

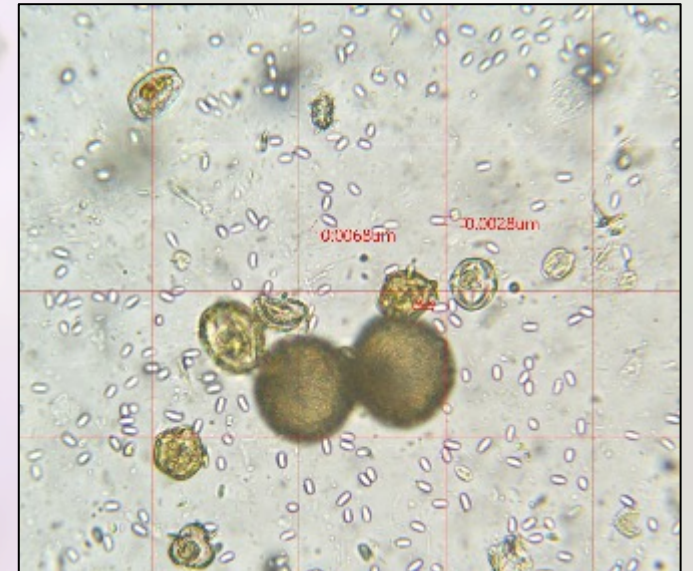


Pests & Diseases

Do you monitor and treat for mites?

Do you recognize common bee pests and diseases?

Do you understand bee stressors?



Best Defense Against Pests and Diseases

- Nutrition (Carbohydrates + Pollens)
- Healthy productive queen
- Beekeeper Education!!!
 - Learn to recognize potential issues (Proactive)
 - Learn to recognize actual issues (Reactive)
- Learn to listen to your bees (hummm, activity, smells and sounds)
- Share your findings and ask for help

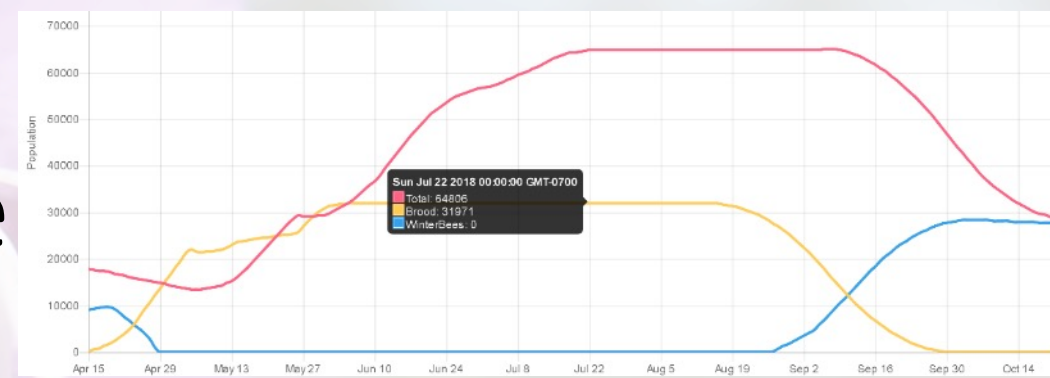
We all go through it so don't feel ashamed!!

Bee Anatomy

Apis mellifera

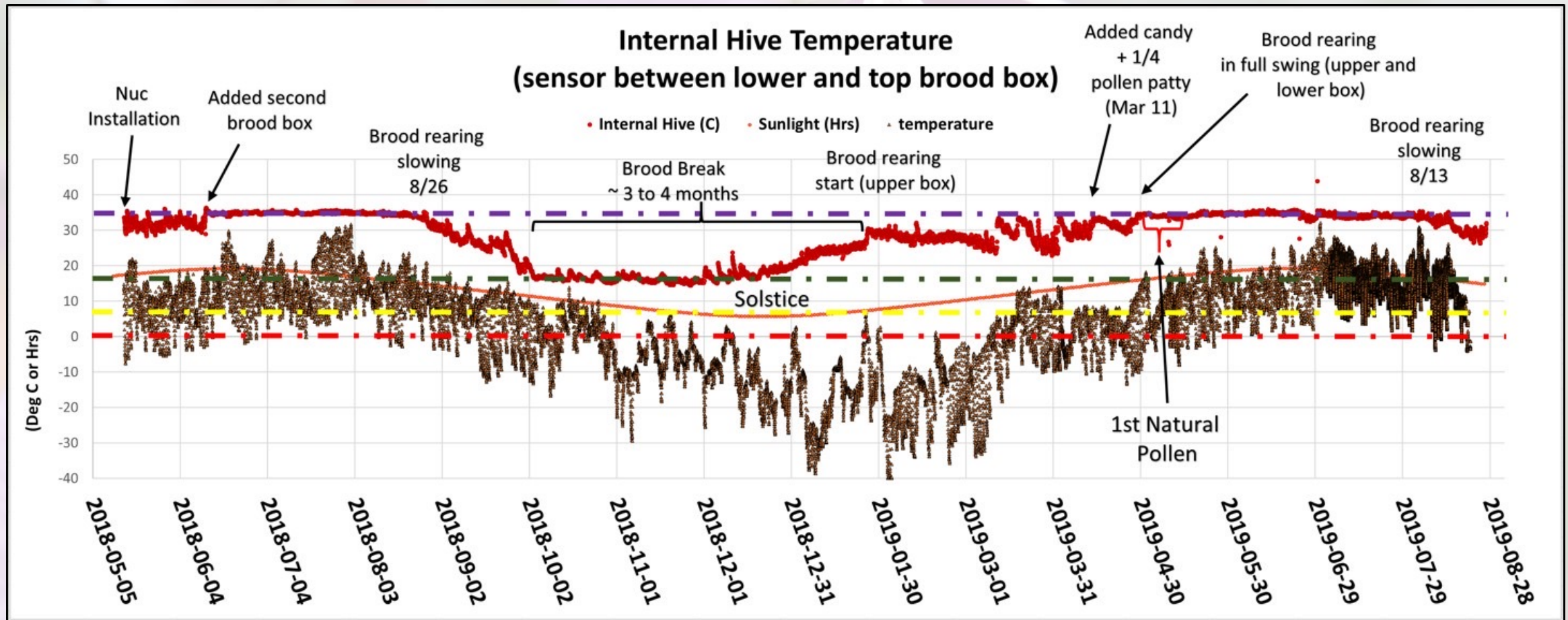


A year in a Honey Bee's Life



- Honey Bees must maintain colony year round with food stores in excess of their day to day requirements in case of **dearth** or long periods of inclement weather (e.g. winter)
- **Spring** – Raise new brood <-> Collect pollen and nectar <-> Stay warm
- **Early Summer** – Grow colony <-> Collect pollen and nectar <-> Swarm
- **Mid Summer** – Maintain Colony <-> Collect pollen and nectar <-> Ripen nectar
- **Late Summer** – Produce winter bees <-> Collect pollen and nectar <-> Prepare nest for winter
- **Fall** – Egg laying ceases <-> Start clustering <14C <-> Kick out drones
- **Winter** – Protect queen from cold <-> Maintain cluster temperature <-> 1.5-2kg honey / month
- **Early Spring** – Start brood rearing <-> internal cluster temp of 35C <-> 7-8kg honey / month

My Local Annual Bee Cycle



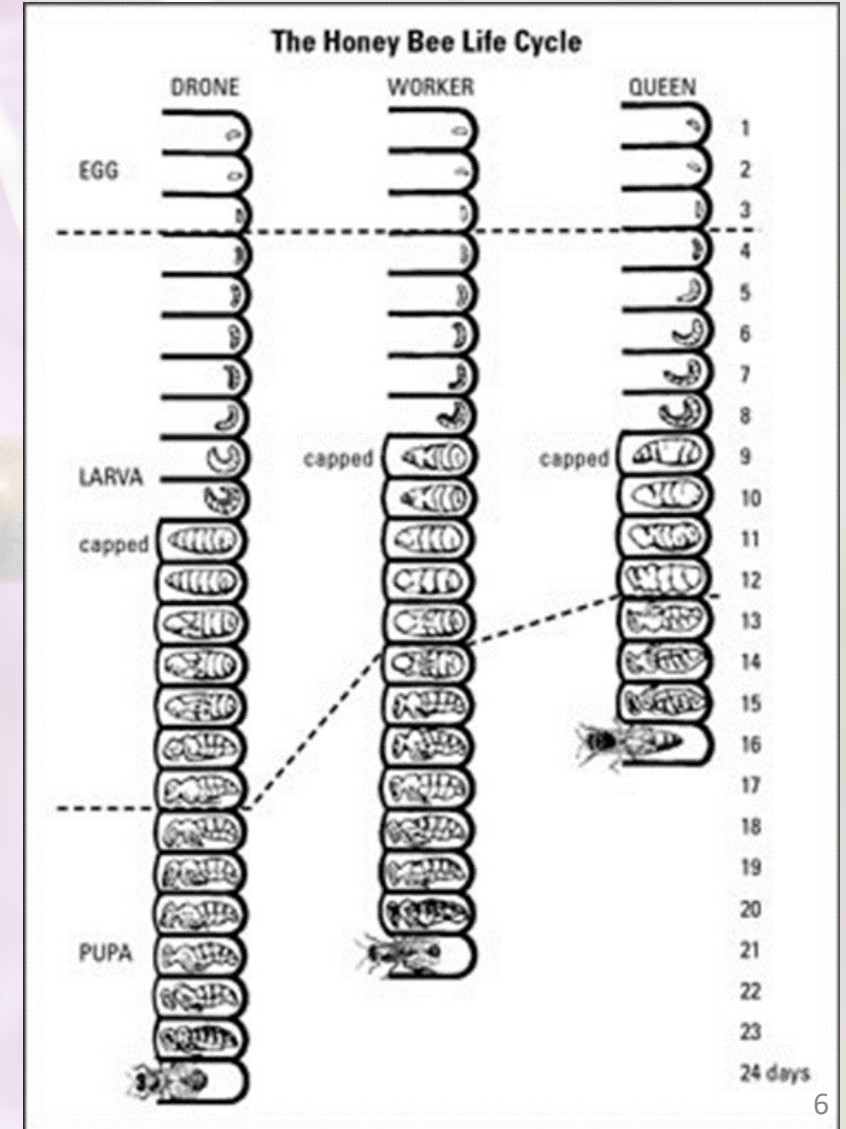
Here is my annual bee cycle – Aka - Queen laying cycle and winter brood break

