ABRC 2023 PROCEEDINGS

SURVEY IS LIVE
April 1st – 30th!

BIP Loss & Management Survey: Monitoring Colony Losses Since 2008

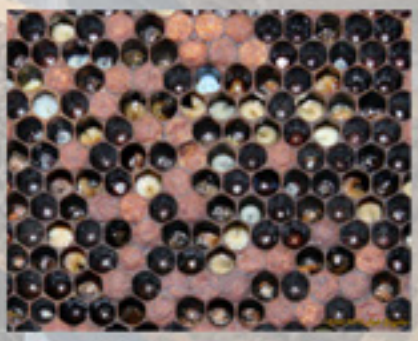
Your participation is **vital** for informing beekeepers, researchers, policy makers, and the greater public on colony management and loss trends.

Management Topic for 2023:

We have shortened the survey to focus on a single management topic each year, revisiting topics every few years. This year, the focus is on:

Pest & Disease Management Practices





Separate questionnaires are available for small-scale and commercial beekeepers.

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Be included. Be involved. Bee informed. **beeinformed.org**

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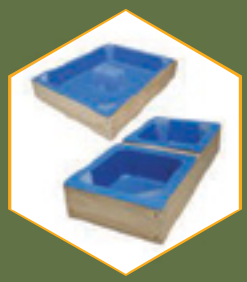
MITE CONTROL

TOP FEEDERS



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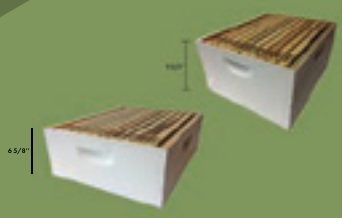

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Cover Photo by Greg Carey as part of our Image Gallery Photo Contest. Find details about the current contest images on page 95!

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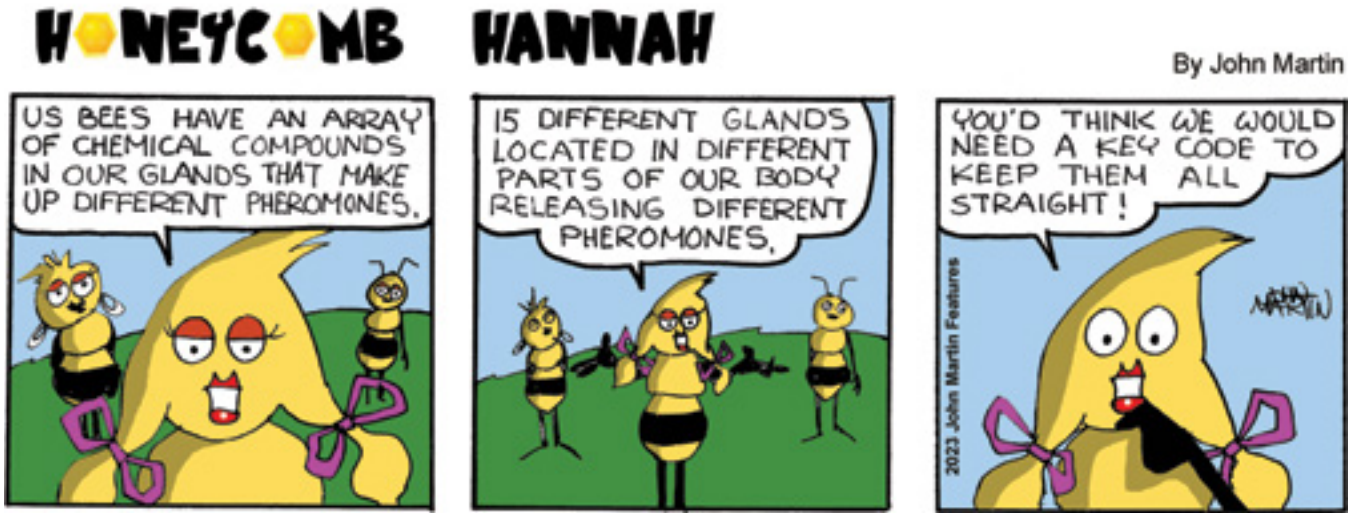

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Masucci Article

Hello Jerry,

I want to bring your attention to some misinformation in an article from January 2023. The article is titled *Ready for Winter – Maybe?* by James Masucci. He incorrectly stated the R-value of Reflexctix is 3.7 in ⅛ of an inch of material. That would mean an inch of the material would be an R-value of 29.6.

Just to give you a reference point, the R-value of an inch of polystyrene foam board is five. An inch of Reflectix bubble wrap would certainly not be an R-value of almost 30.

The company's website is very deceptive in their claim of the R-values of their product. If you read the fine print, those high R-values are achieved by installing the product with air gaps built in between the layers of Reflectix.

According to ASTM C518 testing, the true R-value of Reflectix is 1.04 in one inch of material, certainly not 29.6.

Thank you,
Peg DeSanto

Response from James Masucci

Peg,

Thank you for pointing out my error. I have been digging into this a little bit, and I have to say heat transfer is a complicated topic and I am a novice. Obviously, the point of my article was to show how I am trying Reflectix insulation to keep heat in the hive and I claim ignorance for my error. I asked a Reflectix competitor, EcoFoil, about the R-value, to help me understand what is happening and what I should expect from the bubble insulation. Their reply is as follows:

"Reflectix is one of our competitors and they do not get in trouble for advertising R values, we distanced ourselves from this conversation years ago as it is very misleading... our standard bubble insulations are written around reflectivity, not R value. R value is based on resistance; doesn't stop heat just resists. Pretty simple concept, the thicker it is, the greater the resistance, the higher the R value. Reflectivity is stopping heat. We offer a ¼", ⅛" or five mil products, thin as a sheet of paper, all stopping 96% of radiant heat. The bubbles just act as a thermal break, knocking down condensation."

I asked what the impact would be in the beehive, located on top of the frames. Their answer was, "It will hold 96% of the radiant heat in the hive... A lot of folks with bees are experimenting with our solid radiant barrier. It works great to keep the heat in that is already present. Tricky part is on the sunny days, it then blocks heat from getting into the hive."

This seems straightforward, but the key here is RADIANT heat. Radiant heat is heat transmitted through radiation, so it makes sense that it can be reflected and returned to the hive. But heat is also transmitted by conductance and convection. How important is radiant heat in the hive? To get a small understanding, I went to a department of energy website (**Radiant Barriers | Department of Energy**).

"Heat travels from a warm area to a cool area by a combination of conduction, convection and radiation. Heat flows by conduction from a hotter location within a material or assembly to a colder location, like the way a spoon placed in a hot cup of coffee conducts heat through its handle to your hand. Heat transfer by convection occurs when a liquid or gas – air, for example – is heated, becomes less dense and rises. As the liquid or gas cools, it becomes denser and falls. Radiant heat travels in a straight line, away from any surface and heats anything solid that absorbs the energy... When the sun heats a roof, it's primarily the sun's radiant energy that makes the roof hot. Much of this heat travels by conduction through the roofing materials to the attic side of the roof. The hot roof material then radiates its gained heat energy into the cooler attic surfaces, including the air ducts and the attic floor. A radiant barrier reduces the radiant heat transfer from the underside of the roof to the other surfaces in the attic."

Okay, so what does this mean in the hive? The cluster is generating heat. That heat radiates from the cluster and likely moves both by radiation and convection upwards towards the lid. The heat is conducted out of the hive through the walls and lid of the hive. The bubble wrap will reflect any of the radiated heat from the cluster but have only a small impact on the conduction heat transfer. This may still have a positive impact keeping heat in the hive and may also have a positive impact in the middle of Summer keeping the sun's radiant heat out of the hive. Is this the best choice of materials? Perhaps, if used properly. From Matt, at EcoFoil, "All of these products work off of convective energy, they need an airspace on one side to be effective. If you make a sandwich of the product, tight to the frames and tight to the lid, the product is conductive and heat simply passes through it. I would staple the product to the lid as there is typically an air gap from the lid to the top of the frames. This would be perfect and hold that heat in the hive. If the frames are touching the lid, we would want to put a spacer along the perimeter to hold the lid just above the frames."

James Masucci

• • • • • • • • • • • • • •

A Member

In response to the mailbox entry from Terry Combs in the January 2023 issue entitled *Association Members.*

Dear *Bee Culture,*

As a rookie beekeeper who joined a local association immediately, I found myself in agreement with Terry's assessment. I was very fortunate to have a long-term beekeeper offer to mentor me and, in the beginning the "club" was very patient with my numerous questions. I choose to raise bees, with honey being a by-product, and have been very lucky so far. However, recently, a young woman with one hive joined the club and she could not get anyone to agree to mentor her. I was very disappointed to hear this, so I offered to help her with my mentor as back up. Without

New Product

Summertime in Greece is similar to Southern California... dry with lots of kindling that will easily ignite and become forest fires. The Greek government prohibits beekeepers from lighting their smokers if the conditions are dry and windy.

ANEL, the makers of insulated plastic beehives and accessories, developed a smoker which will allow the beekeepers to light their smokers with no worry of causing fires. Cool Smoke was born. We helped introduce it at Apimondia this year in Istanbul.

Cool Smoke is a battery charged pellet smoker which only allows smoldering, not burning of the proprietary pellets. The battery, on a full charge, will run the smoker for about 90 minutes all the while producing smoke (pine or lavender). The included battery can be charged via household current or in your car with the cords that come standard. And once the beekeeper is finished, simply unplug the battery and the pellets self-extinguish in a matter of minutes. So, after an hour or more of working your bees, unplug your smoker with no worries of burning a veil or a suit or your car seat! It isn't hot!

Once Cool Smoke was introduced to the U.S. at Hive Life it became obvious that there was a secondary market which we had not planned... the new beekeeper who has trouble keeping their smoker lit. Cool Smoke is a foolproof method of smoking bees that anyone can master in a matter of minutes.

Cool Smoke is imported by Southeast Bee Supply. For a list of dealers check their web site at **www.southeastbee.com**. BC

my mentor's generous donation of his time and experience, there would be at lest two discouraged ex-beekeepers who never had a chance.

I would add only this to Terry's comment: kindergarten and grad school cannot be taught together. What long-term beekeeper wants to sit through another hour or two of releasing a package? What newbie waiting for their first hive needs to learn about making mead? So, people don't show up. No one is willing to do service in the club. Everyone suffers!

I would suggest offering separate opportunities. Perhaps rotating each month between experienced topics and rookie topics.

Richard Snyder
Greenville, NY

Big Corps Continued

In response to the mailbox entitled Big Corps from Jose in the February 2023 issue.

I recently traveled I-75, north to south and back.

During this trip, I saw mile after mile of groomed grass in the center median and both sides of the expressway.

There was one space in GA, where I was stopped for traffic and there was signage to the side that read: "Do not cut, space left for natural growth." This space was 20'-30' of uncut space.

As was stated before, if this space was left to grow natural pollinators, it would save the state(s) the cost to groom the land and add space for natural pollinators.

This was just one roadway of many miles in the USA. There is a lot of space that could be used to provide pollinator plants and save money.

RJL BC

NEXT MONTH

Region 1
- Inspect hives! Disease and *Varroa* free?
- Check for swarm cells
- Start queen rearing for June splits
- Do mite alcohol wash Check your numbers
- Check food reserves. Feed if needed
- Are you ready for splits?
- Stay ahead of swarms
- Clean deadouts
- Are supers ready?

Region 2
- Make splits
- Add supers
- Is Spring honey flow on?
- Swarm, swarm, swarm
- Add supers as needed
- Alcohol wash for mite load numbers
- Check queen laying pattern
- What's your plan for success?
- Make nucs

Region 3
- Add honey supers as needed
- Provide water as it gets hot
- Are colonies queenright?
- Make splits
- Do alcohol mite count
- Equalize colonies to slow swarming
- Add more supers
- Make replacement queens

Region 4
- Add second deep for colony growth
- Feed if needed
- Alcohol mite check, treat before supering
- Super
- Swarm control measures
- Reverse boxes
- Split overwintered colonies
- Inspect for queen cells

Region 5
- Feed to support colony growth
- Cross fingers for first nectar flow
- Feed/split
- Get apiary locations
- Sample, treat, sample again for mite control
- Do you need to requeen?
- Reverse boxes for swarm control
- Inspect colonies for disease

Region 6
- Super all strong colonies
- Too late to treat for mites
- Move colonies to good locations
- Look for swarm cells
- Split colonies
- Check on swarms caught
- Check yards for vandals and thefts

Region 7
- Alcohol wash mite sampling
- Look at HBHC's *Tools for* Varroa *Management Guide* (**https://honeybeehealthcoalition.org/wp-content/uploads/2022/08/HBHC-Guide_Varroa-Mg-mt_8thEd-081622.pdf**)
- Feed as needed
- Look for swarm cells
- Super
- Split colonies
- Hopefully make some honey
- Extract earlier and more often this year

Honey Reporters Wanted

We are expanding our Honey Reporter population in EVERY region. We ask that you fill in most of the sections, most months, and our short survey at the bottom. We give you a FREE subscription for your service. So if you are interested fill out the form **https://forms.gle/EnZW531NHM7sbMUz8** OR send an email to **Emma@BeeCulture.com** and put REPORTER in the subject line. Include name, email, phone number and mailing address and we'll get you the next Honey Report form. Sign up today and be a part of the BEST Monthly Honey Price and Beekeeping Management Report in the industry.

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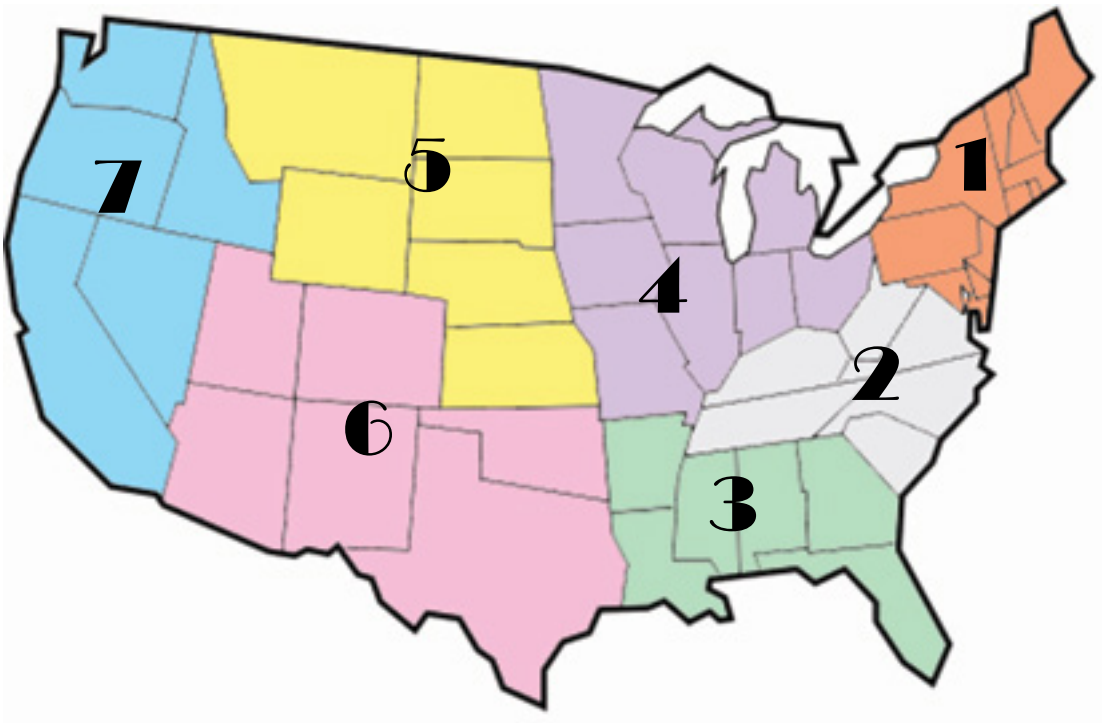
APRIL – REGIONAL HONEY PRICE REPORT

	REPORTING REGIONS							SUMMARY			History	
	1	2	3	4	5	6	7					
EXTRACTED HONEY PRICES SOLD BULK TO PACKERS OR PROCESSORS								**Range**	**Avg.**	**$/lb**	**Last Month**	**Last Year**
55 Gal. Drum, Light	2.64	2.19	3.03	3.00	2.81	2.70	3.45	2.00-4.00	2.82	2.82	2.84	3.75
55 Gal. Drum, Ambr	2.56	2.74	2.87	2.93	-	2.60	3.25	2.00-4.00	2.79	2.79	2.76	3.66
60# Light (retail)	214.52	266.67	216.00	212.25	177.00	186.54	310.00	120.00-350.00	220.53	3.68	225.80	215.64
60# Amber (retail)	216.06	253.75	203.50	216.33	-	203.09	208.33	120.00-310.00	217.27	3.62	218.30	213.12
WHOLESALE PRICES SOLD TO STORES OR DISTRIBUTORS IN CASE LOTS												
1/2# 24/case	105.97	101.87	84.66	95.10	64.80	90.00	-	64.80-200.00	98.89	8.24	112.61	100.09
1# 24/case	164.93	169.50	151.28	131.31	160.06	140.00	144.00	96.00-325.00	152.48	6.35	161.74	149.32
2# 12/case	147.08	178.00	111.31	117.37	173.76	151.50	156.00	60.90-300.00	139.04	5.79	152.42	141.80
12.oz. Plas. 24/cs	127.94	142.20	124.89	102.24	89.76	118.32	117.60	72.00-192.00	117.85	6.55	122.53	118.51
5# 6/case	169.17	240.00	115.59	128.62	123.84	127.88	-	96.00-330.00	154.76	5.16	171.61	156.92
Quarts 12/case	214.50	207.60	191.38	167.50	192.18	131.88	175.50	120.00-330.00	191.79	5.33	191.79	182.83
Pints 12/case	115.67	116.00	113.26	100.21	139.00	-	139.07	72.00-200.00	115.93	6.44	110.23	106.15
RETAIL SHELF PRICES												
1/2#	6.45	7.58	5.69	5.50	5.45	5.00	-	3.50-14.00	6.32	12.63	6.21	5.78
12 oz. Plastic	7.76	8.32	7.76	7.12	7.25	6.20	6.05	3.89-14.00	7.50	10.01	7.45	6.94
1# Glass/Plastic	10.45	12.66	10.48	8.81	10.68	8.50	8.00	5.00-30.00	10.33	10.33	10.21	9.15
2# Glass/Plastic	17.59	19.84	17.18	15.86	21.55	15.99	17.50	7.96-30.00	17.45	8.72	17.78	15.55
Pint	11.91	12.61	11.63	11.79	10.67	17.33	14.00	5.00-25.00	12.32	8.21	11.91	11.54
Quart	22.33	22.90	20.79	21.80	19.65	19.32	22.20	10.00-42.00	21.79	7.26	21.55	20.75
5# Glass/Plastic	36.58	40.25	34.49	31.90	29.43	34.30	-	17.89-60.00	35.08	7.02	35.83	33.53
1# Cream	12.79	10.92	11.49	11.18	12.00	17.50	16.00	7.79-25.00	12.36	12.36	11.66	11.65
1# Cut Comb	15.35	13.44	13.50	14.67	6.00	20.00	24.00	6.00-25.00	14.83	14.83	15.18	14.65
Ross Round	12.56	10.32	-	11.50	4.00	-	14.83	4.00-20.00	11.89	15.85	12.44	12.26
Wholesale Wax (Lt)	8.66	9.66	6.35	8.38	8.00	5.50	5.25	2.65-15.00	8.10	-	9.03	8.32
Wholesale Wax (Dk)	6.13	8.02	5.75	8.40	10.00	4.25	-	2.50-15.00	6.95	-	8.04	6.47
Pollination Fee/Col.	93.33	65.40	95.00	148.33	200.00	-	122.50	50.00-250.00	105.76	-	103.57	99.04

Please note: anywhere within each region that there is a '-' it is because no information was sent to us for that specific item in that region.



STUDY HALL

TREATING WITH ANTIBIOTICS AND VFD

QUESTION

I am a backyard beekeeper. My state inspector came out and looked at my colonies and said I needed to treat with terramycin. I told her I did not have a veterinarian that knew about honey bees so I could get an antibiotic legally through the Veterinary Feed Directive (VFD). She said go ahead and ignore the VFD as terramycin was going to be discontinued anyway. I looked up the FDA Veterinary Feed Directive online and I don't think ignoring the VFD is a good idea.
Anonymous

ANSWER

Short answer is I am not a veterinarian nor have I ever played one on TV. The VFD was put in place to stop the cavalier use of antibiotics in animals, honey bees included, and stop or at least slow down the growth of antibiotic resistant bacteria, keep our food supply safe and bring in animal medical expertise to our industry. So, do not access or use a product illegally in your honey bee colonies.

On the flip side, I can count the number of veterinarians who know anything about honey bees, pests, parasites and diseases on one hand. There is a great organization that is trying to improve this, the Honey Bee Veterinary Consortium (HBVC). I Googled them up at **https://www.hbvc.org/**. On the site there is a link to *Find a Vet*. And in *Bee Culture* we have Dr. Tracy Farone and her column *Bee Vet*.

All this to say, you should set the standard in your state with beekeepers and the state inspector to the best of your ability regardless of how awkward it may seem at first as this veterinarian/beekeeper partnership evolves.

NOW WHAT DO I DO?

QUESTION

Spring has finally come to us in the North. It took all Winter though. Ugh. This is my second year. I had two colonies in October and on a warm day last week, I saw bees flying from one of them. What should I do now?
Marceline Roush

ANSWER

Well, you only had a 50% loss which is unfortunately semi-normal. But it can be better.

Here is my list:

- I hope you are a member of your local beekeeper club. If not join, then ask for mentoring help. The mentor needs to have five plus years of SUCCESSFUL beekeeping. It takes a minimum of five years to be a humble enough beekeeper to help others.
- On the next warm, sunny, 60°F day you and your experienced mentor open the colony for a thorough inspection.
- How many frames of bees are there? Do they have enough stored honey or do they need feeding? Are there eggs, larvae, capped brood? Is the brood healthy? Are there enough bees to support brood rearing? If not, is there a queen? If no queen, has the colony progressed to laying workers? What does comb look like light, dark? Drone cells? And many more things your mentor can point out.
- Go to the Honey Bee Health Coalition website, **https://honeybeehealthcoalition.org/** There is all the info you need for successful *Varroa* control and brood diseases in the *Tools for* Varroa *Management Guide*. I suggest memorizing it.
- There are other questions as you learn that managing honey bees is a visual sport. Learning what to look for and then the comparison and contrast of what you are seeing is critical.
- Remember with *Varroa* and the *Varroa* virus legacy, you have to be the responsible manager of these animals. If not, don't be a beekeeper.

TROPILAELAPS MITE

QUESTION

What is the *Tropilaelaps* mite exactly? I heard about it as another honey bee mite problem.
Clevon Morgan

ANSWER

Let's step back for a moment. First, how did we get *Varroa* mites? *Varroa* was found in Florida in 1987. How it got there is still unclear. Was it in a swarm of *Varroa* infested bees

From the Editor, Jerry Hayes

on a ship or plane or did somebody sneak a queen in with *Varroa*? I mention this because with our global economy, anything can show up on our doorstep from anywhere in the world. A recent example is COVID.

What is *Tropilaelaps* is a great question. Google is an amazing resource... **https://entnemdept.ufl.edu/creatures/MISC/BEES/Tropilaelaps.htm.** This link is from the UF/IFAS website and 'Featured Creatures'. See some highlights I picked out below for Distribution and Life Cycle:

Distribution

Tropilaelaps *is a native pest in tropical and subtropical Asia. However,* Tropilaelaps*' distribution has been expanding over the past 50 years.* Tropilaelaps *can been found in* Apis mellifera *colonies well beyond the mite's native range. Invasive* Tropilaelaps *populations are most successful in warm environments where honey bees produce brood (developing larvae or pupae) throughout the year. For instance,* Tropilaelaps *have been reported in Kenya and Papua New Guinea.*

Life Cycle

Tropilaelaps *have small mouth parts that are unable to pierce the integument (skin) of adult honey bees. Therefore, both nymph and adult* Tropilaelaps *must feed on the hemolymph of the honey bee brood. After emerging from the honey bee brood cell, adult* Tropilaelaps *must re-enter another brood cell to feed on a developing bee or the mite will die within two days.* Tropilaelaps *have a short reproductive cycle and possess the potential for rapid population growth. Furthermore, their rapid reproduction enables* Tropilaelaps *to out compete* Varroa *in honey bee colonies infected by both mites.*

Because of global trade, *Tropilaelaps* will continue to spread and take reproductive advantage in managed honey bee colonies around the world. One of the concerns I have heard is that one of our neighboring country's is/has been bringing in packages from Australia. The tip of Australia is approx. 93 miles from

Papua New Guinea. And as you know, Australia now has *Varroa* which was found at a port location. All that to say, get ready.

STOP SWARMING

QUESTION

How can I stop some of my colonies from swarming?
S. Archibald

ANSWER

Why do honey bees swarm is the real question? Our honey bees figured out long ago that in order to simply survive they had to divide and conquer by spreading their genetics around. One colony staying in one location was genetic survival disaster. Most of our honey bees have genetics from where they survived a long, cold, hard northern Europe Winter. Our honey bees are always preparing for Winter. Many places in the U.S. have Spring upon us now. Honey bees now have a few months to build up, reproduce by dividing up the colony, have that 'other' group of honey bees (a swarm) find another cavity in a tree or wall of a house or collected by a beekeeper and put in a box to establish a colony, build comb, collect nectar, beebread, build up a population that can maintain a temperature to make to through an Ohio, Alabama, Kansas, North Dakota, etc. Winter. Stopping, preventing, slowing this swarming survival genetically imprinted goal is almost impossible. This is like trying to stop _____ (fill in the blank). All that to say if researchers developed a genetically modified honey bee that didn't swarm and left long term consistent management up to us beekeepers, they would disappear like the dinosaurs did. They are survivors because of genetic diversity and they are in fact, managing us beekeepers to keep them alive and healthy so they can swarm, not the other way around. BC

FOUND IN TRANSLATION

Social Nature and the Hive Life

Jay Evans, USDA Beltsville Bee Lab

Listen along here!

Picturing the Spring that will be upon the northern hemisphere when this essay is published, I feel a deep longing to see our bees in full growth, bringing back diverse pollen baskets and crops full of abundant nectar. Spring is my favorite season and it is almost painful to think of it as I write this in February (to many of us, the longest month). As a passionate beekeeping ally, I firmly believe that *on the whole* and *in most settings* honey bees are not only a tremendous asset to humans but intrinsically worthy in their own right. As messy as it might seem, this is true in both their introduced and native ranges (Eurasia and Africa for the 'western' honey bee).

Except for one 14 million-year old flattened specimen that fossil-hunters feel is in the genus *Apis* (all species of which have comb-forming, stinging, honey-storing social habits), there is no firm evidence that honey bees lived in North America before European colonists arrived a few centuries ago. Once here, however, honey bees flourished, swarming from their woven homes and making themselves an important part of both agricultural and natural habitats. In the midst of Winter, I feel the need to celebrate this flourishing.

That said, this is not another economic essay on the value of honey bee pollination or colony products, although $20-25 billion added to the U.S. economy in diverse, nutritious foods is not trivial. Nor is it another diatribe that bee-mediated pollination nourishes people throughout the world, nor that honey bees provide a cash crop for millions of families, with little startup costs, in communities that are stressed for both cash *and* nutritious foods.

And this is not a tribute to all the hardworking beekeepers, with from one to 80,000 colonies, who battle a variety of stresses to stay in the game (though I am not above pandering to that crowd).

It's not even a worshipful look at how pollinators have shaped our world over 100+ million years, not simply by supporting billions of humans but in making every landscape just a bit more colorful and dynamic. This collaboration between bees and flowering plants, which started early and ended well for both, is wonderfully described by Sophie Cardinal and Bryan Danforth in their 2013 paper *Bees diversified in the age of eudicots*, Proceedings of the Royal Society B, **https://doi.org/10.1098/rspb.2012.2686**. I will tackle the larger economic and environmental benefits of honey bees and other pollinators in the future, this essay is more personal.

