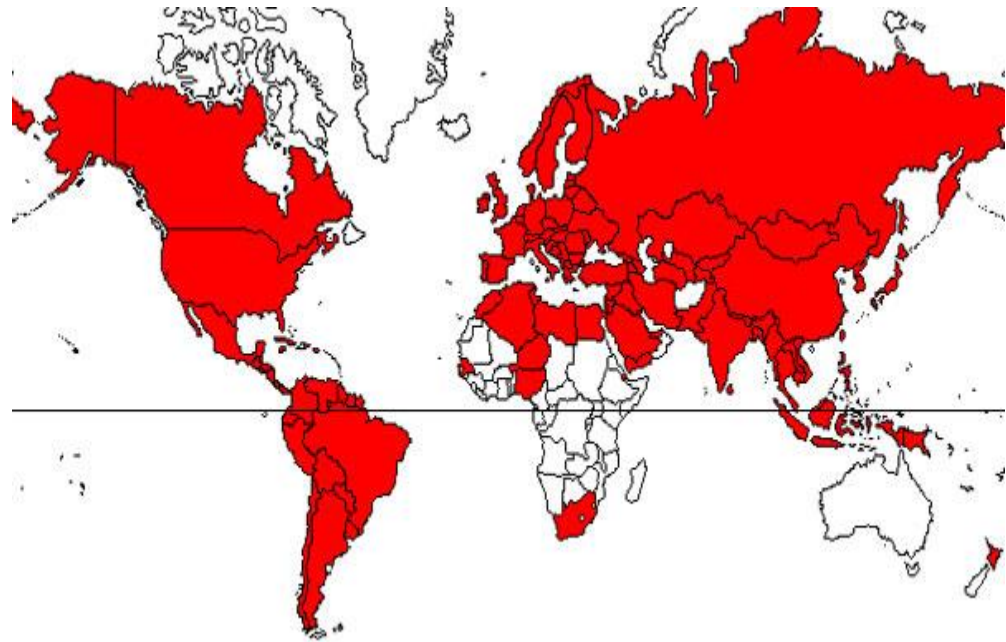
- Deformed Wing Virus
- Sacbrood
- Kashmir Bee Virus
- Black Queen Cell Virus
- Chronic Bee Paralysis Virus
- Acute Bee Paralysis Virus
- Israeli Acute Paralysis Virus

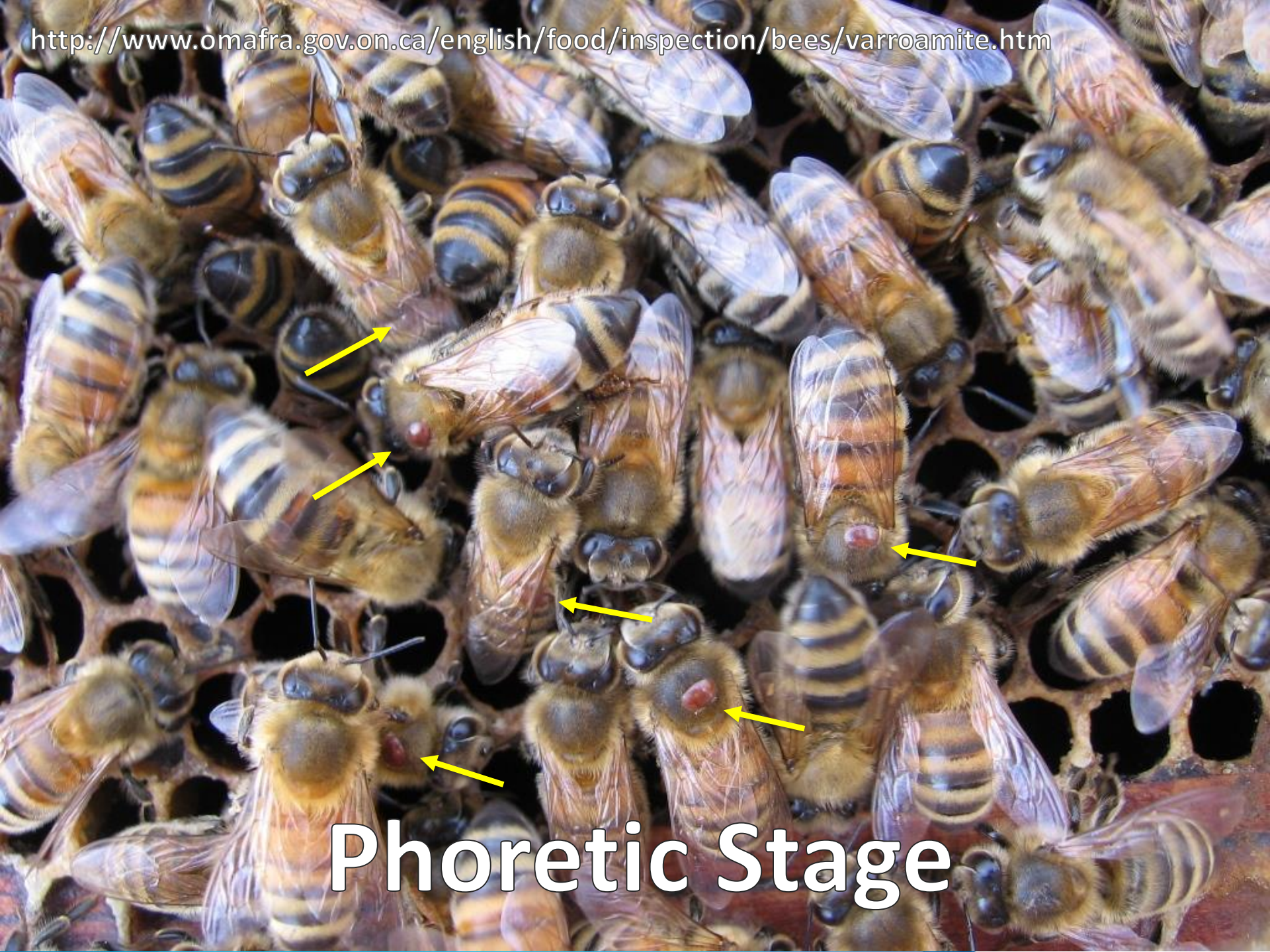


[www.omafra.gov.on.ca/english/food/inspection/bees/varroamite.htm](http://www.omafra.gov.on.ca/english/food/inspection/bees/varroamite.htm)