All my beekeeping practices revolve around this cycle (i.e Spring – Pollen Subs addition, Winter Prep)

Bee Life Cycle

<http://www.dummies.com/home-garden/hobby-farming/beekeeping/tracking-the-life-cycle-of-a-honey-bee/>

Type	Egg	Larva	Cell capped	Pupa	Emergence	Start of Fertility
Queen	until day 3	until day 5½	until day 7½	until day 8	from day 16 on	approx. 23rd day
Worker	until day 3	until day 6	until day 9	until day 12	from day 21 on	N/A
Drone	until day 3	until day 6½	until day 10	until day 14½	from day 24 on	approx. 38th day



Bee Genetics

32 chromosomes in Queens and Workers

16 chromosomes in Drone (Mother Only – no Father)

Typical Traits to look for:

- Defensive Vs Docile
- Hygienic (Disease Control)
- Varroa Mite Resistant (VHS)
- Swarming Instinct
- Pollen Collection (Low to high)
- Honey Production
- Overwintering Success

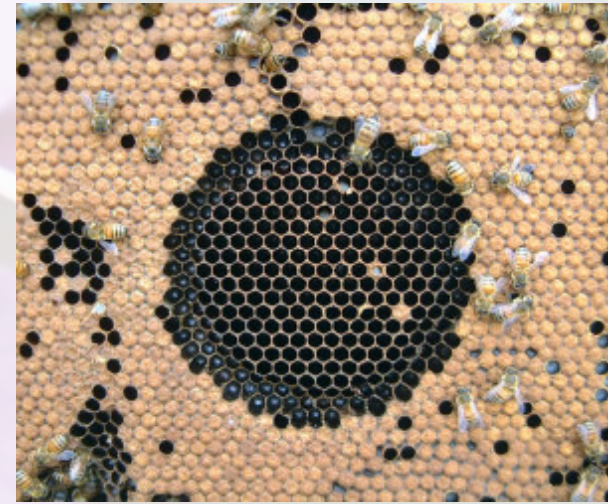
<http://www.glenn-apiaries.com/genetics.html>



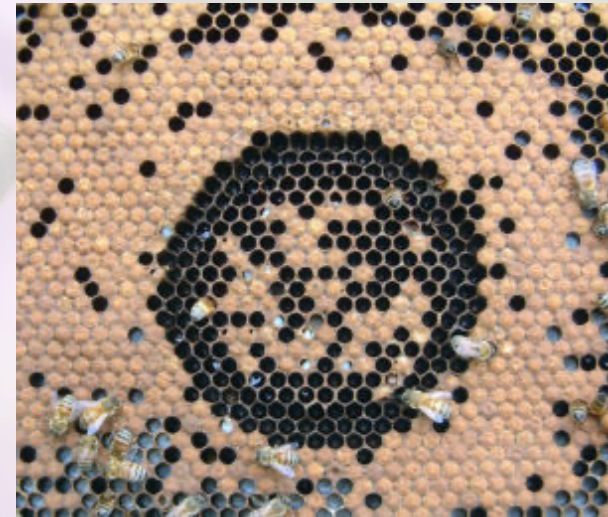
Honeybee Traits

- **Calm on comb**
- Defensive behaviour** (Drone genes)
- **Early Brood Build Up**
- **Forages Early**
- Honey Storage
- Nectar Collection
- Nosema Resistance
- **Overwinter Well**
- **Pollen Collection**
- Swarm Tendency**
- Tracheal Mite Resistant
- **Hygienic Behaviour****
 - Varroa Mite Resistant (VHS)
 - AFB/EFB
 - Chalkbrood

It is our responsibility to keep gentle bees, they make better neighbours and are easier to manage. Re-queening is the only way to manage these.



Hygienic behavior seen after 24hrs



Poor hygienic behavior seen after 24hrs

Honeybee Breeds

(<http://www.dummies.com/home-garden/hobby-farming/beekeeping/how-to-choose-bees-for-your-hive/>)

Typical Honeybee Breeds in the North

- Carniolan (Wintering, Early Brood, Honey, Nectar, Pollen, Gentle)
- Italian (Lots of bees, Honey, Nectar Collection)
- Russians (Wintering, Early Brood, Mite Resistance, High Swarming Instinct)

Note: If a queen breeder claims they have VSH (Varroa Sensitive hygiene) – Ask them for their testing results!!

5 Minute Hive Inspection (95% of my inspections every 10-14 days)

- Have a specific goal (no looking just for looking sakes)
- Pull no more than 2-4 frames
- Look between frames for an idea of bee numbers/drawn frames (overcrowding)
- Brood location on frame and frame number
- Evidence of eggs
- General bee health
- Pollen/honey store levels (Hive tilt test – make it a habit to verify)
- Observing droppings on my screened bottom board tray – usually inserted 24hrs before inspection).

Note: I do 2-3 full inspections per season

- 1 in spring to clean up dead winter bees and determine if I will condense down to one brood box)
- 1 in late summer after the honey harvest to measure winter readiness



Inspections Record Keeping Tricks

- Use a sharpie to mark the top of frames to help you keep track of colony growth
- Develop simple tracking tools (piece of tape on side of lid to keep the basics (YT19 – 2019 Yukon Queen, BC20 – 2020 BC Queen, QR – Queen Right, SB – Seams of bees, FB-Frames of Brood, FH – Frames of Honey, Date of inspections, etc...))



Bottom Board Insert Basics

Used as part of my 5 min inspection or general non-intrusive checks.

Possible Uses of these boards:

- Varroa mite natural drop
- Varroa mite drop after treatment (efficacy)
- Observe hive activity through debris drop
 - Fresh wax (white – new comb building)
 - Brown cappings (hatching brood)
 - Chalkbrood mummies
 - Rows/frames of activity (expanding nest)
 - Pollen drop – current forage target
 - Dead bees and parts
 - Ants (do I need to control?)



Hive Inspections (Continued)