I would argue that we socially aware humans just *need* honey bees beyond their great services. To me, this need comes from two drivers. First, honey bees mirror our own inescapably social natures and teach valuable lessons therein. Second, if you try even half-heartedly to place yourself in the mindset of honey bees and other pollinators you can't escape thinking about, and striving to improve, the plant resources and the overall environment they fly over and visit on their foraging flights.

First, the social connection. It is easy to revere a species in which selfless workers provide for relatives they most likely will never meet. There are so many facets of honey bee communication, biology and nature that are mirrors for our own, leading to profoundly interesting behaviors that resonate with the good and bad

of our communities. My gateway to social insects and ultimately a life studying honey bees opened with a single lecture by an ant biologist, after which I went to my dorm and decided it was inconceivable to fritter my life away without studying these special creatures who build empires largely because they choose, 90% of the time, to drop their conflicts and work for a common goal. Ignoring their preferred diets, ants and honey bees are quite similar. Most importantly, both have succeeded in no small part because they divide tasks efficiently in colonies and can thereby both out-compete their solitary neighbors and regulate their home environments. Thomas Seeley's book *The Lives of Bees: The Untold Story of the Honey Bee in the Wild* (2019) is a great entry into the wonder of bee inner worlds, while German professor Suzanne Foitzik shares similar life stories for ants in her 2021 book *Empire of Ants: The Hidden Worlds and Extraordinary Lives of Earth's Tiny Conquerors*. In my case, the itch to learn about social insects became a full-on rash after opening a small student beehive for the first time while devouring the many stories of how honey bees and humans have been partners for thousands of years. From "busy as a bee" to "dance language" and "guard bees", how we think of bee societies is hard to decouple from how we view our own. Not surprisingly then, neither bee nor human societies are perfect. Both show conflict within, vulnerabilities to parasites of all sorts and an occasional tendency to trample other beings, but both are marvels to behold, and exhilarating to compare and contrast.

A second preeminent reason to value honey bees is that they truly provide a gateway to understanding nature. When beekeepers see their bees exit the hive, circle-wave their home and sail off, they marvel at what that tiny bee will see on a journey across the landscape, wishing the bee luck and the memory cells to return after a successful foraging trip. This care for one's bees inevitably leads to a greater appreciation for the flowering world, leading beekeepers to seek ways to improve and diversify the green world their bees encounter. Beekeepers fret over, and are noisy about, any ill winds that arise from degraded environments within two miles of the colonies they host. Habitat loss, climate, land practices and disease all impact the health of honey bee colonies, and beekeeping forces us to learn about each of those topics. Every beekeeper also has a keen sense of weather and the seasons. Okay, the same is true for gardeners, birders and hunters… and by some stretch of the imagination even golfers, although better if they let their 'greens' revert to wildflowers. Similarly, beekeepers are among the most knowledgeable humans with respect to how diseases spread, how to slow infections, and when it's time to seek a doc, even if we neglect that knowledge sometimes with our own health and that of our colonies.

It's not an easy path, and beekeepers often stumble. But, bees and beekeeping give back incredible riches to those who listen to the buzz and hitch a ride with their bee teachers. Hope springs eternal and here's hoping your Spring is bountiful. BC

What are the Top Beekeeping Myths?

John Miller

I've seen a thing or two. My first visit to the beeyard was in 1960. Back then, we did things the way we did because that's the way my grandfather did things, which was the way my great-grandfather did things. How little I knew of what the future held for beekeeping.

We have myths in the art of beekeeping. In an effort to write with you, not write to you this month, please share your top beekeeping myth(s) with me.

Some myths are stunners. February 9, 2023 I was working bees in an almond orchard near Woodland, CA. Pulled up a center frame from a fair, but not great hive. Smiling at me, on the same side of the same frame – two queens. I know. I know! Another myth bites the dust.

Here is a myth that rocked my world in about 1978 or so. We made divisions or splits, or nucs each Spring to make up Winter loses. Nothing new there. How we made those nucs was nearly a century-old model.

We set out the parent yard. Set out the covers, bottoms, hive bodies, foundation (the hand-wired 7-S real beeswax foundation that so easily shattered when dropped on crisp Spring mornings). We nailed on bottom boards. Each beekeeper carried a hammer, unless we lost a hammer – then we shared; and half enough feeders for the number of hives we ran.

Feeders were constructed of tempered Masonite and laboriously cut ears, end cuts and bottom cuts. The feeders were sealed by pouring a hefty eighth-cup of liquid beeswax into the feeder. Now roll the wax throughout the interior of the feeder – seal the feeder against leaks. At least that was the idea.

The 'ears' on these feeders were notoriously easy to break. The feeders leaked, warped and we had half enough feeders for the number of bees we operated. Even now, 45 years and a couple of chronic sore shoulders removed from the 'old way' of making nucs this is stupid painful to rehearse.

This meant that every two weeks or so in Spring, before the dandelion, or between the dandelion and alfalfa bloom – we had to pull and shove hundreds of feeders in an inelegant race to avoid starving beehives. Plastic feeders did not exist. Feed is not expensive until denied.

We hauled syrup in a 300-gallon tank, with a two inch gate valve. We filled most of a five-gallon can with syrup. We then poured the syrup into the Masonite feeder. That was the idea. On windy days – some of the syrup made it into the feeder. This was before the invention of syrup pumps.

Back to the old way of making divides: the beekeeping crew arrived in the parent yard. We had one-third enough pallets at the time, and one (1) 600 model Bobcat skid-steer loader with the Clark brand mast. Not the 12' mast; the 10' mast. Any nuc made had to be hand-loaded onto the truck once the parent yard was nuced. Not only was the nuc hand-loaded, each nuc had an entrance screen (think screen door screen) shoved into the entrance to prevent drift. We moved the nucs to a two-mile distant nuc yard, [MYTH ALERT!] where the screens were pulled from the nuc entrance so the nuc did not suffocate, and later, virgin queens could take their flights. We usually pulled almost all the screens. We could sometimes make 250 nucs per day. It was exhausting.

I attended an American Beekeeping Federation convention around that time, and sat next to Dick Ruby, from Milnor, North Dakota. Dick Ruby is a gentleman beekeeper and a smart guy. We were talking about Spring splits. As I described our process, I could see his jaw slacken. When Dick makes an exclamatory remark, it is usually, "Oh, my".

He asked why we screened, loaded and moved nucs from the parent yard to the nuc yard?

I rehearsed the myth that a beehive must be moved two miles from the parent hive to prevent the bees from abandoning the newly made nuc; drifting back to the parent.

His response was, "No you don't. Here's what you do. Make your splits in a 360-degree pattern surrounding where the four parent hives sat on the pallet. Upon finishing the pallet, pick up the pallet and take it away. Leave no trace of familiarity for the foraging bees. Don't worry about the young, dumb bees. They will stay with the brood in each nuc."

A myth busted. A back-breaking waste of time, talent and energy schlepping beehives in screened entrances several miles distant from a parent yard to a nuc yard.

The changes were immediate and measurable. The bees drifted some – sometimes. But those young bees always stuck with the brood, keeping it warm and fed. Foragers sort of equalized themselves between the sometimes eight nucs. Sometimes, if the bees were really good, 12 nucs surrounded where the parent pallet of four hives had been.

The myth blown up changed our productivity.

I'll always be thankful for the gentleman – Dick Ruby – who took the time to help another beekeeper.

That's one busted myth.

What is your busted beek myth? What are the consequences of the busted myths?

Please share with **jerry@beeculture.com** – and me: **john@millerhoneyfarms.com**. Really looking forward to readers' busted myths.

We can post the busted myths. Letters to "Busted" will be better managed by Editor Hayes. BC

JRM

MYTH BUSTED

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A Closer LOOK

Tropilaelaps Mites

Clarence Collison

A potential future threat of the western honey bee (*Apis mellifera*) in North America are the parasitic mites in the genus *Tropilaelaps* which are currently confined to Asia and bordering areas. These mites are native brood parasites of the non-domesticated giant Asian honey bees, *Apis dorsata*, *A. breviligula* and *A. laboriosa*. They have spread onto the managed European honey bee (*A. mellifera*) sometime after humans introduced that bee into Asia. Nowadays, *A. mellifera* is kept for beekeeping throughout Asia and *Tropilaelaps* mites are one of its most damaging pests (Anderson and Roberts, 2013).

Mites of the genus *Tropilaelaps* (Acari: Laelapidae) are ectoparasites of honey bees native to Asia (Delfinado and Baker, 1961; Laigo and Morse, 1968). The primary host of one of the better known species *Tropilaelaps clareae* is *Apis dorsata* (Laigo and Morse, 1968) but *Tropilaelaps* mites were able to switch to the western honey bee, *Apis mellifera* (Delfinado and Baker, 1961; Anderson and Morgan, 2007). *Tropilaelaps clareae* was first discovered on *A. mellifera* in the Philippines (Delfinado and Baker, 1961). *Tropilaelaps* species seem to be prevalent in Asia and are able to infect a wide spectrum of honey bee species ranging from *Apis mellifera*, *A. cerana*, *A. dorsata, A. florae* and *A. laboriosa* (Bailey and Ball, 1991). However, these mites appear to be particularly pathogenic in *A. mellifera* (Burgett et al., 1983; De Jong et al., 1982; Laigo and Morse, 1969). Similar to *Varroa destructor* (Acari: Varroaidae), *Tropilaelaps* mites are infecting brood and suck hemolymph/fat from the body. Up to four female mites can invade the same brood cell (Burgett and Akratanakul, 1985; De Jong et al., 1982; Dainat et al., 2009).

Varroa and *Tropilaelaps* mites have coexisted in *Apis mellifera* (western honey bee) colonies in Asia for >50 years (Delfinado, 1963). However, *Tropilaelaps* mites are considered to be the more dominating and reproductively successful parasites of *A. mellifera* than *Varroa* mites (Burgett et al., 1983; Buawangpong et al., 2015). In 2007, a molecular examination of *Tropilaelaps* mites collected from different honey bee hosts from several Asian countries revealed two new *Tropilaelaps* species (*Tropilaelaps mercedesae* and *Tropilaelaps thaii*) distinctly separate from *Tropilaelaps clareae* and *Tropilaelaps koenigerum* (Anderson and Morgan, 2007). Among these four species, *T. mercedesae* and *T. clareae* are the most serious *Tropilaelaps* mites of *A. mellifera*. However, *T. mercedesae* exhibits a wider distribution than *T. clareae*. The life history of *Tropilaelaps* mites and food requirements are similar to that of *Varroa* mites. As a result, both mite genera can inflict severe damages on *A. mellifera* colonies (De Guzman et al., 2017).

An infestation by *Tropilaelaps* can be recognized either visually on bees and brood or by examining hive debris. Feeding on bee larvae and pupae causes brood malformation, death of bees and subsequent colony decline or absconding. Development requires about one week, and the mites are dispersed on bees. Irregular brood pattern, dead or malformed immatures, bees with malformed wings that crawl at the hive's entrance and especially the presence of fast-running, large, red-brown, elongated mites on the combs, are diagnostic for the presence of *T. clareae*. An early diagnosis can be made by opening brood cells and finding immature and adult mites therein (Sammataro, 2004).

Combs of sealed honey bee worker brood (*Apis mellifera ligustica* hybrid) were taken from colonies infested by *Tropilaelaps clareae* and the numbers of mites in different developmental stages recorded. The duration of successive stages was estimated from the times at which the first and last individuals in each stage appeared and also from the relative frequency of occurrence of the different stages in the mite population of infested cells. Altogether 22 eggs, 42 larvae, 187 protonymphs, 251 deutonymphs and 659 young or old imagos (final and fully developed adult stage) were detected. The first individuals of successive stages in the development of the mite were found on honey bee brood of the following stages: mite eggs and larvae on spinning larvae, protonymphs on prepupae, deutonymphs on day-old pupae and young imagos on pupae four days old. The most advanced age of a developing bee (calculated from the time of egg-laying) with which each stage of mite was associated was: egg, 14 days; larvae, 15 days; protonymphs, 16 days and deutonymphs, 19 days. The calculated lengths of successive *T. clareae* stages were: eggs, 0.3–0.4 days; larvae, 0.3–0.6 days; protonymphs, 1.7–2.0 days and deutonymphs, 3.0-3.8 days. Length of the total developmental period was six days. All mites completed their development before the honey bees emerged, a factor that probably contributes

to the faster population build-up of *T. clareae* than of *Varroa jacobsoni* (Woyke, 1987).

Tropilaelaps mercedesae parasitism can cause *Apis mellifera* colony mortality in Asia. Phokasem et al. (2019) reported that *Tropilaelaps* mites feed on both pre- and post-capped stages of honey bees. Feeding on pre-capped brood may extend their survival outside capped brood cells, especially in areas where brood production is year-round. They examined the types of injury inflicted by *Tropilaelaps* mites on different stages of honey bees, the survival of adult honey bees and level of honey bee viruses in fourth instar larvae and prepupae. The injuries inflicted on different developing honey bee stages were visualized by staining with trypan blue. Among pre-capped stages, fourth instar larvae sustained the highest number of wounds (4.6±0.5/larva) while second and third larval instars had at least two wounds. Consequently, wounds were evident on un-infested capped brood (fifth and sixth instar larvae=3.91±0.64 wounds; prepupae=5.25±0.73 wounds). *Tropilaelaps* mite infestations resulted in 3.4- and six-fold increases in the number of wounds in fifth and sixth instar larvae and prepupae as compared to un-infested capped brood, respectively. When wound inflicted prepupae metamorphosed to white-eyed pupae, all wound scars disappeared with the exuviae. This healing of wounds contributed to the reduction of the number of wounds (≤10) observed on the different pupal stages. Transmission of mite-borne virus such as Deformed Wing Virus (DWV) was also enhanced by mites feeding on early larval stages. DWV and Black Queen Cell Virus (BQCV) were detected in all fourth instar larvae and prepupae analyzed. However, viral levels were more pronounced in scarred fourth instar larvae and infested prepupae. The remarkably high numbers of wounds and viral load on scarred or infested developing honey bees may have caused significant weight loss and extensive injuries observed on the abdomen, wings, legs, proboscis and antennae of adult honey bees. Together, the survival of infested honey bees was significantly compromised. This study demonstrates the ability of *Tropilaelaps* mites to inflict profound damage on *A. mellifera* hosts (Phokasem et al., 2019).

In a serious attack of the mite *Tropilaelaps clareae* on *Apis mellifera* colonies at Ludhiana, India, up to 50% of the brood was killed in the late larval and pupal stages, and colony populations dwindled rapidly. Honey bee larvae are killed by the nymphs feeding on them, or (if attacked later) they develop into deformed adults which are evicted from the hive. A badly infested colony is left with practically no brood and it may abscond ultimately, the bees carrying the adult mites with them. After the mites have transformed into adults, they remain just under the cell cappings and are exposed when these are removed (Atwal and Goyal, 1971).

The survival of adult female *Tropilaelaps clareae* of unknown age on caged adult workers of *Apis mellifera* was investigated in ambient conditions during the rainy season in northern Thailand and in an incubator maintained at 35°C (95°F) and 60% RH. Under both conditions, a small percentage of *T. clareae* survived for three days. A similar experiment using adult *T. clareae* on caged adult workers of *Apis dorsata* produced similar results: a small percentage of mites survived for three days. The observed survival of *T. clareae*, whether on *A. mellifera* or *A. dorsata*, is about one day longer than previously reported. It is now clear that the highly pestiferous *T. clareae* could easily survive even the longest of international airline flights (Rinderer et al., 1994).

The prevalence of *Tropilaelaps mercedesae* and *Varroa destructor* in concurrently infested *A. mellifera* colonies in Thailand was monitored. They also assessed the fecundity of *T. mercedesae* and *V. destructor* in naturally infested brood and in brood cells deliberately infested with both mite genera. Results showed that the natural co-infestation of an individual brood cell by both mite genera was rare (<0.1%). Overall, *T. mercedesae* was the more dominant brood parasite of *A. mellifera* than *V. destructor*. In naturally infested brood, the proportion of nonreproductive *Tropilaelaps* (29.8±3.9%) was lower than that of *Varroa* (49.6±5.9%). Both mites produced similar numbers of progeny (*T. mercedesae*=1.48±0.05; *V. destructor*=1.69±0.14). The two mite genera also reproduced normally when they were deliberately introduced into the same brood cells. In two separate assessments, the average worker brood infestations of *T. mercedesae* (19.9%) were significantly higher than that of *V. destructor* (0.7%). Their results on the higher prevalence and reproductive ability of *T. mercedesae* in concurrently infested colonies reaffirm *Tropilaelaps*' competitive advantage over *V. destructor* and their reported negative impact to *A. mellifera* colonies (Buawongpong et al., 2015).

Female *Tropilaelaps clareae* mites were released into small petri dishes without food, or on small pieces of brood comb containing several *Apis mellifera* larvae one to four days old. On each day of the experiment the piece of brood comb was exchanged for a new one containing larvae of the age being tested. In dishes with no food only 5.5% of mites survived for two days. Survival of gravid female mites was significantly higher than that of thin females. On bee larvae one, three and 3.5 days old, 0%, 9% and 47% of *T. clareae* females survived until the second day. None survived until the fourth day. However, on bee larvae four days old, 89%, 68%, 32%, 7% and 4% of females were alive on the second, fifth, 10th, 19th and 28th day, respectively. Thus, *T. clareae* females can survive for up to four weeks on bee larvae four days old. The amount of brood pheromones on larvae four to five days old is greater than that on younger larvae, probably stimulating feeding and thereby supporting mite survival. Fertilized female mites quickly become gravid, and they must enter cells containing bee larvae to lay eggs. *T. clareae* females do not need to feed on prepupae or pupae to lay eggs and to survive for longer periods. Queen honey bees need not be caged after brood removal from the colony in order to control the parasitic mite *T. clareae*, as by the time any eggs laid have developed into four-day-old larvae the mites will have died (Woyke, 1994).

Varroa *(left)* & Tropilaelaps *(right)*

Few data regarding the lethal and sub-lethal effects of *Tropilaelaps mercedesae* on *A. mellifera*

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exist, despite its similarity to the devastating mite *Varroa destructor*. Here they artificially infested worker brood of *A. mellifera* with *T. mercedesae* to investigate lethal (longevity) and sub-lethal (emergence weight, Deformed wing virus (DWV) levels and clinical symptoms of DWV) effects of the mite on its new host. The data show that *T. mercedesae* infestation significantly reduced host longevity and emergence weight and promoted both DWV levels and associated clinical symptoms. The results suggest that *T. mercedesae* is a potentially important parasite to the economically important *A. mellifera* honey bee (Khongphinitbunjong et al., 2016).

The ectoparasitic mites *Varroa destructor* and *Tropilaelaps mercedesae* share life history traits and both infect honey bee colonies, *Apis mellifera*. Since *V. destructor* is a biological vector of several honey bee viruses, it was tested whether *T. mercedesae* can also be infected and enable virus replication. In Kunming (China), workers and *T. mercedesae* mites were sampled from three *A. mellifera* colonies, where workers were exhibiting clinical symptoms of Deformed wing virus (DWV). They analysed a pooled bee sample (15 workers) and 29 mites for the presence of Deformed wing virus (DWV), Black queen cell virus (BQCV), Sacbrood virus (SBV), Kashmir bee virus (KBV), Acute bee paralysis virus (ABPV) and Chronic bee paralysis virus (CBPV). Virus positive samples were analyzed with a qPCR. Only DWV +RNA was found but with a high titre of up to 10^8 equivalent virus copies per mite and 10^6 per bee. Moreover, in all DWV positive mites (N=12) and in the bee sample virus – RNA was also detected using RT-PCR and tagged RT-PCR, strongly suggesting virus replication. The data shows for the first time that *T. mercedesae* may be a biological vector of DWV, which would open a novel route of virus spread in *A. mellifera* (Dainat et al., 2009).

Honey bees are infected by many different viruses, some of them associated with and vectored by *V. destructor*. In recent years, deformed wing virus (DWV) has become the most prevalent virus infection in honey bees associated with *V. destructor*. DWV is distributed world-wide, and found wherever the *Varroa* mite is found, although low levels of the virus can also be found in *Varroa* free colonies. The *Varroa* mite transmits viral particles when feeding on pupae or adult bees. In this study, quantitative real-time RT-PCR was used to show the presence of DWV in infested brood and *Tropilaelaps mercedesae* mites collected in China, and to demonstrate a close quantitative association between mite-infested pupae of *A. mellifera* and DWV infections (Forsgren et al., 2009). BC

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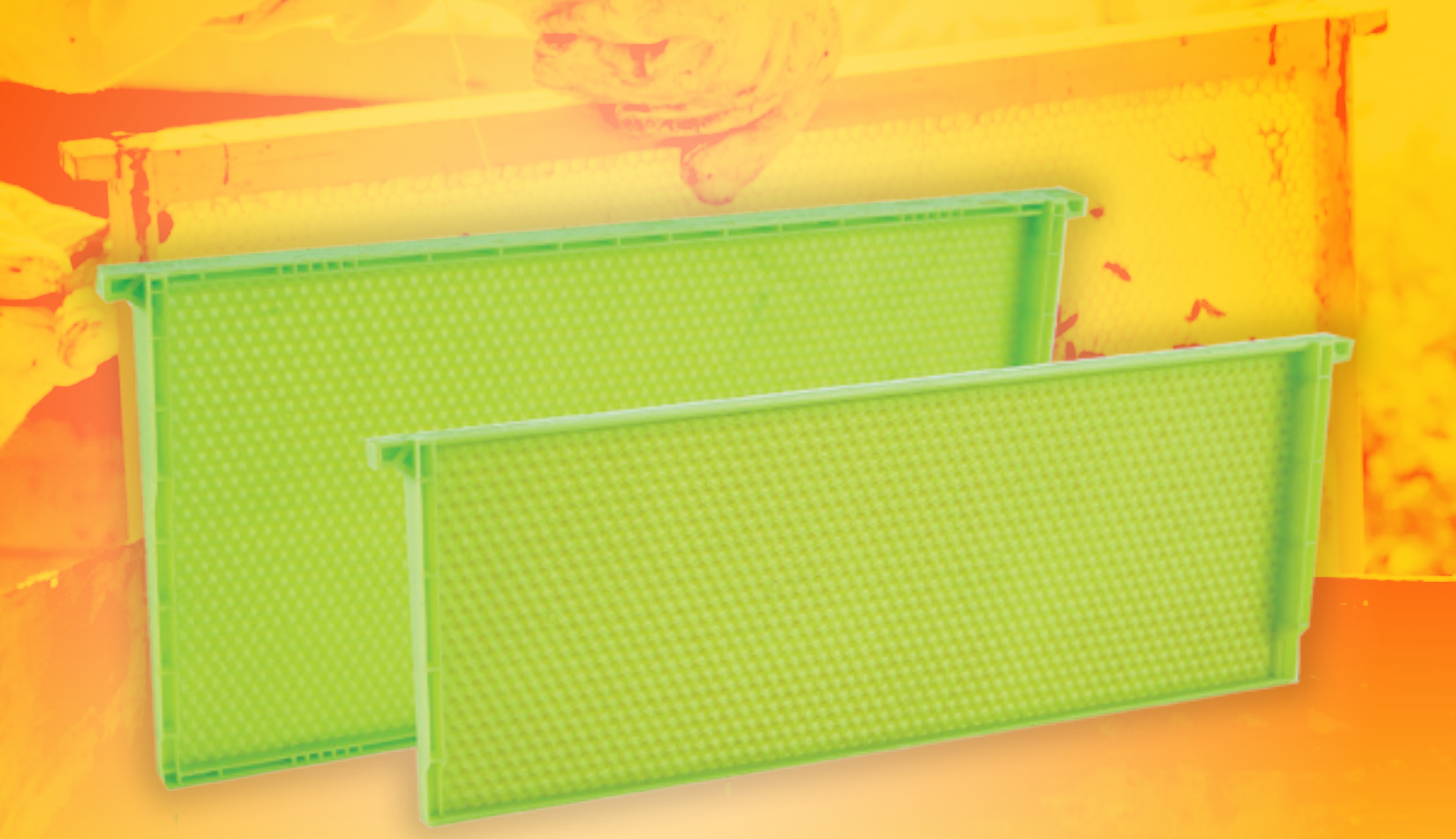

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The Beekeeper and the Tax Man

Stephen Bishop

I'm not much of a puzzle person, but about once a year an overwhelming urge to do a puzzle overtakes me—granted, it's a government-induced urge that nearly always corresponds with the hours leading up to April 15th, hours spent trying to piece together my beekeeping finances for the previous tax year. Each year I tell myself this is the year, the year I'm going to get organized, and each year I find myself on April 15th trying to quickly decipher faded and crumpled up receipts, all while praying the IRS has bigger fish to fry than a lowly, disorganized sideline beekeeper with a bad procrastination problem.

Historically, my financial record keeping system has not been the best, my truck's glove box, but it has progressed from the days when I just stuffed beekeeping and farm receipts into my wallet for safe keeping. I do not recommend a wallet for long-term receipt storage. For one thing, sitting on a billfold that's as big as a softball is bad for the sciatic nerve and as a beekeeper you likely already have a bad back. Also—and this is just my best scientific theory—the downward pressure from sitting repeatedly on receipts causes the ink on the receipts to volatilize and escape into the atmosphere, leaving you to guess what that twenty-five-pound bag of sugar cost ten months ago (though I'm not a CPA, I suspect the IRS frowns on treating faded receipts like a Price is Right game).

Furthermore, if you're like me, a good-hearted, IRS-fearing, tax-paying citizen whose God-given gift is the ability to misplace and lose important objects, like, say, a wallet containing three dollars and a year's worth of beekeeping receipts, I highly recommend QuickBooks Online. With it, you don't have to remember to put your receipts in your wallet, nor do you have to remember where your wallet is. You just have to remember where your cell phone is to take a picture of the receipt, which is then beamed up and stored safely in the Cloud. Also, you'll have to remember your Quickbooks' password. Be forewarned, failure to remember your password may require you to answer security questions, the answers to which you will have likely forgotten. If that happens, your receipts are lost forever in the Cloud, so you would have been better off just stuffing them in your wallet and losing it to begin with.

If receipts are like puzzle pieces, you'll have to figure out where the receipts go in the puzzle. Are the receipts for current year expenses or long-term assets that need depreciating or candy bars that have nothing to do with beekeeping but got misplaced in your wallet? These are questions that CPAs are trained to answer. Other questions they are trained to answer is whether you should file a Schedule F or Schedule C or just go ahead and schedule a meeting with a good tax attorney trained in IRS audits. Apparently, however, CPAs are not trained to answer questions the same way, which is evident by the fact that if you ask ten different accountants the same question, they'll give 11 different answers and tax you differently for each answer.

That's why I like Turbotax; if you ask it questions, it just implodes and takes your half-completed tax return with it. Just kidding. Turbotax is a fine product for those beekeepers who feel confident in their ability to wield numbers correctly or those beekeepers who have no other choice because they've waited until April 15th to file. For those of us in the latter category, Tax Day is something of a yearly tradition involving lots of caffeine, a table covered in receipts, bank statements and W-2s, and a raging headache from staring cross-eyed at numbers all day.

So Happy Tax Season! And for my fellow procrastinators out there, here's hoping your bees don't swarm on April 15th—your attention will be elsewhere. BC

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From the University of Florida Honey

January: Overview of the HBREL at UF
February: Honey Bee/Beekeeping Teaching Programs
March: Research on Honey Bees
April: Apiculture Extension (Part 1)
May: Apiculture Extension (Part 2)
June: Roles in a Typical Honey Bee Lab
July: How Labs are Funded
August: The Lab's Physical Infrastructure
September: What it Take to Run a Laboratory Effectively
October: Professional Development in the Lab
November: Members of the HBREL Team and What They Do
December: The HBREL's Most Notable Successes/Contributions to the Beekeeping Industry

UF IFAS UNIVERSITY of FLORIDA

HONEY BEE RESEARCH & EXTENSION LABORATORY

Hi everyone, my name is Amy Vu and I work at the University of Florida's Institute of Food and Agricultural Sciences Honey Bee Research and Extension Laboratory (UF/IFAS HBREL). Many of you may be familiar with my voice in a podcast called "Two Bees in a Podcast" (if not, now is the time to get your smart phones out and search for it!). This is the first time I have written for *Bee Culture* and I am excited for the opportunity. I have been with the University of Florida since 2016, beginning my career as a county Extension agent in Orange County (Orlando and the surrounding area). Since then, I transitioned to the HBREL in 2019 and the rest is history. My current title at UF/IFAS is "State Specialized Program Extension Agent, Apiculture", and I somehow still fumble over the words in my title anytime I introduce myself. To sum up what I do: my work involves working with beekeepers and their stakeholders, identifying needs, conducting activities and evaluating programs. I will elaborate more throughout this article. If you have been following the past few months of this series, you have learned that there are three key components to a Land Grant Institution (LGU) (Instruction, Research and Extension). Jamie discussed the overview of LGUs and research. Cameron discussed formal instruction program. In this article, I have the honor of writing about the third leg of the stool (and my personal favorite) to bring it all together, Extension! As Jamie mentioned, all universities engage in teaching degree-seeking student and research, but not all universities provide one of the LGUs critical missions, Extension. One thing you will notice throughout the article is that Extension cannot happen without connections and collaborations with our stakeholders and that feedback is extremely important. I am here to share the good, the bad and the ugly. Next month, our program coordinator, Louis, will be sharing with you about the Extension workshops we conduct at our lab.