# Distribution

- 1904 *V. jacobsoni* identified on *Apis cerana*
- ~1940 *V. destructor* infected *A. mellifera*
- 1970's – 1980's – Europe
- 1987 – came to North America
- 1995 – entire North America **except Newfoundland**
- 2000 - New Zealand
- Australia & NFLD are without Varroa





**Phoretic Stage**





# Mite : Bee Emergence

Caste	Egg (days)	Larva (days)	Pupa (days)	Total Development (days)	Adult Longevity
Queen	3	4.6	7.5	15-17	2-5 years
Worker	3	6.0	12.0	19-22	Summer: 30-38 days Winter: 140-320 days
Drone	3	6.3	14.5	24-25	8 weeks

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1.4 mites from worker brood

2.5 emerge from drone brood

# Transmission

- Drifting – apiary layout, hive designs
- Robbing weak / dead hives
- Barrel feeding
- Swarming & hiving swarms
- Uniting / Splitting colonies
- Relocation for pollination



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# Bee Culture

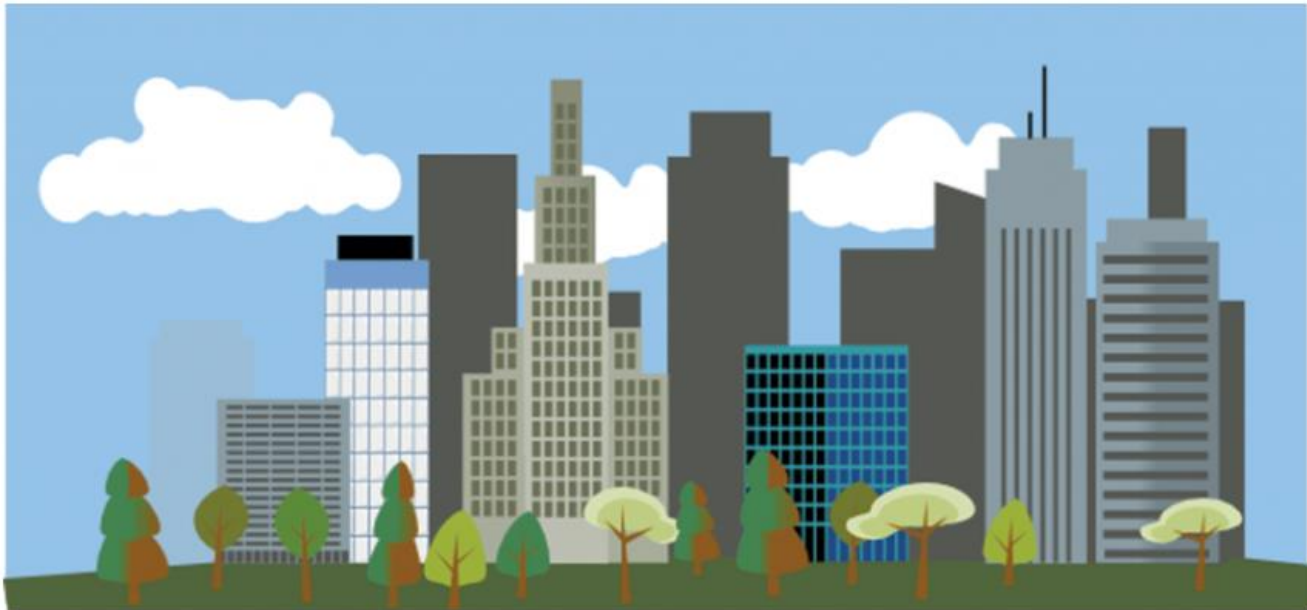
The Magazine of American Beekeeping



BEEKEEPING / LIFE / SCIENCE / RESOURCES / OPINIONS / CATCH THE BUZZ

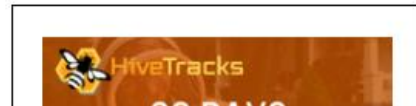
DECEMBER 22, 2016

## VARROA BOMBS ARE REAL



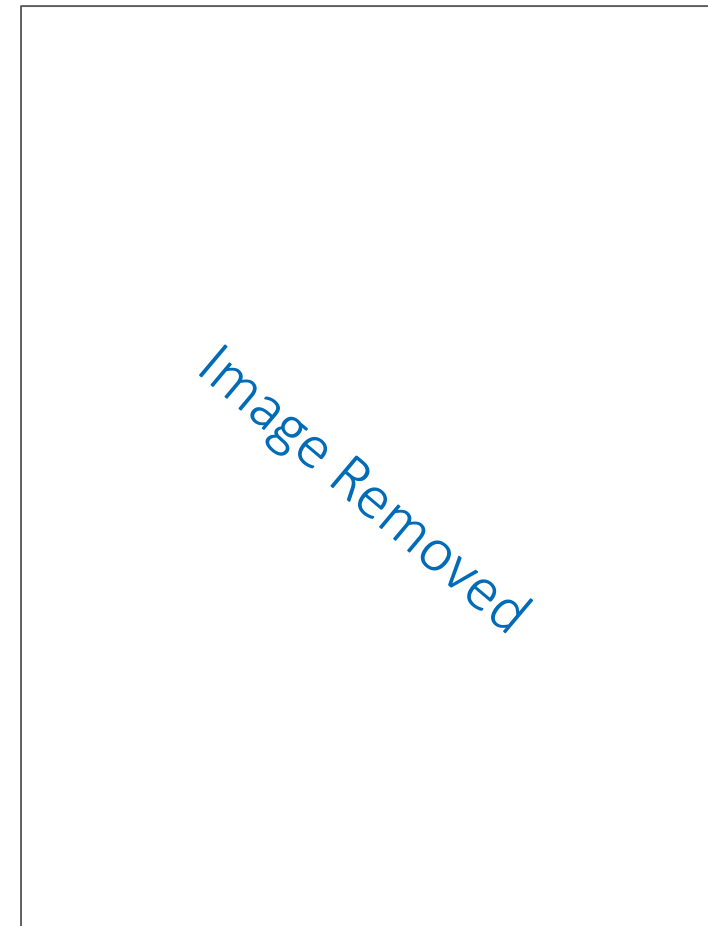
### Please, Be A Good Neighbor

In this season of vitriol we should all perhaps stand down,



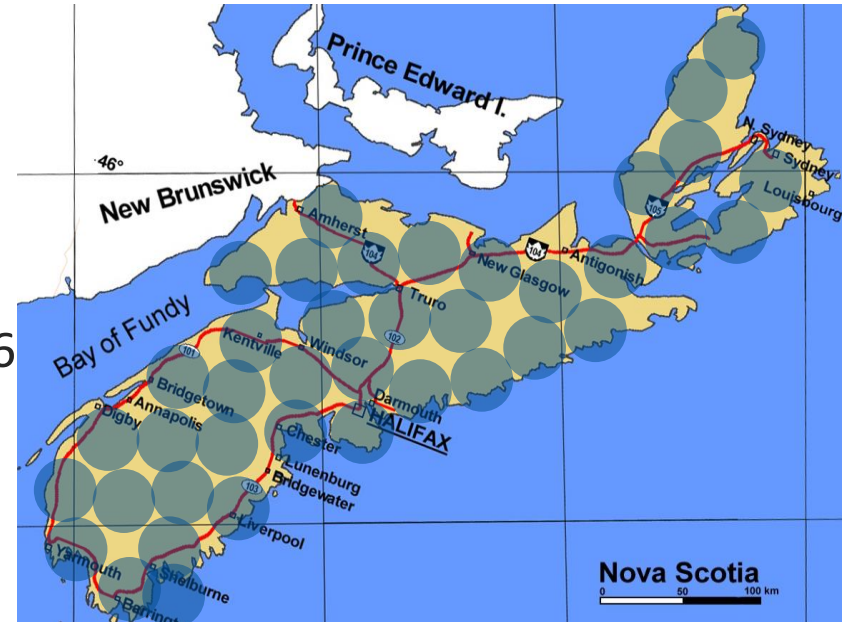
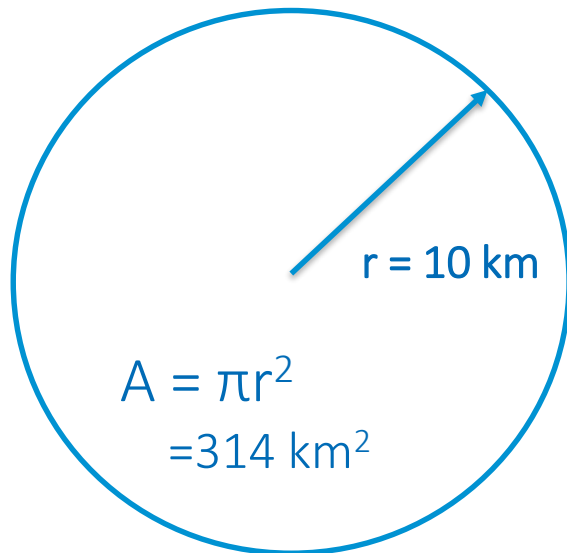
# My Soapbox

- Honey bees are not indigenous to N. America.
- They are managed - feral populations are short-lived.
- Simply keeping more bees does not secure bee populations. Can do more harm.
- Bee health requires regular intervention.
