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MAY 2023

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San Diego

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Monday - Thursday

Marriott Mission Valley Hotel

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May Bee Culture...

Additional comments on the April 2023 cover from Greg Carey: *The beekeeper is Diane Wellons, ASMB President and Master Beekeeper. We had placed an empty frame of comb in the hive in the background about a week before and had just completed grafting some cells from that brood frame. I was handing her the frame of grafted cells to place into her nuc for transport back to her yard.*

Cover Photo by Joan Mahoney, State Apiculturist for the state of New York. "The beehives are located at Farmingdale State College (SUNY) in the Robert F. Ench Teaching Gardens; Joan Mahoney is the caretaker. The Sustainable Garden in which they reside is used to teach students about sustainable horticultural practices. The honey produced by the colonies is bottled and sold to support the Department of Urban Horticulture and Design at the College."

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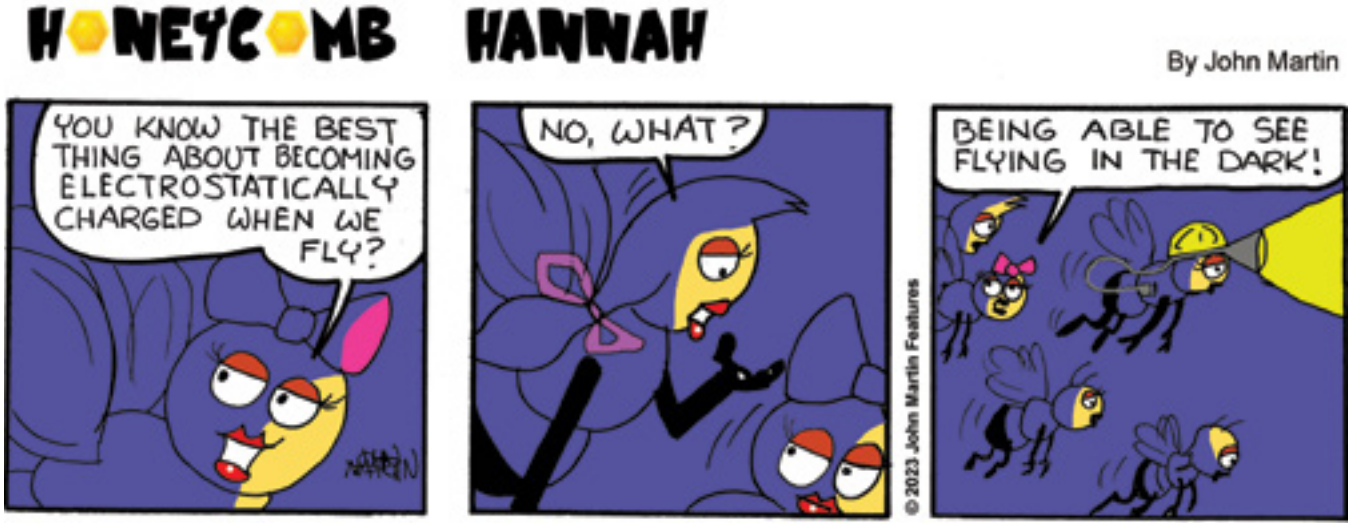
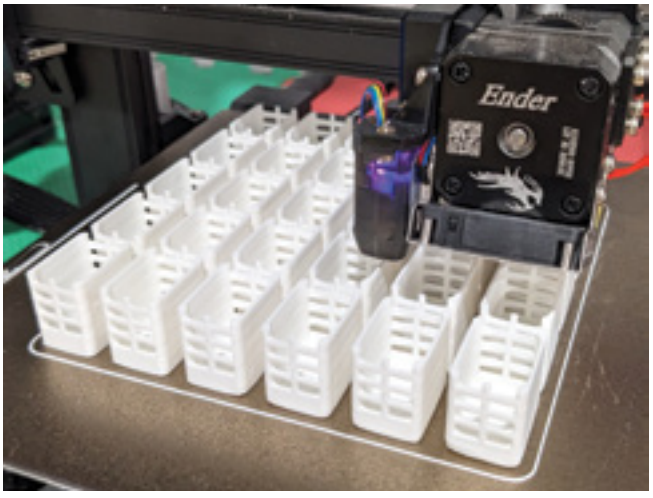


New Product

Finally, a cage for JZBZ cell cups! Introducing the EZPZ Queen Cage. It's designed to work seamlessly with JZBZ cell cups and cell bars. There's also a tray for stable, compact storage in your incubator.

For too long, those of us who raise queens using the JZBZ cell cups have had to make do with protective cages that don't fit. We use roller cages and test tube holders, wooden racks or modified transport cages. I decided it was time to do something about the lack of a proper piece of equipment for the job. Over months of 3D printing prototypes and fitting them to JZBZ cups, I came to an excellent working design. It grabs the rim of the cup and fits over the bar. It's just narrow enough to fit side by side with all 15 cups in place on the bar while still being large enough for fat queen cells. This keeps them safe from each other and rogue queens while in the Finisher. Or pluck them off and place them securely in the tray for finishing in the incubator. Each cage has two narrow troughs in the bottom for a drop of honey and/or water for your newly emerged virgins. With the available candy cap, the EZPZ Queen Cage can also be used for introduction.

Go to **https://ezpz.buzz/** for more information. BC



Celebrating a Birthday!

Brad Root

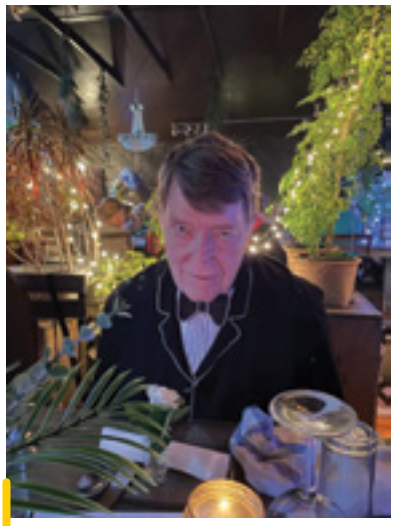
John Root recently celebrated his 90th birthday with family and friends in Sarasota, Florida.

After his three years in the United States Air Force, he has worked 65-plus years for The A. I. Root Company from Advertising Manager to General Manager, to Vice President, to President, to Chairman of the Board, and now, he's still a valued member of the Board of Directors. He was also the Executive Publisher of *Bee Culture Magazine* for many successful years during his time in The A. I. Root Company.

John was on Medina City Council for 14 years with the last 10 years as President and 37 years on Medina General Hospital with 10 years as Chairman.

John was President of the Honey Industry Council of America from 1962-1963 and 1976-1977, President of the Ohio Agricultural Council from 1973-1974, President and Chairman of the Board for the Eastern Apicultural Society of North America, Inc. in 1978 and Chairman of the Board from 1983-1984, as well as Key Advisory Commission of the Agricultural Technical Institute for nine years (1984-1993). There are numerous other organizations that John has served in over the years.

We wish him and Elisabeth many more happy years together as they approach their 30th wedding anniversary this coming July. BC



John Root celebrating his 90th birthday.

John Root

John Root

Bee Culture®
623 West Liberty St.
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mailbox@beeculture.com

Allergy

Thank you for publishing the article by Brad Metz (February 2023, *A Personal Essay on Venom Allergy*). Thank you, Brad, for writing your personal story. This is a timely reminder to all beekeepers that just like the bees we care for, the human species doesn't always behave or act according to the "books". As a retired physician and Emergency Department doctor, I am reminded how easily cognitive biases get in the way of proper diagnosis. Kudos to Dr. McWilliams for persisting despite all of the contradictions you presented. As beekeepers, we are making diagnoses all the time. How often have our cognitive biases mislead us?

Aaron Kolb
Williamsport, PA

P.S. Cognitive bias is a systematic thought process caused by the tendency of the human brain to simplify information processing through a filter of personal experience and preferences.

A Bee Fan

Dr. Farone,

Let me introduce myself. My name is Adeline, and I am an almost six year old kindergartner from Somerset, PA. My mom and I read your articles in *Bee Culture* all the time, and I help my dad take care of our hives. I am doing a school project researching about what I want to be when I grow up. I would very much like to meet you in person or virtually...

Your bee fan,
Adeline

NEXT MONTH

Region 1
- Sell splits/nucs
- Check for swarm cells
- Do bees have enough room?
- Add supers
- Reverse brood boxes to slow swarming
- Watch nectar flow, add supers
- Feed installed packages
- Re-queen where needed

Region 2
- Add more supers
- Swarm control
- Control skunks!
- Harvest early honey
- Check for small hive beetles
- Keep splitting
- Rotate boxes
- Check queen brood pattern

Region 3
- Be sure queen is laying in splits
- Add supers
- Re-queen
- Manage space to prevent swarming
- Pull honey last week in June
- Feed late nucs
- Check colonies weekly for brood and SHB
- Provide water resource

Region 4
- Raise queens
- Super
- Make splits and nucs
- Swarm control
- How is the queen pattern?
- Add brood boxes for more room
- Add capped brood to weaker colonies
- Too late for mite control

Region 5
- Are plenty of supers ready?
- Make splits
- Re-queen where necessary
- Get new locations
- Remove colonies from Winter shed
- Feed if needed
- Move to alfalfa fields
- Catch swarms

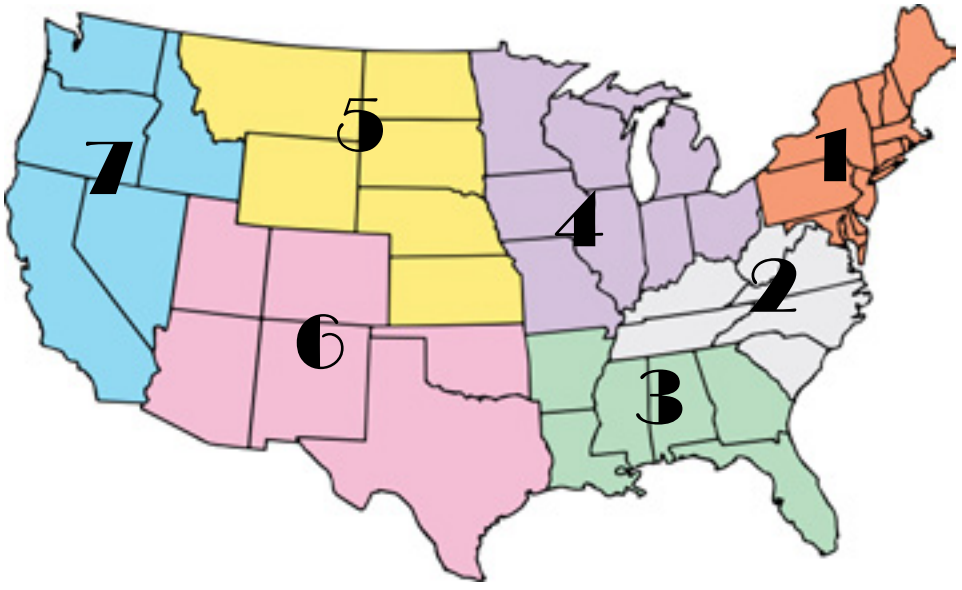
Region 6
- Add supers as needed
- Provide water sources
- Watch for failing queens
- Be careful about AHB in swarms
- Watch for swarming
- Pull honey
- Return wet supers to hives
- Replace poor queens

Region 7
- Doing more splits
- Swarm control
- Add supers
- Healthy colony = healthy queen
- Make nucs for restocking later
- Rotate brood boxes
- Inspect colonies
- Re-queen them all

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.

Scan this to go straight to the form online!



MAY – REGIONAL HONEY PRICE REPORT

	REPORTING REGIONS							SUMMARY			History	
	1	2	3	4	5	6	7	Range	Avg.	$/lb	Last Month	Last Year
EXTRACTED HONEY PRICES SOLD BULK TO PACKERS OR PROCESSORS												
55 Gal. Drum, Light	2.68	2.53	2.90	2.91	2.87	2.78	3.45	2.00-4.00	2.86	2.86	2.82	3.96
55 Gal. Drum, Ambr	2.60	2.96	2.80	2.86	3.00	2.63	3.25	2.00-4.00	2.82	2.82	2.79	3.77
60# Light (retail)	233.74	277.67	235.80	228.22	225.00	187.76	283.33	120.00-350.00	236.90	3.95	220.53	211.41
60# Amber (retail)	232.28	263.40	213.50	225.50	-	177.59	245.00	120.00-310.00	230.99	3.85	217.27	213.90
WHOLESALE PRICES SOLD TO STORES OR DISTRIBUTORS IN CASE LOTS												
1/2# 24/case	108.74	124.80	94.27	93.43	64.80	-	-	64.80-200.00	103.35	8.61	98.89	100.41
1# 24/case	175.72	194.00	162.55	154.12	141.56	132.16	144.00	96.00-325.00	166.29	6.93	152.48	149.49
2# 12/case	155.95	264.00	131.50	129.64	173.76	180.00	156.00	84.00-300.00	149.41	6.23	139.04	139.08
12.oz. Plas. 24/cs	128.68	167.49	130.87	105.47	94.68	114.96	129.60	72.00-288.00	127.33	7.07	117.85	115.07
5# 6/case	170.59	240.00	145.57	131.06	123.84	-	-	96.00-330.00	160.62	5.35	154.76	150.84
Quarts 12/case	210.25	208.25	185.40	193.14	192.18	197.94	201.00	120.00-330.00	200.09	5.56	191.79	176.47
Pints 12/case	121.40	127.80	109.60	115.38	123.50	135.00	123.60	72.00-192.00	119.51	6.64	115.93	101.54
RETAIL SHELF PRICES												
1/2#	6.44	7.13	5.87	5.28	5.45	7.50	-	3.50-11.00	6.28	12.56	6.32	5.72
12 oz. Plastic	8.31	7.82	7.44	6.64	6.38	8.50	6.17	4.29-15.00	7.56	10.09	7.50	6.82
1# Glass/Plastic	10.81	10.86	10.02	8.43	10.35	9.00	9.00	5.69-18.00	10.09	10.09	10.33	9.06
2# Glass/Plastic	18.15	20.00	16.22	15.13	21.55	13.45	17.50	6.89-30.00	17.41	8.70	17.45	15.72
Pint	14.96	12.18	11.32	12.25	9.98	13.50	12.60	5.00-35.00	12.56	8.37	12.32	12.09
Quart	23.87	22.08	20.07	21.54	18.97	24.75	22.29	10.00-42.00	21.97	7.32	21.79	20.95
5# Glass/Plastic	39.19	40.67	37.37	32.23	26.93	32.47	-	15.00-75.00	36.56	7.31	35.08	32.19
1# Cream	13.09	8.57	10.70	10.98	11.33	-	16.00	5.99-20.00	11.88	11.88	12.36	11.94
1# Cut Comb	15.61	13.83	11.50	13.15	-	-	16.00	6.00-25.00	14.21	14.21	14.83	14.43
Ross Round	13.00	7.00	-	11.50	-	-	15.00	7.00-20.00	12.63	16.83	11.89	15.37
Wholesale Wax (Lt)	6.57	6.00	6.25	6.35	7.33	5.50	4.95	3.00-9.50	6.27	-	8.10	7.58
Wholesale Wax (Dk)	5.17	7.10	5.25	5.60	8.00	4.25	6.00	3.00-8.00	5.76	-	6.95	6.73
Pollination Fee/Col.	102.14	70.83	80.00	140.00	-	-	148.17	40.00-225.00	108.44	-	105.76	103.82
Price of Nucs	192.79	191.41	179.06	180.67	200.00	231.88	183.33	115.00-312.50	190.42	-	-	-
Price of Packages	159.67	145.91	132.50	152.58	147.25	198.50	187.50	110.00-225.00	154.74	-	-	-

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.

Honey Price Report Update

You may notice two new categories in the report above. We have added the price of nucs and packages. Our reporters gave the price of nucs and packages in their area or that they sell.

The reporters have been interested in adding additional categories to the report so over the past few months, they have written in what they would be interested in seeing. After we collected those results, we asked them what they want to see out of everyone's ideas and then what they could provide. Over the next few months, you will see new categories start to show up. The first of these is the nucs and packages but it will expand into mite treatment, the honey flow and others! Keep an eye out for those new categories in issues to come!

STUDY HALL

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

OFFICE OF CHEMICAL SAFETY AND POLLUTION PREVENTION

The EPA has offered an assessment on using Api-Bioxal (oxalic acid) prepared with glycerin and has found this use to be unacceptable.

A few bulleted highlights.

- The use described (Oxalic and Glycerin) does not fall within the scope of exemptions from the term "to use any registered pesticide in a manner inconsistent with its labeling"
- "It shall be unlawful for any person to use any registered pesticide in a manner inconsistent with its labeling" as stated in Section 12 (a)(2)(G) of FIFRA
- The existing label states the following: "Only apply Oxalic Acid Dihydrate as a solution when mixed with sugar water."
- Therefore, the instructions on the bulletin to mix the pesticide with glycerin are outside the scope of FIFRA Section 2(ee)

To read the complete message go to: **https://www.beeculture.com/epa-rules-on-oxalic-acid-and-glycerin/** and find the PDF linked at the bottom for download.

TROPILAELAPS OR TRACHEAL

QUESTION

Dear Jerry,

I avidly read Clarence Collision's article on *Tropilaelaps* mites because I researched *T. woodi* for a local beekeeping workshop. It is possible that some readers of the article may not be aware that *T. woodi* has been in the United States since at least 1984. This tracheal mite can be controlled by menthol crystals at a temperature of about 70 degrees or formic acid treatments. Is it possible then for this mite to be treated at the same time as treatments for *Varroa*?

Thank you so much for sharing recent research.

Sincerely,

Anonymous

ANSWER

Just between you and I , Tracheal mites are *Acarapis woodi*, or abbreviated as *A. woodi*, and *Tropilaelaps* is *Tropilaelaps clareae* sometimes abbreviated to *T. clareae* and is from Asia.