Photo 1. Amy Vu portrait. Photo Credit: Randy Fernandez, UF/IFAS Entomology and Nematology

Before I continue further, I would like to share a bit about myself. I was born and raised in Overland Park, Kansas (Go Chiefs!), a city kid with no agriculture exposure. It was not until a study abroad program in Ecuador in 2009 that my attention turned to agriculture and where our food originates. I immediately fell in love with understanding our world's food systems and completed my bachelor's degree at Kansas State University in Agronomy with an emphasis on Soils and Environmental Science. From there, I moved to Blacksburg, Virginia, where I worked on a Master's degree in Agricultural Leadership and Community Education at Virginia Tech. In 2014, a group of colleagues in graduate school and I decided that we wanted to try a new endeavor: beekeeping, because… why not? It seemed like a fun new challenge. Little did I know, that experience would change the course of my entire career. After graduation, I decided to move to Florida, since I am a scuba cave diver and wanted to be closer to the freshwater springs (did you know that Florida has one of the largest concentrations of freshwater springs in the world?). The springs brought me to Florida, but the bees have kept me here. During my time working in Orange County, I attended the local Orange Blossom Beekeepers Association (OBBA) monthly meetings. After a few meetings, I started to realize that the association was spending ¾ of the meeting time an-

Bee Research and Extension Laboratory

Apiculture Extension

Amy Vu

swering basic honey bee terminology and having to take a step back each month to teach newbies equipment terminology. They were losing more advanced beekeepers, and I wanted to help, and knew that I could with my Extension programs. The association and I started working together, which resulted in a beginner beekeeping series. The association helped me promote it and we timed it perfectly, so my programs would be held the Tuesday following monthly meetings. This helped reduce the beginner beekeeping time at the monthly meetings and allowed the association to focus on more advanced topics.

What is Extension and an Extension Agent anyway?

Something I hear often is "So… is your job to run the UF honey bee lab's social media page?" This is something I have heard before, and the answer is "yes, kind of, but also… no, I do so much more than that." Social media is only ***one*** method of communication for how we connect with stakeholders and market our programs. Just to recap and quote Jamie's first article: "Faculty at LGUs engage in formal education (teaching students) ***and*** informal education (teaching everyone else). The latter is called Extension." Let's start with the basics. We define an "agent" as a person who acts on behalf of another person or group. In Extension, my job is to bridge the gap between industry, researchers, government agencies and more by providing non-formal education and learning activities to all types of individuals. In short, we are a resource for our stakeholders. Extension originated to help mostly with rural areas but has evolved to work with both rural and urban areas. We are messengers and disseminate science to our stakeholders.

It is always extremely difficult for me to explain to people what my job is and how it relates to UF/IFAS, but in a nutshell, my job is to share research and do my best to stay up to date with new and emerging topics. In Extension, there are many programmatic areas. The most common programs and topics that are well known are Horticulture, Agriculture and Natural Resources (ANR), 4-H, Family and Consumer Services (FCS) agents.

The History of Extension

The Smith Lever Act formalized Extension in 1914. At the time, Extension services were provided exclusively to rural agricultural issues. Over 50% of the U.S. lived in rural areas, and 30% of the workforce was engaged in farming. Because of Extension, farmers increased their productivity, allowing farmers to make better management decisions. This resulted in a higher production of food. Basically, there was research being conducted at the university, but the practical research was not being shared with farmers. Extension agents were hired to bridge the gap, hold workshops to help growers, and act on behalf of growers to let researchers know what practical research could be conducted to help the industry. Extension has changed immensely in the

Photo 2. Amy cave diving in Madison Blue Spring State Park. Photo credit: Lauren Wilson

last century. Today, less than 2% of Americans farm for a living, and only 17% live in rural areas. That said, Extension specialists must be creative with their programs, increasing their audience size by diversifying their workshops, activities and communication. Programs in urban areas have increased and the specialties have expanded beyond farming and canning classes. In the United States, Extension/Ag offices are located in over 3,000 counties.

What is an Extension Program and How are They Conducted?

Extension is a federal, state and county partnership. The purpose of Extension is to bring the most recent and cutting-edge research from laboratories to those who can use the information to learn and implement skills into practice. This is done through Extension programs. There is a theory to what we do as Extension agents and how we develop programs. Developing a program requires planning, implementing, evaluating and doing that over and over (and over) again. Agents will identify an overarching theme (for example, collaborating with beekeepers to increase honey bee colony health), and then plan workshops or create materials that fall in line with the overarching theme (for example, holding a hands-on honey bee workshop focusing on honey bee stressors, like *Varroa* management). These themes are called "Programs" (with a big P!), which is contrary to what people may think a "program" is. Most individuals hear of the word "program" and think of a workshop or one hour talk on honey bees. In Extension, when we hear the word "Program", we think about the big picture theme of what we are trying to accomplish. To develop, implement and evaluate our programs, we use something called a Logic Model (and I know that as soon as I mentioned the words "logic model", I hear every Extension Agent's eye roll and grunt from here). All joking and sarcasm aside, a Logic Model is an extremely helpful tool that agents use to plan an Extension program. It is a blueprint and vision for our programs to help us focus on the bigger picture.

Photo 3. Picking up our first packages in 2014. Pictured here: Amy Vu, Rachel Kennedy, Sarah Halvorson-Fried and Becca Ligrani

Using a Logic Model

It always starts with a needs assessment and identifying the situation

Conducting a needs assessment is the foundation of a good Extension program. Understanding the needs of a community is crucial to know how to move forward and how to disseminate information. Understanding your audience helps with being successful. This can be done by simply asking questions and listening. Extension is all about the relationships we build with our stakeholders. Without the collaboration, a successful program cannot exist. As apiary educators, we are constantly on the search to hear what is happening in the field. Are we hearing about high colony losses? Why do beekeepers believe they are losing colonies? What time of year is it? Has this happened before? Are we concerned about a new invasive pest or disease?

Let's look at a situational example specific to Florida. This example can be scaled up to be used all over the world: There are over 5,000 registered beekeepers managing approximately 700,000 colonies in Florida. Of these 5,000 beekeepers, hobby (zero to 40 colonies) and sideline (41-99 colonies) beekeepers make up ~92% of all beekeepers, while the rest (~8%) are commercial beekeepers (100+ colonies) (Florida Department of Agriculture and Consumer Services – Division of Plant Industry (FDACS DPI), personal communication). Beekeepers report an annual loss of 40% colony decline. The reasons identified for the losses are *Varroa*, nutrition, queen quality and pesticides. Thus, Extension programming focused on how to monitor, manage and control honey bee stressors is necessary to minimize colony losses.

In this scenario, here are the Programs (overarching themes):

1) Honey bee health: best management practices are needed related to *Varroa*, nutrition, queen quality, minimizing pesticide exposures, etc.
2) Training the trainers: The need is to work with UF/IFAS Extension Agents, apiary inspectors and other Extension educators to extend this content.

How do we acknowledge the situation?

Target Audience

First, we must consider who the program is targeting. Who will show up and in what ways will they show up? Is an e-mail listserv better than an in-person workshop? What good is a program if you hold a workshop and no one attends? Typically, our target audiences are beekeepers: backyard, sideline and commercial. But it is important to recognize that not all beekeeper's needs are the same. Other audiences' agents work with and include non-beekeepers to teach them about the importance of honey bees to our agriculture.

After identifying needs and our audience, we must analyze the needs and turn them into objectives. It is typical for us to have two to three objectives per Program. We use SMART objectives to hold ourselves accountable. So what does SMART as an acronym mean?

Specific: Who is the audience and what is the goal? Are we addressing a specific action or is it too complex or broad?

Measurable: The results should be quantifiable—the goal will have a target timeline or benchmarks designed to measure progress. How will we know when the objective has been accomplished?

Attainable: Is it realistic? Are there clear steps to adopt any recommendations?

Relevant: Does the objective align with the mission and vision of the organization?

Time-bound: It must have a beginning and pre-determined end. Also, there should be timed milestones at which progress can be evaluated along the way. Developing a timeline helps one evaluate performance and efforts on a regular basis.

So here is a SMART objective that I will continue to refer to throughout the article:

"At least 75% of individuals who participate in the UF/IFAS HBREL's events will begin monitoring for *Varroa* using an alcohol wash or sugar shake within six months of attending a program. This will be measured by post program evaluations and follow-up surveys."

Okay, so now that we have an objective, let's talk about the fun part – the activities!

Educational Methods and Activities

Inputs – what we invest

Extension's job is to translate science-based research into digestible bits—whether that be written, verbal, in person or virtual. What money, facilities, technology, people and other resources are needed? What is the time commitment? What materials do we need to conduct a workshop? Can we conduct a *Varroa* monitoring class without the proper equipment? Do we have the appropriate classroom space or apiary space to conduct the program? What personnel (staff, volunteers, etc.) are needed to implement the workshops? Do we need supplementary materials to support our activities (like PowerPoint presentation, fact sheets, a brochure, etc.)? What about technology? When COVID began, we had to be creative and start using Zoom. Our inputs changed and we needed access to Zoom and other programs to implement our trainings. Knowing what inputs are necessary are important to think about to ensure the success of the program.

Outputs

Activities – what we do

The most common activities for apiculture educators are in-person workshops in a classroom or out in the apiary. Sometimes we are invited speakers at beekeeping association meetings. Sometimes we plan and hold workshops in person or a talk on Zoom. This is the piece of Extension that is the most visible. The activities we conduct are completely dependent on our target

Photo 4. A group of UF/IFAS Extension Agents in an in-service training learning about* Varroa *monitoring using the alcohol wash method.

audience. For example, sometimes it is easier for hobbyist beekeepers to attend an evening or weekend event, so we will hold larger classes on hobbyist topics during that time. Other times, commercial beekeepers may be working and unavailable, so it may be easiest to conduct a single site visit to their operation. Another activity that is extremely common is answering beekeeping related questions from our stakeholders, whether that be over the phone, e-mail or a message on social media. It is important that we are available as a resource.

Here at the University of Florida, we have key activities with which you may be familiar. Our Extension Coordinator, Louis will elaborate on these activities in next month's article: the UF/IFAS Master Beekeeper Program, BeeLearning Short Courses, UF/IFAS Bee Colleges, Two Bees in a Podcast and the UF/IFAS Honey Judge Program. Additionally, the UF/IFAS honey bee team regularly provides lectures and workshops at various training events.

Outcomes

What do we want to see accomplished in the short, medium and long term from our programs? How do we identify these outcomes? Let's revisit our example objective mentioned earlier: At least 75% of individuals who participate in the UF/IFAS HBREL's events will begin monitoring for *Varroa* using an alcohol wash or sugar shake within six months of attending a program. This will be measured by post program evaluations and follow-up surveys.

Photo 5. Two Bees in a Podcast logo & QR Code.

Short term outcomes focus on gaining knowledge, raising awareness, creating a positive attitude, developing a skill/opinion or increasing motivation. From our example, a short-term outcome could be that participants increase their knowledge about *Varroa* monitoring and learn how to collect a sample using an alcohol wash. Developing this skill has increased their motivation and attitude to conduct samples more frequently.

Medium term outcomes focus on seeing a behavior or practice in motion. From our example, a medium-term outcome could be that six months after the training, beekeepers have started monitoring for *Varroa* monthly using an alcohol wash and make informed decisions on whether to treat for *Varroa* or not, based on thresholds.

Long term outcomes are the ultimate impact. These are usually social, economic or environmental. When making informed decisions related to *Varroa* management, long term outcomes involve minimizing overall colony losses, which can increase production, and in turn increase profitability.

How do we know our programs are effective?

I will not bore you with the 30-page report we have to submit annually, but I will describe some ways we report our programs. After conducting a needs assessment, coming up with objectives and holding an activity/workshop, we must show that our programs have made a difference. For formal Instruction, students take exams, write papers and end the semester with a grade. Researchers are evaluated by the number of grants they bring in and how many peer-reviewed publications are accepted each year. For Extension, we must show that we are changing lives for the better… CHANGING LIVES! Easy to measure, right? Our big question is: "so you've put all this work into a program… SO WHAT?" That's probably a bit harsher than reality, but you get the gist. If you have taken part in an Extension activity, you have likely taken a pre- and post-test, filled out a survey immediately after a program and have been asked to fill out a follow-up end of year survey. We also use general feedback, verbal and written, in consideration for our evaluation. ***Evaluation is the most critical component of Extension.*** It determines whether we move our programs forward (or not). I cannot stress the importance of evaluation enough. In short, we must show that our Extension efforts are making a positive difference, and if they are not, maybe it is time to rethink how we conduct our programs.

International Extension Activity Highlight

Our Extension efforts extend well beyond our county, state and country. I would like to highlight one international activity in which I participated and maybe you can identify some of the pieces of the logic model I mentioned earlier. I was fortunate to be involved in the United States Agency for International Development (USAID)'s, Partners of the Americas, Farmer-to-Farmer program in February 2023. As a volunteer in the Dominican Republic, I was joined by a Florida commercial beekeeper, Chris, and his wife Melissa Vasquez, with Heritage Bee Farm, LLC. We had the most wonderful field officers, Maria Montas and Francisco Mendez, who helped translate technical honey bee content in Spanish. We worked with ASAJA (their beekeeper association) in the beautiful Jarabacoa mountains for 15 days. The beekeepers were all in their first five years of beekeeping. Many of them were beginner beekeepers, while a few members of the association were not. Those few aspired to become full time beekeepers and wanted to learn more about general management and queen production. It was a huge breath of fresh air (I did not know what to expect) to see that the honey bees were strong and had all the pollen and nectar available to them (the beekeepers do not need to feed there, since there is so much pollen and nectar flow). The beekeepers also do not have small hive beetles present on the island (lucky them!). During our initial meeting, Chris and I learned that the beekeepers were interested in learning more about pest and disease management, equipment management and queen production. We saw *Varroa* on the bees, thus prompting me to ask the beekeepers what they used (and how often) for treatment. They use thymol and oxalic acid-based products. Prior to our visit, beekeepers were only monitoring

Photo 6. Amy speaking to media to discuss the importance of honey bees and commercial beekeepers to agriculture after Hurricane Ian left devastating losses to Florida beekeepers in 2022. Photo Credit: Bori Bennett

and treating once a year. In our program, we spent every day conducting a needs assessment and evaluating colonies, implementing short hands-on workshops and providing recommendations on when to graft larvae for queen production. We also piloted the use of coconut water as a media for queen production and discussed how often to monitor for *Varroa*, when to treat and the importance of rotating active ingredients. At the end of the two weeks, we provided resources for the beekeepers to help continue with their education. On the last day, Chris and I delivered a presentation about what we learned, what we observed, and provided recommendations (using SMART objectives) to the association on how they could be successful as a team in the long term. I evaluated the program by interviewing 10 program participants, asking about potential challenges, what they learned and what other resources or training they still need to be successful as a beekeeper. I hope to spend the next few months evaluating the data. I am fully convinced that our short time in the Dominican Republic will have long term outcomes for the beekeepers and it was an extremely rewarding Extension experience.

What else do Extension agents do?

Okay, so back to Apiary Extension! We discussed needs assessments, developing programs, conducting site visits, speaking engagements to beekeeper associations, responding to phone calls and e-mails, creating content to support our programs and program evaluations. What else do agents do? You will find us at group meetings, speaking at professional conferences, writing and receiving grants, and being involved in other committees at our university and state associations. It may seem like we are everywhere, and that is because we are! Having the ability to be everywhere can be great, but it is all about balance.

Challenges of being in Extension

Not everything in Extension is a rainbow or unicorn. Being in Extension is the most rewarding career (in my humble opinion), but there are some struggles that many agents face. First, it is a blessing and a curse to have the ability of being creative with a program, which usually results in wanting to help and say "yes" to everything. There are so many potential projects, and simply not enough time to do them all. Focusing on long term projects when smaller "fires" arise and having to prioritize projects is crucial. When you speak to an Extension agent who has been successful in their career, the first thing they will tell you is to "focus on the big picture and learn how to say no." Taking on every single project often results in major burnout and it can be very detrimental to our programs. Agents will feel like they are doing so much daily, but at the same time, not doing anything at all. This is something that is often seen, and the reason agents will leave their positions and transition to something else.

Second, agents are required to wear many hats. We are the event planner, marketing specialist, evaluation guru and content specialist. We must stay up to date with the times (whether that is jumping onto a new social media platform, creating content that is user friendly, etc.). We need to know how to design and use multi-media, be an expert in video, photo, or podcast production. We have administrative paperwork, we are expected to submit publications, speak at conferences and respond to thousands of e-mails and phone calls, and media requests at any moment.

Lastly, working with many types of personalities and people can be great, but also challenging. Anyone working with people has likely encountered a conflict before and knowing when and how to handle a conflict is crucial. It is important to remember that needs and priorities can differ from person to person. Facilitating conversations and relationships is important to get everyone on the same page to identify one common goal.

"The Good"

Despite some of the challenges an agent can face, I personally feel like I have the best job in the world. I will end this article with the positives of being in Extension. Extension agents have the privilege of working with people who become our family and friends. Many times, it becomes more than just a job, and it becomes the genuine connections we make with our stakeholders. I get to know personalities on an individual level. I meet their families, friends, pets, learn about their other hobbies, and so much more. I have watched beekeepers' children grow up before my eyes. I have seen beekeepers progress from 50 colonies, to 100, and then to thousands of colonies. I consider beekeeper successes my successes.

Second, I have seen groups of beekeepers work together to make a huge difference for the industry. Just one example is the building of our UF/IFAS HBREL facility. The $4.5 million facility came from the collaborative efforts of the Florida State Beekeepers Association, the Florida Department of Agriculture and Consumer Services, Florida beekeepers and other stakeholders. To watch a simple idea turn into a reality is incredible to see. "Never doubt that a small group of thoughtful, committed citizens can change the world; indeed, it's the only thing that ever has." —Margaret Mead.

Lastly, as Extension agents, we are fortunate to have the opportunity to be flexible with our programs and try new ideas. Extension agents will never have the same day at work. Some days are in the office, some days are in the field and others are presenting to local, state and national associations. We travel around the world to conferences or workshops meeting beekeepers and other individuals in the beekeeping industry, from regulatory/government personnel, non-profit organizations, researchers and other apiculture Extension specialists around the world. We are fortunate to network and work with the various stakeholders who play a piece in this large puzzle. The beekeeping community is so small and knowing what part everyone plays makes a huge difference.

Photo 7. ASAJA Beekeepers Association in Jarabacoa, Dominican Republic. The participants were part of the USAID, Partners of the Americas, Farmer-to-Farmer Program.

Photo 8. Yancarlos Castillo grafting larvae to learn about honey bee queen production in Jarabacoa, Dominican Republic as part of a USAID, Partners of the Americas, Farmer-to-Farmer Program.

In conclusion, being in Extension is not just a job, but a lifestyle. I love working in Extension and with beekeepers around the world. I enjoy connecting with beekeepers, hearing what is going on in their apiaries and being involved with the industry. I feel like I am making an immediate difference in the lives of beekeepers of all operations and hope to continue to serve beekeepers well into the future. Next month, our extension coordinator, Louis Dennin, will highlight specific activities we do at our lab. Thank you beekeepers, for all the great work you do, and allowing me to be part of the beekeeping community. BC

Minding Your Bees And Cues

CRP R(Evolution)

Becky Masterman & Bridget Mendel

In the early 1970's, the Soviet Union experienced massive crop failures. Keep reading...

Desperate, the USSR bought billions of dollars' worth of U.S. subsidized wheat, feed grains and soybeans, depleting world grain reserves and triggering massive price hikes. The U.S. Department of Agriculture's solution was to produce as much as possible, on every inch of farmland, whether it was productive or marginal farmland. The hedgerows and wild borders of farms deemed not worth growing crops on, were now planted with grains and other crops. Critical areas for wildlife, soil health, water filtration and pollinator habitat were now plowed under.[1]

All this over-producing, combined with eventually stagnating demand, led to a crisis in American farming. Moreover, we lost so many of our wild tracts of land.

So in comes the conservation reserve program (CRP), signed into law by President Ronald Reagan in 1985. CRP is a federal program meant to incentivize farmers to take environmentally sensitive farmland *out* of crop production by essentially paying them to do so.[1,2,3] So that's a good thing. CRP is now one of the largest U.S. programs for private land conservation with over 40 potential conservation plan seed mixes available, including the pollinator supporting (albeit expensive) seed mix (CP-42). As of 2022, 514,163 acres are planted in CP-42 Pollinator Habitat (Figure 1).[4,5]

But bear in mind that the farmers—industrial farmers with huge amounts of land in the balance—are *also* being incentivized by government-subsidized crop insurance *to* plant on marginal land. So those two very complicated things are at odds, but let's stick to CRP.

The CRP programs are officially confusing and understanding them makes our head hurt, but beekeepers might want to take a deep dive anyway, because honey production, trending down per the USDA National Agricultural Statistical Services, is on the line (Figures 2 and 3). Once the programs are explored, we predict the following beekeeper questions will follow: how could this initiative be more popular and affordable, and effective for our bees?

The best way to make CRP more popular is to make it easier and more attractive for farmers business-wise. The Minnesota Board of Water and Soil Resources was recently awarded a $750,000 grant by Minnesota's Environmental and Natural Resources Trust Fund to establish a grant program aimed at increasing CRP participation through one time state incentive payments. How cool is that?[6] Another important support team there to help make CRP more popular is county-level NRCS representatives. These are individuals who know the specifics about eligibility, applications and requirements in their specific county and will get on the phone or in the field with you to walk you through your options.

The best way to make CRP more effective is to make it easier and more attractive to bees, habitat-wise. Based on honey bee and wild bee visits to flowers, a U.S. Geological Survey team suggested that: 1) separate honey bee and native bee mixes might be most effective based on bee forbs preference; and 2) some forbs included in USDA mixes might not be attractive to pollinators and would best be removed from the options list.[7]

Out of frustration with Farm Bill complexities and CRP seed mixes has come successful and simplified conservation alternatives. The Bee and Butterfly Habitat does a great job in providing an array of seed mixes for farmers, some focused on honey bees and significantly less expensive than their native pollinator mix. With over 4,700 acres of high-quality habitat for honey bees and butterflies installed, this program is growing in both acres planted and states served. They are a great model for other programs to look at as they meet farmers and their pollinator priorities where they are at.[8]

In 2023, the CRP program expects to see a modest increase in enrolled land. The approximately 23 million acres in the program include trees, grassland and pollinator habitat. With peak CRP enrollment at 36 million acres in 2007, enrollment has been under 25 million acres since 2014.[1] Hearty government subsidies of biofuels have resulted in land being removed from CRP programs[9]: it's harder to choose the right thing for the environment when the government is paying you to do the opposite.

Another thing on the line with declining habitat on farmland is the existence of thousands of native bee species that also depend on habitat restoration efforts. Beekeepers must be the leaders in pushing for habitat for all pollinators. Only when there is enough for all, will honey bees not be taking more than their share from the landscape.

Beekeepers can join scientists and other groups paying attention to and advocating for CRP improvement. The 2023 farm bill is being negotiated now, but it's never too early or too late to badger your reps on this topic; 2028 is around the corner.

Becky Masterman led the UMN Bee Squad from 2013-2019. Bridget Mendel joined the Bee Squad in 2013 and has led the program since 2020. Photos of Becky (left) and Bridget (right) looking for their respective hives. If you would like to contact the authors with your CRP stories or thoguths, please send an email to mindingyourbeesandcues@gmail.com.

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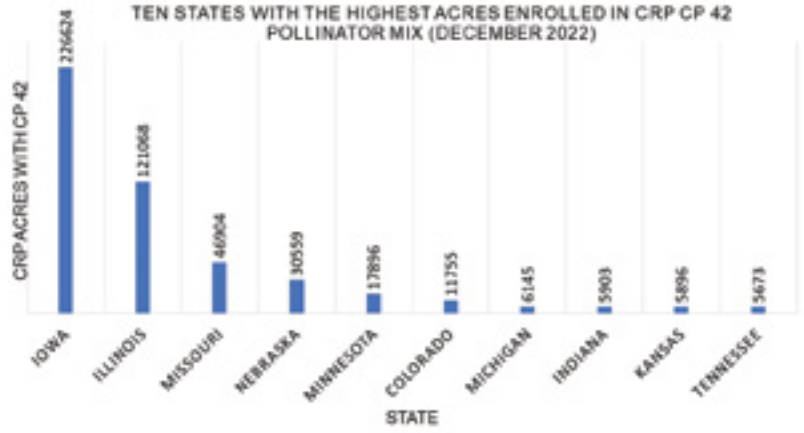

Figure 1. Total CRP acres planted in CP-42 Pollinator Mix as of December 2022 numbered 514,163 acres/ Ten states have over 90%of these acres planted. Data source: https://www.fsa.usda.gov/Assets/USDA-FSA-Public/usdafiles/Conservation/PDF/crpstat0912.pdf

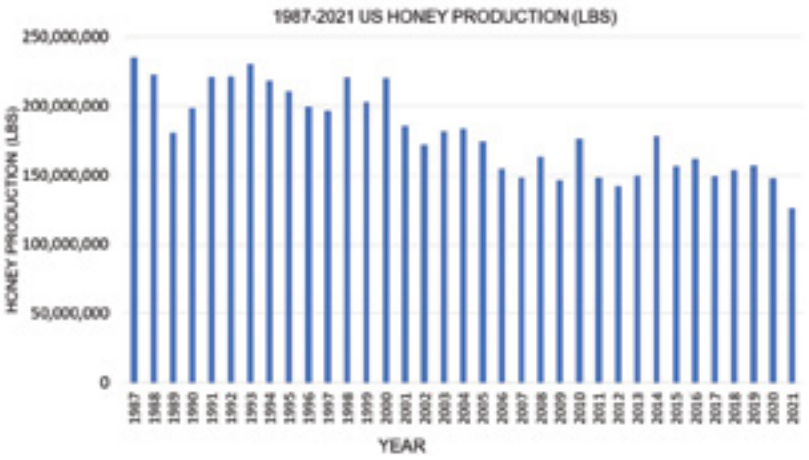

Figure 2. Total U.S. Honey Production from 1987-2021. A honey production total of 123,466,000lbs was reported in 2021. It was the lowest in the 36 years shown in this graph. Data source: USDA National Agricultural Statistics Service

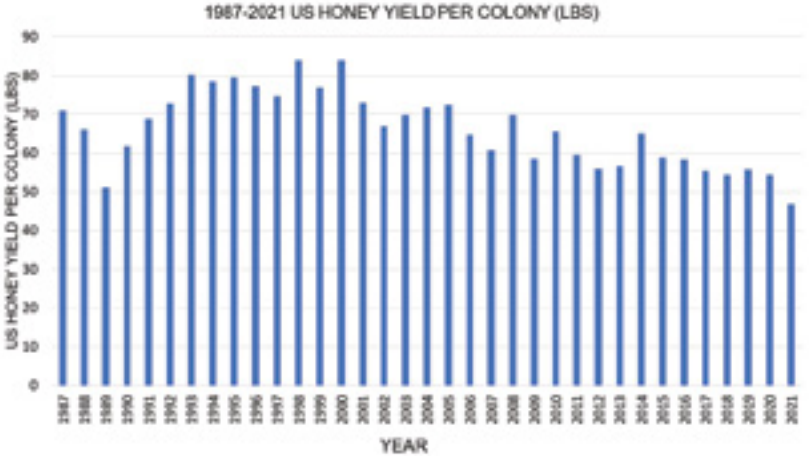

Figure 3. Average honey yield per colony from 1987-2021. The average yield per colony in 2021 was 46.9lbs and the lowest in the 36 years reported in this graph. Data Source: USDA National Agricultural Statistics Service

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Tropilaelaps

Is this mite really going to be worse than *Varroa?* Yes and no.