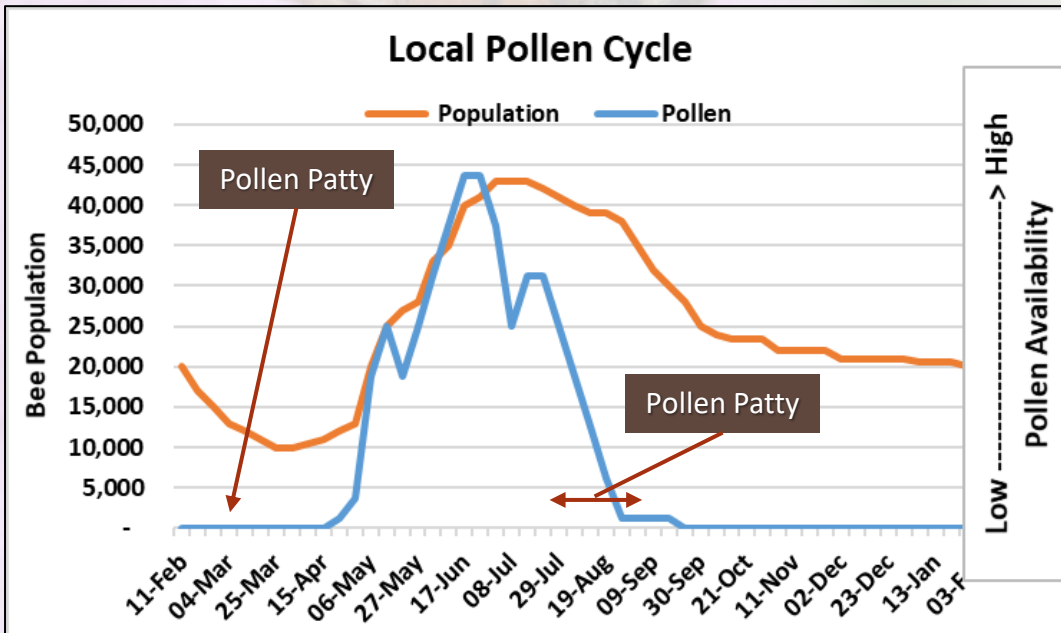
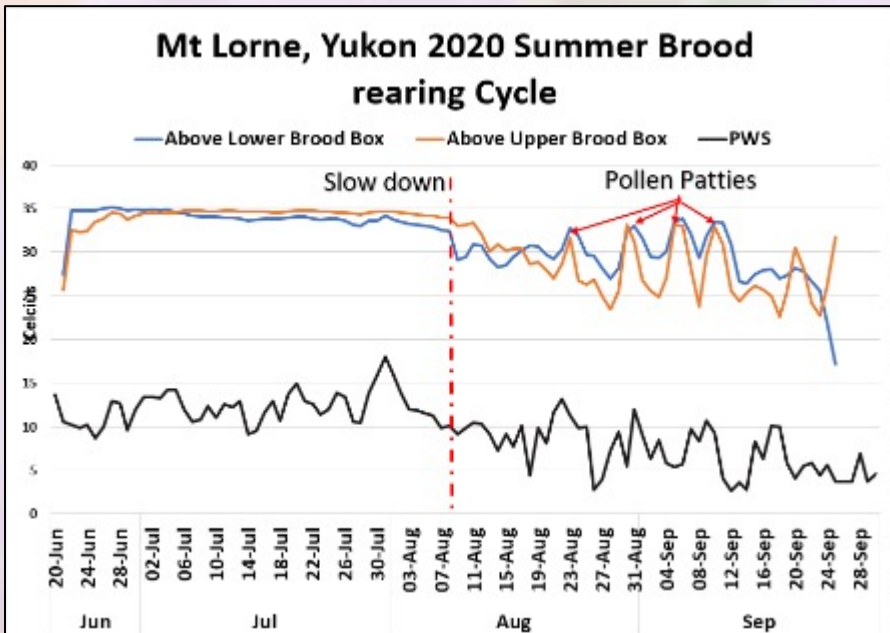


Pollen is Critical for Brood Health & Rearing

40-75lbs of Pollen/colony needed every year

- Early Spring Ramp Up
 - **1st warm spell** after the second week of March, **1st pollen patties** go on
Note: 1st you must ensure they still have at least 20-40lbs of honey (1 or 2 deep frames)
- Late Summer “Winter Bee” rearing
 - 1st week of August, **patties on all my hives**
 - My area is predominately fireweed in the late season (**single source vs poly floral** – Higher risk of developing winter Nosema)
- Other Critical Moment when Pollen is required
 - **Prolonged hot dry weather** (typically late July)

Note: Serious pollen dearths will cause cannibalism and diseases such as EFB/PMS may start to become evident. **REMOVE the nutritional stressors by feeding**



Early July



Bee Population Increase / Decrease Factors

Factors Affecting Increase

- Supply of nutritious pollen
- Behaviour and jelly production by the nurse bees
- Queen's capacity to produce eggs
- Size of the broodnest available to the queen
- Proper temperature environment in the brood nest (35C & 50-75%RH)
- Cannibalism of eggs by workers
- Proportion of larvae that reach adulthood
- Larval disease due to pathogens or parasites
- Larval disease due to pesticides or other toxins

Factors Affecting Decrease

- Nutrition available to newly emerged workers
- Shorter longevity due to being chilled as brood
- Degree of early worker mortality
- Epigenetic regulation of worker longevity?
- Age of first foraging
- Wear of foraging due to wind, distance, cold
- Predation upon, or disorientation of foragers
- Disease due to pathogens or parasites
- Poisoning by pesticides or other toxins

Helping Weaker Hives (Reduce Volume)

(Benefit of having more than one hive)

- Add brood frame with or without nurse bees to bolster weak hive
- Add frames with eggs & larvae in queenless hive to let them create their own (only if you can't source new queen)
- Add honey frames if weaker hive is low on stores
- Decrease the odds of hive swarming by sharing strong hive resources

How do I transfer frame if I am not sure if queen is present on frame?

- 1) *Take a frame of eggs/larva from the strong hive. Shake off all the bees.*
- 2) *Put a queen excluder on top of the strong colony.*
- 3) *Add an empty box on top of the excluder. Put the single frame in the box.*
- 4) *Cover up the hive, leave for an hour or two.*
- 5) *Come back, the frame will be covered with nurse bees (and no queen).*
- 6) *Put the frame of eggs/larva & nurse bees in the weak hive.*

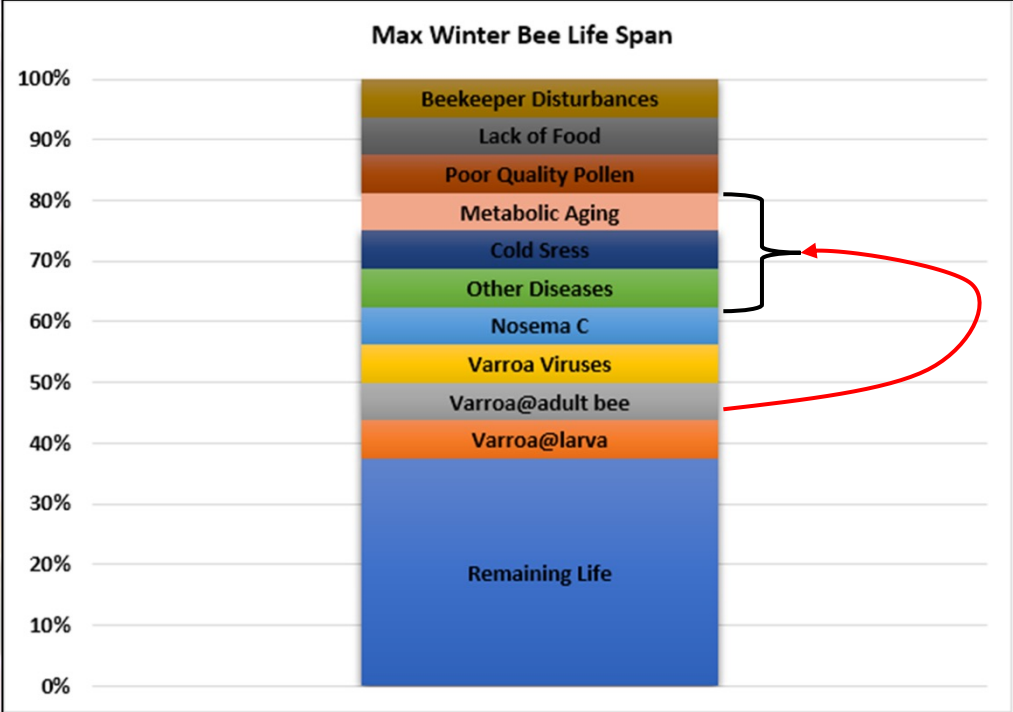
How long does a winter bee live for?

Days from Bee Emergence			1st Natural Pollen
Typical Winter Bee	1st Patty		
New Bee	March 15, 2021	April 15, 2021	May 1, 2021
July 15, 2020	243	274	290
August 1, 2020	226	257	273
September 1, 2020	195	226	242
	Typical 1st Cleansing		

No late summer Pollen Patty equals:
 early stop to queen laying
 late start of brood rearing in Spring
 lack of nutritional diversity
 (Last significant pollen is early August)

This is Yukon Beekeeping

How much does each one affect a bees life in the winter cluster?



- If a bee is healthy, well fed, not diseased, how do we measure natural metabolic aging?
- In summer, bees are faced with predation, wear and tear (distance to forage, wind, etc...) in addition to the ones in winter and likely many others.
- Beekeeper via colony management does “things” to reduce these impacts

Wintering Success Factors

- Lots of healthy fat bees
 - When is your last pollen?
 - How many floral pollen sources do you have late summer?
- Adequate winter stores (at least 60lbs per brood box)
 - Honey quality (honeydew, crystallizes, moisture content)
 - Pollen (do they have stored pollen?)
- Dry home to spend the winter
 - Leaky homes have more condensation consider sealing the hive body seams
 - Insulation is critical # 1 top of hive and #2 sidewalls
 - Where will moisture condense in your setup?
 - How will you manage condensation?
 - Quilt, top vent/No top vent, screened bottom board
 - Mice protection
 - Wind Protection





Pest & Diseases

Do you monitor and treat for mites?

Do you recognize common bee pests and diseases?