- Bees do not quickly evolve immunity.
- Hives don't make good lawn ornaments.
  - **Keep learning.**
- **Consider your reasons for keeping bees and whether this is really for you.**
  - **It can be a very rewarding past-time.**



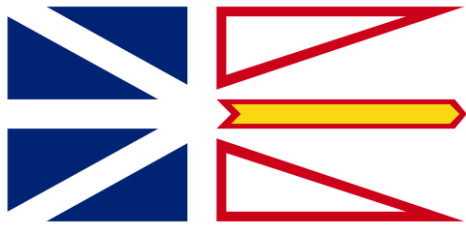
# My Bees, My Business!

- Max honey bee forage distance: ~10 km
- Relocation limit: ~20 km
- Beetle pest flight limit: ~20 km
- NS area = 55,280 km<sup>2</sup>
- Max # of bee yards without overlap = 176
- Actual # of bee yards = 1,113



How you manage your bees directly affects others, their success, production costs, their livelihood, and those who depend on them.





# Exports to NFLD



**Prohibition of the importation of honey bees**

Under the authority of the *Animal Health and Protection Act*, a person shall not bring honey bees (*Apis mellifera*) or honey bee hives into the Province of Newfoundland and Labrador unless accompanied by a certificate signed by an official veterinarian or licensed veterinarian in the place of origin.

**The honeybees and hives must be free from the following pests:**

- honey bee tracheal mite (*Acarapis woodi*)
- varroa mite (*Varroa destructor*)
- greater wax moth (*Galleria mellonella*); and
- small hive beetle (*Aethina tumida*)

For more information, please contact  
ocvo@gov.nl.ca | 709.637.2046

Newfoundland  
Labrador  
Forestry and Agrifoods Agency

Please do not import honey bees, used equipment, pollen, beeswax, etc!!!! It is illegal to import bees or used equipment without a permit from the Government of Newfoundland & Labrador.