Our experience with *Varroa* has shown how much of a challenge dealing with mites can be. Trying to identify miticides that will not contaminate honey and wax, dealing with mites that develop resistance to our most toxic chemicals, relying on treatments that don't always work due to weather or temperature issues, the list is long. This is part of the reason that scientists and others have long issued dire warnings should the *Tropilaelaps* mite ever make its way to European and American shores.

So far *Tropilaelaps*' territory has been limited to its native Asia and bordering areas, and four distinct species of *Tropilaelaps* (*T. careae, T. Koenigerum, T. mercedesae, T. Thaii*) have been identified to date (Anderson and Morgan, 2007). *Tropilaelaps careae* and *mercedesae* are considered to be the most economically important since they are the primary mites that have jumped from their native giant honey bee hosts (*Apis dorsata, Apis laboriosa, Apis breviligula*) to the western honey bee (*Apis mellifera*) (de Guzman et al., 2017).

Like *varroa destructor,* which is also indigenous to Asia, mature *Tropilaelaps* mites are a reddish-brown color and although the mite is smaller in size (about a third of the size of a *varroa* mite), the life cycle of *Tropilaelaps* is similar to that of *varroa.* Adult female mites enter cells containing older larvae, are sealed in the cells when the workers cap the brood and produce offspring that feed on the developing honey bee pupae. Like honey bees, fertilized eggs develop into female mites and unfertilized eggs produce males. Just like with *varroa*, the female offspring of a single *Tropilaelaps* mite are able to mate with their brothers and initiate an infestation. *Tropilaelaps* moves much quicker than *Varroa*, reproduces faster than *varroa* laying eggs in quicker succession and has a much shorter phoretic stage where the mite exists outside the brood cell. While *varroa* are known to create a single wound and repeatedly visit the site to feed, *Tropilaelaps* mites create multiple small wounds from which they feed. Unfortunately, just like *varroa*, *Tropilaelaps* is known to vector honey bee viruses like Deformed Wing Virus. *Tropilaelaps* can also spread naturally within a colony, between colonies in the same apiary and among apiaries via hitching a ride on robbing workers or drifting drones (Rath et al., 1991).

Tropilaelaps also have a severe weakness, the mites are not able to easily feed on mature bees apparently due to the inability of their mouthparts to pierce the hard cuticle layer of adults. While there are some soft areas on an adult bee that the mite could take advantage of, such as at the base of the wings, it is unusual to find *Tropilaelaps* feeding on adult honey bees. *Tropilaelaps* primarily feed on the soft-bodied larvae and pupae and must do so regularly or they will die after two to three days. Without a constant supply of larvae and pupae, *Tropilaelaps* is unable to maintain its rapid reproduction rate and stay alive. This means that in northern climates where honey bees experience a natural period of prolonged brood interruption due to the dearth of Winter, a brood break that is known to severely reduce *varroa* populations, can also be expected to impact *Tropilaelaps* in a similar manner, although the mite's establishment in the temperate regions of South Korea and northern China suggests that a minority of mites (about 15%) are able to somehow adapt to such broodless periods (de Guzman et al., 2017). This may help give northern beekeepers an edge on dealing with *Tropilaelaps* compared to southern beekeepers whose colonies are unlikely to stop all brood production during the season unless exposed to drought conditions. This also means that swarming, which is known to reduce *varroa* populations in colonies, can also be expected to reduce *Tropilaelaps* populations. Also, starting a colony without brood such as through a package of bees is a great way to ensure a colony is *Tropilaelaps*-free, at least during its initial startup phase.

Another reason to think that *Tropilaelaps* will not be a major catastrophe for American beekeepers should the mite arrive in North America is by observing the experience of Chinese beekeepers who have been dealing with *Tropilaelaps* for decades and continue to be the largest producer of honey in the world. Chinese beekeepers are reportedly able to control *Tropilaelaps* with sublimated sulfur. Additionally, there is evidence that many of the currently approved *varroa* treatments available in the U.S. are also effective against *Tropilaelaps*. Current approved *varroa* mite treatments that have been shown to also reduce *Tropilaelaps* infestations include formic acid fumigation, Amitraz and fluvalinate (Webster & Delaplane, 2001), Hopguard® and Mite-Away Quick Strips (Pettis, 2017) and formic acid and thymol (Raffique et al., 2012).

As in the case of *Varroa* Sensitive Hygiene (VSH) where bees are able to detect when *varroa* are feeding on capped brood, worker bees appear able to detect brood cells parasitized by *Tropilaelaps*, and have been known to uncap and remove infested pupae (Webster & Delaplane, 2001).

As mentioned before, *Tropilaelaps* mites need larvae and pupae to feed on or they will die after two to three days. This suggests that bio-mechanical controls such as

caging the queen periodically and depriving the colony of brood can keep *Tropilaelaps* mites at bay by beekeepers that do not wish to use pesticides on their colonies. Another easy way to take advantage of this Achilles heel is to simply divide the colony, moving all brood combs and adhering bees into a new box and leaving the queen and broodless combs and bees in the original hive. The queenless colony will begin rearing a new queen, but the resulting interruption in brood production will kill off all the *Tropilaelaps* mites. Meanwhile, the mites will also all die out in the queenright half of the hive since there will be no brood to feed on and it will be approximately three days before any new eggs the queen lays can hatch and form larvae that the mites need for food. If this process is carried out at the end of the nectar flow, no honey production need be sacrificed and colony numbers can either be expanded by keeping the newly created hives or hive populations can be maintained by recombining the colonies.

Due to their short phoretic phase, traditional *varroa* detection methods such as the sugar shake or alcohol wash, are ineffective in detecting *Tropilaelaps*. Instead, beekeepers will have to rely upon brood uncapping, bump testing, sticky board inspection and thorough colony inspections. Tell-tale signs of *Tropilaelaps* infestation are irregular brood patterns and perforated brood cappings caused by sanitary behavior of the bees. Similar to hives heavily infested with *varroa*, adults in colonies heavily infested with *Tropilaelaps* are likely to have stunted abdomens, deformed wings and exhibit parasitic mite syndrome symptoms. It is commonly reported that heavily infested colonies will abscond from their hive.

When *varroa* first arrived, American beekeepers didn't know much about the mite's biology and we didn't have any approved treatments available. We were basically starting from square one. With *Tropilaelaps*, things are much different and therefore should the mite appear in American beeyards, there is every reason to expect a much less destructive and disruptive experience for most beekeepers. Good news is not easy to come by these days so we should take it wherever we can find it. BC

Although smaller than a* varroa *mite, the* Tropilaelaps *mite is visible to the naked eye and moves much more rapidly than their* varroa *cousins.

Ross Conrad is author of *Natural Beekeeping, Revised and Expanded 2nd edition* and *The Land of Milk and Honey: A history of beekeeping in Vermont.* Ross will be teaching a beginner beekeeping class the weekend of May 20-21, 2023 and an intermediate class on June 4, 2023. For more information or to register for either class visit **dancingbeegardens.com**

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American Honey Queen: Selena Rampolla (left in blue)
American Honey Princess: Allison Hager (right in red)

Anna Kettlewell, American Honey Queen Program Chairperson

2023 American Honey Queen & Princess Hail from Florida & Iowa

The American Beekeeping Federation is proud to announce that Selena Rampolla and Allison Hager were selected as the 2023 American Honey Queen and Princess.

Queen Selena is the 21-year-old daughter of Faye Turke and Renato Rampolla of Lutz and Tampa, Florida. She graduated summa cum laude from the University of South Florida with a bachelor's degree in Psychology. She previously served as the Florida Honey Queen.

Princess Allison is the 22-year-old daughter of Danny and Tracey Hager of Bellevue, Iowa. She is a senior at Iowa State University studying Business Management, minoring in Entrepreneurship. Allison has an A.A.S. degree in Agriculture Business from Kirkwood Community College. She previously served as the Iowa Honey Queen.

Selena and Allison will spend the next year promoting the beekeeping industry throughout the United States in a wide variety of venues, including fairs, festivals, schools, media interviews and virtual presentations. To schedule an appearance or presentation with American Honey Queen Selena Rampolla or American Honey Princess Allison Hager, please contact American Honey Queen Program Chairperson Anna Kettlewell at 414-545-5514. BC

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ABRC 2023 Proceedings – Conference Abstracts

https://doi.org/10.55406/ABRC.23

The American Association of Professional Apiculturists (AAPA) hosted its annual meeting, the American Bee Research Conference (ABRC), in Jacksonville, Florida on January 5th and 6th, 2023 in conjunction with the American Beekeeping Federation's annual convention. This conference provides a unique opportunity for AAPA members to interact and exchange ideas between industry, academia and the beekeeping community. As an organization, AAPA consists of senior and junior scientists, students, beekeepers and inspectors who work with or study honey bees. At this year's ABRC, we showcased nearly 50 talks and poster presentations from bee researchers from the U.S. and Canada. Research topics included Pests, Pathogens and Beneficial Microbes; Breeding, Genetics and Evolution; Chemical Ecology, Behavior and Nutrition; Pesticides and Acaricides; and Beekeeping Management, Education and Outreach. The large number of presentations given by students and postdocs was noteworthy; the high quality of the research they presented is an asset for the AAPA. We were also thrilled to host two keynote speakers: Dr. Chelsea Cook (Marquette University) and Dr. David Tarpy (North Carolina State University). AAPA is pleased to share the abstracts of this year's meeting with the readership of *Bee Culture*. We hope this information helps the beekeeping community learn about the latest research developments regarding honey bees in the U.S. and beyond. Thanks for reading and for participating in this year's ABRC.

Sincerely,
The editors of the 2023 ABRC Proceedings:
Margarita López-Uribe
Priyadarshini Chakrabarti Basu
Brock Harpur
Juliana Rangel
Michael Goblirsch
Robyn Underwood

Keynotes

Stay Cool: The social and ecological components of collective thermoregulation in honey bees

Cook, CN[1]
[1]Marquette University, Milwaukee, WI

Social animals may be particularly resilient to a changing environment because of their ability to utilize social and ecological information to behave collectively. As these social groups behave, they manipulate their environments, creating an extended phenotype. Although many studies show social animals integrate ecological and social information as their environmental context shifts, the mechanisms by which they do this are mostly unknown. Honey bees strictly regulate the temperature of their colony. When it is hot, honey bees circulate cool air into the colony by fanning. Fanning is performed by a relatively small task group (three to 50 bees) but is critical for the survival of the colony, as overheated larvae can die. This makes them an excellent model system by which to understand if and how social animals can be resilient to climate change. As such, the Cook Lab explores the sensory collection, communication and integration of the collective management of temperature in the honey bee colony. We utilize behavioral, physiological and ecological techniques to study the necessary and sufficient mechanisms of honey bee fanning. By understanding how honey bees manage their environment, we then create tools, such as cold storage, to enhance their health and survival.

A love for honey bees: a model system in applied ecology

Tarpy, DR[1]
[1]Department of Applied Ecology, North Carolina State University, Raleigh, NC

Discipline-focused research in the biological sciences focuses on a single fundamental question within a given paradigm (e.g., ecology, evolution, genetics or environmental science). A system-based approach, however, takes a different perspective by asking numerous questions and applying different techniques to a single study system, which promotes interdisciplinarity (i.e., ecology, evolution, genetics and environmental science). Here, I argue that a system-based approach using honey bees is an excellent paradigm for any number of social, organismal and sub-organismal disciplines in biological research. I review some of the work that our collaborators and lab members have conducted on the reproductive plasticity of queens, as well as how such fundamental research can be applicable to the apiculture industry to address practical issues with queen loss and diminished longevity. One general conclusion from our empirical work is that premature supersedure is more likely a function of the colony environment rather than the phenotype of the queen, and I introduce a conceptual model of how colony collective

decision-making is necessary to understand the myriad of queen problems facing the industry. I conclude that only by taking a system-based approach will we be able to better understand the complexities of this model social insect and primary managed pollinator.

Pest, Pathogens and Beneficial Microbes

Evaluating the seasonal efficacy of commonly used chemical treatments on *Varroa destructor* population growth in honey bee colonies

Jack, C[1]; Boncristiani, H[1,2]; Prouty, C[1]; Ellis, J[1]

[1]University of Florida, Entomology and Nematology Department, Gainesville, FL; [2]Inside The Hive Media & Consulting Inc., Odenton, MD

Most beekeepers control *Varroa destructor* by treating honey bee colonies with synthetic miticides. The aim of our research was to determine how commonly used chemical treatments influence *Varroa* population growth rates seasonally so that specific recommendations on product efficacy can be made. We applied the same eight chemical treatments following labeled rates to seasonal cohorts of honey bee colonies to determine how much the mite population growth rates were influenced by the treatments. The chemical treatments tested were: Apivar®, Apistan®, Apiguard®, MAQS®, Checkmite+®, Oxalic Acid (dribble), Oxalic Acid (shop towels) and amitraz (shop towels soaked in Bovitraz®). Many treatments were more effective at reducing *Varroa* populations for at least two months during Winter and Spring than in Summer and Fall. Unfortunately, most treatments were ineffective at controlling *Varroa* in the Summer and Fall. Of the two amitraz-based treatments, the off-label Bovitraz® treatment was more effective, being the only treatment to reduce *Varroa* populations successfully in all seasons. Conversely, the commonly used treatment Apivar® was only effective in the Winter. The seasonal treatment efficacy data gathered through this study will allow for the refinement of treatment recommendations for *Varroa*, especially regarding seasonal efficacy of each miticide and the temporal efficacy post-treatment.

Temperature affects assessment of amitraz resistance in *Varroa destructor*

Rinkevich, F[1]

[1]USDA-ARS Honey Bee Breeding, Genetics, and Physiology Laboratory, Baton Rouge, LA

Amitraz resistance in *Varroa destructor* is a phenomenon that reduces the efficacy of amitraz to control *Varroa*. Surveys have shown an increasing trend of amitraz resistance in many beekeeping operations. Amitraz resistance in *Varroa* is measured using the Apivar efficacy test, which is a consistent predictor of treatment success or failure at the colony level. To ensure the reliability of the test, we investigated how temperature affects the outcomes and interpretation of the Apivar efficacy test. The Apivar efficacy was run at a range of temperatures from 10-35°C in cages with Apivar and control cages. At temperatures higher than 30°C, the proportion of *Varroa* that fell off the bees under control conditions increased with temperature. In cages with Apivar, the Apivar efficacy was reduced and much more variable with lower temperatures. This result was followed with *Varroa* bioassays with technical amitraz at the same temperature ranges. Amitraz became less toxic at lower temperatures, thus corroborating the reduced Apivar efficacy at lower temperatures. These results show that the Apivar efficacy test should be performed between 20-30°C in order to provide consistent results. Considerations on past and future amitraz resistance monitoring efforts are discussed.

Viability of ozone fumigation as a method of sterilizing combs in commercial beekeeping operations

Reed, R[1]; Hopkins, BK[1]

[1]Department of Entomology, Washington State University, Pullman, WA

Beekeepers face many challenges when trying to preserve combs in good condition from year to year. Greater wax moths (*Galleria mellonella*), brood diseases such as American foulbrood (*Paenibacillus larvae*) and pesticide residues can all decrease the useful lifespan of comb. Past and current sterilization/fumigation methods are limiting and hamper adoption, but ozone fumigation presents a potential new strategy. Previous studies have shown the promise of fumigation with high concentrations of ozone as a method of overcoming wax moths, brood diseases and Nosema (*Nosema ceranae*) but were all conducted on a small scale. Here we summarize those findings and propose a study to implement this practice on a commercial scale. This study will monitor greater wax moth mortality, American foulbrood spore viability and pesticide residue degradation in combs placed in a cargo container with an ozone generator.

Stable isotopes elucidate *Vairimorpha ceranae* infection and seasonality

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Stable isotopes (SI) of carbon and nitrogen are often measured in ecosystem studies to elucidate trophic steps between and within organisms. In these steps, the heavier isotopes 13C and 15N "partition" relative to the lighter isotopes 12C and 14N because they move slower through physiological processes. Except for their use in detecting honey adulteration, SI have rarely been used in honey bee research. In our study, we artificially inoculated worker bees with the Microsporidian pathogen *Vairimorpha ceranae* (formerly *Nosema ceranae*) and found that the partitioning of C and N isotopes within the bee midgut was not related to the progress of the infection. No significant difference was found in bee midguts as the infection progressed when comparing the ratio of 13C relative to 12C and 14N to 15N

for control (not inoculated) and treated (inoculated) bees at zero, six, nine and 12 days post-inoculation. However, we found a significant difference in the partitioning of 13C and 15N between bees collected in September and October. A significantly higher ratio of 15N was recorded in bees collected in September than those from October. Conversely, a significantly lower enrichment of 13C was recorded in bees collected in September compared to those in October.

Interactive effects of diet quality, pesticide exposure and virus infection in honey bees

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Honey bees maintained in agricultural landscapes frequently experience the adverse effects of sublethal pesticide exposure, virus infection and poor forage, but the interactions between these factors remain complex and highly variable. To better understand these stressor dynamics, we performed a series of high-throughput bioassays measuring the survivorship of adult honey bee workers when exposed to different combinations of diet types, pesticides (chlorpyrifos, thiamethoxam and lambda-cyhalothrin) and virus (Israeli acute paralysis virus) infection. Our results showed that diet type can significantly influence survivorship response but is dependent on pesticide identity and presence of virus. Pollen consumption can improve survival when bees are exposed to viruses and field-relevant pesticide doses and can even be involved with inducing hormetic responses to chlorpyrifos ingestion, but these effects are not universal across all pesticide types. Quantification of immune gene expression reveals a complicated interaction network that suggests that pollen consumption boosts certain detoxification genes while pesticide exposure depresses it. Taken together, these findings all contribute towards an improved understanding of basic bee biology and can eventually be translated to informing bee health management decisions.

Screening for viral loads in honey bee colonies with various levels of resistance to *Varroa*

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Honey bee viruses, such as Deformed wing virus (DWV), Acute paralysis virus (ABPV), Kashmir bee virus (KBV) and Israeli acute paralysis virus (IAPV) are major contributors to poor colony health and survivorship. A rapid, simple, semi-automated, high throughput and cost effective method of screening colonies for viruses would benefit bee research and the beekeeping industry. Here we describe a novel approach that combines an RNA grade liquid homogenizer followed by magnetic bead capture for total virus nucleic acid extraction. We used this method to screen for viruses in colonies selected for resistance to *Varroa* at the University of Minnesota. We compared the results to virus loads in colonies from a migratory beekeeping operation that also selects colonies for *Varroa* resistance, and to unselected colonies from a commercial queen producer. Our findings showed lower viral loads in the colonies selected for resistance to *Varroa* and more colonies had virus loads below the limit of detection compared to unselected colonies, indicating our method of screening for viruses is effective and may be useful to screen a large number of colonies quickly and inexpensively.

Anthranilic diamides as small hive beetle control and prevention

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Small hive beetles remain a persistent problem in parts of the Southeast, where warm wet soils allow for rapid population growth and the overwhelming of colonies during the Summer dearth. Further, SHB infestation prevents beekeepers from easily provisioning colonies with additional pollen or protein feed (patties). We have demonstrated that the differential specificity of anthranilic diamide insecticides between bees and beetles allows for the control and prevention of small hive beetle infestation in the Southeast even when feeding with large patties, opening new avenues for improving bee health including during Spring splits and throughout the Summer.

Analysis of host-virus interactions in honey bees infected by Israeli Acute Paralysis Virus

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Viruses play a significant role in the current honey bee health crises. Thus, understanding the interactions between the virus and their host is critical for devising strategies to prevent or treat viral diseases. We used a micro-injection method to inject Israeli Acute Paralysis Virus (IAPV) to understand in detail the disease progression, and to define the temporal replication dynamics of IAPV in different body parts of worker honey bees at different developmental stages. In order to explore the induced systemic antiviral responses to IAPV, we quantified the expression of nine immune genes from different innate immune pathways. Our findings confirmed that two-week-old worker bees tolerate virus infection better and survive longer than their two-day-old sisters, even though the progression of viral infection is following the same pattern. Contrary to our expectations, the expression of some immune genes significantly varied among body parts and developmental stages. The findings will be discussed in detail in the context of virus-host interactions.

Is there a trade-off? Impacts of antibiotic treatments on gut microbiota and immune gene expression in honey bees (*Apis mellifera*)

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Antibiotics serve as fundamental treatments to bacterial infections in all organisms. However, these treatments can also kill beneficial microbes that have key functions such as eliminating pathogens and maintaining immune homeostasis. Considering the links between beneficial microbes and immunity, it is critical to understand whether changes in the microbiome can reduce the individual's ability to fight infections. Here, we use honey bees to study the immunological effects of antibiotics. Honey bees are often treated with antibiotics when infected with bacterial infections such as American foulbrood (*Paenibacillus larvae*). To quantify consequences of antibiotic treatment for immune function, we fed honey bees oxytetracycline followed by an immune challenge of heat-killed *Escherichia coli* to characterize changes in key gut bacteria and characterized immunosuppression effects. Honey bees were collected from five colonies and treated under controlled conditions over seven days. The relative expression of three immune genes and several groups of bacteria were quantified through qPCR to assess the immune gene expression and gut microbiota abundance. We did not find significant differences in survival between treatments. The combination of antibiotics and heat-killed *E. coli* are predicted to present trade-offs that reduce immune gene expression and microbiota abundance.

***Nosema ceranae* infection significantly reduces honey bee worker flight ability**

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Nosema ceranae (recently renamed *Vairimorpha*) is an intracellular pathogen for honey bee midgut epithelial cells. Negative effects of *Nosema ceranae* on honey bee behavior and physiology are well studied but it is not clear whether flight ability of workers are impacted when bees are infected by this pathogen. We studied how *N. ceranae* infection could affect worker flight ability by using flight mills in a laboratory setting. We inoculated worker bees at day one (newly emerged bees) with nosema spores and then measured their flight ability on day 11-13 (average of 12 days). We found that *Nosema ceranae* infection significantly reduced the flowing parameters: flight time, flight distance, flight speed, duration of the longest flight episode and distance of the longest flight episode. Not impacted parameters included average flight speed, number of stops and duration of rests. These data suggest honey bee worker flight ability are significantly negatively impacted and this could have implications for reduced foraging in infected foragers.

eDNA as a biological tool to monitor western honey bee (*Apis mellifera*) microbial and arthropod communities

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Expedient methods to determine the identity of organisms that honey bees (*Apis mellifera*) contact are needed for timely detection of pests and pathogens. We explored the feasibility of using eDNA metabarcoding to profile the biota (arthropods, bacteria, fungi) associated with honey bees in order to detect pests and pathogens honey bees encounter in their environment. We sampled representative surfaces (n=13) within and outside hives of an apiary, and surrounding areas, to determine the most informative locations to detect microbial and arthropod communities. Our method proved to be reliable. We were able to detect DNA from the small hive beetle (*Aethina tumida*), *Varroa destructor*, *Melissococcus plutonius* (causative agent of European foulbrood), greater wax moth (*Galleria mellonella*) and lesser wax moth (*Achroia grisella*). Our protocol demonstrated that eDNA metabarcoding can accurately detect DNA from arthropods and microorganisms honey bees contact. This method can be used as a molecular predictor tool for colony health surveys.

Innate immune system components reduce infection intensity and prevalence of the fungal parasite *Nosema* in the honey bee *Apis mellifera*

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Honey bee societies consist of thousands of individuals that live in close proximity to each other within their colonies. These conditions are favorable for pathogens and parasites to establish and spread among closely related hosts. The fungal pathogen *Nosema ceranae* is an obligate intracellular parasite of European honey bees *Apis mellifera.* Infected individuals display a range of symptoms including dysentery, decreased foraging, disorientation, lethargy and infection can increase mortality and decrease the life expectancy of entire colonies. Honey bee drones are susceptible to Nosema infections as well, and the parasite is able to contaminate semen and get transferred sexually to the queen during the mating process. However, the seminal fluid of honey bees contains a range of antimicrobial molecules that are efficient in reducing Nosema spore viability. Here we used a metabolomics approach and identified several metabolites that are known to have anti fungal abilities. The metabolites specified were then

used to orally treat bees artificially infected with *N. ceranae*. We found that bees treated with these metabolites showed significantly lower infection intensities than untreated bees. We also show that the prevalence of infection was reduced by ~40% in bees that received these treatments.

Comparative quantification of honey bee (*Apis mellifera*) associated viruses in wild and managed colonies

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The most detrimental threat to honey bee (*Apis mellifera*) health continues to be the ectoparasitic mite, *Varroa destructor*, which has been linked to colony losses worldwide. *Varroa* is also a prolific vector of several honey bee-associated viruses. Wild honey bee colonies are more tolerant to *Varroa* parasitization than managed colonies. Because they live in feral conditions, wild colonies are not treated for *Varroa* control, allowing for the natural selection of mite tolerant bees. To date, there is limited information about virus prevalence in wild honey bee populations. The Welder Wildlife Refuge (WWR) is a unique site to study the viral landscape of wild bees in the Southern U.S. Our goal was to identify and quantify honey bee-associated viruses in a wild population and compare the presence of these viruses to that in the nearest managed apiaries. We found significant changes of viral titers over time at the WWR for two major viruses (DWV and BQCV). However, there was not a significant difference in viral titers between the managed population and WWR. Our results indicate that perhaps wild honey bees are more tolerant to virus infections than managed colonies in spite of them being equally prone to virus infections, given that wild colonies exhibit lower yearly losses than managed operations.

Screening new compounds against small hive beetles (*Aethina tumida*) with a novel acute toxicity bioassay and field trial

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Beekeepers need new registered products to control small hive beetles (SHBs), *Aethina tumida*, a significant pest of western honey bee (*Apis mellifera*) colonies. Few approved chemical control options exist and those available are often not effective. We developed a novel acute laboratory bioassay and field trial that delivers compounds of interest to adult SHBs via pollen. We assessed the efficacy of coumaphos (only approved in-hive treatment in the U.S.), acetamiprid (frequently used beetle control) and fipronil (commonly used in urban pest baits and by beekeepers to control SHBs) as SHB control agents. Adopting our bioassay, we found acetamiprid (LC_{50} = 20.5 µg/g) to be more toxic to SHBs than was coumaphos (LC_{50} = 1250 µg/g), yet less toxic to SHBs than was fipronil (LC_{50} = 1.78 µg/g). In our field trial, colonies treated with acetamiprid and fipronil had significantly reduced ($p < 0.001$) SHB populations over those of control colonies. Traps containing acetamiprid retained significantly higher ($p < 0.001$) numbers of dead SHBs than did traps containing fipronil. We consider acetamiprid to be a promising control agent against SHBs. Future research is needed to assess the effects of acetamiprid on colony health, hive products and surrounding environments.

Breeding, Genetics and Evolution

Hangry bees: Pollen deprivation affects temper in Pol-line honey bees (*Apis mellifera*)

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Temperament of honey bees (*Apis mellifera*) has long been associated with genetic background, with some honey bee populations (e.g. Africanized bees) being associated with "hot" temperaments. However, beekeepers have also traditionally associated environmental conditions with temperament, as bees that are queenless or in a dearth are commonly more aggressive than they were before entering these conditions. In this study, we simulated a pollen dearth by utilizing pollen traps on colonies, half of which collected pollen and half of which were kept closed. We performed aggression assays and found that colonies deprived of pollen were more aggressive (or "hangry") than their non-pollen deprived counterparts in the same beeyard. Foragers were collected from these colonies on a weekly basis throughout the five week experiment and the expression of 4+ genes associated with temperament were examined. We have found that, regardless of genetic background, an environmental stimulus can play a pivotal role in honey bee temperament. This is something both breeders and scientists should keep in mind as they make operational and research decisions in the future.

Optimization of honey bee queen production practices for greater productivity and performance in northern climates.