Two completely different parasites.

Our secret.

Take care.

MY HIVE IS WET ON THE INSIDE

QUESTION

Hi Jerry and all… as you probably know, here in California we've had tons of rain lately. My two backyard hives have had lots of water accumulating in the pull-out plastic tray under the screened bottom boards (nearly half full to the rim), and on the inside of the top cover, and even small puddles on top of the inner cover. I know this is not ideal for the bees, so I've opened and dried the woodenware every two to three days (did not open hive, just removed top), removed the plastic tray completely and propped up the inner cover in back just a bit to help with ventilation, and checked for leaks on sides and top, but the water continues to appear. It's a strong hive, so I wonder if it could be excessive condensation from the bees themselves? The bees themselves appear okay, are quite populous (one deep with two supers, mostly full of bees), although there are a handful of dead ones below the six inch entrance. Any thoughts on the significance of this situation? Thanks for your always terrific articles and for your opinions regarding this accumulation of excess water.

Dan Smith

Santa Barbara, CA

ANSWER

Let's jump to 'condensation' first. I don't know where you are in California or at what altitude. It is lightly snowing here in Ohio with a high temperature forecast to be 34°F today. Ugh… Anyway, I am sure you have been in cold temps before and have seen as you exhale the hot moisture in your breath be in contact with the cold, cruel world and it condenses i.e. forms water droplets that make your breath a visible fog. Or you are inside your house and taking a close look outside on a cold day, your warm breath hits the inside of the cold window glass and condenses on the surface with water droplets. Our honey bee colonies are a warm mass inside at 93°F at the center of the cluster and the rest of the hive volume is close to the outside ambient temperature. They are inhaling and exhaling through their breathing tubes, the trachea, inside the colony. They have consumed honey at 18% moisture or sugar syrup at 30% water which has been provided to them. When you have 10,000-20,000 honey bees eating in early Spring and exhaling inside the hive, they don't need all the water in a food product. They excrete some of it in their exhaled breath. Warm moist air when it contacts a cold surface condenses and forms water droplets. If there is not some upper ventilation to have the warm moist air flow out of the hive, then the condensed moisture can build up in the inner cover or cover and if there is enough gravity, it can actually rain on the colony which doesn't help in a cold Spring, Fall or Winter. All that to say, an upper entrance can help.

From the Editor, Jerry Hayes

If rain is 'leaking' in, then you need to put better hive parts and pieces on.

Get rid of the plastic pan under the screened bottom board but now consider forever. Having hive debris and *varroa* fall through on to the ground is better. Let's assume the screen mesh is small enough to restrict SHB's.

And finally let's hope it gets warm there and here… very soon.

I hope this helps.

Dan/QUESTION

Thanks Jerry for all the good info!! I'll keep monitoring the water situation. I did remove the slide out tray and increased ventilation… woodenware appears okay. I also added a piece of burlap under the outer cover, with a hole over the feeding area, as I read this may help absorb excess moisture. We do still have some more rain on the way, but today is sunny and the ladies seem much better.

Jerry/ANSWER

I would take out/off the burlap. Not to be a pain but I have asked people about why they put absorbent materials in a hive when they are trying to help the bees remove moisture. Why trap it in the colony???

Dan/QUESTION

Hmmm… Thanks again, Jerry. After thinking about this though, I'm wondering, even though the burlap traps the water inside the hive (not good), it may also prevent the water from dripping down on top of the frames and foundation (which is a worse case scenario)? Maybe it's better to keep the burlap but rotate it out every few days ? Also making sure ventilation is sufficient. Any thoughts on this approach?

Jerry/ANSWER

Feel free to experiment, BUT…

If you have a leaky roof that you cannot fix, then at some point the burlap will absorb more water than it can hold and drip anyway. If the bees are exhaling moisture with each breath then the same thing will happen. Provide an upper entrance and help the high humidity exit the hive naturally.

A poor example would be for you to wash your clothes and try to dry them inside your house. Without your HVAC system running it will get a bit damp in your house and I hope you like moldy walls.

DEAD BEES!

QUESTION

Jerry,

I found a lot of bees dead outside my one hive. Now, I did not go in deep. I have two supers, one deep and one medium. When I pulled some frames, there was honey still stored and about eight to 10 frames were full of bees. The frames I pulled were full of bees on both sides. I did not go to the lower super because it was 59°F but there was some wind and I did not want to chill any brood. I have been feeding them since October. Should I worry about the dead ones?

Peter Zablocky

ANSWER

I can't remember what part of the country you are in, but mentioning that a 59°F day as a good one to open a hive means you are not in South Florida.

So, my colonies have gone through a cold Ohio Winter. When temperatures get below about 57°F, honey bees snuggle up (cluster) and through body movements keep themselves and the queen warm. But over the days, weeks and months bees will die. They only have a certain life span. Winter bees have a little longer life span than Summer bees but as it gets to be late Winter, they die. One of the reasons beekeepers see whole colonies die in March/April in the north is that it hasn't been warm enough for the queen to start laying or the colony left is not large enough and it is too 'sick' to facilitate replacing the dwindling colony members as they die. That is why we need to address *Varroa* and the *Varroa* Virus Legacy in late Summer or early Fall so the bees going into Winter and clustering are healthy enough to stay alive as long as possible. But, as bees die from age, cold, lack of food, viruses, disease, etc. they fall to the bottom of the hive, die in empty comb cells or in the cluster itself and there isn't a lot of movement of the cluster to let the dead and dying fall to the bottom. When outside temperatures get warm enough and either ambient or sun shining on the hive forms a warm micro-climate to let the cluster relax, if you will, and reorganize itself in the hive, one of the things a colony of bees does is clean. They want to manage the hive for some level of cleanliness and get the dead and rotting out of the hive. They clean out/clear out the bottom board of the dead and sometimes struggle to open up the entrance blocked by dead bees. All of this clean up procedure has the hygienic bees drag out this 'refuse'. Because it is still coldish outside, they go dragging a dead sister to the outside and dump the 'refuse' over the far edge of the entrance in front of the hive on the ground instead of flying a distance to move it further away as they will do in the warmer Spring, Summer and Fall seasons.

On some of my colonies, I had significant dead bees in front of the colony on a warmish day as they cleaned up and in some I did not. There is tremendous genetic variability with colonies and how they handle Winter, pests, parasites and disease over this cold, stressful season even with responsible management by 'us' the beekeeper.

But, honey bee health is all about *Varroa* Virus Legacy in 2023. I hope you have a copy of the HBHC '*Tools for* Varroa *Management Guide*' and other info, **https://honeybeehealthcoalition.org/resources/varroa-management/**

Sounds like you are doing the best you can. BC

FOUND IN TRANSLATION

Bees have an increasing say in soybeans

Jay Evans, USDA Beltsville Bee Lab

Listen along here!

Farmers and scientists debate the extent to which one of our country's favored crops, the soybean, benefits from honey bee visits. Nor are they sure that having bees visit soybean crops is a net positive for the bees. Despite research documenting strong benefits to soybeans from honey bee visits (dating since the youth of former *Bee Culture* editor Kim Flottum, **https://www.beeculture.com/found-in-translation-19/**), a perusal of thousands of studies related to soybean farming shows little emphasis on how and when bees should be deployed. As one metric, a March 2023, Google Scholar search of papers mentioning "soybean yield" and "honey bee" provided 276 references. The same search excluding the term "honey bee" provided 62,200 references. This overall trend has not improved in recent years; papers mentioning soybean yields that do not mention honey bees number 5,110 since 2022, while only 32 papers mention honey bees. Fortunately, those 32 papers provide some really important advances. The upshot is that bees can greatly improve soy production, while potentially gathering a resource for themselves and their keepers. What remains to work out:

1)How can beekeepers practice safe soy?
2)How can growers choose varieties and management practices that harness bee visits to boost production of a vital row crop?
3)How can the two sides meet up to work out deals that benefit both industries and the environment?

On the soy side, honey bee pollination impacts were described this month in a freely available paper from Decio Gazzoni and João Paz Barateiro (Gazzoni, D.L. & João Vitor Ganem Rillo Paz Barateiro. 2023. *Soybean yield is increased through complementary pollination by honey bees*, Journal of Apicultural Research, **DOI: 10.1080/00218839.2022.2161219**). These authors showed that, with the right conditions and soybean varieties, honey bees increased soybean yields in controlled environments by 8.5-18.2% in four trials across three years. This increase is not as dramatic as other studies from different cultivars, but still reflects a lot of beans. Hannah Levenson and colleagues at North Carolina State University also showed recently that supporting bees merely by expanding local non-crop habitat led to a significant difference in soybean seed (bean) weights. In an exhaustive survey of 7,000 bees in the field, they found that 30+ bee species had collected soybean pollen but honey bees tended to be more faithful than others for soy versus alternatives (Levenson, H. K., A. E. Sharp, and D. R. Tarpy. 2022. *Evaluating the impact of increased pollinator habitat on bee visitation and yield metrics in soybean crops*. Agriculture, Ecosystems & Environment 331:107901, **https://www.sciencedirect.com/science/article/abs/pii/S0167880922000500**).

If bees are generally good for soybeans, are these visits doing bees any good? Chia-Hua Lin and colleagues at The Ohio State University have been on that story for some time and recently published a complex study asking whether bees 1) make it to abundant local soybean fields and 2) bring home resources for their colonies (Lin, C.-H., Suresh, S., Matcham, E., Monagan, P., Curtis, H., Richardson, R. T., & Johnson, R. M. 2022. *Soybean is a Common Nectar Source for Honey Bees (Hymenoptera: Apidae) in a Midwestern Agricultural Landscape*. Journal of Economic Entomology, 115(6), 1846-1851. **doi:10.1093/jee/toac140**). In a citizen-science twist, the scientists asked members of the Ohio State Beekeepers Association to bring honey collected by bee colonies from across the state to their Fall meeting. This honey was screened for the presence of different pollen types under microscopy. As indicated by the title, soybean pollen was commonly found in Ohio honeys. More than half of the screened honeys held soybean pollen, and this increased for honey derived from foraging in July and August, when soybean flowers were most common. Finally, the authors used the waggle dance, the signal bees

use within their colonies to direct nestmates to good foods, to show that returning bees are eager to tell their nestmates about soybean rewards. For medium-distance flights, returning bees were more likely to 'dance' that they had visited soybean fields than other fields, complementing the pollen collection data and saying that bees preferentially target soybean fields over the alternatives. Dr. Lin has backed up this work with some truly remarkable studies covering the attractiveness of dozens of soybean cultivars to bees in common gardens (e.g., **https://ohiocroptest.cfaes.osu.edu/soy2022/2022_OSPT_pollinator_report.pdf**) and is working relentlessly to improve cross-pollination between beekeepers and soybean growers.

In ongoing work, graduate student Karlan Forrester (working with Chia-Hua Lin and Reed Johnson at Ohio State), has worked out innovative methods for tracking bees as they zero in on soybean flowers, while also confirming that certain soybean varieties are more rewarding, and hence attractive, to discerning bees (Forrester, K. C., Lin, C.-H., & Johnson, R. M. 2022. *Measuring factors affecting honey bee attraction to soybeans using bioacoustics monitoring*. BioRxiv, 2022.2011.2004.512777. **doi:10.1101/2022.11.04.512777)**.

In looking for soy-bee stories that describe ways to enhance this partnership, I came across a series of fascinating works from the other side of the world. Dr. Dolapo Bola Adelabu, a researcher from the Free State of South Africa, and his colleague Angelinus Franke, found remarkable increases in soybean yields that can be attributed to visits by bees and other pollinators (Adelabu, D.B., Franke, A.C. 2023. *Beneficial Role of Pollination and Soil Fertility for Soybean Production in Mountainous Farming Conditions*. In: Membretti, A., Taylor, S.J., Delves, J.L. (eds) *Sustainable Futures in Southern Africa's Mountains*. Sustainable Development Goals Series. Springer, Cham. **https://doi.org/10.1007/978-3-031-15773-8_5**). These yields were greater than 50% when combined with optimal fertilizer supplementation of crops (Nitrogen and Phosphorous), with less striking increases under poor soils. Farming in this region of southern Africa, in a rugged corner of the Free State, is distinguished by "smallholder" farms, where farms are interspersed with homes and natural areas. This farming scheme allows for both wild bee habitat (honey bees are not routinely kept in hives here) and presumably a range of alternate food sources for bees when soybeans are not in flower. In conversing with Dr. Adelabu, the studies did not distinguish *Apis mellifera* from other bee species, but it seems likely that honey bees were a major member of the pollinating community. Thanks to this research, the services bees provide in terms of local soybean yields, among other crops, justifies the work needed to keep healthy bee habitat. The two scientists in this work are also more broadly interested in schemes to provide healthy nutrition to a fairly dense human population, while maintaining a sustainable environment, (e.g., **https://www.ufs.ac.za/aru/aru-team/aru-team/prof-angelinus-franke**). Hannah Levenson phrases it well in her article, "As such, pollinator habitat should be designed to provide resources across the entire active season to help these important pollinator populations, especially since many crops have short bloom durations."

One hope from all this research for the U.S. will be improved dialogue between beekeepers and soybean farmers, ideally driven by profits on both sides. This dialogue will help bees collect soy flower resources while minimizing collateral damage from agricultural practices, including the need to treat for crop diseases and insect pests. In the meantime, what are the best practices for beekeepers around soybean farms? The Honey Bee Health Coalition has focused on this issue, leading to a draft of guidelines led by Adam Dolezal at the University of Illinois showing how management practices, from pesticide applications to habitat, can be more bee-friendly (**https://honeybeehealthcoalition.org/resources/soybean-best-management-practices/**). Making more food on fewer acres is good for the planet and the economy, and it is great that scientists and farmers on both sides are tackling the soy-bee system in a rigorous way. BC

Team B & B (Bees and Beans) collecting flowers in soybean plots last Summer. The white stakes are Karlan Forrester's audio recorders. Photo provided by Chia-Hua Lin from the Rothenbuhler Honey Bee Lab at The Ohio State University

The APHIS Answer to Tropilaelaps

John Miller

Recently, I engaged with the USDA's Animal and Plant Health Inspection Service (APHIS). I'm trying to understand for North American beekeepers the approach regulating agencies are taking to my perception that it's worse than we think.

Please find the APHIS response to my questions, as provided by the APHIS public affairs specialist:

1) What is APHIS doing to prevent the entry of *Tropilaelaps mercedesae* into North America?

Written response to Question 1 provided by Bob Pfannenstiel, Pest Pathogen Biocontrol Permitting Manager, in the U.S. Department of Agriculture's (USDA) Animal and Plant Health Inspection Service (APHIS).

The U.S. Department of Agriculture's (USDA) Animal and Plant Health Inspection Service's (APHIS) mission is to safeguard American agriculture and natural resources while facilitating safe trade.

To accomplish the safeguarding part of our mission, we focus our work in two key areas:

- Preventing pests from entering the United States and becoming established
- Fighting back against any pests that do get in

This work spans a wide spectrum of activities, including offshore programs, permitting, port and border inspection, pest identification and mitigation, and smuggling interdiction and trade compliance—as well as pest detection, response, management and eradication programs.

APHIS is aware of the threat posed by *Tropilaelaps mercedesae* and is taking steps toward preventing its introduction and simultaneously preparing for the possibility that it could move into the United States despite our best efforts to prevent it. Our import regulations do not allow for importation of bees from any countries where *T. mercedesae* is known to occur. In addition, our policy requires our partners at U.S. Customs and Border Protection to search for and address pests of concern, including bees, on incoming cargo and conveyances. Any detected bees are immediately removed and disposed of.

2) If prevention is not APHIS' focus, what then is the APHIS' action plan upon Tropi detection?

Written response to Question 2 provided by Anne LeBrun, National Policy Manager for Domestic Pollinator Pest Programs, in the U.S. Department of Agriculture's (USDA) Animal and Plant Health Inspection Service (APHIS).

APHIS seeks to prevent the entry of *T. mercedesae* in the U.S. and to simultaneously prepare to respond to the pest in case of its entry. APHIS is drafting a New Pest Response Guideline for *Tropilaelaps spp.* and aims to complete it this fiscal year. A New Pest Response Guideline is a literature review that summarizes available options for responding to a specific pest. Once complete, APHIS and impacted state(s) will be able to use the New Pest Response Guideline to determine the best course of action if *Tropilaelaps sp.* is detected in the U.S.

APHIS is also supporting Dr. Samuel Ramsey's work to learn more about *Tropilaelaps* mites. Last fiscal year, APHIS initiated a one-year cooperative agreement with the Ramsey Research Foundation for $101,167. We've budgeted to continue supporting the research with an additional hundred thousand dollars this fiscal year. Furthermore, APHIS allocated $75,000 to work with Colorado State University to develop a molecular assay for *Tropilaelaps spp.* that can be adapted for field use to detect *Tropilaelaps spp.*

The national survey and pollinator community outreach is also an important part of monitoring pollinator health and ensuring early detection of bee pests. APHIS' Pest Identification Technology Laboratory hosts **ID tools online**, such as the Bee Mite ID, to help apiarists and other surveyors detect invasive bees and pollinator pests as early as possible.

I am not a pessimist, or an alarmist. However, I am very alarmed for beekeepers by these responses. There is no example in North American beekeeping of a successful pest/pathogen/parasite response. Let me clarify: We control – to a degree – *Varroa*. Tracheal mites are around, in places, at times – but no one is treating for Tracheal mites. With basic beekeeping skills, American Foulbrood is in the rear-view mirror. What is emerging is unhealthy brood odor – which a well-trained nose can sniff out in a hurry, smelling a malodorous hive even before opening a hive.

North American beekeeping is the most mobile beekeeping industry on earth. We are exceptionally good at spreading threats to our own operations.