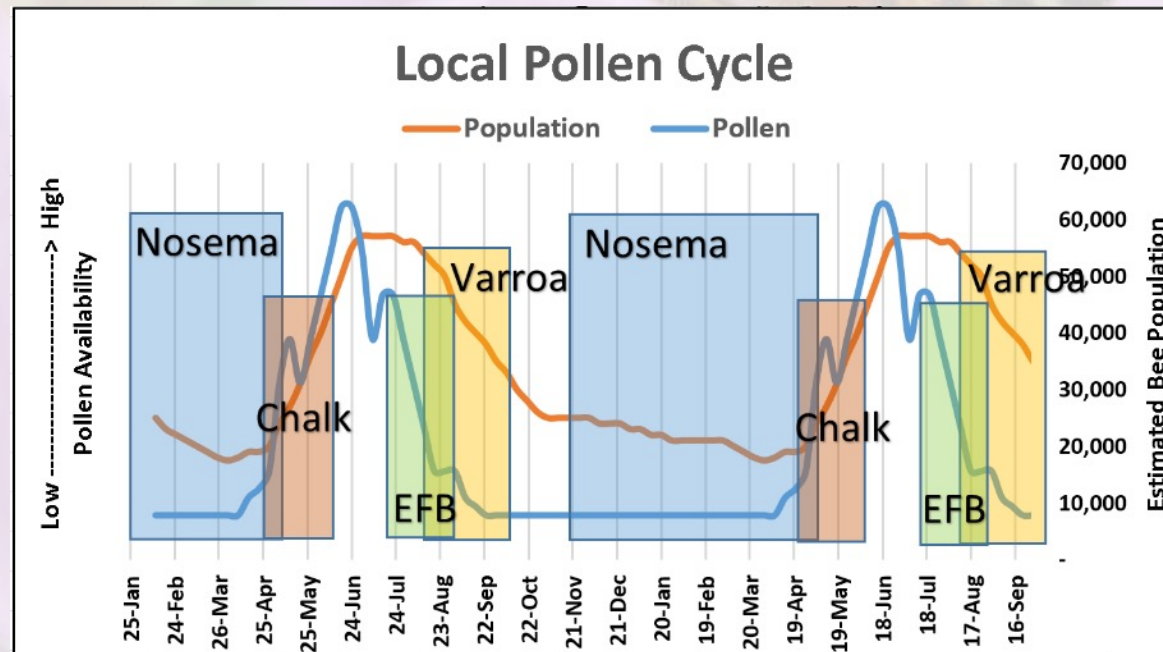
Do you understand bee stressors?



Keeping Bee Stress Under Control

This is the number one **preventive method** to keep disease and pests under control

- Poor nutrition (Feed Pollen Supplements)
- Moisture in winters (Ventilation, Moisture Quilts)
- Mite population peak (IPM, Monitoring, OAV)
- Too many inspections (re-arranging of frames) – (Stop)
- Poor queen performance (Re-queen)



Bee Diseases and Pests

(https://en.wikipedia.org/wiki/List_of_diseases_of_the_honey_bee)



- Mites, Mites, Mites (Varroa Destructor) - Don't ignore
- Mix of virus (in mite infested hives – so keep them under control)
- Nosema (Cabin fever – ensure they can get out on warm winter days to defecate)
- Chilled brood – Hive inspections during cold weather (<10C)
- Chalkbrood / Sacbrood brood diseases usually triggered by stress
- AFB/EFB (Risk of using used equipment or not swapping out older frames)
- Wax moth in 1st year hives (Nucs brought up from the south)
- Bears (Electric Fences, Keep it clean, Visual Barriers)
- Ants (easy fix – petroleum jelly on hive stand legs or underneath stand platform)
- Hornets/Wasps (risk for weak hives – keep your entrances small)

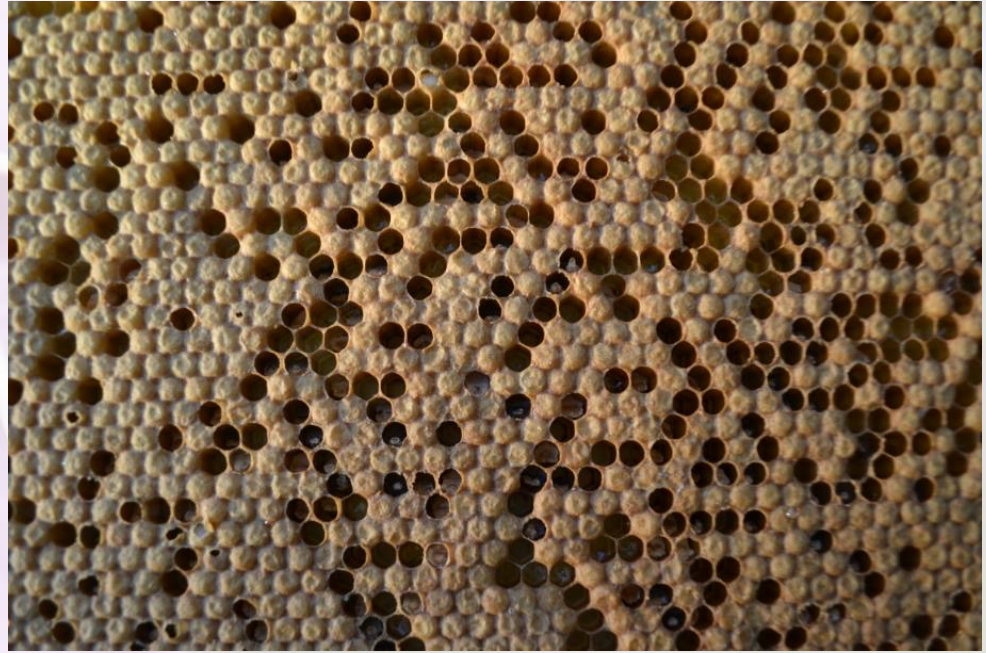
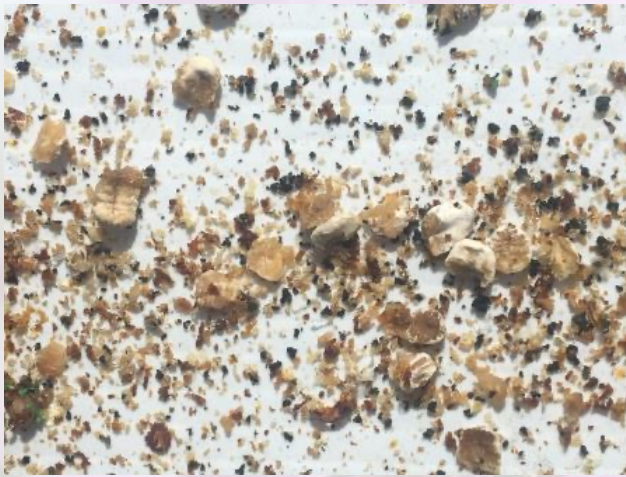


Chalkbrood

Why: Fungal infection typically in stressed colony (cold stress, humidity issues, older queen, moved to new location)

Where: Look for mummies on landing board or debris board. Brood pattern will often be spotty and dried out mummies are left in cells

What to do: Remove stressors (feed, protect from elements), remove and throw out severely infected frames, re-queen colony



AFB American Foulbrood / PMS Parasitic Mite Syndrome / EFB European Foulbrood

<https://txbeeinspection.tamu.edu/files/2018/02/Identifying-Brood-Diseases-trifold.pdf>

American Foulbrood (AFB)

Parasitic Mite Syndrome (PMS)

European Foulbrood (EFB)

Symptoms

- Affects only capped brood
- Spotty brood pattern
- Larvae die in the upright position
- Larvae turn from white to brown to black
- Sunken, punctured cappings
- Cappings may appear wet (Fig. 1)
- Dead larvae exhibit “ropiness” (Fig. 2)
- “Pupal tongue” sometimes present
- Dead larvae form black scales in the bottom of cells and are difficult to remove
- Sulfur-like smell

Symptoms

- Affects ALL stages of larvae, prepupae, and pupae
- Spotty brood pattern
- Larvae appear “melted down” (Fig. 4)
- Chewed down brood (Fig. 3)
- Lack of eggs and developing larvae
- Varroa mites seen on bees and comb
- Rapid decline of the adult bee population
- Supersedure cell often present
- May acquire an odor and become discolored when secondary bacteria set in

Symptoms

- Affects predominately uncapped brood
- Spotty brood pattern
- Larvae are twisted and contorted in cell – in the “stomach ache position” (Fig. 5)
- Larvae turn from white to yellow to brown
- Tracheal system visible (Fig. 6)
- Royal jelly will appear yellow-brown
- Dead larvae form a rubbery brown scale that is easy to remove and often crescent shaped

What To Do

- Does this seem to affect only capped brood?
- Does the dead larvae “rope” out from a match or twig when it is inserted into an infected larvae and then removed? (Fig. 2)
- Are scales present and difficult to remove?

What To Do

- Do you have a high Varroa mite load?
- Does it appear to affect all stages of larvae?
- Are you seeing adults with deformed wing virus?
- Are you seeing mites on bees and comb?
- Are you seeing chewed down brood and prematurely aborted larvae? (Fig. 3)

What To Do

- Does this seem to affect predominately uncapped brood?
- Are the larvae curled or twisted? (Fig. 5)
- Are their tracheal systems visible? (Fig. 6)
- Are scales present and easy to remove?
- Consider using an EFB test kit to confirm your diagnosis.

American Foulbrood (AFB)

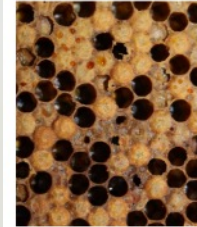


Figure 1. Sunken, punctured, moist cappings of AFB.