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Recent surveys of Winter losses in Canada showed one of the top three causes of high colony mortality is poor queen quality. To address this problem, many Canadian beekeepers rely on importing queens for making new colonies. Although this is a common practice; Saskatchewan beekeepers have been active in raising their own queens. Investigating the quality of produced queens showed that queen production can start as early as mid-May, but queens produced mid-June to early August had significantly higher average number of sperm per queen (6.27±1.08mil). Produced queens significantly varied in head and thoracic measurements among producers and within the rearing season. The average number of sperm per locally produced queen was 2.96±1.54mil and this was overall 1.6 times higher than queens imported from other provinces in Canada or the USA in 2021. Specific recommendations were tailored and given to each local participant beekeeper based on the results in our assessments. Following-up with those queen producers in 2022, significant improvement in the average number of sperm (3.87±1.42mil) and reduced variation among tested queens were found. In 2022, testing imported queens showed that 40% had less than one million sperm per queen. These findings showed that efforts to produce quality queens in northern climates is viable and locally produced queens can be better in improving colony survivorship.

Reproductive mechanisms of evolutionary differentiation of the honey bee (*Apis mellifera* L.)

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Honey bee (*Apis mellifera*) queens store and use sperm from mating with multiple drones early in life. Queens can mate with drones from multiple subspecies to produce viable offspring. There is evidence to suggest that queens differentially use sperm during fertilization, but it is unclear when and where sperm selection is taking place in the queen reproductive tract. To evaluate differential sperm storage and use in honey bee queens, queens from different U.S. strains representing Old World subspecies were instrumentally inseminated with semen from one or multiple strains. Queens inseminated with semen from one strain were sacrificed and dissected 40 hours after insemination. Sperm counts from the dissected spermatheca were performed and data suggests that queens preferentially store more sperm when they are inseminated with semen from drones of the same strain. Queens inseminated with semen from multiple strains were introduced to colonies to evaluate sperm use over time. Using multiplex PCR, microsatellite analysis will be performed to determine paternity among honey bee worker progeny in the population. Findings from this research will further our understanding of female-male interactions in the honey bee queen reproductive tract and their effects on sperm storage and use.

A dose-response transcriptome of honey bee workers: characterizing gene expression across a large range of oxidative stress

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Stress response in insects is often studied through single behaviors, traits or genes to identify quantitative impacts of sublethal stress dosages. While this approach has been used to study stressors and beneficial treatments in honey bees, experimental designs rarely combine a range of doses with a large number of biological outcomes due to costs and/or feasibility. Using a cost-efficient Tag-seq approach, we create a dose response of the entire honey bee transcriptome to the oxidative stressor Paraquat, a herbicide that induces oxidative stress in a wide variety of organisms. Across 10 doses, we vary the stress X-fold and evaluate the physiological responses in 96 whole transcriptome profiles. This whole transcriptome strategy along with a large dose range allows us to obtain both a gene and process view of how honey bees, and potentially other insects, respond to dramatically varying levels of oxidative stress. We are able to identify key biological processes that underlie resistance to oxidative stress and also how the transcriptome appears in response to doses that result in certain death. This study paradigm could help as a general framework for testing other stressors or beneficial treatments both alone and in conjunction to understand stressor-stressor and stressor-treatment interactions and hopefully contribute to improving honey bee health in the future.

Upgrade to the Russian honey bee genotype identification assay

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Russian honey bees (RHB) are a *Varroa*-resistant breeding population developed by USDA-ARS that first incorporated genetic stock identification (GSI) as part of the selection strategy. Novel sequencing approaches and high throughput microfluidic chemistry has afforded an excellent opportunity to update the existing assay. Here we outline a methodological framework that capitalizes on both historical and novel genetic variation to arrive at an updated assay with increased accuracy and processing power. This approach provides an inherently modular framework that can be readily incorporated as a genetic survey of breeding populations or alternatively, modified to examine genetic variation associated with specific traits when available. Ultimately this work provides another genetic-based tool towards the ultimate goal of breeding for healthier more productive bees.

Beekeeping Management, Education and Outreach

Rough hives stimulate propolis production in support of bee health

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When wild honey bee (*Apis mellifera*) colonies nest in hollow tree cavities, they coat rough cavity walls with a thin layer of propolis, derived primarily of plant resins. The resulting "propolis envelope" serves structural and therapeutic functions inside the hive. In this study, we monitored colonies in hive types with different surface texture treatments (rough wood boxes, boxes with propolis traps and standard, smooth boxes) to determine if these surfaces encourage managed colonies to deposit more propolis. We examined the effect of propolis on colony health, pathogen loads, immune gene expression, bacterial gene expression and honey production in stationary and migratory beekeeping contexts. Migratory rough box colonies were significantly larger than migratory control colonies by the end of year one. In both stationary and migratory operations, propolis deposition was correlated to a seasonal decrease and/or stabilization in expression of multiple immune and bacterial genes, suggesting that propolis-rich environments contribute to hive homeostasis. There was also a significant decrease in *Melissococcus plutonius* gene expression with non-significant decreases in clinical symptoms of European foulbrood and *Varroa* loads. These findings provide support for implementation of rough box hives as a means to support propolis collection and colony health in multiple beekeeping contexts.

Perceived impacts of unusual and extreme weather events on beekeeping

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Unusual and extreme weather events, such as heat waves, droughts, wildfires, heavy rainfall and storms, can have serious impacts on honey bee (*Apis mellifera*) colonies: droughts can limit plants' nectar and pollen production; rain and wind can limit foraging time; wildfires and floods can destroy colonies outright or their surrounding resources. With extreme events becoming more frequent, we attempted to quantify their impact on U.S. beekeepers through a perception questionnaire included in the 2022 Bee Informed Partnership survey. Droughts were seen as the most impactful event type on colonies; 25% of U.S. beekeepers (representing 87% of colonies) reported negative impacts from droughts in 2021-2022. The majority of reports came from the West region and migratory beekeepers, and commercial beekeepers were more likely to report droughts. By contrast, "high winds and storms" were widely reported by beekeepers (37%, representing 23% of colonies), but mostly without noticeable impact. Overall, the vast majority of impacts from unusual weather events were negative. This was the first attempt to document the prevalence and severity of weather impacts on the U.S. honey bee population and beekeeping. A better understanding of the scope of their potential impact should help stakeholders and policymakers better plan for changing conditions.

A longitudinal experiment shows that organic honey bee colony management supports healthy and productive colonies

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Honey bee, *Apis mellifera*, colonies face numerous challenges, but management practices can help mitigate some of the negative effects of these stressors, but these practices vary significantly, resulting in striking differences in the type and frequency of chemicals used for pest and parasite control. The goal of this longitudinal, three year study was to use a systems approach to experimentally test the role of three representative beekeeping management systems (conventional, organic, chemical-free) on the health and productivity of stationary honey-producing colonies. We found that, over three Winters, the rates of survival for colonies in the conventional and organic management systems were at least two times higher than under chemical-free management. *Varroa* mite levels in the Fall were 4.52 and 3.53 times higher in the chemical-free than in the conventional and organic management systems, respectively. This led to higher levels of deformed wing virus (DWV) and expression of immune genes. Here, we experimentally demonstrated that beekeeping management practices are key drivers of the survival and productivity of managed honey bee colonies. More importantly, we found that the organic management system supports healthy and productive colonies, and can be incorporated by beekeepers as a sustainable approach for stationary beekeeping operations.

Market implications of changes in climate, land coverage and annual colony loss rates for U.S. commercial beekeeping operations

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In this project, we improved the current econometric models of the U.S. pollination market and updated the integrated model based on our previous published version. By expanding the research area to cover bee movement, pollination behavior and honey production in the lower 48 U.S. states, the data that encompass annual colony

losses and splitting colonies by two units are parameters that were upgraded in the new model. Then, the impact of Summer and Winter percentage loss of colonies on the honey bee pollination and honey production market using the new developed model were investigated. We also embedded our data into the integrated econometric models of the climate change impact on honey production rates and honey bee loss rates, calculated using USDA data on the state-level "dead outs" divided by the maximum inventory of colonies in each state during a given period. The integral impact of climate change on the honey bee pollination market was analyzed using the new U.S. bee movement model. Our model and results will help to identify the climate impact on the honey production rate, honey loss rate and the honey bee pollination market in the U.S. Moreover, the climate change impact and the market changes under different policy and pollination scenarios are projected.

Seeing is bee-lieving – what happens after a sugar shake assay?

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Varroa destructor remains one of the most impactful and widespread challenges in modern beekeeping. Beekeepers are encouraged to monitor to determine when populations have surpassed the economic threshold for intervention. While similar in the method of collection of bees, the alcohol wash destructively monitors for mites while the sugar shake is considered non-destructive and is often referred to as "safe" for the bees, leading many beekeepers to favor this assay despite research showing its lower mite recovery. To investigate whether the sugar shake assay affects assayed bees, we compared bees that underwent the sugar shake assay versus bees in a powdered sugar-coated group (no shaking), and a control group (no powdered sugar or shaking), by documenting their recovery in the hive five days later. Lower recovery rates were found for shaken bees and varying behavioral responses to the focal bees were observed, providing possible explanations for the recovery rates. While sugar shake assays are better than not monitoring at all, our results provide considerations for beekeepers who choose the sugar shake assay believing it is safe for the bees. Understanding and showing impacts of this assay on bees may influence beekeepers' behaviors and increase the adoption of the alcohol wash.

Examining methods for *Varroa destructor* control in honey bee colonies (*Apis mellifera*) using oxalic acid vaporization: the difference between control versus reduction

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Varroa destructor remains the leading cause of honey bee mortality in the United States. Mounting evidence of resistance to synthetic miticides means beekeepers are struggling to keep their colonies alive despite a whole host of other cultural, genetic and chemical options to control this formidable pest. Oxalic acid (OA), when vaporized, has proven to be an effective treatment against the phoretic phase of *V. destructor*, but has its limitations since the compound cannot penetrate brood cell wax caps. We present large, multi-apiary studies examining OA application during brood-rearing periods for *V. destructor* control. We show that repeated applications of OA while brood is present is capable of preventing *V. destructor* population growth but, does not decrease mite populations. More recently, we studied whether incorporating a forced brood break while vaporizing with OA would be a more effective treatment in controlling *V. destructor*. This option is designed to work with the 'beekeeping calendar' based on re-queening schedules or during a brood dearth. We show that a short brood break, achieved by confining the queen in a honey super above an excluder, increases the effectiveness of OA vaporization five-fold, and effectively reduces *V. destructor* populations.

Pesticides and Acaricides

How frequent is synergy to honey bees among pesticide combinations typically used in agricultural operations?

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Understanding the frequency of non-additive effects (synergism and antagonism) is important in the context of pesticide risk assessment. The goal was to investigate the prevalence of non-additive effects of pesticides to honey bees. We investigated mixtures of insecticides and fungicides of different chemical modes of action and classes and whether the experimental toxicity of the mixtures could be predicted based on the Concentration Addition (CA) model for acute contact and oral adult bee toxicity tests. Further, we investigated the appropriate Mixture Deviation Ratio (MDR) thresholds that should be used for the identification of non-additive effects based on acceptable rates for false positive and true positive findings. We found that a deviation factor of MDR = 5 is a sound reference for labeling potential non-additive effects in acute adult bee experimental designs. We found that only 2.4% and 9% of the mixtures evaluated had an MDR > 5 (potential synergy) and MDR < 0.2 (potential antagonism), respectively. The frequency and magnitude of deviation from additivity found for bees in this study are consistent with those of other terrestrial and aquatic taxa. Our findings suggest that synergy of pesticide mixtures to bees is rare and is not random but have mechanistic basis.

Toxicity of the not so "inert ingredients" in pesticides to adult worker honey bees

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The principal functioning agents (PFAs) that make up spray adjuvants and serve as "inert ingredients" in formulated pesticides are a diverse group of agrochemicals that are added to pesticides with the intention of improving the function of spray application through enhanced leaf sticking, spreading and penetration. The significant honey bee colony losses that have been reported during and after almond pollination in California may be related to honey bee exposure to these compounds. The aim of this research was to determine if individual adjuvant PFAs applied during almond bloom can cause increased mortality in adult worker honey bees exposed to simulated spray applications from a Potter Spray Tower. This study established the acute toxicity, expressed as LC50, of sixteen adjuvant PFAs applied during almond bloom. Results show that some PFAs, especially in the ethoxylate, organic polymer and organo-silicone chemical groups, can cause adult bee mortality when applied alone at field relevant concentrations. A better understanding of the inert ingredients that are driving adjuvant and adjuvant-pesticide tank mixture toxicity to honey bees will play a key role in informing "Best Management Practices" for pesticide applicators spraying pesticides during bloom, when honey bee exposure is likely.

Toxicity of potential new varroacides to honey bee queens under laboratory and field conditions

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[1]Department of Biological Sciences, University of Alberta, Edmonton, AB, Canada

Varroa mites are threatening honey bee colony survivorship and the sustainability of beekeeping. Evolution of resistance and low efficacy of current control efforts have increased the demand for new treatment tools that exhibit high efficacy, while minimizing adverse effects on honey bees. Based on previous investigations that assessed *Varroa* and worker bee mortality from 26 potential miticides (Bahreini et al.), we selected five promising candidates to test their long-term effects on honey bee mated-queens. Using a combination of lab and field experiments, we assessed queen mortality, queen performance, bee and brood viability, mite mortality, as well as sublethal effects on queen weight and sperm viability. As predicted, toxicity to queens was dose-dependent and queen survival rate was greater for 1% compared to 10% contact exposure in the laboratory bioassay. Queens proved to be less susceptible than workers in most cases. Field studies indicated that queens are able to tolerate 1000 mg active ingredient of two compounds per nucleus hive. At this concentration, the compounds showed efficacy against *Varroa*, while no adverse phenotypic effects on queens or adult bee populations were observed in treated colonies. Physiological sublethal effects on queens, workers and mites will be assessed in future transcriptomic studies. Further research is required to comprehensively investigate the potential of our candidate substances for effective and safe *Varroa* control under apicultural field conditions.

Bioacoustics monitoring to detect changes in honey bee visitation to blooming soybeans associated with an insecticide application

Johnson, R[1]; Forrester, K[1]; Lindsey, L[2]; Lin, CH[3]

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Utilization of soybean flowers by honey bees has been under-appreciated because it is difficult to observe pollinator activity on flowers through the dense soybean canopy. In the absence of obvious pollinator activity, insecticides carrying label language prohibiting application "if bees are visiting the treatment area" are often applied during soybean bloom. Bioacoustic methods provide a practical approach to (1) assess bee activity in soybeans and (2) determine the effect of an insecticide application on bee activity. An array of eight microphones were affixed to stakes and placed in four experimental soybean fields and recording was started. The day after microphone placement, half of each field, containing four microphones, was treated with the insecticide Fastac EC (alpha-cypermethrin). The following day recording was stopped and microphones were recollected. Honey bee activity in audio files was identified based on the wing beat frequency of honey bees (234±13.9 Hz) using automated analysis, followed by manual validation. Results indicate that honey bee activity in soybean fields was common and was not substantially affected by insecticide application. This work supports recommendations that insecticide applications should not be made to blooming soybeans during daytime hours when pollinators are actively visiting soybean flowers.

Chemical Ecology, Behavior and Nutrition

Monitoring the spread of defensive honey bee behavior in Pennsylvania

Dean, CAE[1]; Underwood, RM[1]; Given, K[2]; Harpur, BA[2]; López-Uribe, MM[1]

[1]Department of Entomology, Penn State University, University Park, PA; [2]Department of Entomology, Purdue University, West Fayetteville, IN

Defensive behavior among managed colonies across the Americas, including the Southern United States, represents one of the phenotypic consequences of crossing honey bees of European origin and a South African subspecies. The resulting cross, referred to as African hybrid honey bees (AHBs), are defined as possessing >20% genetic material derived from African lineages and showing defensive behavior. Here, we explore whether defensive colonies

in Pennsylvania, a Northern state where AHBs are not documented to have previously established, show evidence of defensive behavior suggesting possible introgression from African lineages. We first confirmed the designation of 'defensive' versus 'non-defensive' colonies, as identified by local beekeepers, using an assay wherein the number of stings was recovered from a 6 x 9 cm leather patch waved in front of the colony entrance for one minute upon agitation. Next, we sampled workers for genomic sequencing to perform an ancestry analysis assessing whether defensiveness in Pennsylvania colonies is correlated to a higher proportion of DNA derived from African lineages. Our results confirm the presence of highly defensive colonies in the state of Pennsylvania. We are currently working on developing a pipeline that will enable local beekeepers to diagnose, monitor and manage highly defensive colonies.

Pesticide stress drives premature self-removal behavior in honey bee (*Apis mellifera*) workers

Twombly Ellis, J[1]; Rangel, J[1]

[1]Texas A&M University, Department of Entomology, College Station, TX

Honey bees are challenged by multiple factors, many of which act concomitantly to affect colony health. One negative effect of these stressors is accelerated age polyethism wherein stressed bees perform tasks at a younger age than healthy bees. We recently documented an extreme example of this behavior that we termed premature self-removal. General developmental stress was shown to cause honey bees to remove themselves from the colony before they could fly, leading them to die prematurely. In this study, we tested the hypothesis that undergoing pesticide stress during pupal development can cause adult workers to perform this behavior. We used two pesticides commonly found in wax in honey bee colonies, Amitraz and Chlorothalonil. To determine if these pesticides lead to self-removal behavior, we stressed bees by rearing them in contaminated wax. We individually tagged focal bees upon emergence and introduced them into an observation hive. Tagged bees were followed and monitored for premature self-removal. Our results showed that pesticide stressed bees self-removed more than control bees. The Chlorothalonil stressed bees self-removed at a statistically significantly higher rate. We found that individual, field relevant pesticide levels cause this detrimental behavior. Therefore, contamination by multiple pesticides likely further increases self-removal rates.

Sublethal effects of gelsemine, a toxic alkaloid found in yellow jessamine nectar, on queen bee performance

Goblirsch, M[1]; Werle C[1]; Hamilton A[2]; Robinson GE[3]; Adamczyk J[1]

[1]USDA-ARS, Southern Horticultural Research Laboratory, Poplarville, MS; [2]University of Illinois at Urbana-Champaign, Carl R Woese Institute for Genomic Biology, Urbana, IL; [3]University of Illinois at Urbana-Champaign, Department of Entomology, Neuroscience Program, and Carl R Woese Institute for Genomic Biology, Urbana, IL

Yellow jessamine is native to the southeast U.S. The plant blooms in late Winter/early Spring, producing abundant, fragrant flowers that attract honey bees. It is a popular ornamental, but also establishes readily along roadsides and recently disturbed habitats. Yellow jessamine is a significant source of early season nectar, but there is a downside to its utilization, as beekeepers have observed weakening of colonies during its bloom. Gelsemine, a toxic alkaloid found in yellow jessamine nectar, is the likely cause of these negative effects, but few studies have explored this phytochemical beyond its acute toxicity. We used Queen Monitoring Cages (QMCs) maintained under controlled, laboratory conditions to expand understanding of how gelsemine may weaken colonies. These functional colony units contain a laying queen, 50 attendants and ad libitum provisions that included either untreated sugar solution or sugar solution containing 20 or 100 ppm gelsemine. Preliminary findings suggest that queens in QMCs given gelsemine at naturally occurring concentrations had reduced egg-laying with little to no effects on adult mortality, resource consumption or hatching success. Our results support that chronic exposure to gelsemine, as may occur during yellow jessamine bloom, could lead to a reduction in worker population and ultimately weaken the colony.

Engineered microalgae as a novel pollen substitute and therapeutic delivery system

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[1]USDA-ARS, Honey Bee Breeding, Genetics, and Physiology Research, Baton Rouge, LA; [2]USDA-ARS Carl Hayden Honey Bee Research Center, Tucson, AZ

With a rapidly growing human population and a changing climate, it is more important to devise sustainable agricultural solutions. Intensifying land-use has resulted in extirpations of native pollinators and a reduction in insect biomass, increasing our reliance on honey bees (*Apis mellifera*). However, beekeeping is threatened by unsustainable colony losses due to pests (e.g., *Varroa destructor*), pathogens (e.g., viruses) and inadequate nutrition. Here, we show that a microalgae-augmented diet improves colony size and thermoregulation when supplied to commercial colonies relative to control colonies. Microalgae-supplemented diet resulted in a unique expression profile of nine stress-response genes and biomarkers in nurse bees compared to controls. Bees fed microalgae that have been engineered express immune-stimulating biomolecules against deformed wing virus (DWV) – a major threat to colony health – survive longer and have reduced DWV genome equivalents when injected with DWV relative to various controls. Larvae reared on royal jelly supplemented with microalgae were challenged with 106 DWV genome copies at pupation and scored for deformities at eclosion. Individuals reared on engineered algae showed significantly lower rates of deformity than individuals reared on control jelly. Our data demonstrates that microalgae are a promising nutritional supplement and a scalable therapeutic delivery system for apiculturists.

Beebread production involves functional phytochemical changes in the diet of honey bees

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[1]Department of Entomology, University of Illinois at Urbana-Champaign, 505 S. Goodwin Ave., Urbana, IL

Throughout its range, the western honey bee *Apis mellifera* can process foraged pollen via fermentation into bee bread for consumption during times of dearth. In addition to its nutritional amino acid and lipid content, pollen is rich in phytochemicals, which are now known to play a functional role in enhancing bee defenses against pesticides and pathogens. Beebread production has long been assumed to involve preservation of nutrients and little else. Beyond nutrient content, however, we examined the alteration of functional phytochemicals during beebread production by comparing the phytochemical profile of foraged pollen and beebread samples collected during the same floral blooming period. Chemical analysis via phenolic extraction revealed that the bee bread samples contained a greater diversity and abundance of phytochemicals. Three functional phytochemicals—*p*-coumaric acid, kaempferol and quercetin—were more abundant in the beebread than in the pollen. Moreover, in vitro cage-rearing assays showed that the longevity of adult honey bee workers was differentially affected by pollen or bee bread in the diet. Our findings suggest that beebread has potential as a supplement to enhance colony heath.

Developing a pollen nutrition database for north America: healthy food for healthy bees

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[1]Department of Biochemistry, Molecular Biology, Entomology and Plant Pathology, Mississippi State University, Mississippi State, MS; [2]Department of Horticulture, Oregon State University, Corvallis, OR

Poor nutrition is one of the major stressors of bee species and is a main contributor to loss in pollinator populations. Bees are currently faced with many nutritional challenges including loss of forage habitat and monoculture. The aim of this project is to promote better nutrition for bees by learning which floral resources are nutritionally optimal for all bees based on the nutritional composition of their pollens. This study will first use various methods of pollen collection in order to collect sufficient pollen from each target species of plants. Next, the collected pollen samples will be analyzed in the lab using basic biochemical assays, as well as mass spectrometry based methods, to determine the nutritional quality of the pollen. The pollen will be analyzed for its concentration of proteins, lipids, amino acids, sterols, metabolites and phytochemicals. Finally, all of this data collected will be compiled into an online database showcasing the nutritional quality of each plant species' pollen. This database can be used by beekeepers, conservation groups and growers to scientifically select forage plants for pollinators.

Interactive effects of pesticides and nutrition on honey bee health

Lau, P[1]; Tundo, G[1]; Zhu, Y[1]; Zhang, W[1]

[1]USDA-ARS Pollinator Health in Southern Crop Ecosystem Research Unit, Stoneville, MS

Honey bees often encounter a variety of stressors in their environment, including poor nutrition and pesticides. These stressors interact and can be exacerbated in heavily anthropized habitats such as large-scale agroecosystems. In this study, we build upon our previous work on honey bee nutrition and examine how diets varying in macronutrient ratios can affect nurse bee susceptibility to pesticide stressors. We did so by orally exposing nurse bees to varying sublethal concentrations of clothianidin (CLO), a neonicotinoid insecticide known to have sublethal and lethal effects on honey bees, after newly emerged bees were given an artificial high protein diet, intermediate diet, high lipid diet, natural pollen diet or no diet. In the absence of pesticide stressors or at low concentrations, bees given the higher protein, balanced diet, and natural pollen had better survivorship compared to bees given no diet or a high lipid diet. However, bees given natural pollen had lower susceptibility when exposed to higher concentrations of CLO. Our preliminary results suggest that there may be other nutrients in pollen beyond crude protein and lipids that improve nurse bee tolerance to pesticide stress. BC

All The Buzzz in...

Hello Friends,

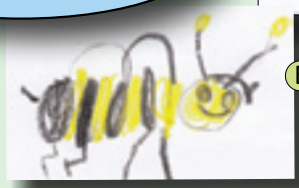
Support our pollinators by planning a pollination celebration.

Bee B.Queen

Bee B. Queen Challenge

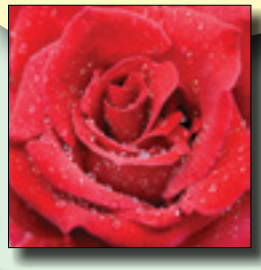
Send photos of ways you support pollinators.

Jake, 4, TX



Emily, 8, TX

The rose is the national flower of the United States of America.



Look at the colors in this bluebonnet. Which florets have the most pollen?

LoadmasterDavid R. Tribbler

The bluebonnet is the Texas state flower. Do you know your state flower?

Bluebonnets

March and April bring beautiful bluebonnets along the roadsides and throughout the fields of Texas. One of the interesting things about bluebonnets is that the flowers change colors to help both the pollinators and the flower itself.

The top part of the floret is called the banner. It's like a little flag with a white spot that attracts pollinators. These florets produce high quality pollen that is an orange-reddish color. The bees collect both the pollen and nectar from bluebonnets for food. As the florets age, the white spots turn purplish-red making the flowers less attractive to bees. The color change signals to the bees that the pollen in that floret is less plentiful, less useful, and less sticky.

This floral color changing action is good for the bees and the flowers. It is good for the bees because they can collect more high-quality pollen without having to waste time and energy on the purplish florets.

It is good for the plant because it means that the bluebonnets are pollinated with fresh pollen rather than with older, drier, and less useful or fertile pollen. What does that mean? The bluebonnets, which depend on insects for pollination (moving pollen from one flower to another) can produce more and better quality seeds to have more plants next year.

1i, 2g, 3h, 4b, 5b, 6d, 7f, 8e, 9c

Bee kid's corner

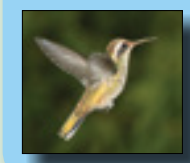
Produced by Kim Lehman
www.kimlehman.com

April 2023

Pollinator Week – June 19 – 25

Now is the time to plan for a pollination celebration in your community. Popular events include planting for pollinators, hosting garden tours, and so much more.

Get activity ideas, amazing resources, and information at Pollinator Partnership https://www.pollinator.org



Don't forget to register your event no matter how small.

A few ideas...

- Host a pollinator planting day at your school, local park, or library
- Show a pollinator film
- Host a nature walk
- Build native bee houses
- Make and distribute seed bombs
- Make and put up pollinator posters in your neihgborhood.
- Display pollinator artwork and outreach materials in your local bank, library, restaurants...

Beecome a Bee Buddy

Send two self-addressed stamped envelopes and the following information to: Bee Buddies, PO Box 117, Smithville, TX 78957.

Name
Address
Age
Birthday Month
E-mail (optional)

We will send you a membership card, a prize, and a birthday surprise!

Send all questions, photos, and artwork to: beebuddiesclub@gmail.com or mail to the above address.

Decode the State Flowers

Each letter in the name of a state flower has been replaced with a random number. Decode the flowers then match the number of the flower to the correct state(s). Use the internet to help you.