A few questions:

- When the first North American *Tropilaelaps mercedesae* (Tropi) detection/admission is made:
  - What happens next?
  - Who has authority?
  - To do what?
- If it's extermination, history teaches us that beekeepers will secret their hives out of and away from quarantine zones, exponentially expanding Tropi's range.
- What is the quarantine plan?

•Who administers quarantine plans?
•Who enforces plans?
•What will the treatment free (TF) crowd response be? History repeats itself…
  ○TF practices will kill hives five times faster ignoring Tropi.
•What will the commercial beekeepers response be? History repeats itself…
  ○What strange voodoo treatments will emerge?
•In five years, I'm afraid we will have:
  ○Botched Tropi prevention
  ○Annual hive losses will exceed 80%.
    ▪*Varroa*, Tropi, pathogens, pasture losses – it all piles up.
•Beekeepers will fail the challenge of keeping hives alive.
  ○There is a tipping point where organism(s) cannot withstand a parasite.
  ○Beekeepers will discover that point.
•A new supply chain management position will emerge – driven by scarcity.
  ○The insect pollinated food supply will change for the worse, creating significant supply chain inconsistencies. Globally.

As Gordy Wardell once said: 'Get ready to eat a lot of corn and rice'. BC

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A Closer Look

Queen / Drone Mating

Clarence Collison

There are many environmental conditions that are required for mating flight activity. Temperature and weather are the most important factors in northern regions. Drones and young queens remain inside their colonies, waiting for the stimuli offered by agreeable temperatures and weather conditions. The minimal temperature for drone flight is around 18°C (64°F), while for queens it is about 20°C (68°F). Strong winds, cloudy skies and rain prevent mating flight activity. Warm days with blue or partly cloudy skies offer the optimal environment for honey bee mating activity (Koeniger et al., 2014).

Drones exit the hive to mate as their only goal, despite the high chances of getting lost, being preyed upon and starving; and only if they are lucky, they will die when mating. These nuptial flights take place in Drone Congregation Areas, and their hive exit time is normally in the afternoons. During the Spring and Summer mating seasons, drones emerge from the hive, perform orientation flights and search for drone congregation areas for mating. This search may lead drones to return to their colony, drift to other colonies (vectoring diseases and parasites) or simply get lost to predation. Drone activity at other hours of the day have not been studied. Using three methods (direct observation, video recording and radio frequency identification (RFID)), drone activity was evaluated during the whole day in Northwest Argentina. Twenty-four-hour activity was detected for the first time. Surprisingly, several drones were active at dawn, morning and late morning. They also discovered that drones may stay in the hive for several days, even after initiation of search flights (up to four days). They also observed drones to leave the hive for several days to return later (up to three days). All three methods confirmed that drones were mostly active in the afternoon. The activity at dawn and during the morning could be a normal pattern in drones around the world, or it could be a result of abnormal factors, such as environmental variables altering their biological clocks (Ayup et al., 2021).

Drone attraction to ether extracts of virgin queens (*Apis mellifera* L.) demonstrated that chemical communication enables the drones to orient themselves to queens during mating flights. The primary source of queen mating attractants is the mandibular glands. Fractionation of mandibular gland lipids yielded several attractive fractions that may act jointly. One fraction was queen substance (9-oxodec-2-enoic acid) (Gary, 1962).

Since mating occurs in the air away from the hive, studying mating behavior and the actual process has been difficult. An apparatus was described by which tethered virgin queens could be suspended for restricted flight at desired heights up to 11 meters, enabling observations on mating. Drones were attracted in large numbers and seemed to show normal mating behavior. Their flight near the queen was described in detail, and the methods by which they locate her. Drones, first attracted by the scent of queen sex attractants, approached from windward, flying typically in sparse swarms that assembled and hovered in conical formation below and behind the tethered queens. Drones were consistently observed to mount on top of the queen's abdomen, but successful mating followed rather rarely. Mating behavior was very stereotyped; the drone clasped the queen's abdomen and everted the genitals into the sting chamber, which must be open. Paralysis of the drone accompanied the onset of genital eversion; this caused the drone to swing over backwards, attached by the genitals which everted more completely as the physical restraints inherent in the initial position were released. Finally, as the drone hung from the queen, the mating act was terminated by an audible snap, presumably caused by compressed air in the drone genitals, and apparently serving to separate the drone physically from the queen. Mating required only a few seconds, and in normal circumstances the entire act probably takes place in the air (Gary, 1963).

Many free-flying drones were induced to 'mate' with queens in which an open sting chamber was simulated by the removal of abdominal segments seven through 10, leaving an open body cavity. Lack of success in getting routine matings, using either the tethering technique or the release of free-flying queens, was probably due to failure on the part of the virgin queens to open their sting chambers (Gary, 1963).

Drone behavior must be considered carefully when conducting bioassays of sex attractants. Weakly attractive fractions are difficult to detect unless drones are attracted into the neighborhood by a lure of crude queen lipid extract, or a tethered virgin queen (Gary, 1963). Wooden models of queen bees, when treated with queen phero-

mones and elevated (five to 15 meters), stimulated mating behavior of flying drones. When sting chamber depths, of 1.6, 4.8 mm or 'infinite' were tested at diameters of 1.6, 2.4, 3.2 and 4.0 mm, respectively, the 'mating' frequency for the respective diameters (all depths pooled) was 4.6, 20.0, 46.7 and 44.8 percent (*N*=240), respectively, for 762 drones that mounted the models. Sting chamber dimensions affected the degree of drone genital eversion. The median time between mounting and eversion was 2.4 seconds. Prolonged mount duration (median=17.8 seconds) was observed when models had sting chambers too small to stimulate eversion. The data document the brevity of mating and the open sting chamber requirement (Gary and Marston, 1971).

In a two-choice test, drones preferred queen models marked by a distinctly colored 'mating sign' (secretions of the drone's copulatory organs) to unmarked models. This was true also for models marked by aluminum foil. Dark-colored drones preferred to copulate with light-colored models and vice versa. Models carrying copulating drones were more attractive than single models. Thus, a copulating drone as well as the mating sign and other colored markers increased the attractiveness of a queen. The mating sign may indicate a form of cooperation between drones by marking a queen after sperm transfer to facilitate the identification of a queen by the following drones (Koeniger, 1990).

Highly polyandrous queens mate with six to 18 drones in one or more nuptial flights when they are about four to six days old, prior to egg laying. During subsequent copulations in the air, semen from each drone is ejaculated forcefully into the vagina and lateral oviducts of the queen. The ejaculates are pressed and probably mixed in greatly expanded lateral oviducts by both subsequent explosive ejaculations of drones and muscular contractions of the reproductive tract of the queen before the migration of spermatozoa into the spermatheca. The queen returns to the hive after mating, with an average of 11.5 µL semen in her lateral oviducts and about 100 million spermatozoa in the entire genital tract (Woyke, 1962).

During mating, pursuing drones are positioned below and behind the fast-flying queen, forming a comet-like mass. They focus on her with their huge eyes, with the upper front part having the highest resolution. The fastest drone closes in on the queen, accelerates as he flies above the queen and his thorax touches her abdomen. His four front legs grip her abdomen from the sides while both hind legs grasp the abdomen from below with their hairy inner part and press it against the drone's thorax. The queen is held tightly. Docking of the drone and the queen has been completed successfully. Now the drone adjusts his position by curving his abdomen down until it is placed directly in the sting chamber kept open by the queen. During this maneuver the drone flies and keeps pace with the queen's flight. The time from grasping the queen until separation of the pair takes less than two seconds (Koeniger et al., 2014).

Drones are able to remove the mating sign of predecessors at the beginning of copulation. It is attached to the hairy field on the ventral side at the basis of the endophallus (Koeniger, 1986). The sequence of a queen mating with numerous drones is described as follows: "The first drone has mated and inserted his mating sign into the sting chamber of a queen before falling to the ground. The hairy patch at the base of the endophallus of the first drone is empty. A second drone mounts the queen and begins the mating process, having pulled out the mating sign of the first drone. The first drone's mating sign is sticking to the hairy patch on the endophallus of the second drone. Now, the second drone inserts his mating sign into the sting chamber of the queen before falling to the ground and the sequence of events continues with each drone" (Koeniger et al., 2014).

Queens returning from successful mating flights have the semen in lateral oviducts and the mating sign in the sting chamber. The mating sign consists of part of the bulb of a drone endophallus. It is located between the elevated sting and the ventral terminal sclerite.

The size of measured signs; height, width and length (without the thin thread at the end), was 1.75 mm, 1.60 mm and 3.21 mm, respectively. The chitinized plates of the mating sign were situated, in most queens, at the ventral side of the sting chamber almost parallel to the terminal sclerite. The pointed ends of the chitinized plates were directed cranially, toward the bursa copulatrix. However, in some queens the chitinized plates of the sign were situated almost vertically to the sclerite (Woyke, 2011). After the last copulation more than 70% mated queens return carrying the last mating sign in her sting chamber. After return from the mating flight, it is removed mostly by the queen rubbing the abdomen on the comb (Koeniger and Koeniger, 2004).

Queens return from successful mating flights with the mating sign, which consists of chitinized plates of drone endophallus filled with mucus. The orange membranes covering both sides of the mating sign do not touch the hairy rim of the bursa copulatrix. The thin thread at the end of the mating sign is pushed forward on the surface of the sign in most queens. This makes the end of the sign look blunt. Simulated stages of natural mating showed that it is impossible for the orange membranes covering the cornua of the endophallus to become stuck to the mating sign of the same drone. Mating signs with additional pairs of orange membranes were found. In some queens, the semen or additional second mating signs were found at the end of the sign protruding from queen's sting chambers. Those three additional parts originated from drones, which attempted to mate, but failed to remove the mating sign of the predecessor. The thin thread at the end of the mating sign was pushed to the surface of the sign, because the next drone attempted to mate, but failed to remove the sign of its predecessor. The last drone, which failed to mate, left the orange membranes of his endophallic cornua at the mating sign of his predecessor. Thus, the mating sign originates from two drones. The chitinized plates and the mucus originate from one drone, but the orange membranes originate from the last drone(s), which attempted to mate, but failed to remove the sign of his predecessor (Wyoke, 2011).

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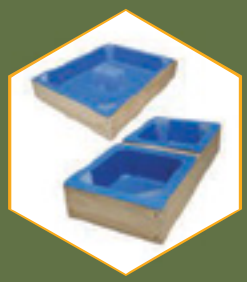

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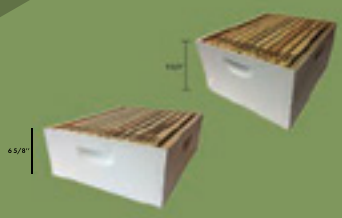

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Five apiaries of nucleus colonies (from west to east: Y, W, O, B, G) were established at 805-meter intervals along a 3220-meter east-west transect in an area of treeless prairie in Kansas, USA. All drones were removed from W, O and G apiaries, and young cordovan drones and brood were added to additional nuclei at Y. Young, marked, wild-type drones were located similarly at B. Virgin queens (>six days) homozygous for the cordovan gene were added to all nucleus colonies when the drones were well established. Eleven days later, these queens were removed and replaced by a second group of virgins. Drones were sampled, sorted and released every five minutes during each flight period. The abundance of cordovan and wild-type drones declined rapidly with increasing distance from their source, and there was general agreement between observed and expected distributions (east to west). It was thus possible to determine the general direction of a queen's mating flight and the minimal distance she flew by assessing the proportions of wild-type and cordovan bees in her progeny. The results showed that the distribution of queen flight distances differed from the distribution of drone flight distances, with queens flying further than the peak in abundance of drones from their own colony. Where colonies with virgin queens occurred <1600 meters from two or more other colonies, the queens mated predominantly with drones from these sources rather than drones from their own colonies. It is suggested that properly distributed drone sources could be used to dilute genetically ("Europeanize") a low-density feral population of Africanized bees (Taylor and Rowell, 1988).

Radio-frequency identification (RFID) was used to record the duration and frequency of nuptial flights of honey bee queens (*Apis mellifera carnica*) at two mainland mating apiaries. They investigated the effect of several factors on flight duration and frequency: mating apiary, number of drone colonies, queen's age and temperature. Significant differences were found between the two locations concerning the number of flights on the first three days. They also observed an effect of the ambient temperature, with queens flying less often but longer at high temperatures compared to lower temperatures. Increasing the number of drone colonies from 33 to 80 colonies had no effect on the duration or on the frequency of nuptial flights (Heidinger et al., 2014). BC

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How to Sell Honey and Avoid Arrest

Stephen Bishop

Some people could sell a sugar cube to an engorged honey bee in a honey bound hive—their salesmanship abilities are that good. Others of us struggle with selling, as evidenced by attempts to sell farm products over the years.

For instance, in eastern North Carolina where I grew up, collards were a big business. It seemed like every small town had a collard peddler who, before Thanksgiving and New Year's, would park at a gas station with a truck bed overflowing with freshly cut collard heads. There, in the parking lot, the collard king would hold court, a big folded up wad of cash in his hand as he bestowed the honor of buying his freshly cut collards on his followers.

And followers he had. There would be a genuine traffic jam in the parking lot from people clamoring to fork over cash to the collard king. The collard king was more a traffic director than salesman, making sure those who wanted to buy expediently didn't have to wade through the old timers who had high selective standards in greens, who examined each collard leaf as if they were at an old timey tobacco auction.

With those childhood memories guiding me, I aspired to be a collard king in western NC, in the foothills where I settled once I got married. I grew a quarter-acre collard patch, tended them with gentle loving care to maturity, then spent a Friday evening picking my first batch to take to the farmers' market. Oddly, nobody was selling collards at the farmers' market, so I thought this was my big break to establish a niche. In my mind, I was already imagining all the cash I would make from selling my greens, not to mention the fame and glory that would come from bringing my crop to the collard-deprived masses.

My farmers' market table certainly had a simple grandeur about it—it was one giant mound of collard heads. The saying was, "pile it high and watch it fly," meaning people are attracted to bountiful displays of produce and would thus buy my collards so fast they would fly off the table. But the only thing that flew, literally, were my collards; they parachuted down due to periodic wind gusts. When I returned home with a pickup full of collards to give away to neighbors, one neighbor said, "We never ate many collards growing up around here. Seems like most folks here ate cabbage."

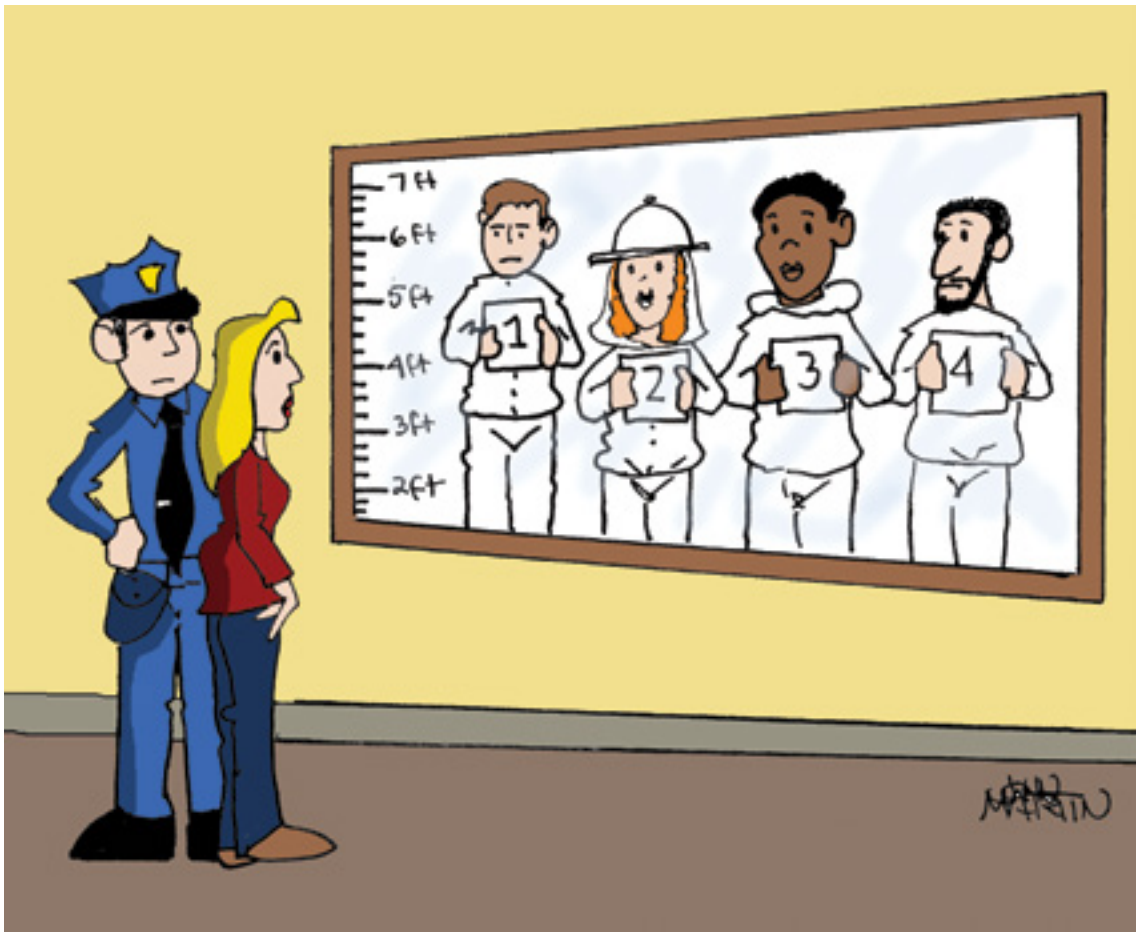
And that's the problem with farming. You can grow the world's most beautiful collards, but if you live in an area where cabbage is king, good luck.