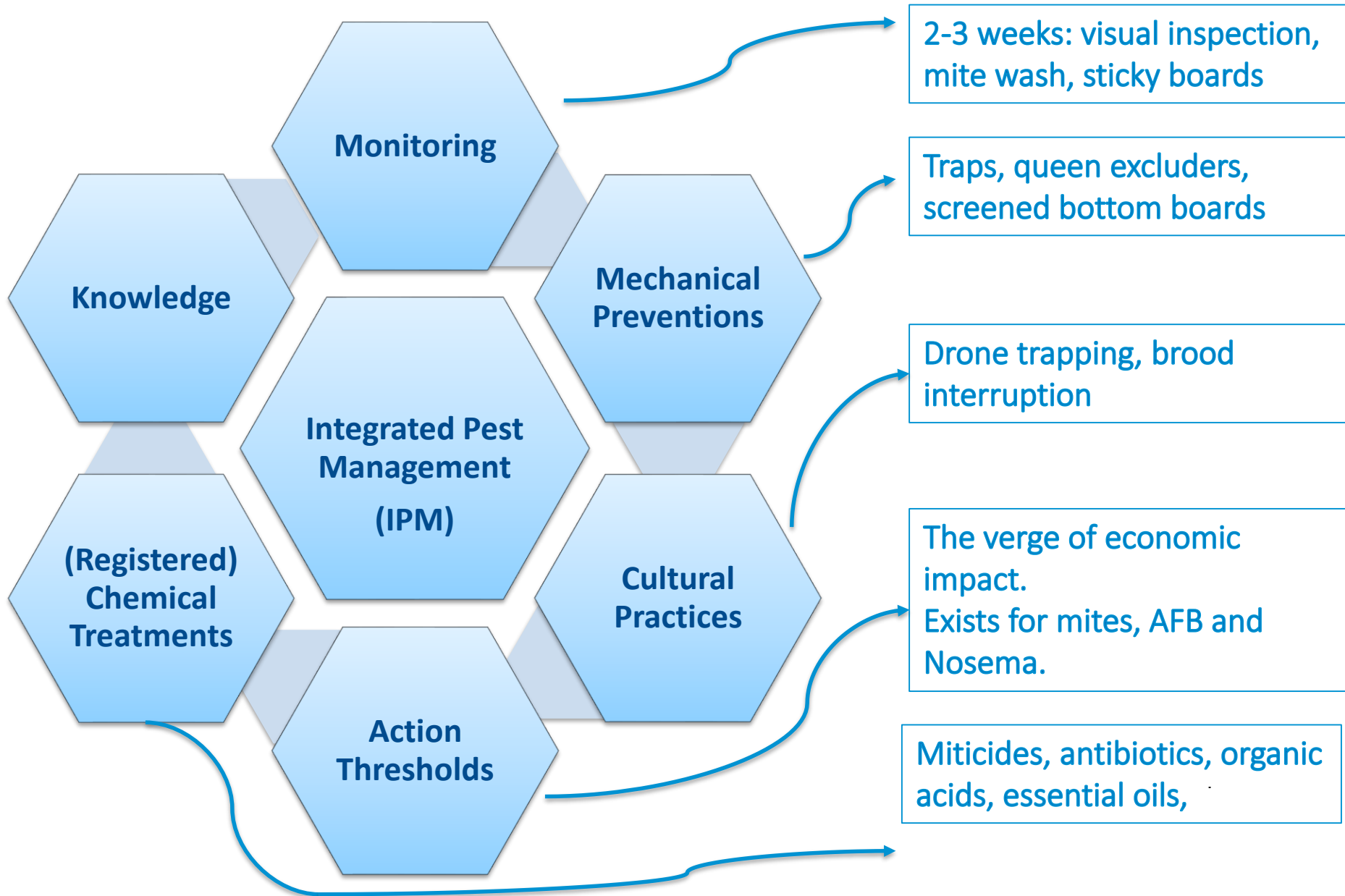
No *Bombus quads* either!!

NFLD maintains freedom from:

- Varro mites
- Small Hive Beetle
- Wax moth
- Tracheal mite
- American foulbrood

<http://www.nlbeekeeping.ca/our-bees-nl/>

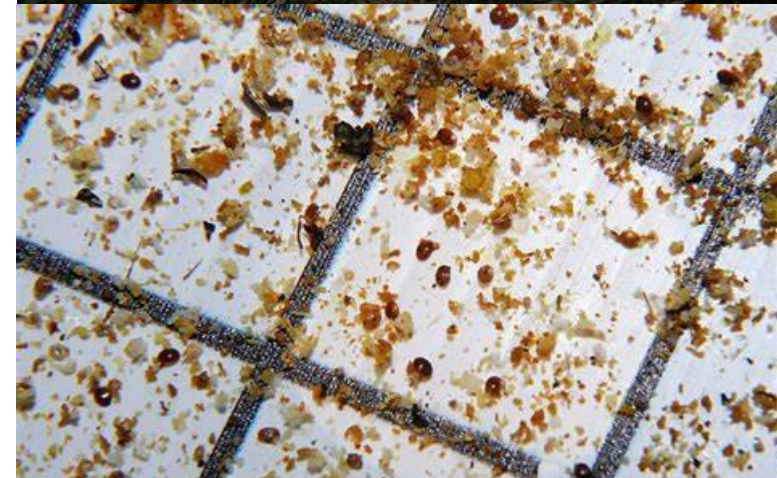




# Monitoring for Varroa

# Sticky Board (natural drop)

- No bees are killed.
- Can be used to monitor drop during treatments.
- must return to obtain sample.
- Results can be variable based on size of colony and bee genetics.
- Does not assess the level of mites still present.



# Alcohol Wash

- Results are obtained in one visit to the beeyard.
- Results are available immediately.
- A standardized number of bees (300) are euthanized.

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# Ether Roll

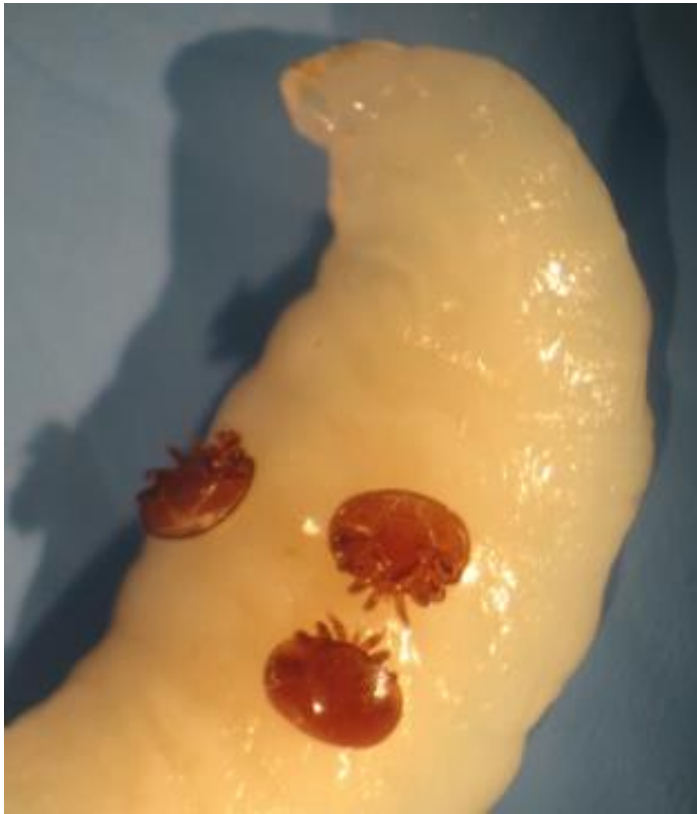
- Results are immediate.
- ~300 bees are euthanized.
- Where do you buy ether?
  
- Perform away from colonies.
- Mites adhere to side of mason jar.