A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z

1. _____ _____ _____ _____ _____ _____ _____ _____ _____ _____ _____ _____
2. _____ _____ _____ _____ _____ _____ _____ _____ _____ _____ _____ _____ _____ _____ _____ _____
3. _____ _____ _____ _____ _____ _____ _____ _____ _____ _____
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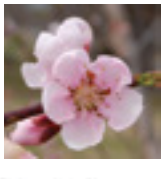
6. _____ _____ _____ _____ _____ _____ _____ _____ _____ _____ _____ _____ _____ _____
7. _____ _____ _____ _____ _____ _____ _____ _____ _____ _____ _____ _____ _____ _____
8. _____ _____ _____ _____ _____ _____ _____ _____ _____ _____ _____ _____ _____ _____
9. _____ _____ _____ _____ _____ _____ _____ _____ _____ _____ _____ _____ _____ _____

___ A. Texas
___ B. Florida
___ C. Kansas
___ D. Oregon
___ E. Vermont
___ F. Delaware
___ G. Maryland
___ H. Kentucky and Nebraska
___ I. Arizona and Michigan



Bees and Women

The Acklin Women

Nina Bagley

Breezing through my 1900s *Gleanings in Bee Culture Magazines*, I found a beekeeping woman and her daughter who caught my interest: Mrs. Helen Goodsell Acklin and her daughter Miss Ethel Acklin from St. Paul, Minnesota. Ethel would marry Howard Root Calvert, son of Maude Root Calvert, who was the daughter of A. I. Root.

Helen Goodsell was born in New York on May 3, 1857. Her parents, Jessie and Laura Goodsell, were both born in New York. Helen was the youngest of five children. Her parents moved to Wisconsin when she was very young. She attended a country school and then a village school, preparing her for a career in teaching. Her passion for honey bees started at a young age. In her teens, she told herself that she would have bees someday, but it would be a while before this happened.

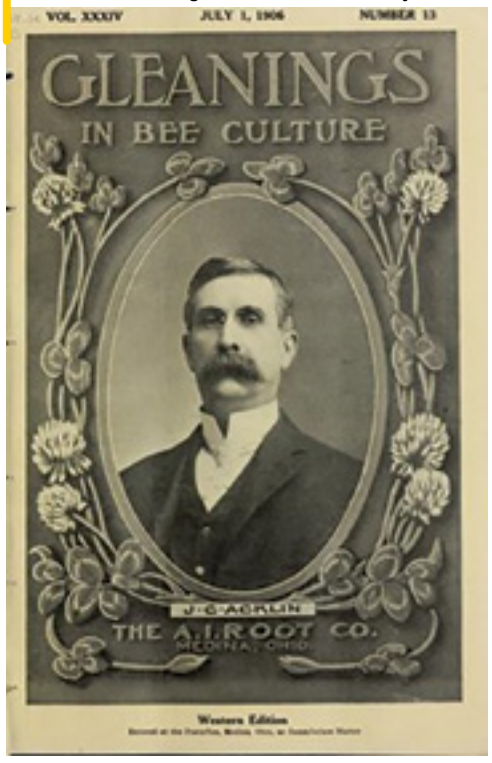
At fifteen, Helen married her first husband, Phillip P. Jewell on November 11, 1872. He was ten years older than Helen. I couldn't find much information about Phillip other than he was in the Civil War and that Helen served him divorce papers. In 1885 you needed proof and a reason for getting divorced. The grounds for divorce were adultery, desertion and abuse. The ink had faded on her divorce papers and was hard to make out. I'm sure she had her reasons-the Civil War was brutal and many men suffered long term mental and physical illnesses from serving in it.

Phillip P. Jewell didn't show up for court. Helen was granted her divorce on December 8, 1885 at the State of Wisconsin Circuit Court for Polk County. While living in St. Paul, Minnesota, in 1884, she met her second husband. James C. Acklin, who was working as a contractor. He had been married before and had a daughter, Annie. The two married on December 8, 1885. The same day Helen was granted her divorce. She was 28 years old. What a courageous young woman! Talk about killing two birds with one stone.

James C. Acklin was born in Pennsylvania in 1857. He was a contractor and builder, and was a prosperous man. A. I. Root described him as dignified, gentlemanly, quiet and significantly large in stature. The time for bees finally came for Helen shortly after they were married. Fortunately, some bees were on the lot where they were building a home and thus began their beekeeping journey. For a present to his wife, Mr. Acklin, made her seventeen colonies of American hives. The bees were not the most friendly, so they replaced them with a gentler stock. The frames were all glued together and made a mess out of the hives. It took some doing to pull them apart.

Nevertheless, Mr. Acklin meant well, and Mrs. Acklin transferred them to Langstroth hives with the assistance of her husband. In 1890, they went west to California, but in the Fall of 1891, they returned to St. Paul, where they planned on building a life together. Their daughter Ethel was born in the Winter of 1892. And the following Spring, 1893, they began handling beekeeping supplies. Very little building was going on during the hard times, and Mr. Acklin secured a position as a lumber inspector with the Great Northern Railway. He worked for several years. Both of them tried their best to prevail. Mrs. Acklin kept a watchful eye on their daughter and ran the bee supply business. Like any good business, with a vision and hard work, it

J C Acklin* Gleanings *Western edition. July 1, 1906



Helen G. Acklin* Gleanings *Eastern edition. February 15, 1906

Ethel Helen Acklin at 13 in 1913

will grow over time, and this is what happened. The work became overwhelming! Her husband effectively resigned from his position with the railroad to help his wife out full-time with the bee supply business. He devoted his time to his family and the business of bees. Mr. and Mrs. Acklin both were active in the Minnesota Beekeepers Association. They both were closely associated with helping each other and working side by side until Mr. Acklin's sudden death in 1906.

After the death of her husband, Mrs. Acklin continued with beekeeping, having her ups and downs working her bees. She had over 100 hives and several out-apiaries. Even then, disaster sometimes comes knocking on one's door. One morning she realized water overflowed the cellar apiary, and sand was running into the entrances and drowning the bees. I'm sure if you kept bees long enough, you would have had issues with your bees. But can you imagine the cellar filling up with water? The colonies floated around like fishing bobbers until rescued by men with rubber boots and a long pole!

A woman with less love for the honey bee and less perseverance would have surrendered in despair, and to add to it, she felt alone. But Mrs. Acklin kept on, learning something by hard knocks, and from experience and her bee books, she followed Doolittle's method of raising queens. It would be discouraging and make one choose another occupation, but with her guiding principles, she prevailed. With her small beginnings, Mrs. Acklin was one of the most successful beekeepers in St. Paul, Minnesota. And she was well known in Wisconsin too. Running a sizeable queen-rearing apiary at her home, she was a prominent dealer in beekeeping supplies for over fifteen years, alongside being an attentive mother.

Her daughter Ethel knew more about bees than most young women and men. She accompanied her mother and father to the bee conventions. Ethel remembers in 1900 when she was nine, singing solo and chorus songs, the music by Dr. C.C Miller, during the National Convention in Chicago. How she enjoyed the time with her parents. The death of her father was not easy on both mother and daughter.

Mrs. Acklin continued her business for a few more years, but her failing health made her make a change of her occupation and climate. So she moved back to California in 1908, eighteen years since she had last been there. She didn't entirely give up on bees. At fifty-one, Mrs. Acklin, with her daughter, bought a home in Glendora, California, and purchased an orange grove twenty-five miles outside of Los Angeles. She became a rancher and an orange grocer keeping a few hives.

She also attended the bee conventions. She edited the *Beekeeping in Southern California* department in *Gleanings*. Mrs. Acklin was against beekeepers that sold adulterated honey and worked aggressively to put them out of business! She wrote in *Gleanings in Bee Culture*: "I wonder how many beekeepers know that honey adulteration is happening right in our midst; if beekeepers work together, these swindlers can be put out of business. Whether it be the small grocer who puts just a little glucose in the honey to keep it liquid or the wholesale man who mixes tons, the effect is the same. People soon take a dislike to glucose honey. They stop eating honey altogether. So beekeepers lose money on two counts, less honey being consumed while the output increases. How can this adulteration be stopped? All beekeeper's associations in our State, whether county clubs, district unions or State organizations, should unite under one banner in fighting this evil, and send a large and enthusiastic delegation, composed of delegates from each society, to the legislature this Winter to represent the beekeeping industry of our State." *Gleanings,* 1910 (pg. 749).

When A. I. Root Co. established a branch office in San Francisco, Mrs. Acklin was given charge of it and continued to work until her death on May 30, 1915. A. I. Root enjoyed visiting Mrs. Acklin's home in Oakland when he was on business in California. And found her to be commendable, a good businesswoman and a loving mother.

A. I. Root's grandson Howard Root Calvert took care of the A. I. Root Company's exhibit booths at the San Francisco expositions. And it was during one of these visits Howard would meet Miss Ethel Acklin. They announced their engagement to be married. Ethel's mother passed away a few months before the wedding. The two were married on Tuesday, July 6, 1915, at the home of the groom's parents, Mr. and Mrs. J. T. Calvert, in Medina, Ohio. Ethel was grieving her mother, her last surviving relative, and is said to have held up bravely. The death of the bride's mother made it necessary for Ethel to be married in Medina, Ohio.

Ethel Acklin Calvert circa 1929

Immediately following the ceremony, the couple drove to Elyria, Ohio where they started their long trip back to California. Mr. and Mrs. Calvert were both in charge of the San Francisco office, taking hold where Ethel's mother left off. Mr. and Mrs. Calvert dealt with life's realities and an active bee business. Ethel was said to have been "the bee man" of the establishment. In 1916, Mr. and Mrs. Calvert returned to live in Medina, Ohio, where they would start their family. Howard continued working for his family's business, the A. I. Root Company.

The family had ultimate happiness and then ultimate loss. Mrs. Calvert's husband died suddenly as a young father at thirty-two in a tragic plane crash while giving lessons on June 27, 1924, in Akron, Ohio. He was not flying the plane but the student, Mrs. Whichershelm, was. What a tragedy! Now widowed at a young age, Ethel had three young daughters to think about. Rebecca, seven; Roberta, five; and Ruth, four. Her daughters were all she had left, falling back on her husband Howard's strength, her mother's tenacity, and her own will and faith, Ethel would return to California and overcome by providing for her girls, owning her own home and bee supplies company just like her mother had done.

It would be thirty-six years before Ethel would remarry. But I always say, "there's a lid for every pot." In 1960, she married Mr. Alfred Francis Nippell. He was fifty years old, his occupation was a bookkeeper, and he had never been married; Ethel was sixty-seven. They were married for twenty-eight years. Ethel slowed down regarding the bees, just keeping some bees in the country. Ethel was ninety-five when she passed away with her family by her side on January 8, 1988.

Alfred Francis Nippell yearbook picture

Mr. and Mrs. Howard Root Calvert

She shared the love of the honey bee. Endured the loss of her parents and her husband at a young age. She raised three daughters who were related to the Root family. She had four grandchildren and eleven great-grandchildren, which gave her much joy. Her second husband Alfred provided her with love, companionship and security. He passed away at the age of ninety in 2000 in San Diego, California. Mother and daughter both having parallel lives. "I admired their tenacity, entrepreneurship and strength; the busy bee has no time for sorrow." —William Blake BC

Nina Bagley
Ohio Queen Bee
Columbus, Ohio

New(ish) Beekeeper Column

Off the Wahl Beekeeping

NUCLEUS HIVES AND SPLITS

Richard Wahl

All too often, the beginning beekeeper tries a few shortcuts, such as not leaving enough honey for the bees in the new hive over that first Winter or simply is not yet knowledgeable enough to spot problems before it is too late. The determined beginner buys another package and tries again. Since they have invested so much in hive equipment, the urge to keep going is huge. And then there are the few who simply give up or lose interest and try to sell off their nearly new, used equipment. I have to admit, I was one of those who for my first half dozen years was purchasing a new package every year to increase my hive count or replace a hive that did not survive the Winter. I have since found this to be an unnecessary expense by changing my approach a slight bit. Rather than maintaining only one or two hives, I have found it better to stay in the three to six hive range or even a few more. Or as our experienced bee club members recommend, keep a minimum of two to three hives with a nucleus (nuc) resource hive as a backup for each two to three honey producing hives.

The nucleus hive can be used for several purposes. It can be the source of a replacement queen if a primary hive were to lose their queen. A brood frame or two can be removed to strengthen a weaker hive; a drawn comb frame or even a honey filled frame can be removed to supplement a primary hive.

A nucleus hive ready for sale or the removal of a frame to strengthen an existing hive

The process of removing a frame or two can continue until mid-July in my area of SE Michigan where subsequent Winters can get quite cold and unpredictable. At that point, the nuc needs the remaining Summer to be allowed to grow with honey stores to survive the Winter or be married to another hive in its entirety. The weaker queen could be pinched if married to another hive or optimally the nuc is allowed to get strong enough to survive the Winter on its own. In the following Spring, it grows to become its own independent hive or again serves as a resource nuc. Using this method, I have not purchased any new bee packages in the past five or six years. My bees, which are now a cross of several different races, seem to have acclimated to our Michigan seasons and have continually produced as many or more bees and as much or more honey than any of my overwintered previous season package purchases.

Hive Strength for Splits

This begs the question, "When is the best time to do a first split?" Normally, a purchased package will need its first Summer and Fall to build up enough bees and honey supply to get through its first Winter. Once that goal is attained and the overwintered hive is perceived to be strong enough to split, the first Spring nectar flow is a good time to split. If all but one or two frames are covered in bees with three to four that have a preponderance of capped brood and eggs, the hive can most likely be split successfully.

A triple deep hive ready to be split into several nucs or starter deeps

If the goal is to simply increase one's hive count, the split can be smaller and the ensuing Summer used to build up the strength of the new hive. I once split a ten frame deep into three sections by inserting ¾ inch boards spaced to provide three equal, three frame spaces. I used small wood scraps to close off the notch where the frames sit. I made separate, wide inner covers for each section with screens over the inner cover vent holes. There was no way bees could move from one section to another. Separate entrances were provided on each of the three sides of the super bottom board, also divided into three sections, facilitating bees only coming and going to/from their own entrance. Within a week or two, each of the three frame nucs were moved to five frame nucs, continued to expand into second story five frame supers, overwintered

and were ready for sale the next Spring. If the intent is to sell a nuc or two, then most buyers will expect to get a five frame nuc with at least three frames of mostly capped brood, larva and eggs along with the queen that laid those brood/larva/eggs. The other two frames can be a combination of capped honey or nectar and pollen with not more than one frame partially empty or with open drawn comb. Some beekeepers may sell smaller four frame nucs with slightly lesser amounts of bee, brood and larva/eggs, so it is a good idea to be sure you understand what you are getting before you purchase a nuc. Another question that may be of interest is to find out if the queen is marked or not. The nuc seller may be willing to sell their wooden or cardboard nuc or may wish to have it returned after the bees are placed in a hive. All of these factors will play into the cost of the nuc and should be researched and clarified by the purchaser beforehand.

Split Timing

The timing of the newly begun nuc is also a factor. I have successfully started nucs in late Summer, overwintered them and sold them the following Spring at the beginning of the first nectar flow which normally occurs in the last week of April or first week of May here in SE Michigan. I have started nucs as late as the end of the first week in August, and with intensive feeding and monitoring they have made it through the next Winter. As a general rule of thumb, the greatest success with a newly started nuc will come if it is begun before the Fourth of July in my area. So the window to start most successful non-overwintered splits in my area seems to be from the first nectar flow in very late April or early May to the beginning of July. One key factor in monitoring splits is to make sure they have enough adult nurse bees to take care of the new brood that will emerge. Shaking a frame of nurse bees from the parent hive or another strong hive of the same race of bees into the nuc can increase success if it seems there are not as many bees as desired in the nuc.

Naturally, the new nuc will need a queen. There are several ways to accomplish this. One could buy a new queen for the nuc, but to some extent that defeats the goal of becoming a self-sustaining beekeeper. I believe an admirable goal of any hobby beekeeper is to become self-sustaining. The decision to purchase a queen may be based on the desire to get new genetics into the nuc or split off a hive so as to produce gentler bees, a more mite resistant strain or even a better honey producing hive. None of these are guaranteed by simply introducing a new queen regardless of the qualifications of the queen supplier.

Care should be taken if purchasing a new queen to match the race of the existing bees with that of the newly purchased queen. If the race of bees of the existing hive or nuc differs significantly from that of the purchased queen, the new queen may not be as readily accepted by the gaining hive or nuc. I find that moving an overwintered queen to the nuc from the hive that is donating brood frames works well. This allows for the near immediate sale of the split off nuc. The queenless hive is then left with a frame or two of eggs and small larva with some remaining capped brood to make and care for a new queen. This will delay the growth of the parent hive and subsequent honey production for about a month as several cells are chosen for new queen development (sixteen days from egg to emergence), waiting for the mating flights of the new queen (one to two weeks' time) and for the new queen to begin laying eggs that will take another 21 days to emerge as the new worker force. There is an old saying among beekeepers that, "You can raise bees or collect honey, but it is impossible to do both to the maximum or most efficient manner at the same time."

Another option is to leave the queen with the existing hive and allow the nuc to produce a new queen. This allows the donating parent hive to recover much more quickly with the new nucleus hive requiring about a month to produce a new laying queen before it would be ready for sale or development into an increase in hives. In addition, many of the donated nuc brood frame bees may have emerged and may need to be replaced with new brood frames from the parent hive before the new nuc queen is consistently laying eggs. Using this method and starting in this manner, my nucs are not ready for sale until the first weeks in June. During that time, I like to use the Boardman jar feeders to help the nuc get off to a strong start. The Boardman feeder makes it easy to monitor the one to one sugar syrup as it is being consumed by the bees during our variable nectar flows. In either case, the brood break that occurs as a result of raising a new queen serves as one of the integrated pest management (IPM) techniques used in the control of mites.

If selling nucs, it is also recommended that a mild mite treatment be applied to the new nuc before sale which may also be a selling point. A single strip of Hopguard applied to the nuc for fourteen days before queen emergence is my preferred nuc mite inhibitor. It should go without saying that whichever choice of queen development is followed, the desired traits of your best hives should be chosen for split increases or further nuc additions. The best nucs for the purchaser tend to be those that were started the previous Summer and have successfully overwintered. An overwintered nucleus hive provides nearly a month head start over the purchase of a package. Nucleus hives started in this manner often grow to two to three story nuc supers containing ten or fifteen total frames. As the queen begins laying new eggs and brood is capped in the Spring, the best frames can be reserved for sale with the five frame nuc while any extra frames are married to other existing hives or used to start additional new nucs.

A single deep ready to be split

Walk Away Splits

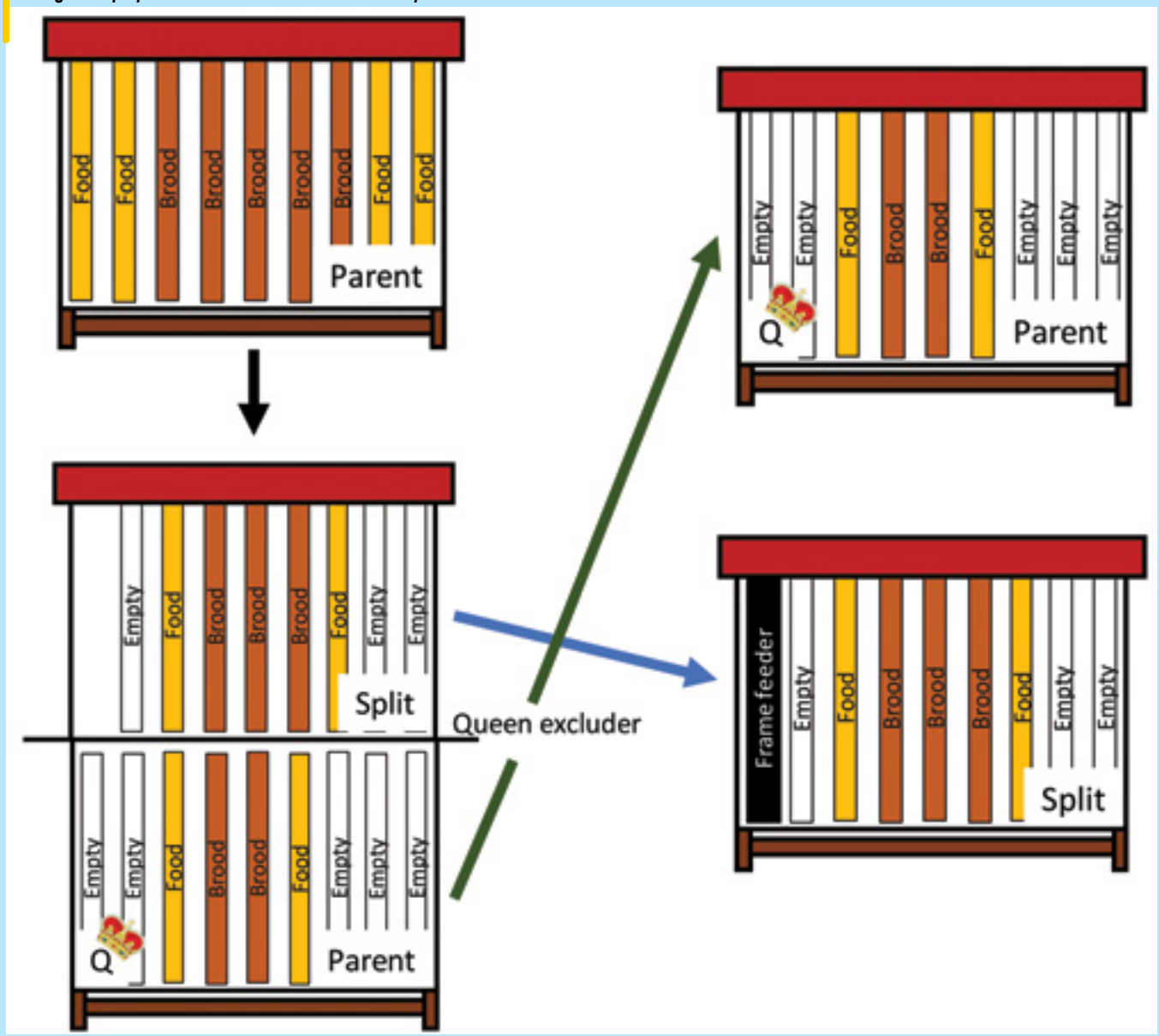
A walk away split is one of the easiest ways to increase your hive count. A populous single deep can be divided equally between two starter hives without regard to which half hive or nuc has the queen.

If both halves have egg and small larva, the queenless portion will commence to make a new queen cell or several cells, provided that eggs and small larva are present in each. Naturally, by not providing a new queen for the queenless half, that new starter hive will be about a month behind the other half. This is the one disadvantage to a walk away split. If the desire is to immediately get both splits off to an equal start, then a new queen needs to be purchased and care taken to ensure the purchased queen is added to the queenless half. I once assisted a new beekeeper who had purchased a new queen and was ready to split a strong hive that had two, ten frame deep supers. Carefully looking at each frame, it took quite a bit of time to go through twenty frames of bees to find the existing unmarked queen. She finally showed up on the eighteenth frame. We inspected as we were nearly ready to give up on finding her. If by chance the queenless half starts queen cells on more than one frame, the second frame with a queen cell or two can be removed, placed in a nuc and a few brood frames added from a different strong hive to get a third nuc or hive started. I have had success with this method on more than one occasion, getting three starter hives or nucs out of one split.

Split Mechanics

The optimal split comes from overwintered hives with two deep supers. An equal number of capped brood and egg/larva frames are moved to the center of each of the new starter supers from donating deep until all egg/larva/capped brood frames are placed. On either side of these brood frames are placed several frames of pollen and nectar/honey as the food source. Any remaining outer frames are of partial pollen or nectar or may even be empty until all frames from the original two deep supers hive have been evenly distributed between the starter hives. It is important to keep any brood frames together in the center of the starter hives since the bees must keep the temperature around the eggs, larva and emerging brood at an optimal state for best survival. A two deep split can be accomplished using a queen excluder, provided there is an upper entrance for the top deep, or the two deeps can be separated as in the illustration. In this manner, a second queen can be added to the queenless deep or the half without a queen can be allowed to raise a new queen, provided there are sufficient eggs and small larva in the queenless deep. This method works best if attempted early in the season when there is a strong nectar flow and greater urge for a hive to swarm.

A single deep split into two hives with or without queen excluder use



If splits are done later in the Summer, on warmer days, keeping brood frames together is not nearly as critical a step as when accomplished in late Spring or early Summer when temperatures can still vary greatly during the days and nights. If the beekeeper is only working with a single strong super that they desire to split, the process is the same except that the remaining missing outer frames will need to be filled in with new frames and foundation. Checking the newly split hives in a week or so after the split becomes important as any moved foraging bees will return to the parent hive. It may be necessary to shake a few frames of parent hive bees into the split-off hive to equalize the bee populations. Nurse bees on brood frames are the best to shake into the less populated hive since they have not yet become foragers and will not likely return to the parent hive. If one is using plastic foundation in their frames, I have found the bees begin to build new comb on the new foundation at a faster rate if a coat of melted beeswax is painted on the foundations before inserting them in a hive.

This is also an opportune time to cull older frames from the hive to be replaced with new frames and foundation. The buildup of pupa cocoon material as each new generation of bees develops in their cells, although minuscule-thin, does build up over time. It is therefore recommended to replace used brood frames every four to six years or when the foundation comb has seemed to darken and harden considerably more than other less used frame foundation comb. Drawn comb on foundation is a golden asset to the bees if the beekeeper has empty drawn comb from other hive disease free dead outs or hive combinations from a previous season. Although the exact stated number varies greatly, it has been said that bees must consume around ten pounds of honey to make one pound of wax. I think that one of the main reasons for success in getting my first swarm catch hive through its first Winter was because seven or eight of the mix of frame styles for my first ten-frame deep that I received from a nearby beekeeper contained empty drawn comb.

Benefits of Splits

I have found the main benefit of late Spring splits of a strong overwintered hive to be that it seems to cut down the tendency for swarming. In effect, a split is the same condition created by swarming and acts as an artificial swarm. Last year, I had six of my seven hives successfully come through the previous Winter. I judged all six to be strong enough for splits. In three instances, I moved the overwintered queen into the nuc and they were ready for sale as soon as I saw the queen was laying eggs on frames in the split off nuc. The donating hives were allowed to make new queen cells and raise new queens. In the other three, I left the queens in the donating hives and allowed the nucs to raise a new queen. This meant those nucs were not ready for sale for about a month while waiting for the new queens to emerge, mate and start laying eggs. Splitting all six nucs last year was the first time in my thirteen years of beekeeping that I did not capture a swarm. Although I believe most of my previous swarms were not coming from my own hives, there is no real way to prove this. I have a neighbor about two miles away who minimally treats for mites, if at all, and went into Winter with eleven hives. By early Summer, he was down to two single deep hives. I believe many of my previous swarms were the result of his minimalist approach to hive management when he had larger numbers of hives survive the Winter. So, if you are having frequent swarms and/or wish to increase your hive count whether for sale or your own use, splitting strong overwintered hives into nucs or additional hives may be the answer you have been looking for. As always your split results could vary based on your conditions, environment, experience or state of your donating hives, but give splits a try and have fun with more adventures in beekeeping. BC

Sometimes the Solution

John Kefuss

In 1975, I went to Weaver Apiaries in Navasota, Texas to learn commercial queen rearing and package bee production. At that time, Weaver Apiaries was producing 50,000 queens and 15,000 packages of bees a year. Today, they are producing much more. I started beekeeping in Canton, Ohio when I was 11 years old. But I did not have much experience in queen rearing and no experience in package bee production. So I knew that I needed more practical experience. For that reason, I went to Weaver Apiaries to get it hands on. If you are going to make mistakes, it is better to do it on someone else's bees instead of your own. It's a lot cheaper.

The year before, I had just finished my PhD studies under Dr. F. Ruttner in Oberursel, Germany, where I had studied the effect of photoperiodism on honey bee colony development. I applied for a research position at the honey bee research lab in Davis, California but I was among the numerous applicants that did not get the position. At that time, there were not many job openings available in bee research, so I decided to go from Frankfurt, Germany where I had studied Zoology to Toulouse, France to keep bees. The choice was simple, my wife is from Toulouse and the climate was good for bees.

When I got back from Texas, I began my queen rearing business "Le Rucher D'Oc". Then I joined the ANERCEA (French queen breeders association) not long after it was formed by Charles Goetz. In January 1982, I gave a talk at Lyon, France to the ANERCEA and later the ANERCEA published my price list free of charge for queens and insemination services (Tome 1 pages 146-148). This was probably the ANERCEA's first announcement for selling queens.

Before I left for Texas, I knew that there was a market for package bees in Europe, so I joined forces with Jean and Jacques Hollander and a few other beekeepers to produce swarms. They furnished the bees and I furnished the queens. One year we had an order for 100+ swarms of French Black bees for exportation to England. The English did not wish

is Simpler than You Think

for yellow Italian bees, they only wished for French black bees. At that time, our French black bees were real stingers. They stung faster than a flash of lightning. But that is another story.