As far as honey goes, the saying is it "sells itself." In my experience, I've found that it does until it doesn't. Eventually, you get to the point where you've exhausted the ability of all your friends, family and neighbors to consume and pay for honey and you're left to peddle honey to complete strangers, which can cause considerable confusion, especially if the stranger drives a silver minivan and the honey drop-off spot is the parking lot of a Hobby Lobby.

It didn't dawn on me at the time of the setup for this particular honey deal that Hobby Lobby likely has more customers who drive silver minivans than any other type and color of vehicle. I just drove up to the first silver minivan I saw parked toward the back, rolled down my window, and said, "Hi, are you here for honey?"

Needless to say, she was not here for honey, as the conversation turned quickly, really instantly, to the topic of pepper spray. Realizing my mistake, I felt terrified for both her and me. Thankfully, at that very moment, the stranger in the other silver minivan drove up and corroborated my story that I wasn't propositioning women for "honey," that there was no need to call the police, that I was indeed merely a lowly beekeeper trying to deliver honey and provide good customer service.

From that incident, I learned an important life lesson and have outsourced all my honey deals in the Hobby Lobby parking lot to my wife. She is a much better salesperson with the silver minivan demographic—or any really demographic, if I'm being honest. BC



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From the University of Florida Honey

The following is a continuation of an article authored by Amy Vu and published in the April 2023 edition of *Bee Culture*, wherein which she defined and discussed the role extension programs play as a part of American land grant institutions. The goal of this sequel article will be to present you all with the specific honey bee extension programs that we have underway here at the University of Florida, and we hope that by reading about what we do here you might be inspired to learn more about the extension programs in your area.

My name is Louis, and I work as an Extension Coordinator for the University of Florida Institute of Food and Agricultural Sciences (UF/IFAS). I want to start by briefly going over what it means to be an Extension Coordinator, but if you would like a more thorough introduction to extension, please see the aforementioned article in the prior edition of *Bee Culture*. When you imagine institutions of higher education, you're likely to picture two types of people almost immediately: professors, which are experts that oversee research and provide classes, and students, who are aspiring experts studying under the tutelage of the professors. Throughout the lifespan of a university these two groups form a sort of cyclical relationship, where information multiplies as it is passed down again and again from professors to students, refined by age like a fancy cheese. For some subjects in academia this cycle is meant to last indefinitely, spurring forth the endless pursuit of knowledge for knowledge's sake. Some subjects, however, require this cycle to open up and allow these resources to escape beyond the walls of the university.

Extension personnel work to facilitate that outward flow of knowledge. We ***extend*** the reach of a university's information to the people who need it. I work with the UF/IFAS Honey Bee Research and Extension Laboratory (HBREL) on our honey bee extension programs, which means finding ways to bring the breakthroughs and expertise of researchers to the people out there who are managing, dealing with or teaching about honey bees! In this article, I'd like to tell you all about some of our current extension programs here at the UF/IFAS HBREL, and how we believe these programs will make a difference in the lives of bees, beekeepers and our communities.

(If you'd like to learn more about any of the following topics, please see our website at: **www.ufhoneybee.com**)

Two Bees in a Podcast

Sometimes the most important conversations happen in the most casual moments. An office chit chat by the water cooler, gossip on the school bus or even just a few passing remarks between strangers while standing in line can bring new perspectives to light. Podcasts, which are essentially web-based radio talk shows, are a great way to expose ourselves to engaging banter even when we're alone. They allow listeners a chance to hear people give their thoughts in a format that is looser and more conversational than in a scripted medium, and these days great podcasts exist for virtually any genre or topic you can think of.

The UF/IFAS HBREL has been producing a podcast show called *Two Bees in a Podcast*. Episodes were first released in January 2020. We have over one hundred and thirty episodes available to be freely listened to online. The show, hosted by Ms. Amy Vu and Dr. Jamie Ellis, aims to provide beekeepers and other honey bee enthusiasts a place to listen to apicultural advice, research and stories from a long lineup of special guests. Our show strives to showcase a diverse stock of topics, from basic beekeeping practices to highly specialized scientific research.

Most episodes of *Two Bees in a Podcast* feature an interview with a guest speaker, management tips from Dr. Ellis and a Q&A segment where we answer questions submitted by our listeners. Beekeepers come from all different walks of life, and every apiary is unique, so there is no shortage of new ideas and difficult questions to spark fascinating discussions about our favorite little insects.

If a beekeeping radio show sounds like something you might enjoy, we invite you to tune in by visiting **www.ufhoneybee.com**, or by tuning in to any podcasting app on your smart device! Podcasts are an excellent way to keep your mind engaged in something you love while doing chores, traveling or even while working your hives.

Bee College

Bee College is a semiannual beekeeping workshop run by the UF/IFAS HBREL. It is a two-day event that welcomes beekeepers of all levels to come and grow together, from sideline or commercial beekeepers to curious fresh faces. So, how exactly does Bee College work, and how do we aim to best serve those who attend?

Bee Research and Extension Laboratory

Extension Programs

Louis Dennin & Amy Vu

Attendees at Bee College receive a program with a timetable of classes being taught by an expert team of instructors. These classes all occupy sixty-minute class periods, and each attendee can create a schedule for themselves that suits their needs and interests. The event is organized in much the same way a conference is organized, giving attendees freedom in what seminars they wish to engage with. Beginners have access to classes like "How to Light a Smoker" and "Setting Up Your Apiary," while experienced beekeepers can attend classes covering the latest research happening at our lab or learn how they can expand a hobbyist operation into a business. Some classes are held inside of classrooms while others will be out in an apiary, depending on the topic and the instructor. So, whether someone wants to be outside all day with the bees, listening to lectures from honey bee experts in a classroom environment or a little bit of both, we try our best to make sure every attendee can create a schedule that makes the most of their visit. (Figures 1, 2 – next page, 3)

Figure 1. Bee College attendees in a honey extraction class at the University of Florida. Credit: Cat Wofford, UF/IFAS Communications

Figure 3. A sample Bee College schedule from the Spring 2023 Bee College in Gainesville, FL. Adapted from UF/IFAS HBREL provided table

SATURDAY MARCH 18	**HBREL Museum RM 112**	**RM 1027**	**RM 1031**	**RM 2216**	**RM 2218**	**RM 3118**	**RM 105 (HBREL)**	**Apiary I**	**Apiary II**	**Dadant Honey Processing Facility**
8:00AM	**Registration (Breezeway in Steinmetz Hall)**									
9:00AM-10:00AM	Honey Show	Honey Judge Training	Honey Bee Basics **Clementel**	Apiary Pest Control **Kern**	Rules & Regs **Stanford**	Leveling Up **Deeringer**	Research Updates **HBREL**	Hive Demo **Keith**	Making Splits **Jack**	Candle Making **Murphy**
10:10AM-11:10AM			Swarm Control **Stanford**	Common Mistake Beginners Make **Sterk**	Crop Pollination **Ternest**		Protecting Bees from Pesticides **Bultemeier**	Setting Up Your Apiary **Oster**	Reading Frames **St. Amant**	Cooking With Honey **Duncan**
11:10AM-11:30AM	**Coffee Break (Vendors, Information Booths, and Coffee in the Steinmetz Hall Lobby)**									
11:30AM-12:30PM			Cottage Food Law **Hagen**	*Varroa* Biology **St. Amant**	African Derived Honey Bees **Kern**	Honey Bee Viruses **Iredale**	Creamed Honey **Rawn**	Hive Demo **Clementel**	How to Capture Swarms **Keith**	Honey Extraction **Sullivan**
12:30PM-1:45PM	**Break for Lunch (Vendors and Information Booths Will Be Open)**									
1:50PM-2:50PM			Intro to Pests & Diseases **Yarborough**	*Varroa* Control **Jack**	Processing & Selling Honey in Florida **Hagen**	Honey Bee Diagnostics Lab Updates **Fulton**	Microscopy & Gut Pathogens **Iredale**	Hive Demo **St. Amant**	Installing Your First Hive **Bammer**	Beeswax Wraps **Murphy**
3:00PM-4:00PM			Queen Management **Rawn**	Business Planning **Athearn**	CSI: Honey Bee **Sterk**	A Detailed Look At IPM **Gill**	Plants For Bees **Kern**	Equalizing Colonies **Keith**	*Varroa* Monitoring **Oster**	

Figure 2. Bee College attendees attending an apiary class. Credit: UF/IFAS HBREL

In addition to our lectures and demonstrations, there is one other invaluable, amazing component of Bee College, and that is, of course, the beekeepers themselves. One of my favorite parts of Bee College is looking around at the groups of people chatting in between classes. People who, in another setting, would be perfect strangers with little in common with one another enjoying a coffee and talking as if they were lifelong friends, all thanks to this strange and wonderful love of honey bees they share. I love imagining how much information is being shared in those little chat circles. New beekeepers receiving advice, veterans swapping stories about their apiaries and completely off-topic discussions that bring the ever-interesting community of beekeepers we have closer together.

Bee College also serves as a space to promote the business and craftsmanship of beekeeping. (Figure 4) We have vendors register to sell their wares and answer questions, carrying apicultural items like honey, *Varroa* treatments, beeswax products, equipment and more! Sometimes these vendors split their time between selling their wares and teaching classes, passing along the tricks of the trade to people eager to learn. Bee College also serves as the venue for our semiannual honey shows, which are contests for beekeepers where certified Florida honey judges grade their bee product entries. This includes things like beeswax, mead, beekeeping gadgets, baked goods and of course, honey! (Figures 7 & 8) Earning high marks in a honey show is a great achievement for beekeepers, as it takes a lot of talent and skill to meet the high standards of these contests.

As I mentioned before, Bee College is held semiannually; here at our lab in Gainesville during the Spring, and again in another city in the Summer. Currently, our Summer Bee Colleges change location each year, alternating between northern Florida and southern Florida to help make it more accessible to those who live far from the University of Florida's main campus. Our next Bee College event will be held on August 18 & 19, 2023 in Davie, Florida.

Figure 4. Vendors are able to present and sell merchandise at Bee College. Credit: Cat Wofford, UF/IFAS Communications

Figure 7. The University of Florida honey show, which happens as a part of Bee College. Credit: Bori Bennett

Figure 8. A honey judge inspects a block of beeswax entered in the honey show. Credit: Bori Bennett

The Master Beekeeper Program and Online Learning

You don't need to travel far participate in our honey bee extension programs, however. In fact, to provide the best education we can to as many people as possible, the UF/IFAS HBREL has been iterating and improving upon a catalog of online course materials for beekeepers around the world.

Chief among these online courses is our Master Beekeeper Program (MBP) (Figure 5), which is a detailed and rigorous series of coursework paired with real-life experience requisites, designed to provide new beekeepers with a guide to get started and to support the continued growth of experienced beekeepers. The MBP is divided into four levels, which can be thought of kind of like the belts in martial arts. Each level has

Figure 5. The Master Beekeeper Program logo. Credit: UF/IFAS HBREL

MASTER BEEKEEPER PROGRAM

its own requirements that must be completed, and upon each advancement to a new level, participants are awarded a certificate and patch to signify their accomplishments. These levels are Apprentice Beekeeper, Advanced Beekeeper, Master Beekeeper and Master Craftsman. I won't go into the nitty-gritty of what each rank involves in this article, but completing even just the Apprentice Beekeeper program alone gives new beekeepers a great foundation of honey bee biology, beekeeping techniques, and problem-solving skills to get them started.

In addition to the aforementioned MBP, our online catalog features an always-expanding library of what we call "bee-Learning" short courses, which are individually packaged lessons for those who really just want to study the ins and outs of a specific topic. The topics covered by our bee-Learning catalog range from entry-level topics like honey bee biology and beekeeping equipment to more specialized lessons like overwintering strategies and the methods of rearing queens.

Not sure if an electronic learning platform is right for you? We have one course that is open to enrollments free of charge! It is a bee-Learning course titled *Is Beekeeping Right for You?*, which is always there for anyone curious about our online interface, or is on the fence about becoming a beekeeper. Anyone can freely join anytime and see what they can expect from our other online offerings.

On that note, I should mention that all of our online classes can be joined at any time (with the exception of upper levels of the MBP, which have prerequisite courses) and can be completed at the participant's own pace. There is no prescribed "class time" that participants must attend, and all the lectures and materials can be worked on at any time of day. The lectures for these classes are provided by some of the University of Florida's top honey bee experts, including Dr. Jamie Ellis, Dr. Cameron Jack and our Instructional Designer Ms. Mary Bammer, who currently maintains all of the online courses, grades the written and video assignments and actively provides support to those enrolled. So despite not actually being in our classroom, beekeepers who engage with our online materials are in good hands.

HBREL Website and Social Media

Also an online resource for beekeepers, our official website (**ufhoneybee.com**) is kept up to date with a lot of useful links and guides. We have links to all of Florida's county-level beekeeper clubs in one place, so people who would like to seek out a beekeeping community in their area have a way to find a group that is accessible to them. You can also find articles about pollination, pests, diseases, best management practices and more! It is our hope that our website can act as a versatile, 24/7 resource to anyone with honey bee questions.

We also maintain a social media presence on Instagram, Facebook and Twitter, where we post announcements, honey bee facts, photos from our lab and a monthly management calendar for Florida beekeepers. The calendar is accompanied by a post on our blog, which goes into detail about recommended best management practices for that month in Florida. You can find us on social media @UFHoneyBeeLab, and you can find a link to our blogs on our website.

Train the Trainer

Here in Florida, there are 67 counties and only one UF/IFAS HBREL. That said, part of our Extension efforts focus on supporting County Extension Agents to hold their own beekeeping workshops in their communities. Since Florida has over 5,000 registered beekeepers, there is plenty of opportunity for Extension Agents to provide beginner classes, or build networks with commercial beekeepers to help with rules, regulations and necessary permits to keep businesses afloat. Twice a year, UF/IFAS HBREL provides in-service trainings for UF/IFAS Extension Agents interested in starting a honey bee program in their county.

A team called the Honey Bee Extension Education Team (HBEET) was also created to represent each district in Florida. These individuals not only meet monthly to discuss commercial beekeeping needs, how to provide resources and ways to understand the industry better, but they also act as a resource to County Extension agents who may have immediate questions related to where they are in Florida. Together, the UF/IFAS HBREL and HBEET provide resources to Florida beekeepers and beyond.

Collaborations

As extension agents that specialize in honey bees, one of our jobs is providing support to other honey bee health education efforts in the state. We aren't the only ones working towards bettering the lives of Florida's beekeepers, and we take pride in collaborating with some other incredible organizations.

We collaborate with the Florida State Beekeepers Association (FSBA), who serve as the representative body for the beekeepers in Florida. To list just some of the work that they do, the FSBA works towards protecting the legislative rights of Floridian beekeepers, raises funds to aid beekeepers impacted by hurricanes and were an instrumental part of securing the funding and approval to get the HBREL built in the first place. They lobbied to have a dedicated honey bee research facility installed on UF's campus because they so generously believed in the value of the work we're now able to do, and our lab owes a great deal to them for that. Because everything we do was made possible by their support, we take great pride in being able to work with them. We share an annual research update with their members at the yearly FSBA conference, giving their members a chance to hear about the incredible amount of science and education we are able to turn out from this facility. (I'll leave it to my colleagues to go into more detail about all of that in other installments of our lab highlights in future articles.) Our lab also actively participates in some of FSBA's projects. For example, Amy Vu, who leads the extension efforts at the HBREL, worked many long days partnering with FSBA's initiative to aid beekeepers in the wake of 2022's Hurricane Ian, which was a devastating event for beekeepers living in and visiting Florida last October. (Figure 6)

Another incredibly important collaborative effort of ours is working with the Florida Department of Agriculture and Consumer Services (FDACS) to make strides towards bettering honey bee health. In the state of Florida, it is legally required that beekeepers register themselves with the state through

Figure 6. Amy Vu, State Specialized Extension Agent and HBREL Faculty (middle) coordinated relief in the aftermath of Hurricane Ian with FSBA President John Coldwell (left) and Keith Councell (right). Credit: Bori Bennett

FDACS so that their colonies can be inspected by qualified state apiary inspectors. The FDACS office that oversees these registrations and inspections is actually located right beside our lab, despite technically being a separate entity from the university. This proximity allows us to meet together frequently and discuss the current challenges facing Florida's beekeepers. We consider assessing the needs of our stakeholders to be a crucial part of the extension process; the first step towards creating resources that can help our beekeeping community thrive. FDACS now has an active honey bee diagnostics lab, which was something our lab helped them establish and a great example of one such resource.

Our lab also plays a role in two very exciting grants: The USDA NIFA Beginning Farmer and Rancher Development Grant and the USDA NIFA Veterinarian Training Grant. The former is an initiative to help new beekeepers 1) develop a business plan, 2) diversify their value-added product making skills, 3) market in a digital era and 4) learn the rules and regulations of hiring employees, with the latter being a collaborative effort between Michigan State University, The University of Florida and Texas A&M University to train veterinarians in honey bee medicine. The two grants were both awarded in 2022, and they represent a lot of very promising new resources and work to be done in the very near future.

Finally, we also assist with finding speakers for events at schools, honey bee clubs/associations and other educational venues. Many of these speakers come from our Master Beekeeper Program, which requires members to perform public service to achieve the Advanced Beekeeper rank or higher. This entails engagements like tabling at events or lecturing to audiences. These MBP participants are located all over the state (with some in other parts of the country and even other parts of the world), and their participation in the program allows us to expand our opportunities to facilitate speaking events in vastly more cities than our lab would be able to cover on its own.

Communications

The last extension service I would like to discuss with all of you is maybe the least "flashy" part of our job, but an essential part of any well-established extension office and one I feel can be of great use to many of you reading. Extension agents help their clients get in touch with the contacts and resources they need to solve problems facing their operation. We answer phone calls and emails from members of the public that have honey bee-related inquiries, and if we don't have a good answer for you, our job is to find a specialist who is able to help. As an example, the most frequent call we get is from people who are trying to have a swarm or nest of bees removed from their property.