Figure 2. Example of the “ropiness” of AFB infected larvae.

Parasitic Mite Syndrome (PMS)



Figure 3. Chewed down and prematurely uncapped brood.



Figure 4. Melted, snotty brood. Varroa mites present in cells.

European Foulbrood (EFB)

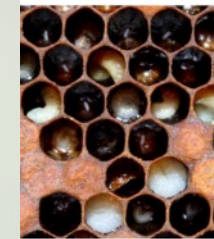


Figure 5. EFB infected larvae twisted in the “stomach ache” position.



Figure 6. Tracheal system visible in EFB infected larvae. Scale beginning to form.

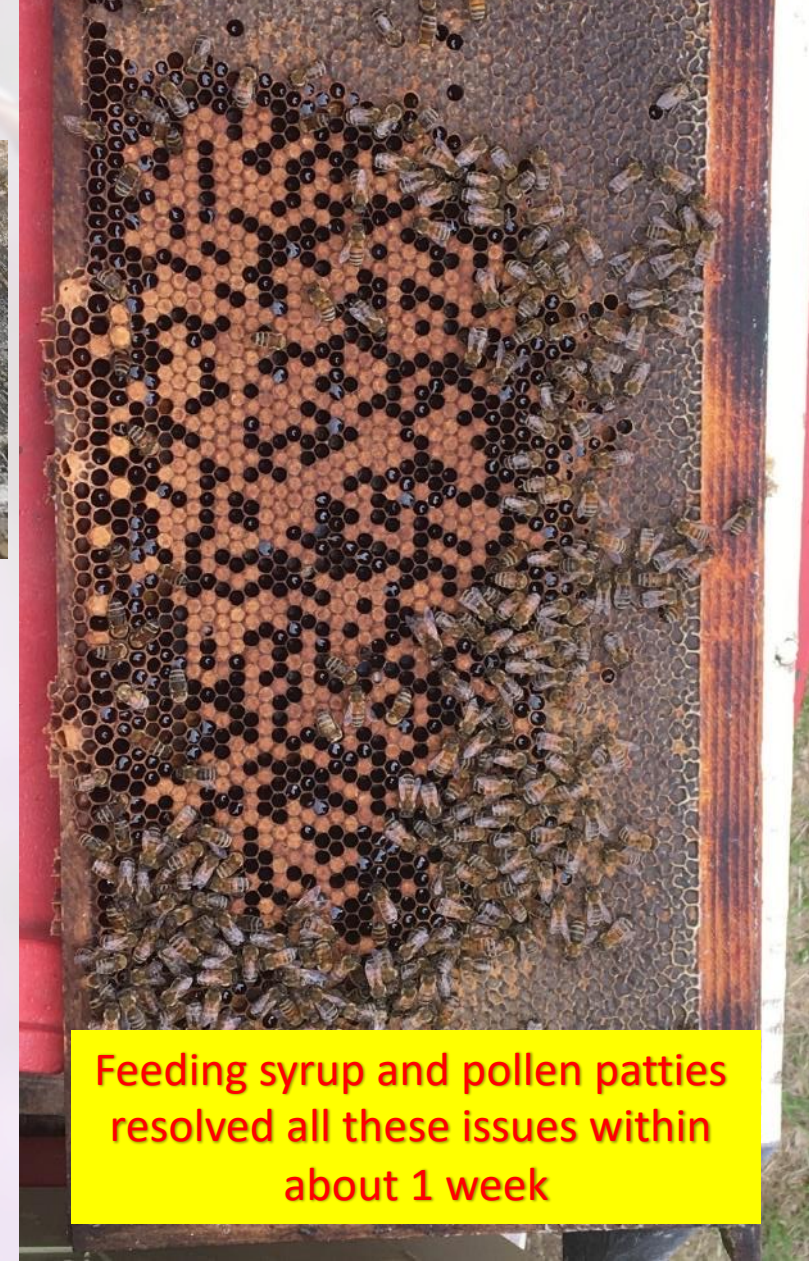
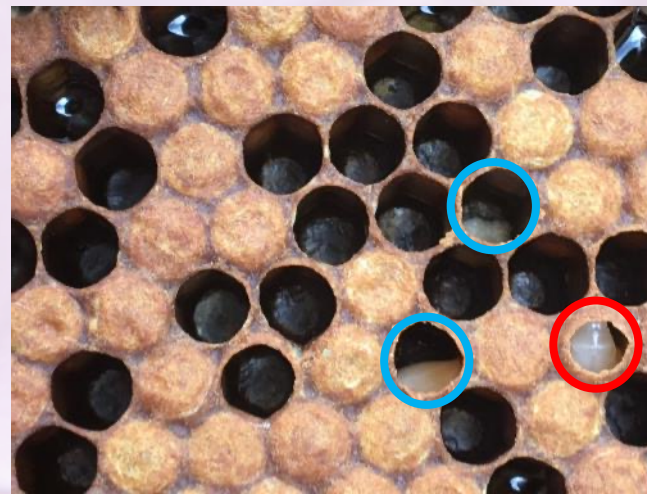
Disease Event Example:

(all occurred at the same time during very hot/dry weather)

- Chalkbrood (Blue) & Sacbrood (Red) like symptoms
 - Mummies
 - White milky brood
 - Spotty brood
 - Rolled over larvae
- Causes
 - Fungus (Chalkbrood) / Virus (Sacbrood)
 - Bee Stress (Hot Dry / Cold Wet / Too many inspections)
 - Lack of resources



Due to the multitude of symptoms this hive is likely suffering from PMS



Feeding syrup and pollen patties resolved all these issues within about 1 week

Example of Varroa related Viruses



Varroa Mites

- Varroa mites can and likely will be a problem for you if they are left un-managed.
- You will have difficulty overwintering, your bees may abscond, your queen might fail, you might have "angry" bees or you may start noticing deformed bees if left unchecked.
- Manage early (measure mite levels and treat if required - Alcohol wash/powdered sugar shake) and you will not have any problems up here (low density of honey bees and long brood breaks at 4-6 months) or wait a year when the mite population spikes and you will learn the hard way (I did).
- The mites are also the main vector for many of the bee viruses.
- They feed on Fat Body tissue (organ that has 9 main functions). All 9 are negatively impact by varroa.

Learn more about Varroa -

https://en.wikipedia.org/wiki/Varroa_destructor

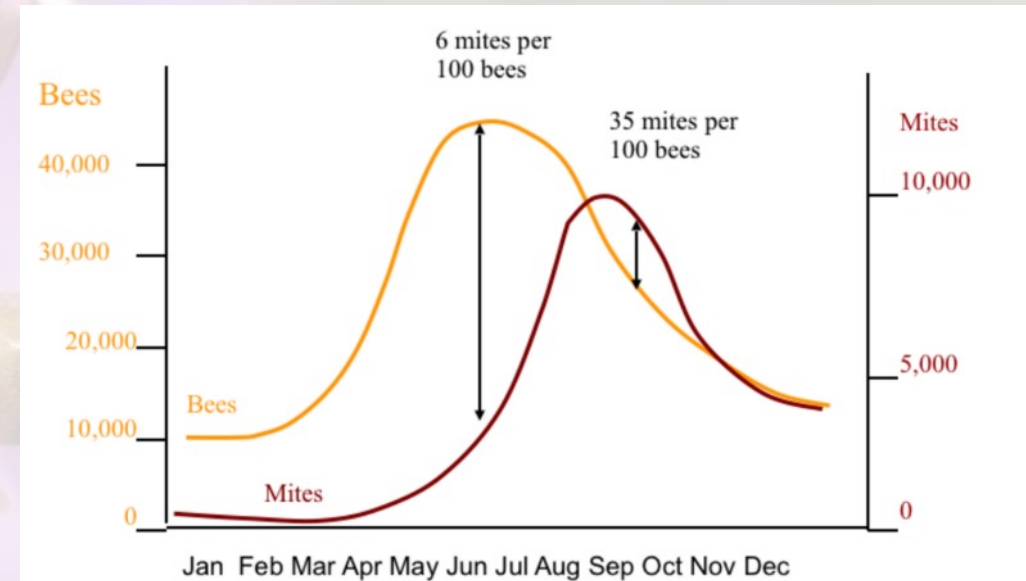


Figure 1. Simplified bee and mite population growth curves for a temperate climate. The mite growth curve lags behind the bee curve. Note how the number of mites per hundred bees greatly increases in fall. A colony is unlikely to survive a fall infestation rate this high.