Several months before the shipment, I went to the French customs service at Portet-sur-Garonne to take care of the exportation paperwork. Not so easy for an American even with a "Toulouse accent". But I am used to solving problems because I have them all the time. Actually, I am surprised when I don't have any problems. I filled out their customs papers and paid the cash deposit that they requested. Everything had to be coordinated in advance because the packages were to be driven from Toulouse, in the South of France up to Dunkirk, in the north of France to be shipped by boat to England. At that time, it was a good days drive when things went well.

I pulled out the queens the day before we shook the packages. The rainy weather was not good on the day we shook the bees. We were wet to the skin. Our bee suits stuck to our bodies. The bees were so mean that they stung everything that moved. A big brown hawk that was sitting in a tree watching us was stung so bad that it fell to the ground on its back with its wings completely spread out like it was nailed to a cross. Its beak was wide open as if it was trying to scream but it did not make a sound. I still feel pity for that bird. Jacques Hollander's bee veil was too close to his ears and he put scotch tape on his ears to protect them. He was shaking bees in open sandals with no socks but did not get any stings on his feet. I had a few small holes in my bee suit and of course the bees found them. I had the feeling that more bees were crawling inside than outside my bee suit. I got stung in a few areas that I won't mention. I was not crying, but at one point a stream of "water" came out of my eyes. On the positive side, after the first 30-50 stings I did not feel the additional stings or pain anymore. Just a warm feeling. It was shake bees as usual and get the job done.

We took the packages back to Hollander's honey house in Toulouse and prepared them for shipping. Then, we drove the bees to the customs service at Portet-sur-Garonne to complete the customs inspection and paperwork. We were wet, covered with mud, bee stingers, hadn't shaved for a few days and probably did not smell or look very good. Someone you really would not like to meet at night in the dark. But for us, the main thing was that the packages were in the truck and ready to go.

At the customs service, I handed them the paperwork and told them that the truck (the English vehicle with its steering wheel on the right side), was driving in a clockwise circle in the customs loading area below with its rear doors open to keep the bees cool. When they were ready we would stop the truck so that they could inspect the packages. The officer asked me if I was a transit agent and I said no, but that several months earlier I had visited the customs office to check out their conditions, filled out the papers and paid them their fee. He shook his head and said *"This is France... we don't do things that way"* and refused to sign the papers. Then he sent me upstairs to the third floor to talk with the director. The answer again was an emphatic no. When I went back downstairs the agent who had refused to sign my papers angrily waved me into his office, stamped my papers and told me in a very strong voice *"Here's your papers, never come back!"* At the time, I did not understand why they had suddenly decided to complete the paperwork. But you know people do change their minds, so being polite I did not ask him why. You can't imagine how good I felt when I got the paperwork completed and was able to get out of that building. Some feelings just can't be explained.

A few moments later, I found out why the paperwork was so quickly completed. The English driver told me that while I was in the building trying to get the papers signed, a group of angry French bees that were on the outside of the packages flew out of the truck and quickly stung up the customs inspectors and people on the loading platform. The customs employees closed all the doors to the customs loading platform, which completely blocked all customs activities for everyone else. The English driver said that there were two to three people looking out every window of the three story administrative building at the action that was taking place in the courtyard below. Perhaps they were attracted by the screams and rapid movements of the customs employees and customers running inside and closing the big doors. But thanks to the bees, the customs agents got the point and we got our administrative papers. "Nature" has a way of solving complex problems. Sometimes the solution is simpler than you think! We left the customs buildings as fast as possible and never came back. BC

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10-24.....$22.25	#4	119.25	116.75	115.25	113.25
25-UP.....$22.00	NO NUCS THIS SEASON				

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QUEENS	PKGS.	1-9	10-24	25-99	100-UP
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10-24.....$24.50	#4	122.25	120.25	118.25	116.25
25-UP.....$24.25	NO NUCS THIS SEASON				

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Tradescantia – A Pollinators' Feast for Shade

Alyssum Flowers

Tradescantia ohiensis *https://www.northeastpollinator.com/products/tradescantia-ohiensis*

Tradescantia virginiana *https://www.illinoiswildflowers.info/savanna/plants/va_spiderwort.htm*

Tradescantia ***"Charlotte's Web" PPAF CPBRAF*** *http://www.perennialresource.com/variety.php?ID=TRACW*

It is relatively easy to find blooming plants for sunny areas, but growing shade plants that provide food for pollinators can be difficult. *Tradescantia*, known as Spiderwort, Dayflower or Trinity Flower is an easy answer to offer color, interesting flowers and striking foliage contrast as well as nutrition for bees, butterflies, select beetles and syrphid flies and other pollinators.

Spiderworts are in the *Commelinaceae* (Dayflower) Family and native to the United States but have been naturalized worldwide. In fact, over seventy five species are known and have been found growing from southern Canada to South America! Some species tolerate moist woods, some tropical humidity and some arid, sandy conditions. Several are popular houseplants, such as Moses-in-the-Boat and Wandering Jew. The genus is named after John Tradescant (1608-1662) who served as gardener to Charles I of England. The origin of the name "Spiderwort" has two explanations. It may be derived from the resin secreted from a cut stem, that once hardened, becomes threadlike and thought to resemble a spider web; or another suggestion is that when looking down at the flower with the alternating leaves beneath it, resembles a spider squatting.

The species found in Eastern United States are *Tradescantia ohiensis* (called Bluejacket), *T. subaspera* (zigzag spiderwort) and Virginia spiderwort (*T. virginiana),* which are used to cultivate numerous varieties for gardens. Native Americans used Virginia spiderwort to treat illnesses such as stomach aches and cancer. The Native Americans gave pieces of the fleshy root to early settlers in the 1600's to grow for medicinal purposes, however some research shows that it is mildly toxic for humans to eat. Interestingly, the fuzzy filamentous hairs in the center of the flowers turn from blue to pink when exposed to low levels of nuclear radiation, so perhaps we should all grow some of these useful plants!

Tradescantia varieties developed for the United States grow well in moist, shaded areas with loamy, rich soil but can easily adapt to home gardens, naturalized areas, rain gardens or along garden pathways. It is impressive in mass plantings or in border gardens, although it mixes well with bushy plants, especially in mid-Summer when it can get leggy in hot Summer sun.

The flowers of spiderwort are as unusual as the one inch wide, 12-18" long grass-like leaves folded lengthwise that taper to a point. The leaves can be bright green or olive green, variegated, gold or lavender and clasp the flowering stems. The clump-like plants display three petaled flowers forming a triangle, with cultivars available in deep or light blue, lavender or pure white – truly spectacular! In partial shade, these gems will continue to bloom from Summer to Fall. In deeper shade, they may have fewer flowers. Keep in mind that each flower lasts one day, then fades and eventually forms a three lobed seed pod, which is as unique as the rest of the plant. Like

most perennials, if the spent flowers are removed, the plants will continue to bloom with gusto. If they receive too much sun, the leaves may burn and die. Mow the plants at the highest cutting height in mid-Summer to encourage new growth and renewed flowering.

Although the species *Tradescantia* are commonly grown, many *cultivars* offering multiple color combinations, sizes and growth habits are available for your designing pleasure. *Tradescantia* 'Charlotte's Web' PPAF (U.S. plant patent applied for or pending) is one of the favorite cultivars and was planted at the A.I. Root Company in Medina, Ohio. The lime green leaves emerge in early Spring and become more golden as the Summer progresses. The true-blue flowers which appear in June, are a stunning contrast against the golden leaves. This cultivar grows 16-18" tall and spreads about two feet. Hardy in most Northeastern regions, it grows in Hardiness Zones three to nine. "Bilberry Ice" sports pure white flowers with deep blue pollen filaments, while "Purple Heart" has purple leaves and violet petals.

Enjoy these beauties in your yard and wait for the pollinators to arrive! Although *Tradescantia* will self seed, you can also cut sections of the root with a sharp shovel, once the plants are mature enough that side shoots begin to emerge from the stem. Make these splits in Spring or Fall when the soil is moist, then plant as soon as possible to prevent the roots from drying, and share with fellow gardeners. Hassle free and deer resistant, spiderwort will be an easy and unusual addition to any moist, shaded area of the yard. BC

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Tradescantia x andersoniana *"Bilberry Ice"*

T. pallida, *"Purple Heart"* *https://hort.extension.wisc.edu/articles/purple-heart-tradescantia-pallida/*

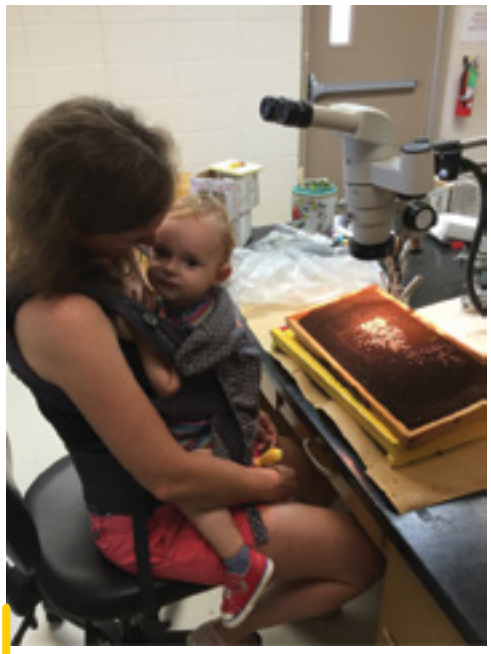


Photo by Bob Danka

Baton Rouge Scientist Spotlight

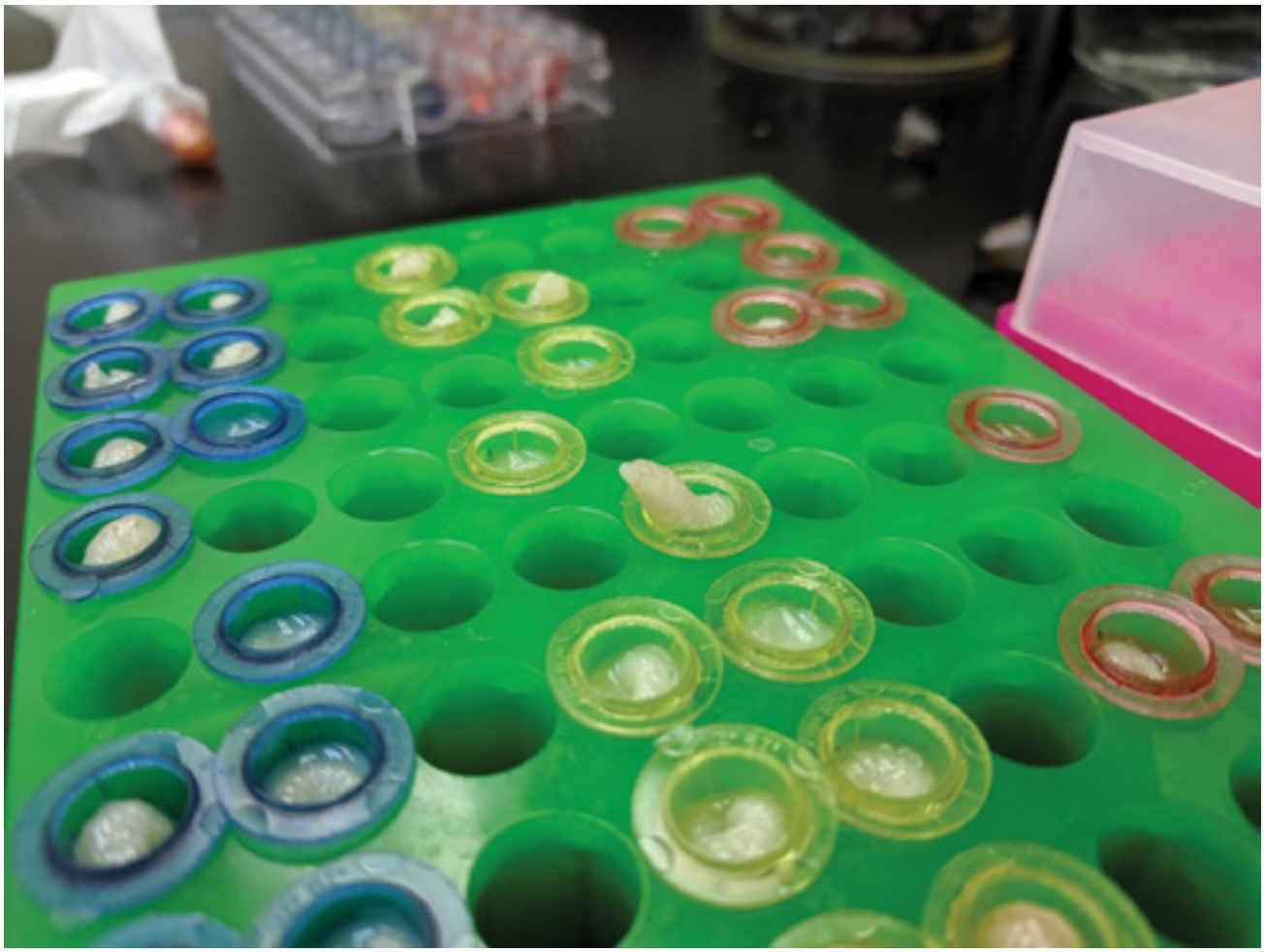
Kate E. Ihle

Kate Ihle, USDA Baton Rouge

In the USDA lab in Baton Rouge, our mission is to breed stronger, more resilient honey bees. We typically do that by looking for traits in worker bees that keep colony pest populations low, help them resist disease and keep them alive longer. We often tend to test disease resistance, pesticide tolerance and other physical traits in individual workers. But honey bees are social animals, and we know that what's best for an individual bee might not be best for the colony.

Honey bees have their own individual immune systems and defenses, but they also have defenses against disease and parasites – this is called "social immunity" (Evans and Spivak, 2010). A stark example is called "self-removal" in which worker bees that are diseased or under too much stress of any kind will leave the colony early and permanently—in some cases, leaving so young that they're not capable of strong flight. In this act of apparent self-sacrifice, they remove a potential source of broader infection from the colony. Social immunity behaviors have also been the base of successful breeding programs for *Varroa* resistance. Two well-known examples are the hygienic and VSH behaviors selected for in the Minnesota Hygienic and VSH Pol-line stocks. In both of these stocks, worker bees uncap and remove diseased or parasitized brood, helping to keep the colony healthy. But at the same time, hygienic behavior can expose them to whatever was afflicting the pupae that they remove.

Social immunity is a key defense against *Varroa* in the Eastern honey bees (*Apis cerana*). This Asian bee is the original host of *Varroa* mites, and they can thrive with active, untreated *Varroa* infestations by successfully keeping the mite populations low and relatively steady without human intervention. They don't experience the seasonal peak in *Varroa* levels so familiar to beekeepers in the United States and Europe who use the Western honey bee (*Apis mellifera*) in their operations. One major reason for *cerana's* steady mite levels is that *Varroa* almost exclusively reproduce in their drone brood. As drone production is limited in number and in the time of production, there are fewer opportunities for *Varroa* to produce new



offspring (Fries et al., 1994). That is not to say that *Varroa* don't infest *A. cerana* worker brood.

Varroa mites do infest worker *cerana* brood, but as *cerana* are highly hygienic, many of those infested pupae are removed by adult workers. However, this didn't totally explain the near zero mite reproduction in worker brood cells. Recently, an international group of researchers discovered that the worker brood in *Apis cerana* is actively involved in the colony's ability to tolerate *Varroa* infestations. The researchers introduced mites into newly capped brood cells or gave the pupae tiny wounds to mimic a *Varroa* feeding site, and raised them in an incubator to keep them away from their hygienic older sisters. They found that the pupae that had a mite or wound significantly slowed their development and eventually died, preventing the mites from successfully reproducing (Page et al., 2016; Lin et al., 2018). They called this phenomenon "social apoptosis" after the way that cells can initiate a self-destruct process when they're infected to prevent the spread of that infection.

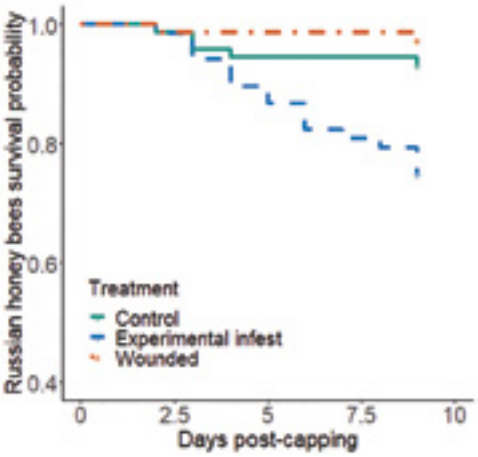
The social apoptosis trait is another very stark example of a social immunity trait. Worker pupae appear to be very delicate or susceptible to illness and injury. Counterintuitively, these fragile pupae help contribute to strong, healthy colonies by limiting the reproductive opportunities for mites and potentially the diseases that they carry. We were curious if this mite resistant trait was present in *Varroa* resistant lines of the Western honey bees.

Here at the USDA Honey Bee, Breeding, Genetics and Physiology lab in Baton Rouge, we've bred and released two *Varroa* resistant stocks: the Pol-line and Russian honey bees. These stocks were bred from bees with very different histories using very different selection regimes. The Pol-line were bred from commercial stocks of Italian honey bees and were bred for a very specific trait: suppression of mite reproduction (SMR). Colonies that score high in SMR not only have low *Varroa* numbers, but the mites that do infest cells are less likely to have offspring. The Russian honey bees were brought from the far east of Russia, near Vladivostok in Siberia. These bees are thought to have the longest association with *Varroa* of any Western honey bee, as their location overlapped with that of *cerana's*. They were subsequently bred by the USDA for low mite population growth over the Summer months.

We tested for the social apoptosis trait in these stocks by manipulating same aged, newly capped brood from the two resistant stocks along with commercially available Italian honey bees as our non-mite resistant control. In the lab, we removed the cell caps and either introduced a *Varroa* foundress, gave the pupa a micro-wound or left the pupa unmolested. We covered our manipulated cells with the ends of clear pill capsules. Dr. Lilia De Guzman developed this simple, ingenious technique that allows us to watch as the brood develops and the *Varroa* reproduce (super fun project for kids or science fairs!). We kept these

frames in an incubator to keep them away from adult workers who would clean up the mess we made and end the experiment. At the end of our experiment we were excited to see clear evidence for social apoptosis in the Russian honey bees, where our experimentally infested pupae died at significantly higher rates than the wounded or unmolested groups, but also at higher rates than the experimentally mite infested Italian bees. We also found hints of the social apoptosis trait in the Pol-line pupae, but not to the same extent as in the Russians. This research showed that brood can contribute to Western honey bee colony health, but sometimes in surprising ways.

When I first started in the lab four years ago, I came in with the idea of targeting brood resistance mechanisms to breed for more resilient bees. What I was envisioning was raising brood in the lab and trying to find the ones that were the strongest, the ones who could survive infestations and infections best to breed the Iron Man of honey bee pupae. What I found instead was that by breeding for super strong brood, I could be removing an important *Varroa* resistance trait. I learned in the process that sometimes the fragility or susceptibility of an individual pupae or worker might be the key to breeding healthy colonies. That is one of the most important challenges and quirks of breeding honey bees: as social animals, it's the sum of the traits of the colony members that determines the resilience and strength of the colony. And sometimes that colony-level strength relies on the apparent weakness of its individual members. BC



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THE NUC HOUSE REVIEW

James Masucci

In January, I wrote about two things I tried to help my bees overwinter ("Ready for Winter – Maybe" January *Bee Culture*, **https://www.beeculture.com/ready-for-winter/**). It's time to review one of them, the European-style bee house used to overwinter my nucs. The bee house, which I am calling my nuc house, is partially insulated, heated with two space heaters, and was loaded with ~70 nucs ranging from two to six frames each. The circumstances at the time didn't allow me to put much effort into this little experiment, so I threw what I had into the nuc house without any documentation. However, I have been able to observe colonies as Winter progressed and I've been able to determine that the nuc house is worth it for me. It's not necessary, nor is it without problems, but it does help me solve one of my beekeeping dilemmas… how do I sell a lot of nucs without hurting my production hives?

Picture 1: Inside of the nuc house described in the January 2023 issue of* Bee Culture. *The insulated building is heated by two space heaters, which maintain it at 55°F. In very cold weather (-6°F), indoor temperatures are 30°F warmer. Each colony has its own entrance to the outside. The building allows for easy feeding and access to the hives.

Before I describe my strategy, there is an important albeit old, lesson in all of this… garbage in, garbage out. This should be no surprise to anybody. No facility, no matter how fancy, can make up for poor beekeeping. I went into the Winter season with about 70 nucs representing a range of quality. At the time of writing this, in mid-February, 54 nucs are still alive. Because it is a heated building with red lights, I feel comfortable peeking inside to evaluate the cluster size (yes, the bees still cluster even though it is warm inside). What I found was encouraging. Most of the colonies that died were tiny. Some were robbed out and some died as baseball-sized clusters that had no right going into Winter in the first place. Those still alive range from softball sized clusters to large, legitimate nucs. I anticipate some, but not all, of these smaller nucs may not make it either. Even though there may be little value in getting the small colonies through the Winter, (they will be too small for Spring build up) I believe these results highlight how the heated building makes it easier for colonies to overwinter by tempering the cold.

It's this tempering that is the advantage of the nuc house! What happens if bees start brooding up too soon in the year? A cold snap hits and the bees have to choose between covering the brood or clustering. In the first case, they die. In the latter, they survive, but lose all their brood. A lot of resources went into that brood, resources needed to make the transition from overwintering to Spring build-up. Some colonies will never recover. Take away the danger of the cold snap and the risks of brooding up early become minimal. Because the nuc house is heated, I can entice these bees to brood up sooner (see picture 2), thus providing more bees in the Spring. More bees mean more opportunities.

I make money selling nucs and honey and generate my own queens for Summer requeening. I sell overwintered nucs that are delivered in mid-April and Spring nucs, derived from splits, that are delivered in mid-May. Everyone wants their bees early, so there is more demand for the overwintered nucs. The issue is that overwintered nucs come from strong, overwintered colonies where I remove the queen and five frames and recover the remaining bees with a purchased queen. The Spring nucs come from splits I do for swarm control. The demand for nucs is large, so I am constantly balancing how many nucs to sell vs how many hives remain for production. Throw in a high mortality Winter or the desire to expand my operation, and the honey harvest goes down because I don't have enough production colonies. In addition, all the bees I need for queen rearing come from my production hives. With the nuc house, I no longer need to choose between honey and nucs.

I developed a strategy to eliminate the conflict between selling nucs and selling honey utilizing the nuc house. I've outlined the new strategy in Figure 1 where I manage two populations of bees. I eliminate the need to steal bees from my production hives to meet my nuc and queen demands. On the left side of the figure is the general scheme for my production hive management. Pollen starts coming in towards the end of February and I can start feeding in March. I do swarm management splits in April. I use those splits to fulfill any colony

need in my production fleet. In addition, I use the large population of bees at the end of the honey flow to make mid-Summer splits which I grow into nucs for the nuc house. The number of production hives remains constant and focused on production until the honey flow is over. Only then are they used to build-up the nuc population.

On the right side of Figure 1 is the management of my nuc population. Because of the heated building, I can start feeding (syrup and protein, notice feeders in Picture 1 and pollen substitute bucket in Picture 2) a month sooner than the outdoor bees, giving them extra time to build up in the Spring. The larger nucs can be sold in mid-April, whereas the smaller, healthy nucs can build up an extra month and be sold in mid-May. The left-over bees from the nucs (there are always more than five frames of bees in the colonies), go towards mating nucs. These mating nucs are used to: 1. Provide bees for cell builders, 2. Draw out comb, 3. Mate queens. The number of nucs available for sale becomes dependent on the number of Summer splits I do. Something in MY control.

The strategy I just described is not dependent on a heated nuc house. Strong nucs will survive outside. I have done it. One could easily substitute a nuc yard for the nuc house in Figure 1. There is an argument that having the colonies separated is the better option due to drifting, disease spread and robbing. Plus, there is the cost of both building and heating the nuc house. But there are several advantages to the nuc house. The biggest is the early Spring build up. An extra month is a big advantage. Mid-Summer splits don't always grow as fast as I want them so the nucs may not be as large as I want them going into Winter. Having all the nucs in a heated building, conveniently located next to my honey house where I visit often and have the capacity to make up syrup, means that I can baby them through the Winter resulting in fewer losses and more bees to start the Spring build-up. In the end, I am glad I did it. I will make some improvements to the bee house (like more insulation) and implement my new strategy. Hopefully, you will hear how I reached both my honey production goals AND my nuc sale goals. BC

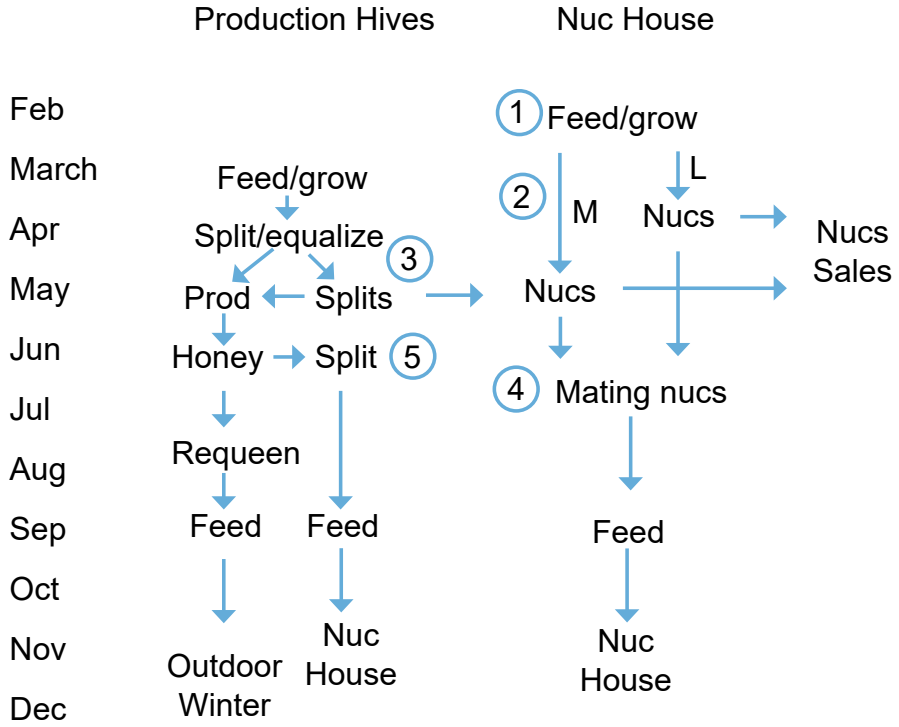

Figure 1: The nuc house allows me to separate my nuc business from my honey business. On the left is the general timeline for production hive management. On the right is the general timeline for nucs. The key advantages to this strategy are labeled 1-5.
1. The heated building reduces the risk of chilled brood, so I can induce brood rearing sooner.
2. The extra time gives smaller clusters (M) more time to build up, making them available for mid-May nuc sales.
3. With a healthy supply of overwintered nucs, I can focus my production hives on production, using splits to repopulate production yards.
4. Extra bees from making nucs go into mating nucs, which eliminates the need to use production hives to source my queen rearing needs.
5. Mid-Summer splits are used to grow a healthy population of nucs to overwinter.
M = medium-size nucs. L = large-size nucs.

Picture 2: Outdoor feeding of pollen substitute to induce brood production can occur earlier with the nuc house since the heated building reduces the risk of chilled brood in late Winter / early Spring.

IMPROVING HONEY BEE QUEEN QUALITY AND DIVERSITY IN OHIO

Hongmei Li-Byarlay is working to improve the quality and quantity of queen bee production in Ohio. Photo courtesy of the Li-Byarlay Lab.

Ohio beekeepers are losing 50-60 percent of their managed bee colonies each year, according to Hongmei Li-Byarlay, Associate Professor of Entomology at Central State University. Li-Byarlay studies the genetics and behavior of honey bees and believes mite-resistant bees could help improve Ohio honey bees. Her research lab focuses on honey bee genetics and behavior, and recently she has been exploring queen bee quality and genetic diversity.