Our job is to connect the individual to find a registered beekeeper that is near them to conduct the removal. In this case, we direct them to the Florida Department of Agriculture and Consumer Services' updated list of beekeepers and pest control operatives that can legally handle situations like those.

One other example of such a resource is Ask IFAS (previously called EDIS), which is a library of freely accessible articles covering issues that UF/IFAS extension agents have written for the purpose of helping clients. You can read about honey bee biology, African-derived honey bees, find a youth activity book about beekeeping, and much more via Ask IFAS (especially if you're interested in topics beyond honey bees). Ask IFAS is a powerful tool for all UF/IFAS extension agents, and it's likely one of the first places we'll look to find accredited information to answer questions from our clients.

As I mentioned at the beginning of this article, our mission is extending the reach of the university's resources to the people who can put that information to use in the real world. The common thread between all our extension programs is facilitating the movement of information. Sometimes we do it in a high-production method like a podcast or a two-day workshop, but sometimes it's just a simple phone call helping someone in need. This isn't exclusive to beekeeping, either. In the state of Florida, at least, every county has an extension office prepared to assist with all kinds of issues facing the state's stakeholders. If someone contacts a Florida extension office with a real head-scratcher of a beekeeping question, they may very well be sent our way!

Who knows, a good question like that might end up featured on the Q&A segment of *Two Bees in a Podcast*, and a really good question may even inspire a new Ask IFAS publication or a Bee College class! We are always trying to keep up-to-date with what beekeepers need to know, and figuring out how best to make that information accessible to them. It is a real honor to serve Florida's beekeepers, and I hope that by taking the time to read this article you feel I may have been of some service to you, too. Thank you. BC

Figure 9. A rainbow as seen from an apiary set up as part of our Summer 2022 Bee College in Panama City, FL. Credit: Amy Vu

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Minding Your Bees And Cues

Numbers

Becky Masterman & Bridget Mendel

Managing bees is kind of a numbers game. Not in the illegal gambling sense, but instead in the measuring bee health and business sense. New beekeepers are warned about the importance of counting *varroa* mite numbers in their colonies and hear stories about high percentages of colony loss. Long time beekeepers and many commercial operations remember stories of high honey yields and market prices that are impacted by imports. Whether you are new to beekeeping or a long-time participant, keeping track of key numbers could be good for you, the bees and beekeeping.

It has been said often that beekeeping is local, so your beekeeping numbers should be too. Honey yields per colony vary greatly from state to state (and apiary to apiary within a state and hive to hive within an apiary) as do the pounds of honey that bees need to get through Winter or dearth periods. Tracking key numbers within your state each year can serve as a bee health conversation starter. Let's hope that the conversations continue each year and are about lower colony losses and higher honey yields.

Here are some numbers that we think are important.

Varroa Mite Loads

Let's get the mite talk out of the way and address it right away. *Varroa* mites and the viruses they vector are still one of the greatest threats to the health of your honey bee colonies. Successful beekeepers keep on top of the latest management recommendations and know the threshold where intervention is key to maintaining healthy bees. This threshold might be different than what you think and the threshold changes depending on the time of year. Monitoring mite loads is important. Keeping up on the latest research-based recommendations is also critical to successful beekeeping as your management will change over the years as the threats to your bees change (anyone remember tracheal mites?). This excellent update from the Bee Informed Partnership will

Successful beekeepers track numbers throughout their colonies and apiaries over time. Knowing varroa mite loads might help explain colony death. Honey production yields can reflect habitat quality around your apiaries. Photo credit: Rebecca Masterman

bring you up to date on mites as well as provide a link to the latest free edition of *Tools for* Varroa *Management* from the Honey Bee Health Coalition. While you are there, we suggest signing up for updates from the Bee Informed Partnership (**https://beeinformed.org/2023/03/01/the-importance-of-spring-mite-loads**).

Colony Loss Data

Let's also get the colony loss data out of the way. Following significant colony losses across the U.S. in 2006, the Bee Informed Partnership has been tracking colony losses across the U.S. You can contribute to the survey each year in April by reporting your losses. Reported loss data by states is available all the way back to 2008 (**https://research.beeinformed.org/loss-map/**).

Honey Market Numbers

The National Honey Board compiles honey data from multiple sources on their website and you can easily spend some time looking at the numbers (**https://honey.com/honey-industry/market-overview**). For a monthly regional report, *Bee Culture's* detailed guide will provide everything you need to know (**https://www.beeculture.com/monthly-regional-honey-price-report/,** or turn to page 8 for this month's report).

Honey Yields

If you want to explore your state honey data, the USDA National Agricultural Statistics Service has a searchable database for all things honey and bees, including reported honey yield per colony. You can search national as well as state data across more than 30 years (**https://quickstats.nass.usda.gov/**).

Measuring available habitat for your bees is difficult but doing so might inspire others to increase floral resources for pollinators. These bees are enjoying the blooming mountain mint planted in the apiary. Photo credit: Rebecca Masterman

Because honey bees are managed pollinators, it is easier to track the numbers described before. One other number that is more difficult to track, yet very important, when talking about honey bee health is **Acres of Pollinator Habitat.**

How much pollinator habitat is available for bees in your state? It is a difficult number to track as counting the flowers on trees, shrubs, prairies, conservation land, cover crops and more (bee lawns, gardens, roadside habitat, etc.) is not easy, but we love those who are trying to do just that. Please visit Homegrown National Park's website and spend some time appreciating their efforts to support grassroots conservation with a way for all of us to map our native plantings (**https://map.homegrownnationalpark.org/Dashboard/Country**).

Knowing the status of food for your bees is important. Beekeepers usually work backwards, as they place their bees and measure the honey. If honey production is low (compare yours to the average honey yield), then it is possible that there are not adequate resources for your bees. If honey production is high, then you are in luck. If you planted flowers specifically for your bees to make honey on, then it isn't luck, but good planning.

Should we be measuring some of the pollinator habitat in our states? We think it is a great idea and good to know if the numbers are going up or down. Some numbers, like acres planted in CP42 Pollinator Mix in the Conservation Reserve Program are being measured. Is it possible for state or federal agencies to keep track of the habitat they have installed without too much of a record-keeping burden? We don't know but think we should ask.

Acknowledgments and suggestions:

The authors would like to thank Dr. Marla Spivak for helpful edits and suggestions. BC

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 number stories or thoughts, please send an email to mindingyourbeesandcues@gmail.com.

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American Honey Producers Association
www.ahpanet.com

News from AHPA

This is meant to provide some clarification to the issue of shipping U.S. honey bee packages into Canada.

The Canadian Food Inspection Agency (CFIA) is in charge of allowing or not allowing U.S. packages into Canada. In 2013, the CFIA conducted a Risk Assessment on importing U.S. packages into Canada, evaluating a number of disease concerns and risk thresholds vs. assessed impact on the Canadian beekeeping industry. The conclusion of the 2013 Risk Assessment was that importing packages from the U.S. was a greater risk vs. reward to Canadian beekeepers, and so the border remained closed to U.S. packages. The CFIA will not allow U.S. packages to enter Canada without a favorable Risk Assessment.

Significant overwintering losses over the 2021/22 Winter, where Canadian beekeepers experienced a reported 45.5% loss, has increased the call for CFIA to re-evaluate the Risk Assessment. The common theory for the high over-wintering loss is a very warm Spring in 2021, and very warm Fall, which provided *Varroa* mites a much longer reproductive cycle that typically seen in Canada – typically brood is present for six to seven months, mid March-early October. The provinces of Alberta and Manitoba had the highest over-wintering losses, and beekeepers from those provinces have led the push for the current call to open the Canadian border to U.S. packages. While most other provinces have shown opposition to opening the border to U.S. packages, some have also indicated support for CFIA to perform another Risk Assessment. CFIA has indicated this is not a priority for them at this time.

A small group of beekeepers have continued to push for the opening of the border to allow packages into Canada, and have been pushing for this since the border closed in 1987. In a year of significant overwinter losses, there is a larger call for the border to open; further, in a year with high honey prices ($2.35-$2.55 USD) but with high Winter losses, there is a perceived greater loss as beekeepers are thinking about 'what could have been'.

Prior to COVID, Canadian beekeepers were importing approximately 30,000-35,000 (1kg) packages annually, mostly from Australia and New Zealand, but more recently also from Chile. In 2020 and 2021, airline and travel issues caused a significant decrease in packages arriving to Canada, with a total of approximately 22,000 (1kg) packages arriving in those two years combined. That being said, even though Canada had roughly 80,000 fewer packages arrive, 2021 saw Canada with the highest number of hives in the last 25 years at nearly 800,000. This is likely because Canadian beekeepers are beekeeping with a proactive attitude and building more nucs the prior year, overwintering them, and then running them as hives the following year. This is reducing the quantity of packages needed to sustain the industry, even in years with higher losses.

Much of the opposition from Canadian beekeepers to U.S. packages comes from a concern about disease or pest issues that have not been noted in local jurisdictions. Oxy-tet resistant AFB, Tylosin resistant AFB, Small Hive Beetle, *Varroa* resistance to Amitraz, Africanized Honey bee genetics (AHB) and EFB have not been noted in many jurisdictions in Canada. Many Canadian beekeepers are hesitant to allow packages which may introduce new pest or disease pressures to the local beekeeping industry. Beekeeping is becoming a much more difficult occupation than in past years and introducing possible new pests will only result in additional workload and costs.

It should be noted that the U.S. currently also has a Risk Assessment to evaluate bee imports into the U.S. The export of Canadian packages and Canadian queen bees to the U.S., while technically allowed, is logistically nearly impossible due to the protocols and timing of required inspections by U.S. APHIS inspectors.

Simon Lalonde – Canadian Liason,
American Honey Producers Association

Hello, fellow AHPA members.

First of all, what a crazy almond pollination season! After many were talking about a glut of hives, it ended up being one of the shortest supplies in the last 10 years. The biggest story was higher than normal losses. Many members I talked to lost double their normal loss or a higher percentage this year coming out of the Idaho/Utah sheds (us included). Was it too many mites going in? Higher virus loads? A new Bee Paralysis virus that is showing up in most of the samples sent into labs? Drought in the Dakotas and Montana? Or just a combination of all those things? Adding to the losses were that less hives were shipped in from Florida due to the hurricane. Maybe it's wise to just expect our operations to have bad Winter losses about every four to five years, even with more pollen patties, replacing queens, adding new bee feeds, etc.

Big growers short on hives were calling around looking for anything, even two-framers so that they could get covered for crop insurance. There are still a lot of acres of almonds coming into production to take the place of the old orchards being pulled. January was the third highest

almond shipment total for the industry on record, so they are moving product, prices have gone up 30-40 cents per pound as of mid-March and we finally got above-average snow/rain totals this Winter. At my orchard here in central CA, we are at around 10 inches for January and February, which is more than all of last year. We've seen flooding and even snow on the valley floor, with many mountain communities cut off due to snow. At the time of writing this, Yosemite National Park has been closed for two weeks with no date yet to reopen due to snow. Below-normal bee flight hours in almonds will mean a smaller crop and higher prices. However, sage/orange crops will benefit from the increased rainfall, and our bees will benefit by foraging on cover crops planted in almonds after bloom and on wildflowers. This is obviously all good news for California beekeepers.

The sad news is SO MUCH rainwater has turned into salt water! Instead of capturing this much-needed rain, it went out to the ocean. The capacity to capture rainwater in weather events like this has not improved for 40 years here. The San Joaquin, Kings and Fresno Rivers in my area have run at high capacity for weeks because the dams are full. Frustrating, to say the least.

Another hot topic has been the push to open the border again for packages to Canada. At the start, AHPA's stance was neutral, as we had nothing in writing from the concerned parties and a lot of hearsay flying around. After more discussions, AHPA has changed our position to state that we will support packages going back into Canada, as long as they stop getting packages from Australia and other at-risk countries that are in close proximity to countries with Tropi mites. There are reports out of Australia that *varroa* was in their country 12 months before they detected it. The same could happen with Tropi as packages come into Canada. Another reason the new policy would be in the Canadians' best interest is that Aussie packages are older Fall bees and American packages would be new Spring ones (with queens they are already getting). In the end, this issue is up to the CFIA (Canadian Food Inspection Agency).

As for the dumping suit, the appeals are filed for the low Indian rate as well as three appeals by packers on critical circumstance with Vietnam. Argentine and Brazilian packers are also appealing their rates. We still need more money to finish these appeals. We appreciate those that continue to donate to help see this through. Some of you have chosen to set up quarterly payments. Thank you! Please consider another nickel a pound for 2023. It looks like it should be a good crop in the midwest this Summer!

To finish, we will be going to Capitol Hill in May to keep up the good fight. FSA is being a little difficult not following the ELAP payment/loss rates Congress directed them to follow… stay tuned. This will be a focus along with getting more funding for lab research. Also, CRP/forage, H2A visa reform, updating the grading standard and country of origin labeling are among the issues we will be working on as we do the rounds with Eric Silva in DC.

As always, I enjoy hearing from you. Email/call me with concerns you have. Be safe moving bees, lifting boxes (our backs are all getting older), making nucs and producing queens. I love the hard-working, can-do-attitude our members have.

Chris Hiatt – President, American Honey Producers Association

We present several great awards during our conference, the most memorable being our Beekeeper of the Year Award! This year, former AHPA President, Kelvin Adee, was the recipient.

Kelvin is a true friend, in and out of the beeyard, who cares deeply about the U.S. honey industry! Kelvin and Adee Honey Farms have had an undeniable impact on the honey industry through their advocacy and love for honey bees. As passionate as he is about the industry, Kelvin is devoted to his family, and loves spending time with (i.e., spoiling) his grandchildren. We couldn't be more thrilled to honor him with this award! It is well deserved and hard earned. We love having Kelvin and the Adee's as a part of the AHPA family!

Another great distinction awarded at our conference is the Friend of the Industry Award. We were proud to honor Kevin Rader with it this year!

Kevin has been a loyal friend to beekeepers across the U.S. and the beekeeping industry for many years. A former state senator, Kevin was instrumental in helping beekeepers get access to rainfall insurance and has generously supported the antidumping suit. We enjoyed getting to see Kevin this year and couldn't be prouder to call him our friend!

This year, our members took a break from the everyday worry and hit the golf course! There were only a few participants with golf experience, but AHPA's 1st Annual Golf Tournament was a buzzing success! Spending time outdoors—out of a bee suit—with good friends gave our members a chance to catch up on life beyond the beeyard.

There was so much laughter, banter, and friendly competition, we didn't even make it through the whole course! Although a lot of golf balls ended up missing and few (if any) made par, we loved starting out our conference on such a positive, laid-back note.

Start brushing up on your swing and bring your clubs to San Diego! We'll see you on the course for our 2nd Annual Golf Tournament, December 4th, 2023. BC

Mattie Joiner – American Honey Producers Association Media Specialist

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The Carl Hayden Bee

Gloria Hoffman

The Carl Hayden Bee Research Center (CHBRC) in Tucson, Arizona is the nutrition laboratory of the USDA-ARS bee research program. The Laboratory studies nutrition in a broad sense and conducts research on defining colony nutritional needs throughout the year, acquisition of nutrients from pollen, environmental and landscape factors that can influence nutrients in pollen, and worker-worker and worker-queen interactions. The role that microbes play in nutrient metabolism and defense against invading pathogens also is investigated. The impact of nutrition on the population dynamics of colonies is another research area, as colony growth in the Spring affects its size in the Summer and Fall and the chances of surviving the Winter. Recently, we have added the effects of climate change on colony growth and survival as weather conditions can affect the availability of flowering plants, nutrient composition of pollen, overwintering survival and colony growth in the Spring.

Figure 1. Honey bees visiting sunflowers in the field to test the attractiveness of different cultivars. The nutritional composition of the pollen from the sunflowers also was collected so comparisons could be made among the cultivars. Brassica *plants also are grown in greenhouses under controlled conditions to determine the effects of environment on nutrients in pollen.*

Research at the CHBRC is led by five scientists with specialized areas of expertise that create an integrated and comprehensive program focused on honey bee nutrition. The areas are honey bee physiology (Dr. Vanessa Corby-Harris), chemical ecology (Dr. Mark Carroll), population dynamics and behavior (Drs. Gloria DeGrandi-Hoffman and William Meikle) and microbial ecology (Dr. Kirk Anderson). The following is an overview of each program highlighting how they interact to achieve the goal of providing a comprehensive understanding of nutrition that can optimize colony health and reduce colony loss. To obtain more information and read about our latest findings, go to: **https://www.ars.usda.gov/pacific-west-area/tucson-az/carl-hayden-bee-research-center/**

Dr. Vanessa Corby-Harris (VC-H)

The Corby-Harris laboratory studies honey bee nutrition, with the goal of improving honey bees' access to high-quality natural forage and supplemental diets. The lab's first area of focus is to measure how bees use the nutrients in pollen and how the patterns change with seasons. Combined with information about changes in the colony's adult and brood population size during the annual colony cycle, these studies will determine what nutrients colonies need throughout the year. For example, in periods of population increase in the Spring and Summer, nurse bees have large amounts of protein in tissues important for brood food production (i.e., hypopharyngeal glands and fat body). Therefore, higher protein diets could be more beneficial during times of colony growth. In periods of colony contraction when preparing for Winter, the physiology of nest bees shifts from storing and using protein to make brood food to an overwintering profile favoring lipid storage. The lipids provide concentrated energy to help bees endure periods of confinement in colder conditions. Therefore, colonies preparing for Winter could benefit from diets with less protein but more lipid.