<http://scientificbeekeeping.com/ipm-3-strategy-understanding-varroa-population-dynamics/>

Mite Biology

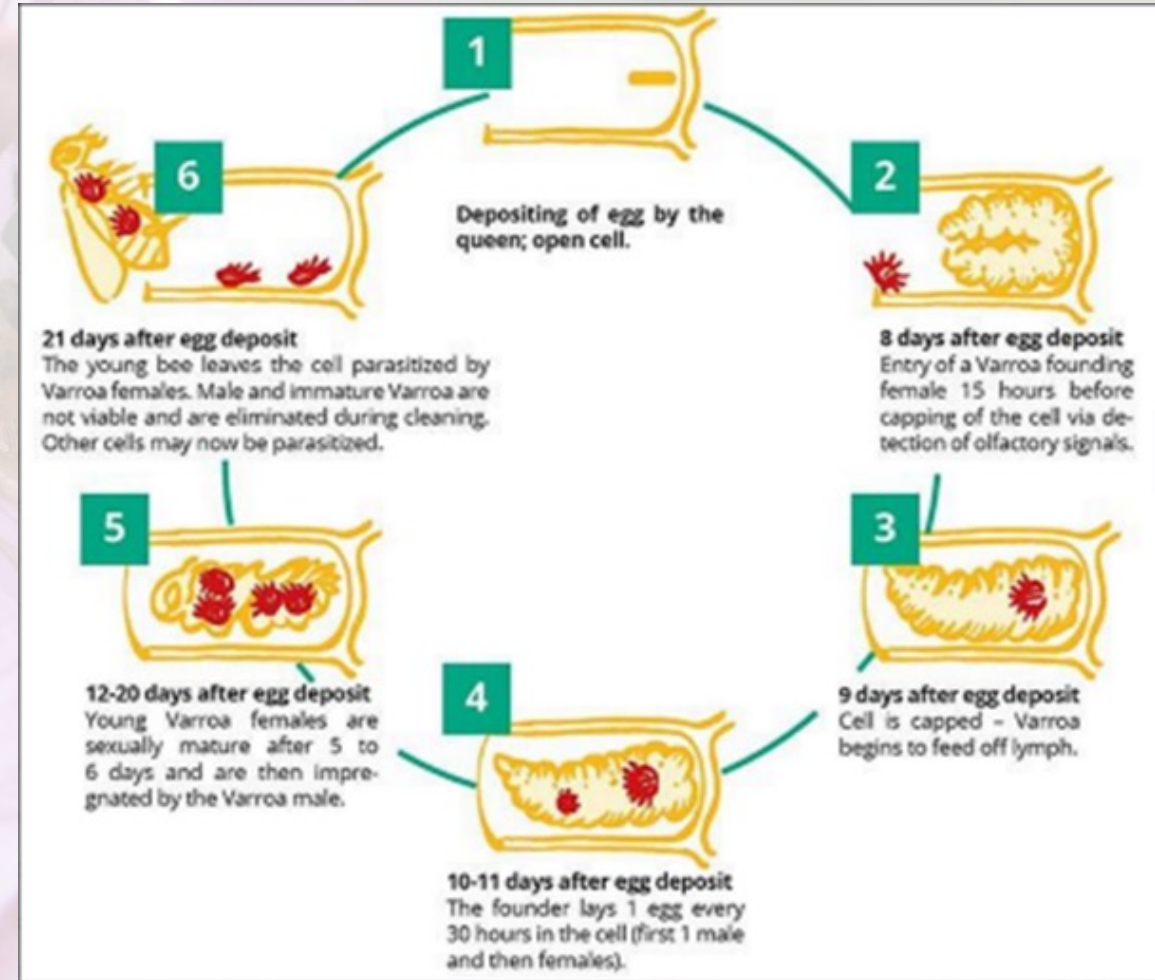


A true parasite during all bee life cycle

Bee Fat Body (9 Functions)

- Growth and Metamorphosis
- Storage & Energy/Nutrient Mobilization
- Pesticide Detoxification
- Water Loss/Osmoregulation
- Immune Function
- Temperature Regulation
- Metabolic Activity
- Protein & Fat Synthesis
- Vitellogenesis (Winter Survival – Early Brood Rearing)

<https://www.beekeeping.com/downtown-new-hope-fight-varroa/>



Integrated Pest Management (IPM)



www.betterbee.com

1. Tolerance Levels (Acceptable Limits)
2. Cultural Practices
 - i. (Hygienic beekeeping (clean tools after every use, wear disposable gloves, inspect healthy hives first))
 - ii. Good Nutrition
3. Physical Controls
 - i. Use drone frames/or medium frame in deep box for varroa mites / screened bottom boards / Brood Breaks
4. Monitoring (Alcohol wash, powder sugar shake)
5. Chemical Controls (As required) Soft Vs Hard
6. Biological Controls (Genetic Traits) Long-term or buy from proven queen suppliers

The timed application of cultural practices, [chemicals / drugs](#) and other techniques that are complementary and compatible with each other.

Monitoring for Mites Levels

Alcohol Wash / Powdered Sugar Wash (Most Reliable)

- Collect ½ cup of live bees (300 bees)
- Place bees in monitoring container
- Add alcohol/powder sugar 2 table spoons
- Alcohol - Shake vigorously and flip/strain to drop mites out
- Sugar – Shake for 1 minutes until all bees are covered / let sit for 1 mins / Invert and shake for another minutes through mesh screen onto white surface (out of the wind)

Advantages:

- Results are obtained in one visit to the beeyard
- Results are available immediately
- A standardized number of bees (300) is ideal for comparison between colonies

Treat when: a daily sticky count of around 25, or 4-5 mites in a 300-bee jar sample (record and trend values for each hive)



Natural Mite drops on Sticky Board (Less Reliable)

- Sticky boards are part of the screened bottom board
- Clean board off prior to check
- Add Vaseline to board to ensure mites do not crawl off

Disadvantages:

- Results can be variable based on the size of the colony and the behaviour of the bees (grooming and hygienic behaviour)
- Does not assess the level of mites still present on the bees. Although there may be large numbers of mites dropping in a bottom board sample, this may only represent a much larger population that is still left on the bees

Using OAV in monitoring + control strategy

- Early May, about 1 week after 1st spring inspection, I do 1 OAV treatment on all my colonies.
- I use my debris board to measure mite drop over 48h to 72h

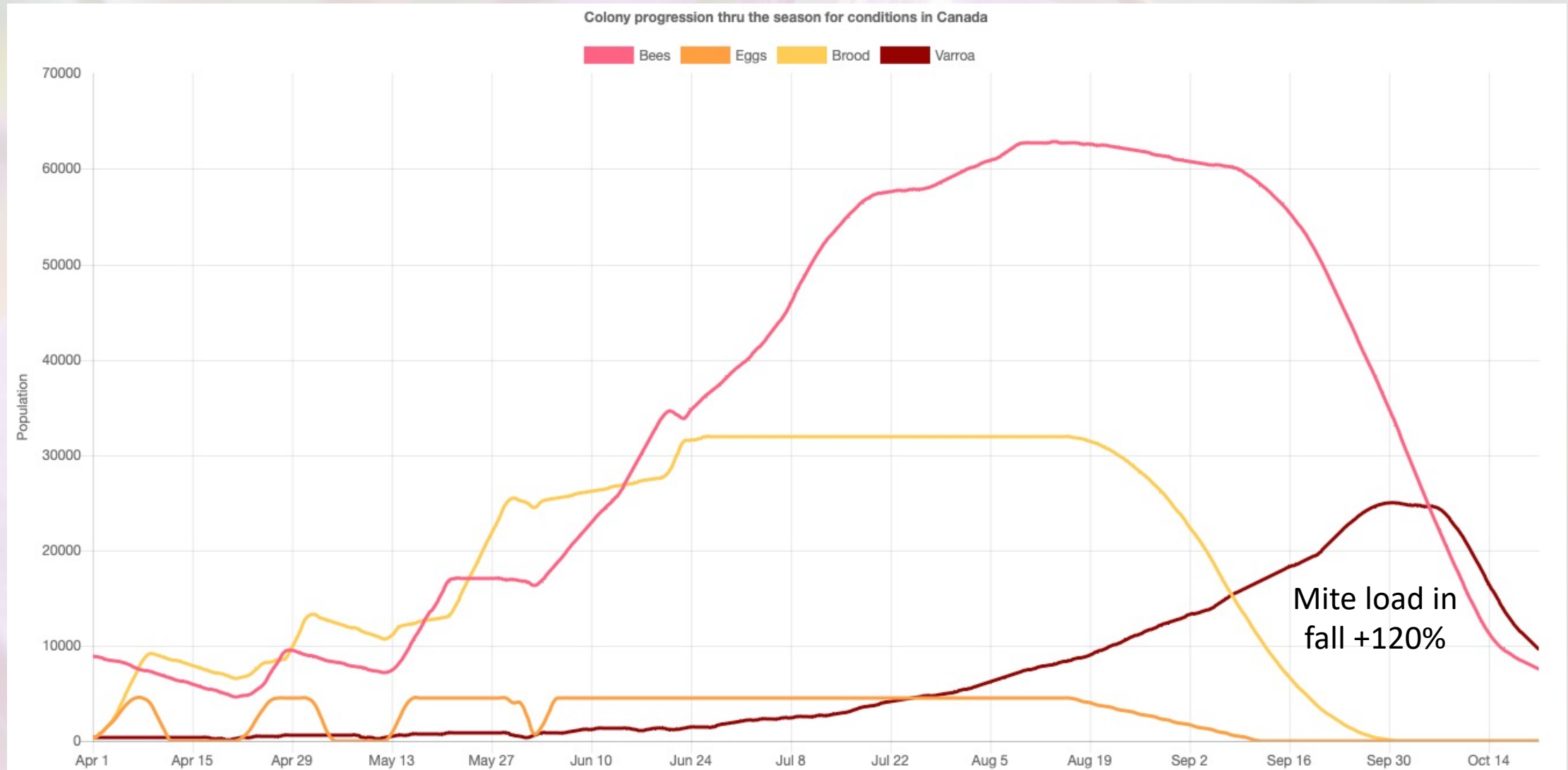
May 9 2021 - OAV Drop #1									48h OAV Drop	30h OAV drop		
ID	Type	April 26 2021 Natural drop	W-weak/M-Med /S- Strong	24h	36h	48h	72h	Total Drop (3 days)	Queen	June 17 2020	Aug 22 2020	Comment
H3	single		M (Broodless)	7		25	15	47	BC19	1	9	Was a double going into winter but was reduced mid April 2021
H7	single		M (small brood nest)	3		4	1	8	YK19	11	100	
H8	single		S (Large brood nest)	5		4	3	12	BC20		30	
H9	double		S (Large brood nest)	0		0	0	0	BC19		15	
H2	single	5	M (small brood nest)	3			0	3	BC20	70	200	Displayed ABPV and collapsed last summer before recovering
H12	single	1	W (small brood nest)	0			0	0	BC20		200	
H5	double		M (Large brood nest)		35		42	77	BC19		70	
H6	single		S (Large brood nest)		2		3	5	YK19		200	Broodless during fall treatment