"Promoting mite-resistant bees is one of the most effective ways to mitigate bee decline," said Li-Byarlay. "We have a collection of bee stocks from feral colonies that are mite resistant with high mite biting behavior. However, the limiting factor is too few queens and nuclei available to fulfill the demand of local beekeepers."

With support from an NCR-SARE Partnership Grant, Li-Byarlay's Lab worked with experienced queen producers in Ohio to improve the queen quality of honey bee stocks in Ohio.

"We want to improve the beekeepers' understanding of the biology of queen bees and help to transfer and distribute favorable genetics to more bee farmers," said Li-Byarlay. "The outcome is to improve the quality and quantity of queen production in the region."

The Art of Grafting

Commercial queen bees start their lives through an activity that queen rearers call "grafting." Grafting is when queen bee producers transfer young larvae from breeder queens into cell-building colonies. The traditional grafting process takes ten days and requires specialized knowledge and resources.

For this SARE project, Li-Byarlay successfully used a relatively new 48-hour method of grafting. This abbreviated 48-hour method is promising because it's faster and requires fewer resources than traditional queen-rearing.

"For many beekeepers, the bottleneck to diversifying their queen genetics is finding an affordable price for queen purchasing," said Li-Byarlay. "Our approach is to lower the cost by providing 48-hour queen cells. At the same time, beekeepers can have more diversity in their queen and honey bee colony genetics in their backyard, which will promote more outbreeding and less inbreeding."

Feral vs. Commercial Bees

The team studied feral, Russian and commercial package bees when looking at the egg-laying behavior/rate of queens from different bee stocks. Queen cells from Russian stock, feral colonies and commercial queen stock emerged, mated and were placed into new nuc colonies with the same amount of worker bees.

Results showed that the feral bees had a higher egg-laying rate than the commercial bees. The team hosted field days to demonstrate how to do queen rearing and make 48-hour queen cells. 100 queen cells from their mite-resistant stocks went home with workshop participants. They also held several workshops on how to make and use swarm traps to catch feral bee colonies.

"Overall, we have had a broad impact on the change of knowledge in queen rearing, genetics and breeding in Ohio, especially in Southwestern Ohio regions," said Li-Byarlay.

NCR-SARE starts accepting Partnership grant proposals in mid-August. Learn more at **https://northcentral.sare.org/Grants/**. BC

Xaryn Cleare, an alumnus of the Li-Byarlay Lab, transfers young larvae from breeder queens into cell cups. He will place these in a nutrient-rich starter hive. The queen cells will then hatch into future queen bees. This process is called "grafting". Photo courtesy of the Li-Byarlay Lab.

Want more information? See the related SARE grant:

- Improving the Honeybee Queen Qualities and Genetic Diversity by Transferring Selected Queen Cells (ONC19-062) **https://projects.sare.org/sare_project/onc19-062/**

Originally published at **https://northcentral.sare.org/news/improving-honeybee-queen-quality-and-diversity-in-ohio/**

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For context...

As most of you hopefully know, the potential of another parasitic mite of honey bees, the *Tropilaelaps* mite that is spreading globally, will at some point enter North America.

There are concerns from the American Honey Producers Association (AHPA) and the American Beekeeping Federation (ABF) of this mite and additional honey bee health decline in the U.S. These concerns are based on the importation of package bees from countries outside of North America into Canada to replace losses. These countries, because of location, have more of a potential of *Tropilaelaps* accidental introduction into them. U.S. imports of package bees into Canada, currently restricted, does not have significant pest, parasite or disease issues that are different than Canada, according to AHPA and ABF.

The statement below from the Canadian Honey Council addresses this situation.

Jerry Hayes

A Statement from the CHC

Rod Scarlett

Canadian Honey Council

It is indeed unfortunate that the American Beekeeping Federation, the American Honey Producers Association and those Canadian operators having an interest in importing American packaged bees are attempting to capitalize on the fear of introducing *Tropilaelaps* mites.

The Canadian Honey Council would much have preferred if the ABF and the AHPA had first contacted the CHC for information regarding status, demand and possible rationale for border opening. The CHC would have appreciated nothing more than to add to a substantive history of working together in a mutually beneficial manner. As it is, the CHC feels it necessary to clarify some issues concerning Canada's permitted importation of package bees, particularly from Australia as well as the threat of the introduction of *Tropilaelaps* mites. With respect, the two issues should have been dealt with separately, but they have unfortunately been intertwined.

The CHC represents every provincial beekeeping organization in Canada and as such, speaks for all beekeepers. The package issue in Canada is divisive, but it is important to note that the interest group calling for the opening of the U.S. border does not represent all commercial operations nor is it even clear they represent a majority of commercial operations. They do, however represent a substantial number of colonies in certain regions of the country and we continue to listen to those from all points of view.

The CHC and the ABF have had a good working relationship. More recently, we have expanded our relationship building to work closer with the American Honey Producers Association. While honey sales, adulterated honey and trans-shipped honey has been a primary concern, stock issues, particularly related to queen sales has also been important. Working with California queen producers, the Canadian Honey Council was able to ease some of their reporting burdens and when "Africanized bees" were found in the quarantine zone, we were quickly able to work with the Canadian Food Inspection Agency based on science and agreed to developed strategies to mitigate the issue. Consequently, imports were resumed in a timely manner.

Last year, Canadian beekeepers from most areas in the country experienced devastating losses and the demand for stock increased dramatically. Calls to open the border to U.S. packages intensified, firstly focusing on receiving packages from the northern California quarantine zone, then expanding to Georgia and now the mainland U.S. The Canadian Food Inspection Agency put out an open call for additional research to see if there were any changes to the risks that had been identified in a 2013 risk assessment of U.S. packages. Four risks were identified in 2013:

- Amitraz resistant mites
- Small hive beetle
- AFB resistance
- Africanized bees

The CHC has indicated that if the science supports the decision to open the border, the border should open. However, it is not up to beekeepers or associations to determine if the science is sound, it is up to the experts at CFIA that evaluate the honey bee health status in Canada and the potential bee exporting country. For example, there have been assertions by some Canadian beekeepers that there is amitraz re-

Year	# of Packages	Total # of Colonies	Year	# of Packages	Total # of Colonies
2008	11,070	570,070	2016	44,997	767,683
2009	11,360	592,120	2017	27,387	790,668
2010	10,622	620,291	2018	31,638	790,023
2011	42,466	637,920	2019	41,339	791,051
2012	33,913	690,037	2020	13,746	764,616
2013	65,066	667,397	2021	8,661	834,262
2014	52,774	696,252	2022	56,737	764,828
2015	55,786	726,008	2023	TBD	

Table 1

sistance in Canada. Certainly, some "preliminary" work has been done and it suggests that there may be limited emerging resistance in some operations, but no conclusive or scientific evidence has been produced. Moreover, the African bees, AFB resistance and the small hive beetle are issues that must be addressed and mitigated to acceptable levels of risks to the CFIA and Canadian beekeepers.

It may very well be that CFIA decides that a new risk assessment should be conducted, but it will be because of scientific reasons, not political or economic reasons. As for package bees imported to Canada, Table 1 shows the historic numbers.

For many operations, they are producing their own stock and as COVID-19 restrictions proved, domestic production and domestic sustainability are goals we in Canada need to work towards.

For some reason, the Canadians wishing to import U.S. packages decided to introduce the threat of *Tropilaelaps* entering the USA from Canada. Last year, about 38,000 packages came into Canada from Australia. Where does Canada get its package bees from in Australia? Australian package bees come from regions of the continent that are isolated by unpassable physical barriers to bees or the human trafficking of bees (4000 km of desert and the Tasman Sea – its 1,000 km by sea from Sydney to Hobart). There is no *Tropilaelaps* in Australia. In addition, New Zealand is just as close or closer to where *Tropilaelaps* is found and it is important to note that the U.S. can import bees from New Zealand (**https://www.aphis.usda.gov/aphis/ourfocus/planthealth/import-information/permits/plant-pests/bees/honeybees-other**).

A North American concern is justified, but it is far more likely that the mite will arrive by ocean liners than it will by packaged bees. The U.S. has 162 ocean freighters arriving every day and many of those are from China and Japan, two countries much more likely to have unwanted "visitors" aboard. That is why calls in the USA for sentinel hives at port have increased. Canada needs to step up as well, but by eliminating the countries we currently import packages and replacing them by U.S. packages is not the answer unless the science warrants it. We need not confuse the opening of the border to packages from the U.S. with closing the border for all other imports. This is not a trade issue, it is always looked at as an animal health risk issue. Even those Canadian commercial operators who want to see the border open should be wary of putting all our eggs in one basket. BC

Rod Scarlett – Executive Director, Canadian Honey Council

BUYING AND ESTABLISHING BEE COLONY SPLITS

Listen along here!

Lots of suggestions, but not many rules

No doubt, you've heard this before

When either presenting or listening to a discussion on increasing bee colony numbers, there is always an informational requirement to list the four major ways to increase colony numbers: (1) Buy a package of bees, (2) Buy a colony split, (3) Capture a swarm or (4) Purchase a fully functional colony from another beekeeper[1].

Nearly always, the presenter then elucidates the advantages and disadvantages of each option. Procuring a swarm requires good luck and purchasing a colony requires just about as much luck, but much requires more monetary investment. The two surest options for increasing (or replacing) colony numbers are buying a package or buying a split.

Package bees

Purchasing a package of bees is the tried-and-true option for getting new bees at a time when you are most prepared for them. While I have always enjoyed installing packages, some common problems can present. Maybe something goes wrong with the queen. Maybe the bees drift to other colonies. But I suspect the most routine negative characteristic of package installation is the adult bee population drop that begins to occur within a few days after the package is installed. This happens every time and in every package.

In total, it takes a serious amount of time for the queen to become established, begin laying, brood to develop and then twenty-one days later, for new workers to emerge – maybe four to five weeks. Therefore, four to five weeks after the installation date, the beekeeper has significantly fewer bees in the hive than when the package was originally installed. Any worker bee that died during that broodless period was not replaced.

Colony splits

Colony splits with established queens on a brood nest eliminate the characteristic population decline that is experienced with package bees. Those are the main selling points for colony splits. The split comes with an introduced queen that should be laying the entire time that the colony is being established in your yard. So why does anyone ever buy a package? Because they are readily available.

There has never been an established bee industry infrastructure for routinely producing and distributing splits. Every season, you and I must search for someone who has decided to split their bee colonies and equipment from their established colonies, provide a queen, and sell these *"baby"* colonies. The cost in time, and energy from both beekeeper and bees is significant, so the selling cost of the split is always more than the selling price for a package.

Figure 1. A five frame split awaiting transfer to standard equipment.

In general, I prefer splits over packages, but the split-purchasing and installing procedure can be more complicated and costly than the simplicity of package usage.

In all my years of buying packages and splits, I have found that for me, personally, the confusion is in the details. What details? Well, there's quite a few. In no order of priority, I would like to review some of these characteristics below.

Detail #1 – Split vs Nuc

Splits and nucs are essentially the same bee hive component, but not exactly. In my opinion, a split is a type of nuc that is intended to grow into a fully functional colony. That can't be said of all nucs (aka nucleus hives or nucleus colonies). For instance, some nucs are only intended to be a component of queen production. They will never grow to full-sized colonies. Other nucs have specialty functions such as populating an observation hive or possibly being used as a component of a colony cut-out procedure (removing a bee colony from a building). Various sizes and components of nucs frequently have significant use in the scientific community and research organizations. A nucleus hive is frequently just for the moment.

In a way, a nucleus hive could be said to be comparable to a cutting taken from a plant. How big was the cutting? How was the cutting rooted? When, during the season, was the plant cutting taken? A nucleus hive is just a bee colony *"cutting."* Details and specifics abound.

Detail #2 – Where to find a split colony purveyor?

A few paragraphs ago, I wrote that a nucleus hive is frequently just for the moment. In a way, I want to write that finding someone

James E. Tew with two splits (Circa 1995)

[1]Removing bees from a building or a tree is an unlisted specialized method of acquiring bees. For most of us, such events do not routinely occur.

to sell you colony splits is also for the moment (or season). I ask around. I have contacts from previous seasons. I read advertisements in journals and newsletters. I see online messages. In general, I try to make good luck happen when searching for a producer. In a few instances, the producer was actually just doing me a favor and was not in the split-producing business. In fact, only in a couple of instances have I purchased splits from the same person more than two consecutive seasons. Why? Let's go with that discussion in Detail #3 below.

Detail #3 – Why produce splits for sale?

There is no single standard reason that jumps out to me that justifies someone splitting their colonies. Monetary income is the clear and present reason, but that is always hard-earned money. Other than money, it could be local reasons. Maybe the beekeeper who is interested in selling splits is in an area that provides good early Spring buildup and is followed up with a good main nectar flow. They have bees, but those bees do not make a lot of honey. So, they sell bees and not honey.

A producer may be trying to prevent upcoming swarming behavior. To limit that behavior, the beekeeper simply removes some of the bees and brood from the brood nest. Maybe the beekeeper has more colonies than can be maintained. Maybe the beekeeper is interested in doing something different that will provide a needed flush of extra income.

Bottom line? I don't know exactly why someone decides to produce splits for sale. Other than large production companies that have management sophistication beyond that of a typical beekeeper, most split producers have limited production capacity and are local. In my bee life, providers vary from season to season.

Detail #4 – What am I paying for?

You are paying for whatever you have negotiated. Unlike three-pound packages, there is no "*standard*" split. Three, four or five frame splits are common. The producer should tell you how much honey, pollen, brood and bees will be in the split. Yes, you will probably be buying the beekeeper's older combs. In some instances, you will want to phase them out as soon as possible.

Nowadays, producers rarely require the frames and equipment to be returned to them. The equipment is included in the selling price. It becomes yours. Being an old guy, I can tell you that in decades past, I was required to provide new frames and foundation and to return the nuc box, but mites and viral diseases have put a damper on that requirement. Though it surely increased the selling price, not requiring equipment replacement made the split transition simpler.

Throughout this entire encounter, if the provider is marketing to others and not only doing you a favor, be sure they are inspected by the state apiarist and are approved for selling *"baby"* colonies. In fact, you want to know that answer even if the provider is a friend who is trying to help you out. Without a doubt, you are going to be buying *varroa* mites in the deal but you do not want to be buying American foulbrood, too. Always be alert.

Detail #5 – Speaking of nuc boxes

In what kind of box do you transfer the split to your home yard? For sure, ask that question during the transaction period. I have had experience with two broad types of transfer boxes – wood and temporary (paper or corrugated plastic). I felt best about the wood boxes but acquiring a permanent five-frame wooden nuc box obviously increased the selling price. Years later, I still have several wooden boxes in my bee operation that I acquired from various nuc-split deals.

Wax-coated paper nucs are popular as temporary bee hive boxes, especially for splits. In my mind, I live in a perfect bee world, so in that perfect world, I plan to bring these small colonies to my home yard and immediately transfer them to standard equipment. There, they will live happily ever after. However, the following saga describes what happens in the real bee world.

I bought about twenty five-frame splits from a respected provider about one hundred miles from me. I made the trip and loaded the splits onto a small, open trailer. Using common duct tape, I attached the lid to each paper box and then ratchet-strapped rows of boxes to the trailer. Of course, it was going to rain on me and my new bees on the trip home. It did.

Upon arriving at home, I found that on two boxes, the dampened lids had bent back – due to the wind velocity – and had exposed the internal colony to highway wind speed. I essentially scattered some bees up and down the interstate. Worse, one lid was completely gone. I still had some bees in the open

Figure 2. Paper nucs boxes filled with a colony split ready for the ride home.

Figure 3. Nuc boxes improvised by cutting a deep hive body in half. J. Kerns photo.

Figure 4. Some of the paper nuc boxes the next day. I left lids askew to aid lost bees in finding a home.

boxes, but the populations had been reduced. But the story does not end here.

After I arrived at home, the weather prediction only grew worse. I hurriedly got the boxes set up in my yard and placed a brick on each corrugated paper colony. After getting back to my easy chair at home, it became official. Within a few hours, a storm was to pass through my home town with high winds and heavy rain. Back to the yard I raced, with a different enclosed box trailer that was not truly road worthy. I hurriedly placed the colonies within the enclosed trailer scattering bees everywhere. As I was working, I took a second to wonder if the high winds would now destroy *both* the bees and the trailer.

The storm passed. The trailer, and the protected the paper-housed hives, survived without incident. The next day, I got the bee splits set out again and transferred to them to standard equipment. Yep, there was flight confusion and drifting, but ultimately everything settled out.

My point for this long story? When I casually agreed to wax-papered nuc boxes, I did not envision a rainy drive home and subsequent high wind and rain storms before I could get the splits into permanent boxes. As usual, I envisioned a perfect bee world. I suggest that you have a doomsday plan for what to do if things do not go as planned.

Detail #6 – All things queen-related

No doubt, the reason more beekeepers do not produce splits is queen availability needed to head the splits. Yes, some rarified few beekeepers are set up to produce a few queens of their own, but many of these producers must buy queens at a time when they are most in demand. The type and caliber of the queen will vary from producer to producer.

Honestly, this is difficult to put into practical wording, but I must try. Your goal with this split is to get the colony established. In the real world, your primary requirement is that the queen's ability is great enough to establish a successful brood nest and stabilize the colony with her pheromone output. I would suggest that if she is able to do that, the producer has met their obligation to you.

In the perfect bee world, you would get a high-dollar, fancy-bred queen that would lead the young colony to population greatness in a short time. In the real world, you just hope to get a queen that can lead the young colony to accumulate enough colony resources to survive the next Winter that is still months away. In my case, I am only trying to get the small colony stabilized. Once the split colony is on firm survival ground, I may then decide to upgrade the colony's queen leadership.

What's to prevent the provider from selling me an old queen? Honestly, not much. The good news is that the provider will probably not have a large inventory of old queens. But while I don't really want a queen that's already approaching her supersedure time, if she is productive enough to stabilize the colony and importantly, if the colony's worker bees have shown that they are okay with her, then so be it. I just wrote before that I may very well be considering replacing the queen anyway. Even a new, young queen may be superseded by finicky nurse bees. Nothing is assured. At the risk of repeating myself, I feel that the primary goal is to get a stable, established colony that I can work and manage as it develops into a full-featured colony.

Detail #7 – The season

If the split provider let the baby colony produce its own queen, then I and my new bees have already missed the early Spring nectar and pollen flow. That part of the season had to be used to grow the queen. I need to be prepared to feed this young colony as it tries to accumulate enough resource wealth to Winter its first major dearth. To assist this small colony, in addition to supplemental feeding, I will need to perform all the beekeeper assigned tasks like *varroa* control and small hive beetle suppression.

The queen's output and the season are interrelated. Sometimes the queen just does not work out. If you have enough of the season remaining (you must decide that answer), then replace her. If the season has progressed to the typical Summer dearth – or even into Autumn – you and your new colony may be better off to pass the Winter with a subpar queen leading the colony. Hey, no one said beekeeping was always easy.

Detail #8 – Failure

What recourse do you have if the splitting project fails? Honestly, not much. I am not defending producers, but many things and seasonal events are beyond their control but it's not just about failed splits. What recourse do you have if a package project fails? Not much. Are all hived swarms successful? No. As you know, there are no guarantees in any aspect of beekeeping.

If you truly feel that what was in your nuc box when you got home was not what you negotiated, certainly you can complain, but I doubt much will come of it. I am sure you will not return to that provider next season and I also expect that you will quietly let others know of your negative experience. I feel a need to say that I have never been given a split that seemed to be significantly less than what I bargained for. No doubt, some of you have other stories.

Have you heard *Bee Culture* magazine?

By clicking on the computer code (QR Code) at the beginning of this article, you can go to *Bee Culture's* audio-article web page. In the audio version of my article, in addition to my monthly article, I have posted extra comments and details that I don't have space to address in written form.

Have you heard *Honey Bee Obscura?*

Some weeks ago, Kim Flottum and I posted a podcast at **HoneyBeeObscura.com** where we discussed conversational aspects of buying and managing splits. It's free. Have a listen.

As always, thanks for reading (and listening). BC

Dr. James E. Tew
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Co-Host, Honey Bee Obscura Podcast
www.honeybeeobscura.com

Dark Chocolate Mousse

Shana Archibald

Directions

Step 1
Stir the Greek yogurt, cocoa powder and honey in a bowl.

Step 2
Add the fresh berries of choice.

Step 3
Place the chocolate chips in a bowl and heat in the microwave for 30 seconds at a time until melted and smooth; stirring in between.

Step 4
Drizzle the chocolate over the raspberries.

Optional Step 5
Top with whipped cream if desired.

Ingredients

- □ ⅔ cup nonfat, plain Greek yogurt
- □ 1 tablespoon cocoa powder
- □ 1 teaspoon honey
- □ ¼ cup fresh raspberries or strawberries
- □ 2 tablespoons dark chocolate chips, melted
- □ 2 tablespoons spray whipped cream topping (optional)

CALENDAR

♦ILLINOIS♦

Save the Date! The **Mississippi Valley Beekeepers Association** will be hosting the ISBA Summer Conference in Quincy, IL on July 14th and 15th, 2023. It will be held at the Oakley Lindsay Center (300 Civic Center Plaza #237, Quincy, IL 62301).

Speakers include Kamon Reynolds, Randy McCaffrey, Natalie Summers, Jeff Horchoff, Cory Stevens, Elsa Gallagher and more.

There is something for everyone including vendors, breakout sessions and bluegrass music.

Keep an eye out for more details at **https://mvbees.com/**

♦TEXAS♦

The **Texas Beekeepers Association** will be hosting their Summer Clinic on June 17th, 2023 in Conroe, TX.

The clinic will include speakers, classes, demos and vendors.

For more information, go to **www.texasbeekeepers.org**

♦WASHINGTON♦

The **Washington State Beekeepers Association (WASBA)'s** upcoming beekeeping conference is October 7-8, 2023 in Olympia, WA!

The event will include a Saturday evening banquet with the famous "Dessert Auction", a live auction, raffles and much more!

The conference will conclude with the WASBA Annual Board Meeting on Sunday, October 8.

Profits from the conference benefits Washington Honey Bee Research.

You can learn more at **https://wasba.org/**.

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- Five frame nucs $160.00 each. Overwintered $185.00. FREE SHIPPING on prepaid orders of 5+ nucs. **717-548-0330** Double Echo Apiaries, 244 Soapstone Hill Rd., Peach Bottom, PA 17563

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Contact Jen Manis to place an ad: Jen@BeeCulture.com

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Image Contest – Splitting & Nucs

We've started an image gallery! This month, we want to see any and all pictures you have of **Splitting Hives and Making Nucs**. Please make sure that your image is nice and big! We may pick your image for the gallery, or you have the chance to get on the cover! So get creative.

How To Submit:

Email your images to **Emma@BeeCulture.com**
Use the subject "**Image Gallery**"
Please include in your email:
- The image as an attachment (we will not consider it if it is embedded)
- Your First and Last name
- Your mailing address
- Your renewal code (if you know it)

If your image is chosen:

For the Gallery:
You will get three months added to your current subscription.
For the Cover:
You will get twelve months added to your current subscription.

Up the road at the nudie hot springs, the mercury hovers in the 'teens. Shafts of early morning sunlight pierce a blanket of steam that rises from the water and frosts the trees an ethereal Winter-wonderland white.

As I crab-walk across the stone barrier between two outdoor pools, I lose my balance and turn turtle. I find this disconcerting. If you can picture an ancient beekeeper with not a stitch on, on his back, legs up in the air, kicking his feet to right himself, you've captured the moment.

These hot springs are not a mecca for the young and beautiful, although there are some of those. Mostly it's a bunch of hippies-turned-dinosaurs who frequent this place. TM and I strike up a conversation with two silver-haired women from my generation. In my mind's eye, I see them a half-century earlier, still fresh-faced and innocent, frolicking in some alpine meadow. They have flowers in their hair.

That was all in the morning. When I got home I learned that Pepper the blue heeler had treed our bobcat earlier in the day. The gal Marilyn took a video of him climbing down three hours later. I say "our" bobcat because he clearly thinks he's part of the family. When he's not racing up and down in front of the chicken fence panicking those poor darlings into flying the coop, Pepper's likely got him treed. The bobcat seems to enjoy these little rituals.

Once he's treed, he falls asleep up there. When I trained binoculars on him from the ground, he couldn't keep his eyes open. And all this in broad daylight. Wild cats are supposed to be nocturnal, or at least crepuscular.

And bobcats are supposed to be much smaller than our feline friend – like about twice the size of a housecat.

Pepper weighs 50 pounds. I guess you could call him a medium-sized dog. My first encounter with the bobcat occurred when Pepper and I were headed up to the barn at twilight. Of course, Pepper ran ahead. I saw him 30 yards in front of me, nose to nose with another blue heeler. The other blue heeler looked bigger than Pepper.

Of course what I thought was another dog was the bobcat, and that time Pepper didn't run him up a tree. The bobcat wasn't about to play dog-and-cat games when he had a dead chicken on the ground in front of him. I called Pepper off, and we escaped yet another round of vet bills. Whew!

So this is a very large bobcat. He's also very cute. To give him credit, he doesn't kill for sport like a housecat. He only harvests our chickens when he's hungry. Let's say about one a day, until I put a stop to it. I locked the birds up tight.

Marilyn thought this was cruel, so I installed a "Critter Gitter" on the perimeter of their run. This is a sensor that shrieks when it detects motion. This way we can let the birds into their run during the day.

Well, why am I going to all this trouble? When I explained to Marilyn that I could quickly and efficiently deal with our uninvited guest, she didn't take it well. "Don't you dare!" she warned.

It's February 10 as I write, and I recently popped the lids on my 70 overwintering honey bee colonies. It was a sunny 40-plus degree day, and the bees were mostly in the top supers. A few had taken flight. If I couldn't see capped honey in that top super I laid down a sheet of newspaper and dumped some dry white sugar on it. I fed 10 colonies that way. Some folks insist you should never open a hive in cold weather, but not me. I just break that propolis seal under the inner cover and pry it off. I work pretty fast. Opening beehives in Wintertime is not ideal, but starvation is the end of the line. So take your pick.

I figure if a two-deep hive is dead heavy with honey in November, it ought to be fine until April, anyway. But honey bee colonies are like people – some have bigger appetites than others, and a few really power through their honey stores. This is an unpredictable occurrence that I don't pretend to understand. It's also part of the larger truth that bees will fool you every time.

It's been a couple of weeks since we've seen the bobcat. Marilyn thinks our chickens are being denied a full and meaningful life if they don't get out of their pen to peck and scratch. So yesterday she turned them loose into the wide world again. She thinks our kitty may be gone for good.

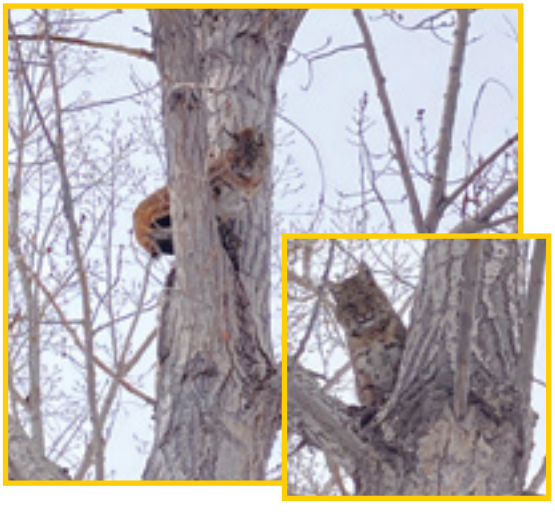
I'm not so sure. Predators are creatures of habit and come back for easy pickings.

But I know how to pick my battles. I'm going to let this one pass. Life is nothing if not a series of lessons. We'll see how this one turns out. BC

Gentle reader, did you find this piece amusing, heartwarming, perhaps even instructive? If you clamor for more of Ed Colby's writing, contact him at **Coloradobees1@gmail.com.** Ask him to promptly mail you a signed copy of *A Beekeeper's Life, Tales from the Bottom Board*, a collection of his *Bee Culture* columns. Price: $25. Satisfaction guaranteed or your money back!

Ed Colby

Our Bobcat



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