The VC-H lab is also researching how to improve supplemental diets by comparing them to natural pollen, finding what nutrients the diets are missing and asking whether those missing nutrients affect bee health. An initial comparison between pollen and commercial supplements showed that supplemental diets vary in their lipid content and many lack certain lipids that are found in pollen. In a Fall field trial in North Dakota (funded by Project Apis m.), the VC-H lab found that colonies con-

suming certain supplemental diets stored more lipids going into Winter and grew more in the Spring compared to colonies fed lipid-deficient supplements. The lipids also may play an important role in behavior and colony health. Dr. Meghan Bennett, a postdoctoral researcher in the VC-H lab, found that certain lipids help bees discriminate between damaged and healthy brood. Megan Deeter, a graduate student (research funded by Project Apis m.), found that dietary lipids improve pesticide resilience. These studies can be used to improve existing dietary supplements, particularly for colonies undergoing key seasonal transitions or that are under stressful conditions.

The last area of research in the VC-H lab focuses on how the environment might affect the nutritional value of bee forage (Figure 1). This area of investigation was prompted by discussions with stakeholders and scientists, and visits to the Northern Great Plains in an atypically dry year. Using sunflowers, an abundant Summer/Fall resource in the Upper Midwest, VC-H and colleagues from the Fargo, North Dakota ARS lab first looked at how pollen nutrients differed for plants grown in either North Dakota or Arizona at the same time of year. Essential nutrients, such as fatty acids differed across locations, suggesting that plant growth conditions affect pollen nutrition. The team is now using field, greenhouse and growth chamber experiments to test this question under more controlled conditions where temperature and soil moisture can be carefully manipulated. This project has multiple implications for honey bee nutrition and colony health. For example, if drought diminishes pollen nutrients, and certain plant cultivars are more resistant to drought, bee health might be improved by growing these cultivars in drought-prone areas. Knowing how environment affects bee nutrition can also translate to better predictions for how colony health will respond to different weather conditions.

Dr. Mark J. Carroll (MJC)

The MJC lab examines how honey bee stressors (poor nutrition, pesticides, parasites and pathogens) affect coordination and performance of critical colony functions such as queen care, brood rearing, nutritional balance and resistance to pathogens and parasites. The MJC lab also has led the efforts to analyze the nutritional composition of pollen by developing nutrient analysis methods for amino and fatty acids. The development of the nutritional analysis methods has enabled our investigations of the nutrient composition of seasonal pollens, and effects of environmental and genetic factors on the nutrients in pollen.

In addition to developing methods for nutritional analyses, MJC also researches semiochemical (pheromones, odors, other chemical cues) communication systems in the hive. As a chemical ecologist, MJC identifies the chemical cues that trigger worker behaviors for important colony tasks including queen care, brood and adult feeding, food stores maintenance and hygienic responses to disease and parasites. However, semiochemical-mediated communication can be disrupted by colony stressors. Our research is directed at understanding how semiochemical communication is affected by stressful conditions, and then use this knowledge to counter stressors through better monitoring, management interventions, and targeted development of hive remedies. The MJC laboratory recently identified odor cues that strongly attract nest workers to starving adults and brood, the first step in feeding support of malnourished individuals. Some of these are colony pheromones that vary considerably with individual and colony nutritional states and affect worker nursing behaviors. MJC is currently examining how workers respond to starvation cues during times of forage dearth and abundance. The odors may provide insights into the colony nutritional state and could serve as tools to determine if supplemental feed and management approaches are reducing malnutrition.

The Carroll lab is exploring how chemical signaling might be used to improve hygienic behavior. Pathogen-infected and parasite-infested bees give off odors that differ from healthy individuals, whether as generalized distress signals, odors from damaged tissues or odors produced by the natural enemies themselves. Workers use chemical cues to detect and hygienically remove stressed individuals from the colony before they become highly infectious to other colony members. MJC is exploring chemical signals associated with early infections that may serve as cues for rapid hygienic responses. To date, MJC has identified odor cues produced by asymptomatic larvae and adult workers during the early stages of infection by the chalkbrood pathogen *Ascosphaera apis*. Similar cues produced by bees infected by other pathogens and parasites could be used to select for hygienic lines with more timely and targeted responses.

A central focus of the Carroll Lab has been on improving queen quality and productivity. Queens are largely shielded from direct impacts of colony stressors such as poor nutrition and pesticide exposure by the workers that tend them. However, stress can affect the queen indirectly through the workers that care for her and raise her brood. MJC recently found that worker hypopharyngeal glands and internal nutrient stores (used to make jellies to feed queens and brood) decrease sharply as the colony expands after crop pollination probably due to increasing nutritional stress. Improving worker seasonal nutrition supports both queen productivity and brood rearing as colonies endure nutritional dearths (Figure 2, next page). Exposure to pesticides might also affect queen health. MJC recently found that the Insect Growth Regulator, methoxyfenozide does not affect queen development, most likely due to the absence of the compound in royal jelly but does affect queen mating and sperm storage.

Dr. William Meikle (WM)

The Meikle lab focuses on continuously monitoring the activities of bees within the hive or laboratory cages to

Figure 2. The Carroll lab observes queen retinue behaviors in temperature-controlled conditions. Please note that daylight has been added to see activities here. These videos are usually taken under red light or in shaded tents.

Figure 3. Temperature sensor installed near the top rail of the center frame in a hive. The CO_2 sensors are installed in a riser space on top of the frames.

determine how factors such as pesticides, cold storage or queen line influence colony weight (i.e., growth, foraging activity and honey stores), internal temperature and CO_2 concentration. Once installed, the electronic sensors can detect changes in honey bee behavior and colony population dynamics with little or no colony disturbance and provide objective longitudinal data. Methods have been developed to statistically model daily weight changes. Those changes provide information about colony food stores and dramatic shifts in adult bee population associated with events like swarming, bee kills or robbing. Within-day changes in weight reveal foraging activity, foraging success and the precise activity schedule of the hive.

Colony temperature, humidity and CO_2 also can be continuously monitored. The values obtained depend on where in the hive the sensors are placed (Figure 3). For example, temperature sensors installed in the brood area to monitor thermoregulation provide different values than sensors placed outside of the cluster near the interior wall of the hive. Average brood nest temperature and variability provide a strong signal regarding colony survival and success. In addition, temperature variability is highly correlated with brood rearing effort and can be used to identify factors that disrupt this activity. Our data on CO_2 levels in the hive indicate that concentrations can be much higher (over 100 times) than ambient levels and much more variable. CO_2 concentrations above ambient concentrations are generated by the bees, so CO_2 concentration data has information on the behavior and health of the colony.

WM's lab has used continuous monitoring methods to explore the effects of sublethal pesticide exposure on bee colony behavior. For example, experiments conducted over five years with imidacloprid, a neonicotinoid pesticide, showed that thermoregulation, hive CO_2 management and daily hive weight change were significantly affected by pesticide exposure and can impact colony growth and activity even at very low concentrations. The research showed that imidacloprid could inhibit certain colony behaviors at high concentrations (100 parts per billion), and agitate the bees at low concentrations (five parts per billion). Thermoregulatory behavior also was monitored using sensors in a temperature-controlled laboratory incubator with cages containing small groups of bees exposed to different levels of pesticides and daily temperature cycles. We found that even among small groups of bees without a queen or brood, the pesticide affected clustering behavior and thermoregulation. Continuous monitoring data also revealed effects on colony-level behaviors after exposure to clothianidin (another neonicotinoid) and methoxyfenozide (an insect growth hormone mimic).

Colony behavior, particularly thermoregulation, also has been monitored in commercial settings. In a recent study, WM's group monitored the colony size and temperature of hives placed in different kinds of environments, from agricultural areas like California's Imperial

Valley, to unmanaged areas. Pesticide residues also were monitored, and results showed that while pesticide exposure, both in terms of concentration and diversity, varied among the environments, it was not often a major determinant of the health of commercial colonies. The factor most affecting colony health was access to forage. Studies conducted by WM's group monitored the effects of hive orientation on colony growth and behavior and found that east and south facing hives had significantly more foraging activity than others in the Spring. Screen bottom boards also were found to affect thermoregulation and hive CO_2 levels. Colonies increased CO_2 concentrations when the hive was better ventilated with a screen bottom board, indicating that maintaining high CO_2 concentrations for at least part of the day is important for bee colonies.

In 2020, the CHBRC installed a cold storage unit (CSU), with temperature and CO_2 monitoring and controlled ventilation to explore the effects of cold storage on the health of the colony and on individual bees (purchase of unit partially funded by Project Apis m.) (Figure 4). Currently, the WM lab has been monitoring weight, temperature and CO_2 levels in hives stored in the CSU for short periods to induce Fall brood breaks or for longer periods for hive overwintering. The CSU is ideal for the studying of circadian rhythms and the role of CO_2 concentration within the hive. In current experiments, hives in the cold storage unit experience constant temperature (about 5°C) and no light, so there are no external cues to "set" any circadian rhythms. Colonies are equipped with temperature and CO_2 sensors that generate data that reflect locomotor activity, which is typically used in circadian studies. Within-hive temperature and CO_2 control are "emergent" behaviors coming from colonial living, so these studies may reveal new aspects of bee colony behavior and ecology.

Dr. Kirk E. Anderson (KEA)

Studies on the role that microorganisms play in the processing of nectar and pollen in individual bees and the colony are essential to fully understand honey bee nutrition. KEA has characterized many fundamental processes associated with the gut microbiome (i.e., the collection of microorganisms established in the digestive system) and social microbiome (microorganisms transmitted among bees), producing a comprehensive understanding of microbial ecology in the honey bee gut and colony. The specialized bacteria that populate the adult worker hindgut govern or contribute to a variety of physiological processes and behaviors. The bacteria are critical for colony health and have been defined and characterized according to the symbiotic and highly beneficial functional relationships they provide to the bees.

A focal project in the KEA lab is the microbes associated with social nutrient processing. This includes food stores and developing larvae. The adult honey bee gut, larvae and food stores have a highly predictable but very different social microbiome that prospers with exposure to oxygen. This set of oxygen tolerant microbes is found throughout the colony environment. Like aerobic environments in humans (e.g., skin, lungs, mucus membranes), the social microbiome functions in general social hygiene, controlling the growth of Nosema in the midgut, and other pathogenic fungi and opportunistic microbes common throughout the hive environment.

While many microbes are routinely introduced from the pollination environment, the social microbiome is comprised of a suite of beneficial bacteria and yeasts that is part of the microbial collection carried with worker bees when they swarm. Two primary species of bacteria that dominate the social microbiome, *Lactobacillus kunkeei* and *Bombella apis*, are core species that also colonize and reside in the queen gut. Newly emerged queen bees do not contact their mother queen, so they might acquire their gut microbiota through contact with the hive and social environment. The microbes carried by a swarm include those that populate the queen gut and the hive environment. When filled with stored food and developing young, the hive environment provides a variety of niche characteristics similar to those encountered in the hindgut environment. KEA has recently shown that the social microbiome is enhanced with exposure to propolis (plant resin) nearly tripling in size relative to low propolis colonies. Additionally, colonies lined with propolis resulted in a 10x reduction of fungi in the hindgut, and significantly more robust bacterial microbiomes.

Symbiotic relationships between the insect Order Hymenoptera and fungi are numerous, and the relationship between bacteria and fungi in the gut is an emerging area of study. The worker midgut possesses the largest fungal

Figure 4. The honey bee cold storage unit (HBCSU), with adjustable ventilation fans, CO_2 sensors and temperature control. Hives inside the cold storage unit. The hives were fitted with individual CO_2 sensors.

microbiome and is affected by changes in pH and oxygen. Studies by KEA suggests that the midgut of late Winter bees is vulnerable to invading microbes following an age associated transition in physiology, and if not countered by immune responses, may contribute to an imbalance among beneficial microorganisms (i.e., dysbiosis) and premature senescence of workers and colonies. In a study with colonies overwintered in cold storage, all sampled worker bees effectively transitioned to long-lived Winter bees. In contrast, colonies kept outdoors in mild Winter environments did not develop into long-lived Winter bees and the aging workers suffered dysbiosis that proliferated primarily in the midgut. Fungal load increased significantly in the midgut and hindgut overwinter, concurrent with significant increases of bacterial opportunists in the midgut. The hindgut microbiota remained relatively unchanged indicating that the midgut is a target tissue for host health in aging foragers and overwintering workers.

In addition to studying the microbes in the worker honey bee gut, KEA has also examined the microbiome of queens. Early queen death or rejection by the colony has become more common in beekeeping. KEA placed newly mated commercially produced queens in either small containment cages (i.e., queen bank) or free-running and laying eggs in colonies. Feeding intensity, social context, and metabolic demand differ greatly between the two environments. A microbiome analysis examining the queen's mouthparts, midguts, ileums and rectums, and associated gene expression analysis of other tissues found that both social context and queen breeder source affect gut microbiota and associated queen metabolism. For example, free-running queens exposed to the colony environment contained significantly less bacterial diversity than the banked queens indicating that social immune factors may shape the queen's microbiome. Queens housed in queen banks resembled much older queens with decreased beneficial bacteria in the hindgut, and significantly larger ileum microbiotas, dominated by blooms of worker associated gut bacteria. Combined with earlier findings, it is evident that the queen gut microbiota experiences an extended period of microbial succession associated with queen breeder source, post-mating development and colony assimilation. The results suggest that queens may produce signals based on the microbiome that are perceived by workers. In collaboration with commercial beekeepers, we are testing these hypotheses in the coming year.

Microbes that do not originate from the honey bee gut or hive environment stand little chance of establishing and surviving in a honey bee colony. KEA performed a longitudinal study of commercial honey bee colonies to explore the effects of probiotics both over the long term, and following antibiotic treatment. The two tested probiotics were comprised of various lactic acid bacteria and yeast commonly fed to humans or used in large animal agriculture. The probiotics had no effect on colony growth, colony weight, the gut microbiome or disease status following seven months of probiotic treatment applied as suggested, or when applied to aid recovery from antibiotic induced dysbiosis. The study concludes that non-native probiotics cannot survive in the honey-rich hive environment or highly competitive worker gut environment (Figure 5).

Dr. Gloria DeGrandi-Hoffman (GD-H)

GD-H's research program investigates colony population dynamics and the effects of *Varroa*, nutrition, and most recently climate change on colony growth and survival. The studies on climate change and *Varroa* led to research to develop best management strategies for overwintering colonies in cold storage. GD-H has studied the population dynamics of honey bee colonies and built computer models to predict factors that influence the growth and survival of colonies throughout the year. Her studies on honey bee nutrition are predicated on colonies having a yearly life cycle, that might cause nutritional requirements to differ between times of brood rearing and colony expansion in the Spring and population contraction and preparation for overwintering in the Fall. Collaborating with Mark Carroll and Vanessa Corby-Harris, polyfloral mixes of Spring and Fall pollens were analyzed to determine if the nutrient composition differed with season. Next, seasonal pollens were fed to bees reared in Spring and Fall, and comparisons were made of the

Figure 5. Feeding supplements to commercial colonies to test for effects on gut microbiota and colony health.

effects on brood food gland development (i.e., hypopharyngeal glands – HPG), and the expression of genes in the fat body between bees fed pollen from the same (in-season) or different season (out-of-season) from when they were reared. Because pathogen challenges often heighten the effects of nutritional stress, GD-H infected a subset of bees with *Nosema* to determine if bees responded differently to the infection depending on the seasonal pollen they consumed. She found that Spring and Fall pollens were similar in total protein and lipid concentrations, but Spring pollens had higher concentrations of certain amino and fatty acids that support hypopharyngeal gland (HPG) growth and brood production. Bees responded differently when fed in vs. out of season pollen. The HPG of both uninfected and *Nosema*-infected Spring bees were larger when they were fed Spring (in-season) compared to Fall pollen. Pollen type also affected gene expression and physiology in Spring bees. Fall bee responses to pollen type and *Nosema* infection differed from Spring bees. In Fall bees, HPG size was not affected by pollen type, though HPG were smaller in bees infected with *Nosema*. The study showed that physiological responses to seasonal pollens differ between bees reared in the Spring and Fall with Spring bees being significantly more sensitive to pollen type especially when infected with *Nosema*. The study provided evidence that seasonal pollens may provide levels of nutrients that align with the activities of honey bees during their yearly colony cycle. The findings are important for the planning and establishment of forage plantings to sustain honey bees, and in the development of seasonal nutritional supplements fed to colonies when pollen is unavailable.

A major factor influencing colony survival is *Varroa* mites. Using *Varroa* and colony population dynamics models she created with Robert Curry, GD-H found that the growth of *Varroa* population in colonies far exceeds what is predicted by *Varroa* reproduction alone. This led to research on the migration of *Varroa* into colonies on foragers as a possible explanation for the rapid mite population growth in colonies, especially in the Fall. She found that the frequency of capturing foragers with mites at colony entrances was correlated with *Varroa* population growth. This occurred with mite resistant Russian bees and unselected lines of bees. Research in collaboration with Dr. Judy Chen from the ARS Beltsville Bee Lab showed that Deformed Wing Virus (DWV) levels increased throughout the Summer and Fall and were correlated with the increasing *Varroa* infestation levels. She tested if supplemental feeding could reduce DWV levels but found that both *Varroa* and DWV levels were similar between colonies with and without supplemental pollen feeding.

Reducing overwinter colony losses using cold storage has been the most recent area of study for the GD-H lab. This area of research was pursued because climate change is affecting many aspects of beekeeping and colony survival including overwintering survival. Warm temperatures in Fall and even during periods in the Winter in temperate areas cause honey bees to fly when they should be clustered in the hive. Warmer Fall temperatures can lead to extended periods of foraging late in the season resulting in greater proportions of physiologically older bees in the Winter cluster and a deeper population decline during Spring dwindling. Placing hives in cold storage would curtail Fall foraging and possibly preserve the longevity of Winter bees. Cold storage could also reduce Fall miticide applications needed to suppress *Varroa* population growth from mite migration.