Note: I re-treat everything over 10 mites

Do Nothing!! Bee Packages (<https://www.rozehaven.ca/hivemodels/index.html>)

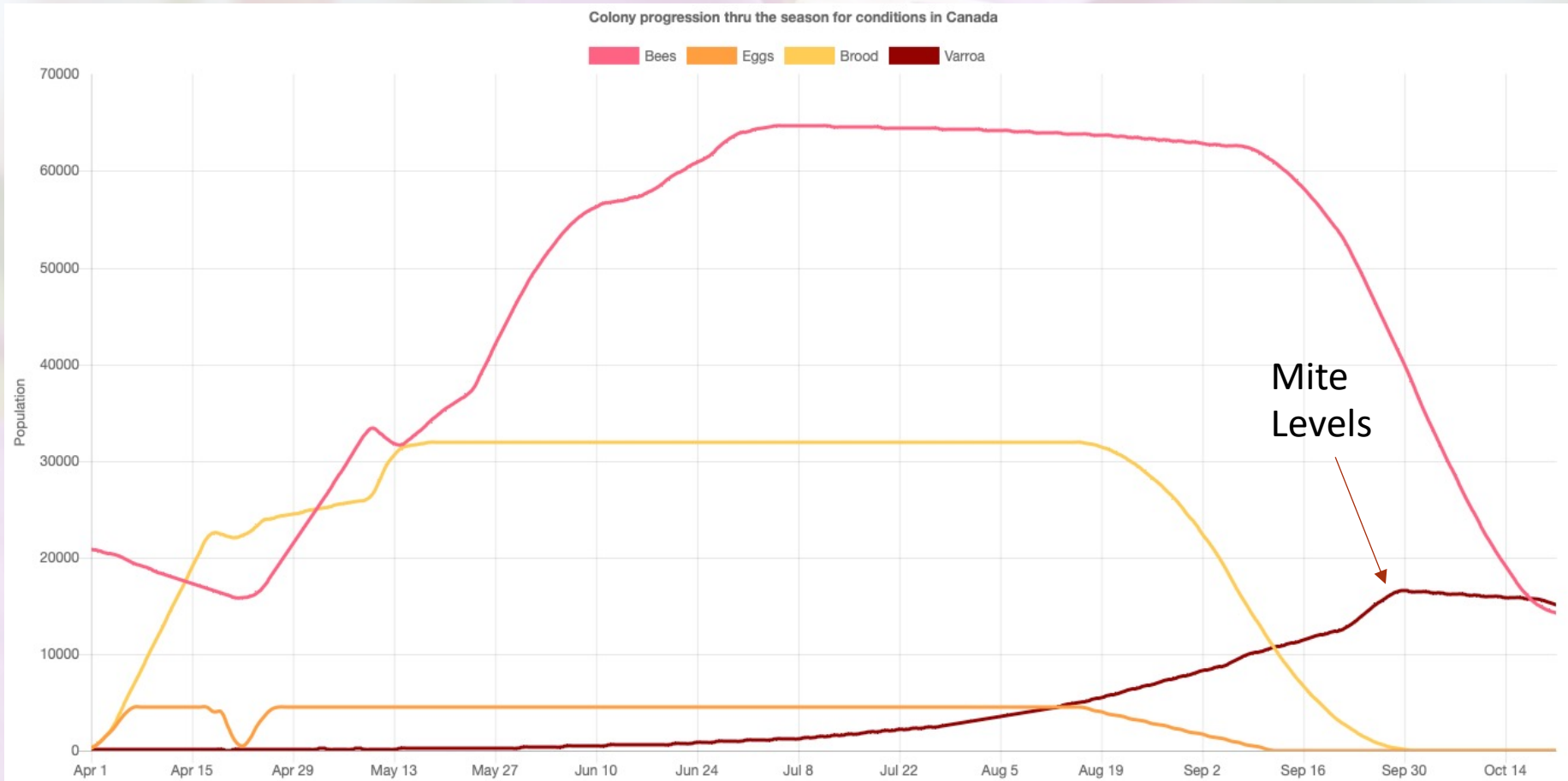
Study shows packages have 5.4 mites/100 bees –

Aliano, Nicholas P. and Marion D. Ellis. "Oxalic Acid: A Prospective Tool for Reducing Varroa Mite Populations in Package Bees." *Experimental and Applied Acarology*, 48 (2009), pp. 303–309. Accessed 12 April 2018.



Do Nothing!! Mite Population Peaks in Fall

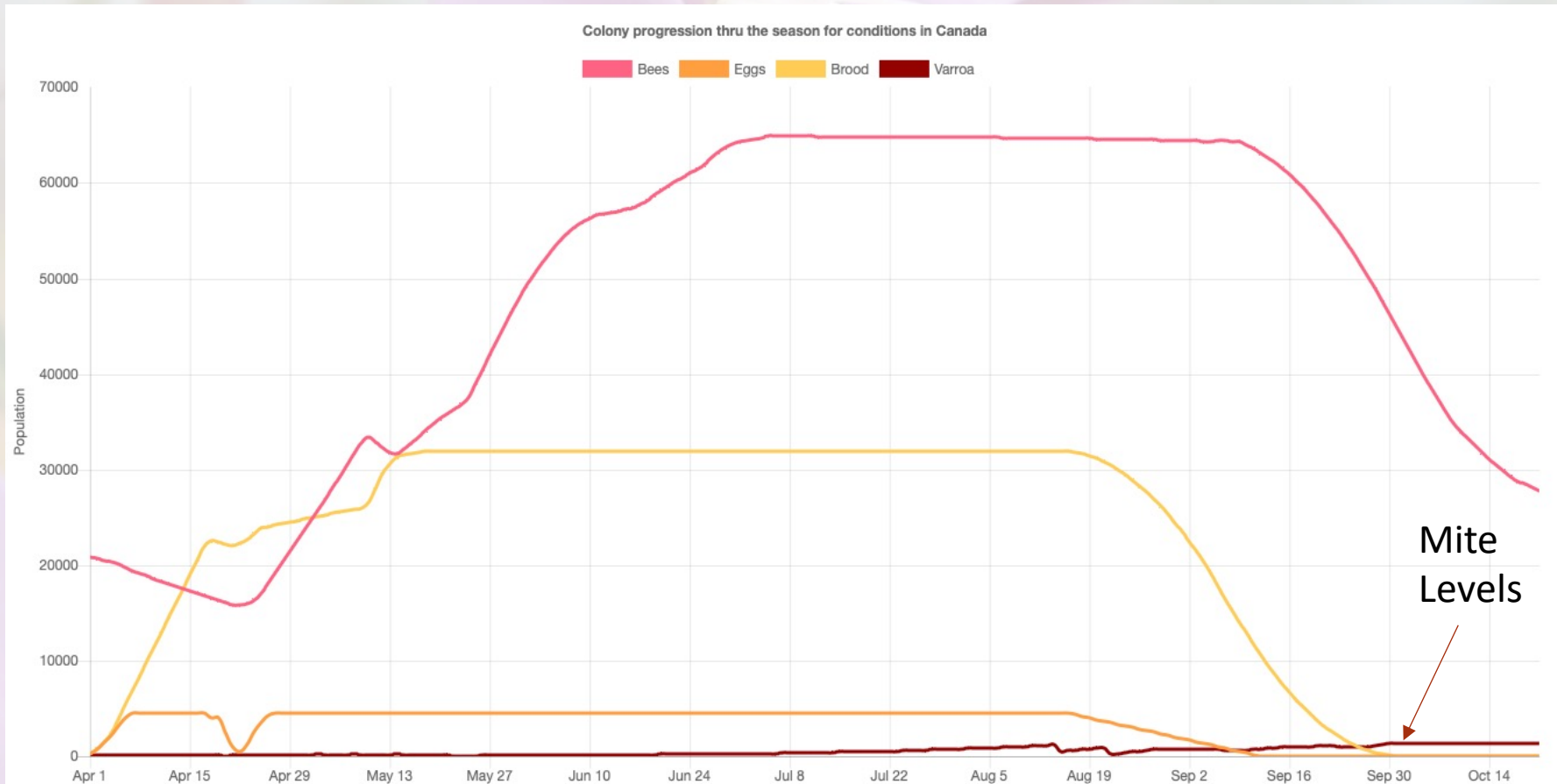
(<https://www.rozehaven.ca/hivemodels/index.html>)