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# Icing Sugar Roll

- Lubricates bees, irritating, initiates grooming behaviour,
- Requires ideal day, warm, sunny, low wind
- Slightly more labour intensive.
- Does not kill bees

# Brood Uncapping



[www.omafr.gov.on.ca/english/food/inspection/bees/varroamite.htm](http://www.omafr.gov.on.ca/english/food/inspection/bees/varroamite.htm)

# Thresholds

## 2014 Ontario Treatment Recommendations for Honey Bee Disease and Mite Control

### Infosheet

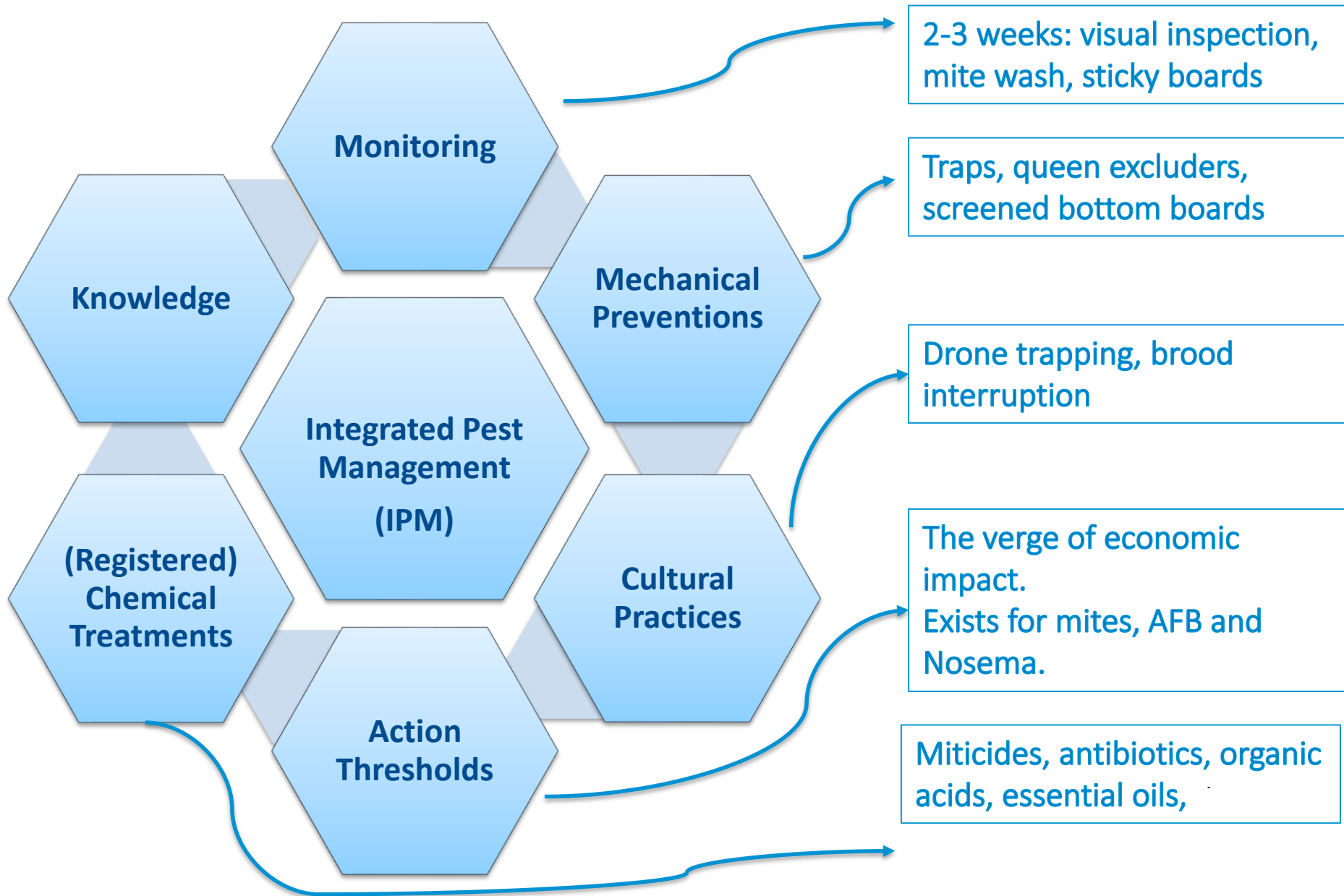
April 2014

This document is intended as a guide for the management of pests and diseases of honey bee colonies in Ontario. It includes detailed recommendations for treatment, monitoring methods and information on the status of pests and diseases in Ontario.

Monitoring Method	Number of Varroa Mites in May	Number of Varroa Mites in August
Ether Roll	1 mite/100 bees	2 mites/100 bees
Alcohol Wash	2 mites/100 bees	3 mites/100 bees
Sticky Board	9 mites/24 hr drop	12 mites/24 hr drop



# Varroa Treatments



(Registered)  
Chemical  
Treatments

Synthetic  
miticides

Apivar (amitraz)  
Apistan (tau-fluvalinate)  
Bavarol (flumethrin)  
Checkmite (coumaphos)

Botanicals

Thymovar (thyme oil)  
HopGuard II (Hop  $\beta$  acids)

Organic  
Acids

Formic acid  
Oxalic acid

# Pesticide Labels

The label is law regulated by PMRA. Labels for all pesticides registered in Canada are available from Health Canada (PMRA):

<https://pr-rp.hc-sc.gc.ca/lr-re/index-eng.php>

- Directions for use:
  - Dose
  - Application period
  - Withdrawal period / season timing / honey flow compatibility
- Personal Protective Equipment: chem resistant gloves, respirator, etc. (never bee gloves)
- Proper disposal
- Storage conditions & shelf life
- Precautions & emergency measures (first-aid)

# Apivar (amitraz)

- Active: group 19 ( $\alpha$ 2-adrenergic receptor agonist)
- 2 per chamber (1 per 5 FoB).
- Hand between frames in brood - min. 2 frames apart.
- Period: 42- 56 days \*remove after 56 days.
- Remove 2 weeks before honey flow (not compatible with supers).

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# Apistan (tau-fluvalinate)

- 2 per chamber (1 per 5 FoB).
- Daytime temp  $\geq 10^{\circ}\text{C}$ .
- Hang between frames in brood - min. 2 frames apart.
- Period: 42 days.
- No withdrawal, but not compatible with honey supers.
- Resistance is common but not permanent?