Our research on cold storage began with an analysis of costs for overwintering colonies followed by studies to determine which colonies should be put into overwintering facilities. The cost analysis revealed that putting colonies in cold storage costs less per colony than overwintering them outdoors in southern locations. However, the study also revealed that not all colonies are suitable for overwintering in cold storage. Colonies do not increase in population in cold storage. In fact, colonies lose three to five frames of bees on average. Also, colonies with *Varroa* do not do well in cold storage. Our study showed that colonies to be managed for cold storage overwintering should be selected in September based on their size and mite loads. To assist beekeepers in choosing colonies to put into cold storage, we developed a decision support tool (**https://www.ars.usda.gov/pacific-west-area/tucson-az/carl-hayden-bee-research-center/research/cold-storage/cold-storage-overwintering-tool/**) that predicts the probability of a colony achieving a particular size after cold storage based on its size and mite numbers (mites per 100 bees) in September.

The next questions addressed by GD-H research is when to put colonies in cold storage. Through a study of colonies that spent the Summer in North Dakota, we found that putting colonies in cold storage when they contain only sealed brood and adult bees results in colonies with larger populations and more brood immediately after cold storage compared with those put in cold storage later when they contain only adult bees (Figure 6, next page). The colonies put into cold storage that contained bees and sealed brood also were larger after almond pollination. We also tested if colonies from southern regions that are still rearing brood can be successfully overwintered in cold storage. We found that colonies that spent the Summer in Texas apiaries and then were put into cold storage in November were significantly smaller after cold storage and after almond pollination than those that summered in North Dakota. Our current research is investigating the role that queen line might play in successful cold storage overwintering and is being done in collaboration with Drs. Lanie Bilodeau and Kate Iles at the ARS Baton Rouge Bee Lab. Stay tuned for results.

Grand Challenge Synergies Project

The CHBRC is leading a Grand Challenge Synergies project to create pollinator landscapes and overwintering practices to increase pollinator populations in a changing climate. Grand Challenge projects are designed to address high-order problems of national importance by integrating multiple existing projects across National Programs, Agencies, Universities and the private sector and building collaborations to create something more than the sum of their parts. Our project includes 10 CRIS projects, four National programs, three USDA agencies, four Universities and four private businesses.

Climate change is impacting the survival and diversity of pollinators in two fundamental areas: availability of flowering plants that supply food to pollinators during periods of nest establishment, expansion and reproduction, and survival during overwintering. Our project addresses both challenges by creating a coordinated interdisciplin-

ary effort that incorporates the interactions of genetics (both pollinators and plants), environment, management practices and end users that will play critical roles in developing and implementing the innovative strategies generated from our Project. Specifically, we will assess the composition and nutritional value of landscapes planted to sustain pollinators, determine the effects of genetic, environmental and management factors on the nutrient composition of floral rewards such as pollen, and determine the impact on pollinator diversity and health. We will link nutrition, genetic and environmental factors with management practices to address the second fundamental area being affected by climate change; overwintering survival. By including studies to improve floral landscapes for nest establishment and expansion and management practices to increase overwintering survival, we present a comprehensive year-round plan to sustain and grow pollinator populations. Our findings will be shared with stakeholders involved in production of crops requiring bee pollination, land managers, beekeepers and companies and organizations providing seeds for pollinator plantings so that strategies to ensure pollinator diversity and population growth will be feasible and sustainable in a changing climate. BC

Figure 6. Colonies in North Dakota that were put in cold storage for overwintering. The colonies measured for strength in almond orchards after overwintering in cold storage.

BEE VET

Connections

Dr. Tracy Farone

I must admit, over these last couple of Winter months (I'm currently writing in early March), I've been struggling to find something to write about. It is not that things are not going on. There are several projects "brewing" on my end. However, nothing has fully matured into a full-blown story that I feel would be worthy of sharing for the edification of others. I am sure you all can relate to the Winter time doldrums. For beekeepers, perhaps it is the frustrating feeling of reduced ability to do little for our bees over the Winter and/or anxiety of how many hives are going to make it to Spring.

Personally, I think it is the waiting. But anything worthwhile involves waiting. As a kid, I can remember that turning maple sap into syrup took what seemed like an eternity of boiling, and even longer to turn it into taffy. Fine wine and whiskey can take months and years to produce and refine. Doctors train for eight years in school and then eight to 10 more years in residency and fellowships before being able to fully practice medicine on their own. Babies take nine months to form in their moms' wombs. Horse babies take nearly a year and elephants gestate for almost two years.

Waiting is a season, but it is never just a season of waiting. It is not passive but a season of preparation, self-improvement, and investment in building connections. Just as honey bee populations seem to explode in the late Spring, be prepared for what you are hoping for, as when results occur, they may unfold very quickly. And you better be ready for it.

Identifying connections that may lead to currently undiscovered solutions to complex problems takes work, time and patience. So, I thought I would give you all a summary update on what is "brewing" on my apicultural plate. All are small strings of a web reaching out directly or indirectly to address some of the major issues beekeeping faces, such as honey bee health, communication and developing the next generation of beekeepers.

Part of "waiting" may be taking the time to form new relationships. In a recent *BC* article I reported that the Honey Bee Veterinary Consortium (HBVC) has two delegates seated on the American Veterinary Medical Association's Agricultural Animal Liaison Committee (AVMA-AALC) representing honey bees for the first time **ever**. Serving as the alternate delegate for only two months, I can report that the honey bee reps were strongly welcomed to the committee, and the committee is very active in reviewing and giving input on federal legislation and regulations affecting agricultural animals. It can only benefit honey bees to have a voice alongside all of the other agricultural animals' industries, such as cattle, hogs, chickens and aquaculture. An additional new relationship between the HBVC and the Honey Bee Health Coalition (HBHC) has also formed. The HBVC has joined the membership of the HBHC to partner in supporting honey bee health. The HBVC will be sending officers to the HBHC's meeting for the first time this Spring.

Part of "waiting" may be improvising in serving others. In 2022, I served as a speaker on honey bees for over a dozen events around the country, talking with veterinarians, beekeepers, students and the general community. I've also had several meetings on my docket this year, including a community podcast for a radio station in Seattle, WA and the new veterinary bee club at The Ohio State University College of Veterinary Medicine. Most recently, I was asked to speak for the Utah Beekeeping Association Annual Meeting in Salt Lake City in February. Unfortunately, I only got as far as the airport when my plane was delayed to the point that I would miss my connection to Salt Lake. While certainly it was disappointing not being in person, we worked together so I could still deliver my lectures online.

Part of "waiting" may be dealing with fear and frustration. I have recently been contacted by a small scale beekeeper who believes he needs to use Terramycin on his bees for prevention of AFB every Spring and Fall. He was frustrated because he could not find a veterinarian in his area who was willing to see bees, had any knowledge of honey bees, could write him a VFD and/or exam his bees in a legal way. Truth is, he is totally correct in his frustrations and also mistaken that use of antibiotic for prevention of AFB is legal (per the label) in the first place.

Here's an excerpt from our email conservation:

> "We have talked to several beekeepers in our area, commercial and sideliners, about this situation. They have said they will continue to use, no matter what they have to do to obtain it. We understand that Terramycin will not eliminate AFB but will keep it at bay. Once our bees have AFB, we burn and we are out equipment and bees. That is very hard on the wallet. Our idea of the whole situation is, politicians, vets, bee equipment suppliers

need to sit at the round table and discuss what the outcome of this whole matter will be. We have again contacted vets in a 200 mile radius and have found none that want to be involved. Sorry to vent on you but we just can't get answers."

My response:

"As you know, this is a common concern of many beekeepers, a devastating disease the persists in the dirt that you 100% know is highly contaminated. I get it and I'm not the vet that's going to tell you to stop, as it's hard to prove a counterintuitive in the field without risk. Outbreaks are always possible, however statistically unlikely.

It's also true that beekeepers have been and are using Terramycin (and Lincomycin and Tylosin) on their bees illegally. "Prevention" is not on any label… treatment and control is. It's always puzzled me about the rationale for Spring and Fall applications… think about it… If the spores are ever present in the environment, wouldn't you have to treat continuously for "prevention"? I've also wondered about the efficacy of using expired drugs and/or drugs obtained through foreign countries which is common practice I've been told. Seems like strange places to put your faith.

Clearly a better solution is needed for beekeepers and honey bees. I hope one is on the horizon. Have you heard about the new bee vaccine for AFB? I've attached a copy of some information from the company. It's supposed to be available in April. I have no idea if it's going to work in the field but larger field trials with commercial beekeepers are underway this Spring. If it does work, it could be a much better solution to AFB and perhaps many of the diseases that plague honey bees."

Even though I did not have all the answers the beekeeper thanked me for my time and information. Which brings me to the next point…

Part of "waiting" might be investing in research. Progress seems to be an ebb and flow ranging from advancements to catastrophes. Consider a few events that have happened in the last few months. Vaccine(s) are now on the market for honey bees with the promise of an alternate tool that can be used against the dreaded pathogen that causes American Foulbrood with other potential pathogen targets in the future. Will it work or not? We will wait and see.

Consider the train derailment and chemical explosion in East Palestine, Ohio (just five miles from where I lived for 21 years – btw. I just moved out of the immediate area a year and a half ago), how will this effect honey bees in the area? Can the bees act as sentinels for the area? Well, research is underway to answer these questions, but it will take time to determine the results.

Part of waiting may be investing in the next generation. I recently received an email from a little girl named Adeline. She and her parents keep bees and are fans of *Bee Culture*. She recently wrote to me (you can read part of her message in this month's Mailbox on page 7) about visiting the College I work for and our apiary. So, on what happens to be my fiftieth birthday, I will have the privilege of showing this budding beekeeper around with the help of some of my older students.

For many beekeepers, May is certainly the time waited for after a long Winter and a fickle early Spring. Spring has finally completely sprung! Now all beekeepers everywhere in the country are going mad trying to keep up with their bees. The season of splitting, swarming and otherwise blossoming bees is fully upon us. What have you been waiting on? What have you been doing in your waiting period? What can you be doing? BC

Tropilaelaps – Part 2

Listen along here!

Last month, we looked at the *Tropilaelaps* mite and its potential impact on North American beekeeping. While *Tropilaelaps* has yet to appear on the shores of North America, it can be found in the middle of a spat between the American Beekeeping Federation (ABF) and the Canadian Honey Council (CHC) over package imports.

A Warning Issued

On February 1, 2023, the ABF released a statement issuing a call for American beekeepers to encourage their congressional delegations to support the opening up of the Canadian border to honey bee package importation from the United States (Winter & Miller, 2023). The ABF letter notes that "the threat of the T mite *(Tropilaelaps)* being found in a southern hemisphere package and introduced to Canada is a real threat to all North American beekeepers." The letter goes on to say, "This would be devastating to the North American beekeeping industry and production agriculture." Furthermore, "ABF believes a new expedited risk analysis is needed" for both U.S. packages and those from other countries currently approved to export bees to Canada, in order to properly assess the current risk of a possible *Tropilaelaps* infestation.

So far, *Tropilaelaps* has spread among South Asian countries including India, China, Pakistan, Myanmar (Burma), Thailand, Sri Lanka, Philippines, Afghanistan, S. Korea, Vietnam and Papua New Guinea. New Guinea and Australia are about 150 km (93 miles) apart at their closest shores: roughly the distance between Cuba and the U.S. mainland. The Canadian Food Inspection Agency (CFIA) currently allows the importation of honey bee packages into Canada from Australia, New Zealand, Chile, Ukraine and Italy. Queen imports into Canada are allowed from the same five countries as well as from the United States, Denmark and Malta. Given the close proximity of Canada's Australian source of bees to a known *Tropilaelaps* infested country (New Guinea), the ABF is sounding the alarm concerning the risk of the mite making its way to Canada and then to the U.S.

Canada Weighs In

On February 22, 2023, the Canadian Honey Council responded to the ABF with their own statement (Scarlett, 2023). In it, the CHC called it "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 CHC goes on to say, "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… 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." The risks identified in 2013 were: Amitraz resistant mites, small hive beetle, American foulbrood resistance to antibiotics and Africanized bees. "The CHC has indicated that if the science supports the decision to open the border, the border should open," the statement emphasized.

The CHC went on to note that since U.S. beekeepers can import bees from just two countries, Canada and New Zealand, and "New Zealand is just as close or closer to where *Tropilaelaps* is found…" they suggest that the U.S. could also import bees with the potential to harbor the mite. The CHC statement concludes by stating, "a North American concern is justified but it is far more likely that the mite will arrive by ocean liners than it is 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 ports have increased… This is not a trade issue, and it is always looked at as an animal health risk issue."

Reality or Hype?

There is a high demand right now among Canadian beekeepers for packaged bees to replace heavy losses. Meanwhile for the first time in decades, almond production is contracting due to low almond prices and water issues aggravated by prolonged drought, and U.S. beekeepers are looking to replace some of this lost income. Opening up the Canadian border to U.S. package imports could help replace lost almond pollination fees.

American beekeepers certainly do not need another stressor on their bees, should *Tropilaelaps* make its way to America. However, as I pointed out last month, the T mite's impact is not likely to be as devastating to the beekeeping industry as *Varroa* was in its initial years. Unlike the situation when the *Varroa* mite first arrived in North America, today we have approved mite treatments available for *Varroa* that are reported to also work on *Tropilaelaps*. We also know more about the biology of the T mite and its critical vulnerability of having to have constant access to its primary food source (uncapped brood) or they starve to death. These facts make the dire warnings spelled out in the ABF letter appear exaggerated.

Real World Impact

So how likely is a mite infestation into Canada from packages or caged queens really? Since no combs of brood are shipped within packages or

Tropilaelaps' *need to access uncapped brood in order to feed every two days or so is the primary reason why it has not spread around the world so rapidly and extensively as the* Varroa *mite.*

queen cages, the chance that T mites will infiltrate North America through a bee shipment is slim. As numerous researchers have all pointed out, any mites that make it into the package or cage when it is initially populated with bees, are likely to be dead within two to three days at the most (Woyke, 1984 & 1987; Koeniger & Muzaffar, 1988; Rinderer et al., 1994). This is primarily why *Varroa*, which also originated in Asia, has spread to the four corners of the earth while *Tropilaelaps* is still largely confined to its native range.

There are a couple theoretical possibilities where mites could survive importation in packages and queens. If there are package producers or queen breeders that are super efficient and ship orders out the same day that they are packaged or caged, it is possible that the receiving beekeeper will install their shipment into a hive the same day that it arrives via overnight airfreight. Thus, any mites that happen to be riding along in a package or cage would only be without food for a day or so and could survive the trip. To protect American beekeepers, a simple requirement that bee shipments must be held for a minimum of 48 hours before they are introduced into hives containing uncapped brood, would help ensure no *Tropilaelaps* mites that hitched a ride along with the bees are able to survive the journey. This would mostly affect queen imports since packages are usually installed into hives with foundation or empty frames of drawn comb, or perhaps combs containing some honey and/or pollen. It is rare that packages get installed into hives in which uncapped brood is already present.

The other possibility is that there are occasional reports in the literature of *Tropilaelaps* being observed sitting at the base of an adult honey bee's wings. This is significant since the base of the wings is one of the few locations where the hard exoskeleton of the bee is soft enough for the *Tropilaelaps* mite to be able to pierce it with their mouth parts and feed on hemolymph (Khongphinitbunjong et al., 2012). Thus, it appears that sometimes a T mite figures out that it can feed on an adult bee.

While it is certainly a possibility that Canada will become a *Tropilaelaps* host country and spread the mite to America, the availability of approved *Varroa* mite treatments that are also reported to work on *Tropilaelaps* means that should such an infestation take place, is unlikely to cause a major catastrophe for American beekeepers.

The Scofflaw Factor

Unfortunately, we beekeepers are notorious scofflaws. This tendency exposed itself clearly after *Varroa* arrived and many beekeepers turned to off-label (illegal) uses of pesticides to control the mites. Since there are likely to be some beekeepers that cannot be trusted to honor a 48 hour delay before installing bees into hives that contain uncapped brood, Canadian bee breeders that supply the U.S. could also be required to wait 48 hours after packaging or caging bees before shipment. This way if one person in the supply chain "bends the rules" the other acts as a backup to ensure the mites are unlikely to survive. Of course, the extensive border between our two countries would almost guarantee that should *Tropilaelaps* make its way to Canada and spread throughout the country, at some point natural swarms will carry the mite across the border into the United States. However, unless a Canadian swarm usurps a U.S. colony and replaces the mother queen with their usurping queen (a highly unlikely situation), natural swarms are not expected to cause *Tropilaelaps* to spread across the border. The extended broodless period when a swarm emerges from a hive and when it begins raise new brood in a new location also prevents swarm castaways on an ocean liner from carrying the mite far.

There is always the possibility however that the mite could be smuggled in illegally. Some people claim that back in the 1980s, Argentina was getting bees from Asia, breeding queens, smuggling them into Florida under the radar and ended up bringing the *Varroa* mite to the U.S. Folks worry that something similar might happen should Australia end up getting the mite, and export the mite to Canada. Please note, all this is still theoretical. As far as anyone knows, while *Varroa* has recently arrived in Australia, *Tropilaelaps* has not yet made its way to the island continent.

You Catch More Bees with Honey Than You do With Vinegar

Rather than point fingers at our Canadian neighbors and make them out to be the "bad guy", U.S. beekeepers would do better to focus on the positive impacts Canadians can expect should they open up their border to U.S. honey bee packages. The main one that comes to mind is an improved environmental footprint.