Start Conditions:	April 1	7 Frames (21000 bees)	Wintered	A wintered unit starts with no brood half the bees are long lived winter bees		Winter Population	
Peak egg rate:	1500	Slowdown:	Aug 15			Bees	14198
Evict Drones:	Sept 15	Broodless Date:	Oct 1	Start Mites:	100	Mites	15104
No manipulations	June 1						
Total Eggs:	221438	Treatment: None	May 15	Treatment: None	Aug 15	Mite Load	106.4 %
Items to Show:	<input checked="" type="checkbox"/> Legend	<input type="checkbox"/> Show Population by Age			<input checked="" type="checkbox"/> Fit Graph to Page		

Do Something!! Mite Population Peaks in Fall

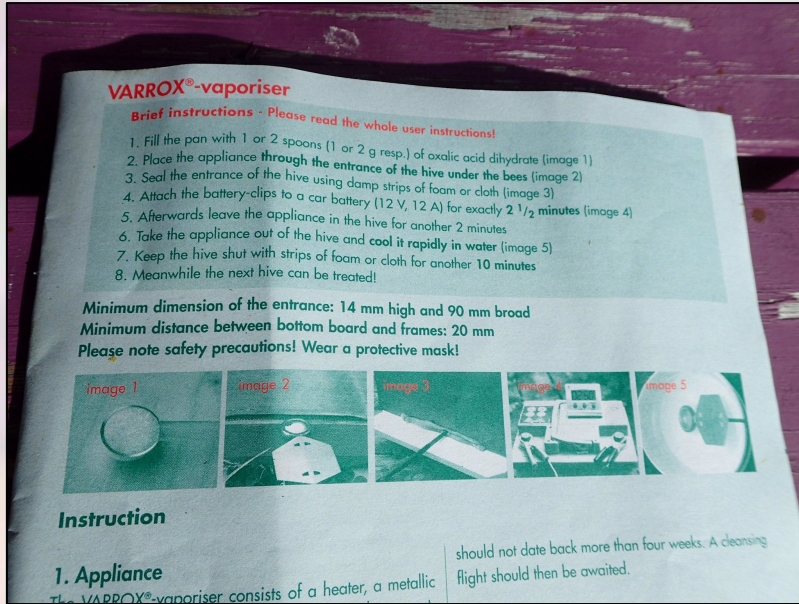
(<https://www.rozehaven.ca/hivemodels/index.html>)



Mite Levels

Start Conditions:	April 1	7 Frames (21000 bees)	Wintered	A wintered unit starts with no brood half the bees are long lived winter bees		Winter Population	
Peak egg rate:	1500	Slowdown:	Aug 15			Bees	27742
Evict Drones:	Sept 15	Broodless Date:	Oct 1	Start Mites:	100	Mites	1289
No manipulations	June 1						
Total Eggs:	221438	Treatment: OAV 2x7 day	May 15	Treatment: OAV 2x7 day	Aug 15	Mite Load	4.6 %
Items to Show:	<input checked="" type="checkbox"/> Legend	<input type="checkbox"/> Show Population by Age			<input checked="" type="checkbox"/> Fit Graph to Page		

Treating Your Hive for Varroa (OAV)



Use proper PPE
And follow the procedure.

Treat through screen
bottom board



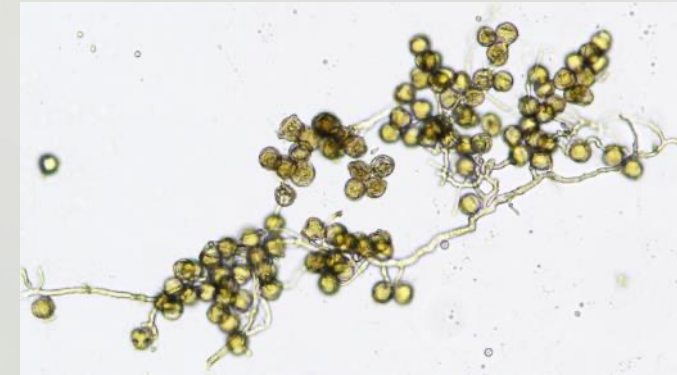
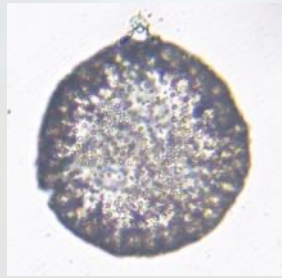
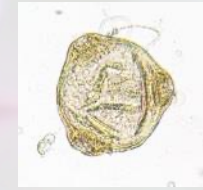
Count your mites



Keep records

Microscopy Basics [Online presentation](#)

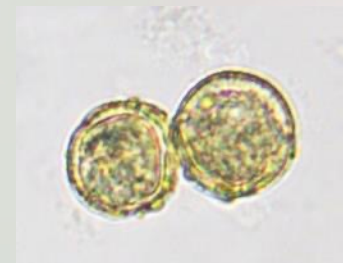
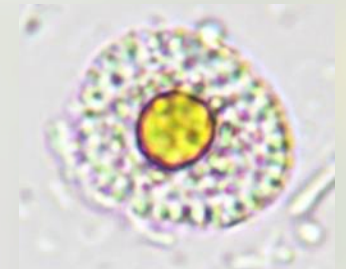
- Identify some basic diseases (Nosema Spores, tracheal mites)
- Learn more about bee anatomy
- Study pollen sources
- Help Identify honey type (Floral types Vs Honey Dew)



x40-x2500



x400



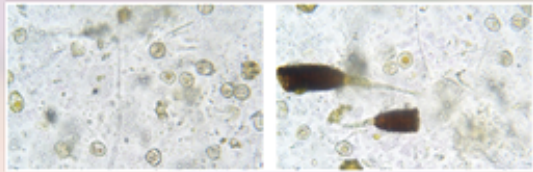
Disease / Pollen / Honey Type

Purchase a microscope or find an unused one

- Ok this one is more expensive but is a good bee club purchase



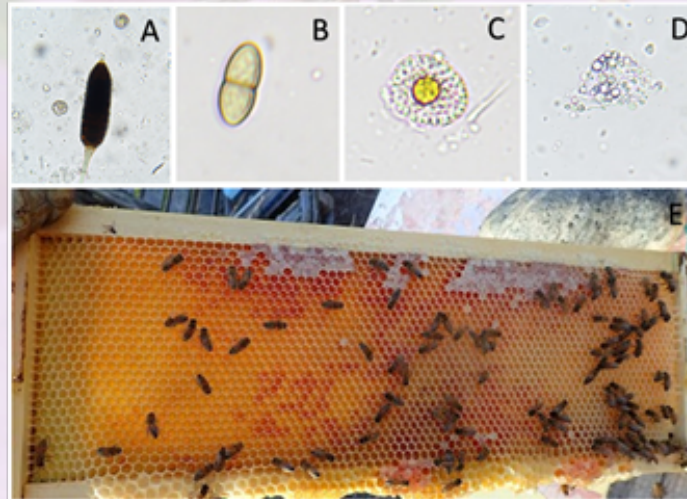
Nosema Ceranae



Bee gut content



Honeydew Honey



Typical HDE (Honeydew Elements) using basic microscopy at x 400 mag; (A - Alternaria sp (Aka Cat-tails); B - Cladosporium sp; C - Urediniospores sp - Rust Spores (Aka fried Eggs); D - Algae - Common Coniferous HD Honey; E - Honey frame filling during late July 2018 with a mix of light coloured nectar and darker honeydew)

Etienne Tardif
Admin · August 9 at 9:36 PM

Today after coming back from town I noticed a very loud hum coming from one of my expired fireweed patches. Upon checking, I noticed 100s of bees collecting what looked like pollen. Their sacs were full of bright fluorescent orange "pollen".

Curious as always I went to the hive to see if I could find discarded pollen leaf. I found a few and decided to test them along with a orange fireweed leaf.

What is the impact on the bees? What is the nutrition of *Pucciniastrum epilobii* (Fireweed Rust) vs pollen?

We had our 1st frost in a while (-4C) this morning.

Here is nice article on a rust spores (last section is on Honey Bees)
<https://weirdandwonderfulwildmushrooms.blogspot.com/2014/06/rust-fungi-femme-fatales-gorgons-and.html>