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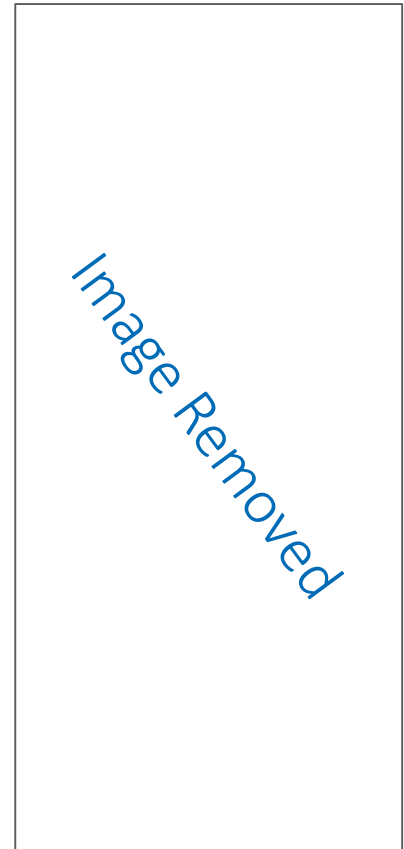
# Bayvarol (flumethrin)

- Max 4 strips per standard brood chamber (2 for nucs).
- Hang between frames.
- Period: 42 days.
- No withdrawal, but not compatible with honey supers.
- Best used in late summer after harvest.
- **\*Potential cross-resistance with Apistan (group 3).**



# Checkmite (coumaphos)

- Largely discontinued due to resistance and health impacts.
- Also registered for SHB.
- **Still registered but not recommended!**







Atlantic Tech Transfer Team  
*for Apiculture*

J. Acad. Entomol. Soc. 15: 46-49 (2019)



## Apivar® and Bayvarol® suppress varroa mites in honey bee colonies in Canadian Maritime Provinces

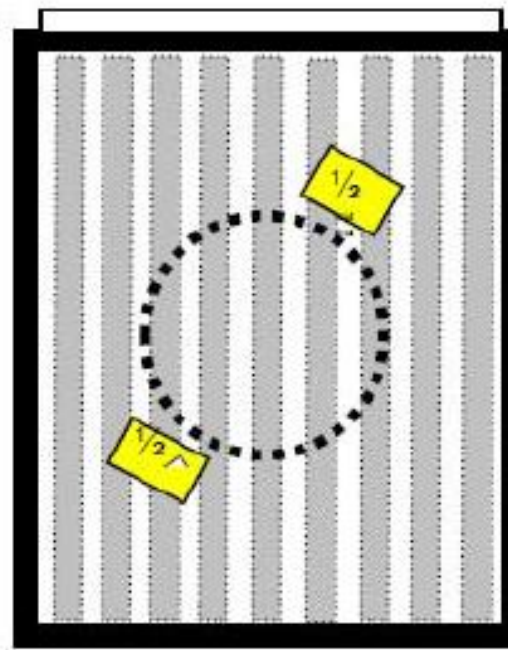
Sawyer Olmstead, Cameron Menzies, Robyn McCallum, Kathleen Glasgow, and Chris Cutler

### ABSTRACT

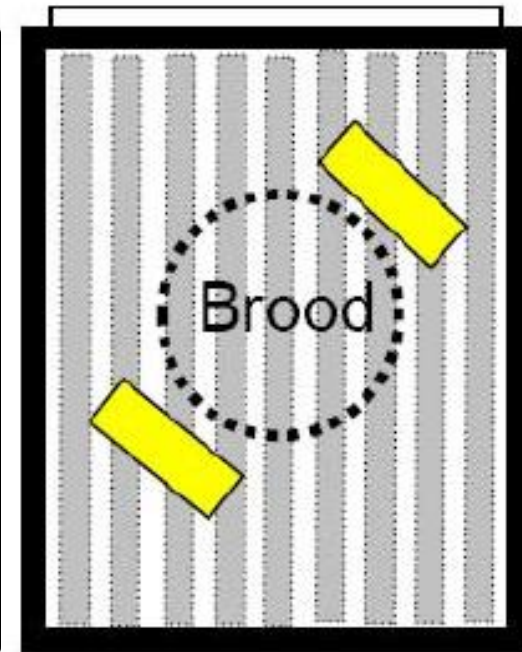
Two synthetic miticides were tested against varroa mites in honey bee (*Apis mellifera*) colonies in the Maritime Provinces of Canada in 2017 and 2018. We found no significant difference between Apivar® (a.i., amitraz) and Bayvarol® (a.i., flumethrin) in controlling varroa mites. Apivar caused 99.8% mortality of varroa mites and Bayvarol caused 96.5% mortality of varroa mites, on average, although Bayvarol demonstrated greater variability in mite mortality. Our results are encouraging due to the widespread reliance on Apivar in the Maritimes, suggesting that Bayvarol could be an effective alternative treatment.

# Thymovar (thyme oil)

- 1 wafer per chamber.
- 2 consecutive applications
- Treatment period: 3-4 weeks and immediately repeat; (6-8 weeks total).
- Use solid hive bottoms.
- Not compatible with supers.
- $12^{\circ}\text{C} \leq \text{Max temp} \leq 30^{\circ}\text{C}$



1. Single Chamber



2. Double Chamber  
(place on top)

# HopGuard II (Hop $\beta$ acids)

- Now registered in Canada.
- Max 2 strips per chamber.
- Center of cluster, 2 frames apart.
- Max 2 applications at 10-15 d apart.
- Max 4 per year: 2 in spring, 2 in fall.
- Too much brood reduces efficacy.
- Honey super compatible.

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No. combs covered with bees	$\leq 5$	6-10	11-15	$\geq 16$
No. of HopGuard II strips	1	2	3	4

# Formic acid 65%

- **Wear PPE!**
- Not honey super compatible; 2 week withdrawal.
- Seal holes; leave entrance fully open.
- Highly corrosive to metal.
- Absorbent pads on bottom board or top bars.
- $10^{\circ}\text{C} \leq \text{temp} \leq 26^{\circ}\text{C}$ . ( $>30^{\circ}\text{C}$  harms bees).
- **Method 1.**
  - 15-20 mL for singles, 30-40 mL for doubles.
  - Repeat 4-6x at 1-10 day interval.
- **Method 2. (slow release)**
  - 250 mL in a pinpricked Ziploc (with wipes) for 21-30 days.

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# Formic Pro (formic acid)

- Polysaccharide gel strip.
- Place on top of lower chamber.
- No withdrawal period.
- Honey super compatible.
- Risks brood mortality and queen health.

14 day treatment: 2 strips

20 day treatment: 2 x 1 strip every 10 days.

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## The efficacy of Formic Pro™ and 65% liquid formic acid against varroa mite (*Varroa destructor*) in honey bee (*Apis mellifera*) colonies in autumn in Nova Scotia, Canada



Cameron Menzies, Sawyer Olmstead, Robyn McCallum, and Chris Cutler

Atlantic Tech Transfer Team  
for Apiculture

### ABSTRACT

The efficacy of Formic Pro™ and 65% liquid formic acid to reduce infestations of varroa mite (*Varroa destructor* Anderson and Trueman) in colonies of honey bees (*Apis mellifera* L.) was tested in autumn 2017 in Nova Scotia, Canada. A total of 36 colonies were divided into three treatment groups. One treatment group (n=12) received five separate doses of 65% liquid formic acid across a 20 day period, while the other two treatment groups were treated with strips of Formic Pro, either with two strips for 14 days (n=12) or two consecutive rounds of a single strip, each for 10 days (n=12). The 65% liquid formic acid was used as a standard to compare the efficacy of Formic Pro strips. All three treatments reduced mite infestations, but the Formic Pro treatments resulted in the greatest mite mortality during the treatment period. Percent efficacies for the treatments were 62.0%, 89.4%, and 82.4% for the 65% liquid formic acid, 14-day Formic Pro, and 20-day Formic Pro treatments, respectively. The majority of mite drop occurred during the first two days of product application. Based on this trial, Formic Pro appears to be an effective tool for varroa mite control in Nova Scotia.

# Oxalic Acid Vapourization

- Sublimation of Oxalic acid dihydrate crystals
- Not honey super compatible.
- No withdrawal.
- Excellent season finisher.
- Use on sealed/wrapped hives.
- 2 g per hive; 2 min to sublimate.
- Damages bee brood?

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# Oxalic Acid Dribble

- Dissolve 35 g in 1L of 1:1 sugar:water (m:v).
- Apply with syringe or cattle syringe gun.
- Trickle 5 mL directly onto seems of bees.
- Max 50 mL per hive.
- Some mortality expected.

<https://countryfields.ca>



PHOTO BY: MELINDA JEAN STAFFORD



# Treatment Costs

	Relative Cost (\$)	Cost per double (\$)
Apivar	38.75	15.50
Apistan	40.25	16.10
Bayvarol	42.95	17.20
HopGuard II	?	?
Thymovar	48.50	19.40
Formic Pro	24.50	12.25
Formic 65%	19.00	1.00
Oxalic Vaporization	19.95	0.04 - 0.12
Oxalic Dribble	19.95	0.04

# Powdered Sugar Dusting

Ineffective:

“No difference in mite loads after 1 year of bi-weekly dustings”.

Ellis, Amanda M., Gerry W. Hayes, and James D. Ellis. "The efficacy of dusting honey bee colonies with powdered sugar to reduce Varroa mite populations." *Journal of apicultural research* 48.1 (2009): 72-76.

**Table 1.** The effects of dusting colonies every 2 weeks with 250 g of powdered sugar every 2 weeks for 1 year. Data are means  $\pm$  SE (*n*).

variable	powdered sugar	no treatment	ANOVA
adult bee population	10061.7 $\pm$ 629.4 (60)	10691.0 $\pm$ 554.4 (67)	$F = 0.74$ ; $df = 1, 4$ ; $P = 0.4397$
brood area (cm <sup>2</sup> )	4521.9 $\pm$ 342.8 (59)	4472.55 $\pm$ 365.85 (64)	$F = 0.01$ ; $df = 1, 4$ ; $P = 0.9280$
no. mites per colony	2112.2 $\pm$ 224.6 (61)	2197.80 $\pm$ 207.75 (67)	$F = 0.25$ ; $df = 1, 30$ ; $P = 0.6208$
no. mites per sealed brood cell	0.112 $\pm$ 0.013 (52)	0.106 $\pm$ 0.018 (54)	$F = 0.00$ ; $df = 1, 25$ ; $P = 0.09724$
no. mites per adult bee	0.080 $\pm$ 0.010 (61)	0.097 $\pm$ 0.010 (67)	$F = 1.65$ ; $df = 1, 30$ ; $P = 0.2082$

# Essential Oils

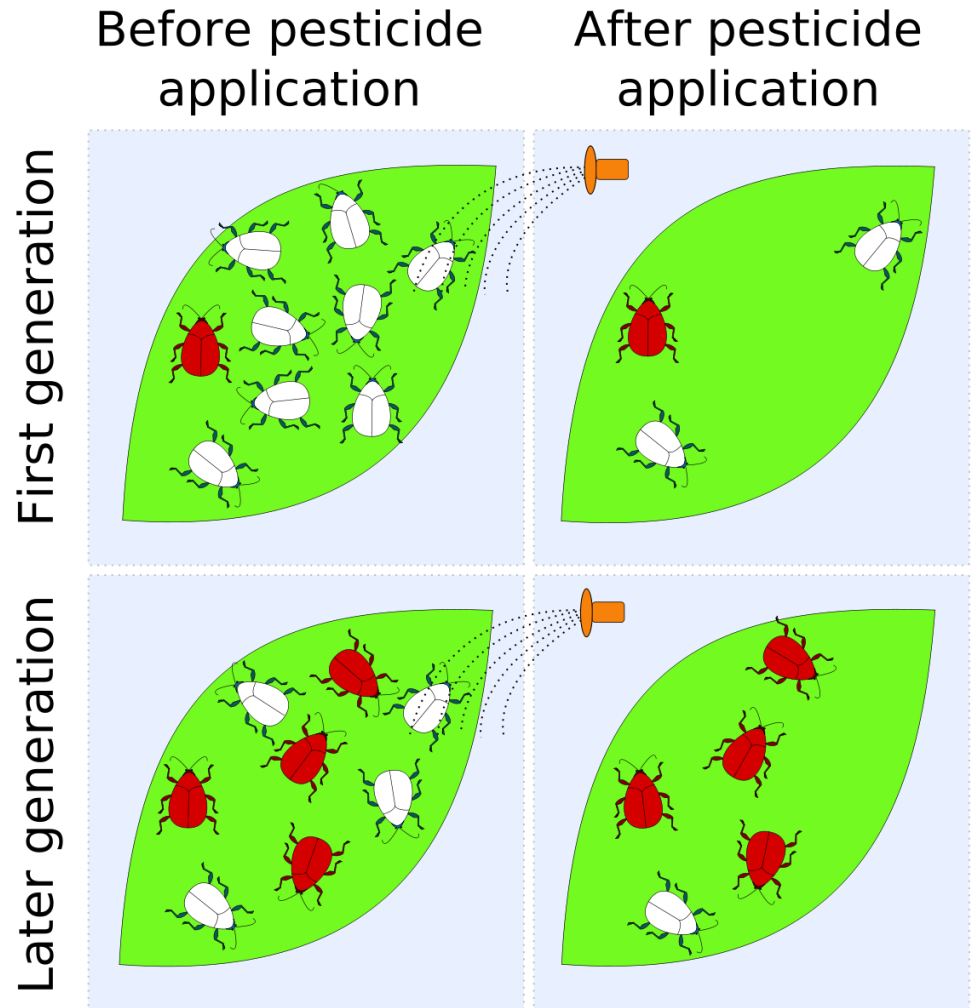
- Pesticide treatments must be registered with PMRA.
- Proceed with caution!!!
- Risks: inefficacy, mortality, sub-lethal health impacts, synergism, not always food grade, honey contamination, resistance.

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# Post-Treatment Efficacy Check

# Resistance

- Process where pest population becomes less susceptible to a treatment through repeated selection for heritable trait of natural tolerance.
- Major consideration for importation but also relevant regionally.
- Resistance should be monitored for, proactively but also after poor treatment efficacy.



# Resistance Management

- Rotate products with different MoA
  - avoid repeated use of same synthetic in same year.
  - alternate conventional with organic.
- Evaluate treatment efficacy
  - Monitor mite levels post-treatment.
- Follow label instructions
  - dose, application period, timing, removal.
- Apply treatments only when needed (action threshold)
- Employ physical & cultural practices

# Pettis Test

# Brood Interruption

- Standalone or with pesticide application.
- Examples:
  - Splitting with cells,
  - Nuc production,
  - Winter,

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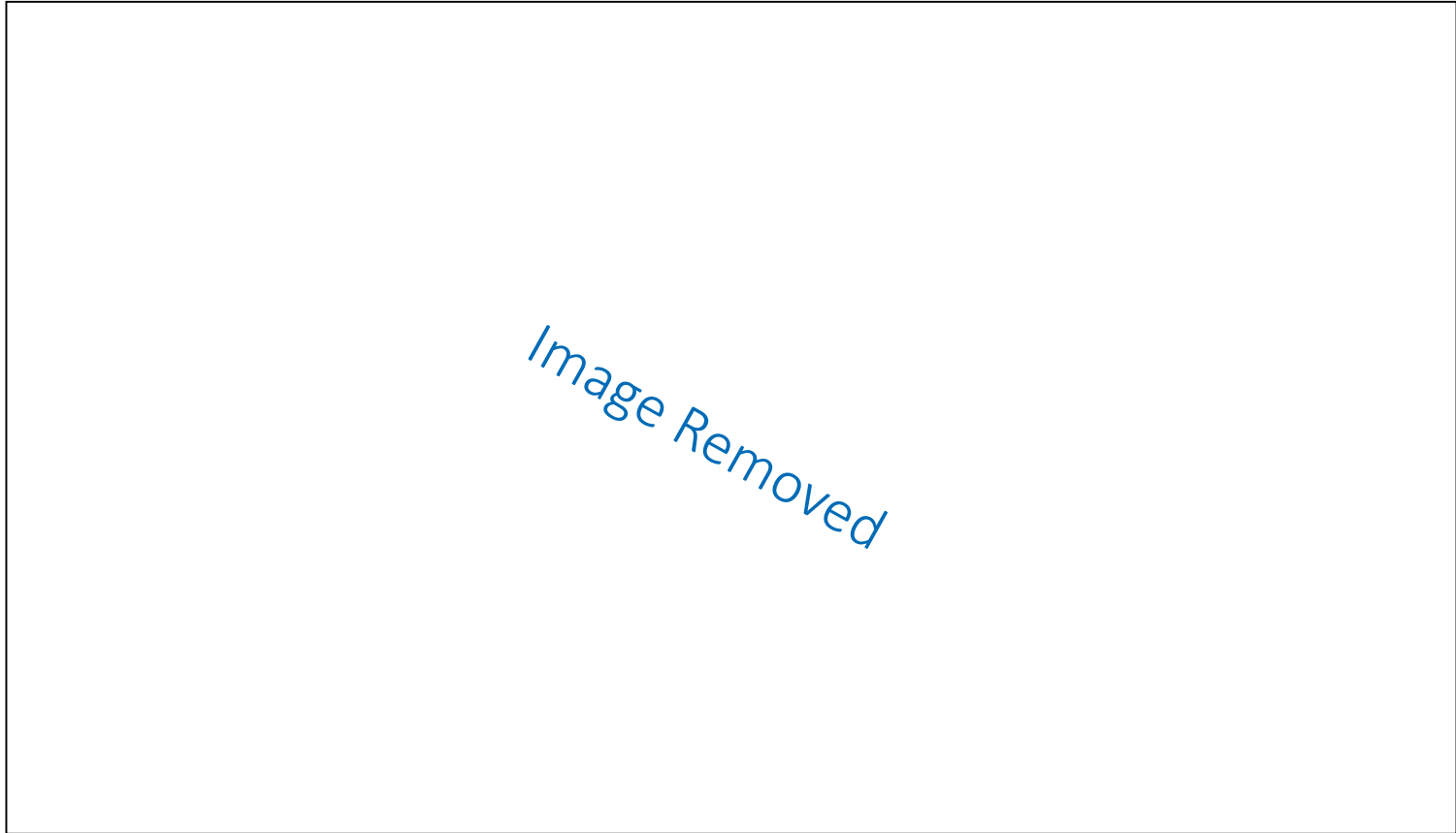


# Drone Trapping

1. Remove an empty frame or food frame.
2. Insert 1 frame/ standard brood box.
3. Remove before drones emerge (24-28 days)
4. Freeze, scrape and dispose of comb safely.
5. Reinsert in hive.
6. Continue until late August or Sept.
7. Move to the side of chamber and use for food storage.

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# Screened Bottom Boards



[Naturalbeekeepingblog.blogspot.com](http://Naturalbeekeepingblog.blogspot.com)

# Hygienic Stock

Genetic Selection for improving resistance to Varroa

- Hygienic behaviour
- Grooming behaviour

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# Info Sources



**Atlantic Tech Transfer Team**  
*for Apiculture*

<https://www.perennia.ca/portfolio-items/honey-bees/>



<https://honeybee.uoguelph.ca/videos/video-list/>

# Questions