The American beekeeping industry is very fossil fuel intensive. Regularly transporting bees throughout the country on 18-wheeled, diesel powered trucks and shipping bees overnight by airfreight creates a lot of green-house gas emissions. Dramatically reducing the distance that packages must travel by air, will

Year	# of Packages	Year	# of Packages
2008	11,070	2016	44,997
2009	11,360	2017	27,387
2010	10,611	2018	31,638
2011	42,466	2019	41,339
2012	33,913	2020	13,746
2013	65,066	2021	8,661
2014	52,774	2022	56,737
2015	55,786	2023	TBD

After declining dramatically during the COVID pandemic, Canadian package imports rebounded strongly in 2022.

greatly help the beekeeping industry start to address the festering issue of heavy fossil-fuel reliance that has mostly been ignored to date. This means doing exactly what the ABF recommends, localizing and regionalizing industry so we no longer are relying on extensively long supply chains. The global COVID pandemic exposed the serious drawback of relying on products and supplies that have to be shipped from overseas and the global climate crisis is exposing another. Relocalizing as much of society as possible will be required if we are to successfully reduce energy use and GHG emissions, prevent global ecological collapse, save our bees and maintain organized human existence. An additional benefit is that reduced shipping distances should result in lower overall costs, allowing U.S. bee producers to compete competitively with bees from down under while allowing Canadian beekeepers to enjoy lower prices.

I get the ABF's concerns. Declining almond prices and a lack of available water from increasing droughts out west is causing many almond producers to pull their older trees from production. For the first time in well over a decade, almond growers will be requiring fewer hives for pollination, not more. For those beekeepers that fell into the economic trap of relying on almond pollination fees for a large percentage of their annual income, the severe economic hit they are going to receive will be challenging. The greater the share of their annual income from almond pollination, the more difficult it will be for the beekeeper to stay afloat. Opening up a new market in Canada for U.S. packaged bees, while certainly not enough to entirely replace the lost almond pollination income, will help take some of the sting out of the loss. Efforts to use the fear of *Tropilaelaps* to facilitate such a trade agreement is a weak approach. BC

Ross Conrad is the author or Natural Beekeeping: Organic approaches to modern apiculture and the Land of Milk and Honey: A history of beekeeping in Vermont. Ross will be teaching a beginner organic beekeeping class the weekend of May 20-21 and an intermediate class June 4th in Vermont. For more information visit: **www.dancingbeegardens.com**

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How to Inspect &

David Burns

In 2008, I began making beekeeping videos on YouTube. At first, it was only a way for me to share what I was learning. Over the years, I have learned to enjoy sharing beekeeping especially with new beginners and one way is by helping beekeepers learn to enjoy inspecting their bees. Over the years I have gathered a wealth of knowledge on the common difficulties, mistakes and inquiries that beekeepers encounter during hive inspections. I've taken this information and have simplified key elements to a productive hive inspection.

1. Plan the Frequency of Your Inspections

Typically, inspecting your bees twice a month is sufficient, with one of these inspections being brief and focused on specific aspects, such as the queen's productivity and the need for additional space. This focused inspection should take no more than ten minutes. The second inspection can be conducted two weeks later, during which you can devote more time to observing potential issues. By striking the right balance and tailoring your inspections to the needs of your hive, you can ensure the health and productivity of your bees without causing undue stress or harm.

2. Bring Focus & Specifics to Each Inspection: The Brief Inspection

To ensure an efficient and productive hive inspection, it is crucial to have a well-defined plan in place. Instead of attempting to inspect all twenty or thirty frames, identify specific elements to focus on during an inspection. For instance, you may prioritize a mite inspection or assess your queen's productivity. This allows you to streamline your inspection and reduce its duration significantly. Not only will this approach be more enjoyable for you, but it will also be less disruptive for your bees. Ultimately, having a clear plan and defined objectives for each inspection can save you time and effort, while helping you achieve the desired outcomes.

Another single focus inspection may be to evaluate the need to add boxes. It's crucial to assess whether the colony has sufficient room to expand and grow. As a rule of thumb, when one box is filled with five to seven frames of drawn comb, it's time to add the next brood box or super. This ensures that the bees have ample room to continue building and developing their colony, ultimately promoting a healthy and productive hive. By keeping a close eye on the space requirements of your hive and making adjustments as necessary, you can help your bees thrive and prosper.

3. Learn To Spot Trouble Quickly & Simply: A More Thorough Inspection

Discovering issues within our colony, such as a mite infestation or disease, is something that no beekeeper wants to encounter. However, it's crucial to remain vigilant and not let our reluctance to confront problems impede our ability to identify them. For instance, when I inquire about mite counts, I often hear responses like, "I didn't see any," which may indicate a subconscious reluctance to detect any potential issues.

A thorough inspection should take place every four to six weeks, dedicated to observing critical issues such as pests and diseases. When conducting this inspection, the first pest you should be on the lookout for is the small hive beetle. As soon as you lift the top, these pests will scatter and can typically be found on the top cover or the tops of frames. Be sure to take notice of their presence, and if you spot an alarming number, it's time to take action by placing beetle traps between the frames. These traps can help slow down and contain your beetle problem, ensuring that your hive remains healthy and protected.

As you make your way to the brood frames a quick inspection of the open brood can quickly reveal any issues. The larvae should be swimming in a glistening pool of royal jelly and each larvae should be pearly white in color. The bacterial brood disease, European foulbrood, causes the larvae to be discolored, darkened and their spericals to be visible. From just a ten second glance of the larvae, this problem can be diagnosed.

Moving on, take a moment to observe the capped brood – the sealed pupae can provide valuable insights into the health of the brood and the queen. Healthy brood should appear smooth and even, with very few empty cells. This is known as a solid brood pattern and is a positive indication of a thriving hive. However, American foulbrood – another bacterial brood disease – can cause sunken and perforated brood, often accompanied by a foul odor. Keep a sharp eye out for any signs of irregularities, as early detection can be critical in preventing the spread of disease and preserving the health of your colony.

I have a video you may enjoy on YouTube that may help you enjoy your inspections and be better able to assess the condition of your colony.

How To Inspect & Evaluate Your Hive: https://youtu.be/iEEhkJ2Qzx0 or go to YouTube and search for "David Burns Beekeeping."

Beekeeping can be a rewarding and fascinating hobby, but it also requires careful attention and diligent management to ensure the health and productivity of your bees. By following a few simple guidelines and adopting a focused and well-defined approach to hive inspections, you can minimize disruption, avoid harm to your bees and quickly detect any potential issues before they become more significant problems. BC

Evaluate Your Hive

New(ish) Beekeeper Column

Off the Wahl Beekeeping

SWARMS

Richard Wahl

As late Spring moves into Summer and the bee numbers in the hive begin to increase, it is not unusual to have a hive release a swarm. I have seen swarms in our area of SE Michigan begin in mid-May and continue as late as late August. The most frequent occurrence of swarms seems to occur from early June to late July. During my first few years of beekeeping, I would have insisted that these swarms were not coming from my hives. As I have become more aware of the causes for swarming I now believe that in those early years that at least some of the swarms I was catching did indeed come from my hives. But what would cause this natural tendency to swarm and how can it be minimized? The most probable cause for a hive to swarm is overcrowding. Although I knew some of my earlier year hives were strong and felt they had not swarmed, I have now changed my opinion on this point. Just because there still seem to be a lot of bees in the hive after a swarm is not a good indication that the hive did not swarm. An overcrowded hive after a swarm may look, to the new beekeeper, very similar to the pre-swarmed hive even though ⅓ to ½ of the hive may have departed. If a hive is not examined the day before and the day after a swarm it will be very hard to tell if the hive has swarmed. As the hive begins its late Spring and early Summer build-up it experiences a large population increase. By late June or early July, this huge increase may be the precursor to a swarm. If something is not done to preclude this there could be a loss of a significant honey crop later in the season. This is because it has been found that up to 75% of the hive foragers may leave with the swarm. This large decrease in the bees that have reached the forager stage leaves most of the new bees to still go through the nurse bee and internal hive job stages before becoming foragers. This makes sense, since the swarm needs foragers to supply the nectar needs and comb building of a new hive while the bees remaining in the original hive serve as nurse and house bees to support the care of newly emerging bees before becoming foragers. I once had the privilege/misfortune to watch a swarm emanate from a hive and it is an exhilarating and exciting sight to see and at the same time very disappointing. I was about to inspect my hives around 11:30 in the morning. As I was inspecting my most western hive, there seemed to be a lot of activity at the hive entrance of the next hive over. I initially chalked this up to orientation flights as these also exhibit a lot of activity in front of the hive for a short time. But suddenly there was a massive exodus of bees from that next hive as wave after wave of bees marched out the reduced hive entrance and circled around the calm air in a thirty to forty foot circle in front of my hives. After about ten to fifteen minutes the bees coalesced into about a five to six foot diameter circle and departed to the south about ten to twelve feet off the ground never to be seen again. I checked the hive and there were still many bees present. Had I not seen the swarm depart with my own eyes, I would have been none the wiser that this hive had swarmed. It was then I realized some of my earlier year swarms may have been from my own hives. The propensity to swarm is not to be viewed as a bad thing as it indicates the hive was strong to begin with. Hopefully, it will regain its strength as it rebuilds, although this can be a time consuming process. Before I get into some steps that can mitigate a swarm, there are a few other conditions that may be reasons for swarming.

A captured swarm from a backyard pine tree began my beekeeping adventure with no previous knowledge or equipment.

Reasons for Swarming

In addition to the crowding previously mentioned, swarming may also occur due to a heavy mite infestation. As the bee population increases, the potential for mite increase is also present due to the availability of many more capped brood cells in which to reproduce. If the mite population gets out of hand, the bees could decide to swarm to find a better location only taking the phoretic mites with them. Phoretic mites are those riding around on the bee's backs or thoraxes. Mites in un-emerged cells will be left behind in the hive. Not initiating some type of mite mitigating protocol on one's hives is the greatest reason for hive losses. Likewise, some method of mite treatment management should take place with a captured swarm to assist the success of that swam in becoming a productive hive.

As mentioned before, not enough space can be a reason for swarming. This is not only true for the crowded double deep hive, but can also happen in as small as a three frame nuc. Small three to five frame nucs need to be watched much more carefully and given added space sooner to preclude the possibility of all frames being filled with nectar and brood almost requiring the nuc to swarm if there is not enough room for more eggs and brood or honey storage space. Over time, brood frames become old and minimally smaller with the pupae cocoons of repeatedly raised new brood in those cells. Additionally, those continually reused cells may retain slight bits of the agrochemicals used in pesticides, which leads to near universal contamination of beeswax in the bee colony. Wax contaminated with these pesticides negatively affects the reproductive quality of queens, drones and the overall quality of worker bees. When the bee's tolerance of the contaminants in the reused wax brood cells exceeds an unknown threshold the bees may decide to swarm. Therefore, it is a good idea to replace old brood

foundation with new frames on a regular basis. I have read that every four to five years is a good time allowance for replacing brood frames but have also seen some respected beekeeper researchers let this reach to an eight to ten year replacement cycle.

Another reason for swarming is the internal hive climate. If the temperature is continually getting too hot or the bees do not have the capability to provide proper ventilation, this may also induce swarming. The bees spend a great deal of effort keeping the internal humidity and temperature at the ideal state around the queen, brood and nectar stores. If drainage or ventilation needs become too severe the bees could decide to swarm.

Yet another reason for the hive to swarm is that there is a problem with the current queen. She may simply have exhausted her ability to lay or fertilize eggs and the hive senses it is time to move on with a new queen.

One final reason for swarming is that it is a natural tendency for all living things to have a propensity for procreation. The simple desire to continue ones genetic stock in future generations can best be accomplished by *Apis mellifera* with swarming. This inherent drive is almost impossible to identify in order to preclude a swarm by even more experienced beekeepers.

A swarm in flight getting ready to depart the hive area.

Swarming Symptoms

There are a few things the beekeeper can look for in hive inspections that may indicate a precursor to a hive's potential for swarming. That first, late Spring hive inspection becomes very important in determining a hive's swarm probability. We all hope for a strong cluster to survive the Winter and become a thriving hive as the first nectar flow begins. If within a month of that first strong hive inspection and there are more than five to seven frames of brood in a double deep Langstroth hive, then it is most likely time to do something to manage that hive. I have found that adding another brood deep or honey super when all but the last frame or two are filled results in a less likely potential for swarming with first time overwintered hives.

The presence of open, unused queen cups along the bottom of frames is normally nothing to be concerned about. These are usually only present for an emergency response if needed. But if those cells become fully developed queen cells, or start to contain larva, the hive may already have decided to swarm.

Significantly reduced activity can be a sign of potential swarming as bees are not bringing much into the hive. This can be hard to ascertain by the new beekeeper and may be caused by lack of space for more nectar or pollen brought into the hive. I find I often need to remove a frame or two of older pollen filled frames as there is such a wealth of pollen sources here in SE Michigan. Often, more frames than needed become nearly saturated with pollen using up valuable space for more brood or nectar stores.

Another indication that a hive is getting ready to swarm is that the hive has had no weight gain in a week or so period. I have to admit that I do not monitor my hive's weights until the early Winter weight check, if at all. But research has shown that if a hive does not gain much weight during a nectar flow week, it is almost a sure sign of swarm preparation to come. As I became more experienced as a beekeeper, I found that more careful monitoring of my hives could give a good indication of swarming potential. From there I have found that splitting a strong hive early on is the best way to avoid the swarming instinct. In a previous article, I went into the elements of how to split a hive so I will not repeat those steps here.

Mitigating a Swarm

There is a lot written about removing queen cups to preclude the swarming instinct. The thing to remember is that by removing queen cups you are not changing the bee's instinct to swarm if it already exists. The bees can build new queen cups in a matter of days so removal must be a continual process every two to three days, not an objective most beekeepers prefer to try. The destruction of queen cells has never proven to be a successful method of swarm control. I have seen eggs laid in cells for worker bees that appear to be only ⅓ of their final size. The bees continue to build the cells even as the egg and larva begin to grow. The bees may use this same technique for new queen cells and if an unfound queen cell that was missed emerges the hive may swarm earlier in the normal development of the replacement queen. Destroying queen cells on a second try runs the risk of early swarming and no new queen left for the remaining hive to develop. This could also result in the initial swarm being even larger than if you had not interfered with the removal of queen cells.

The best way to curtail the possibility of swarms is to do a split as soon as a hive is perceived to have swarm characteristics or seems strong enough for a split. A split is actually akin to creating an artificial swarm and the best known way to minimize the possibility of swarming. If developed queen cells or queen cups containing larva are found, these are perfect frames to move to starter nucleus (nuc) hives. A year ago, I split all six of my hives that came through Winter in a strong state with plenty of bees in each. That is the first time that I did not see or catch any swarms during that following Summer. Even if the hobby beekeeper does not desire to increase their hive count with splits, there is plenty of interest among new beekeepers to purchase nuc hives. Or the beekeeper could marry the queenless part of a split to another weaker hive in the apiary.

The swarm gathers around the queen in or on a bucket.

Capturing a Swarm

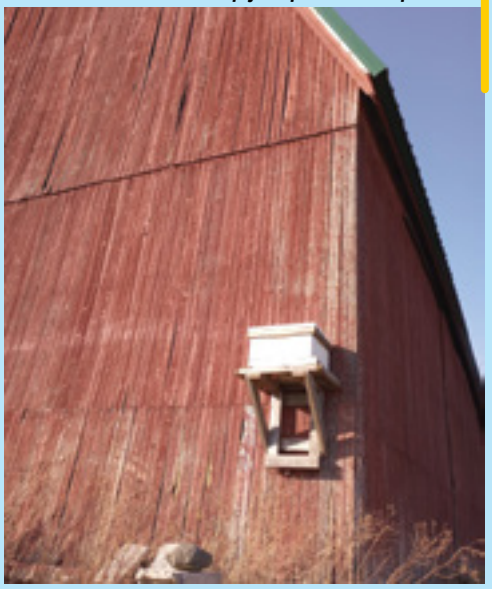
The capture of a swarm may be as simple as shaking them into a hive from a hanging branch or have the complexity of extracting them from an enclosed building cavity. When a queen leaves a hive with a swarm she usually will land within 100 feet or so of the originating hive. Most of my early swarm catches have been within several 100 feet of my own hives. This might be an indi-

cation that they were coming from my hives. Although six large swarms within about two weeks coming from the only two hives I had one Summer seems a bit implausible.

Bees surround the queen to keep her warm, dry and safe until scouts find a new location for their new home. This could be any sort of building or tree hollow that the scouts agree upon. Although a swarm can be intimidating in appearance, they have engorged themselves on honey before leaving the hive and have no eggs, brood or stores to protect. As a result the swarm is relatively unlikely to sting and can be quite docile. The one reason bees tend to sting is if some are getting squeezed or feel threatened. The swarm may move off in a matter of hours or stay in the initial swarm location for several days depending on weather and how soon the scouts find a new home. So it is wise to capture a swarm as soon as possible to avoid their eminent departure.

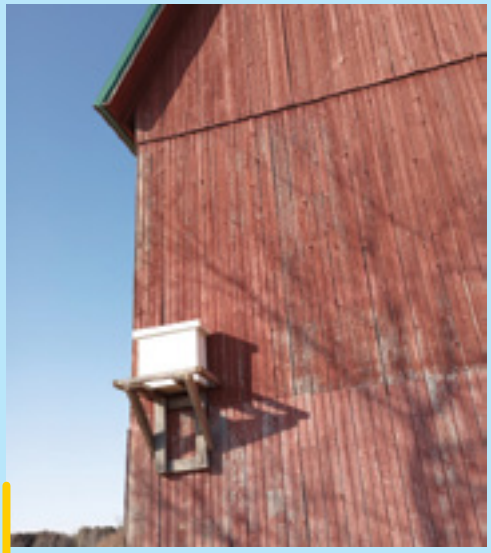
The steps to capture a swarm are relatively easy. It is advisable to wear a bee suit and veil as the disturbance of the swarm may be enough to make them feel threatened. You will need some sort of container for transport, if it is not convenient to drop them directly into a new hive. A five gallon bucket will work well, particularly if it has a ventilation screen on the top or a cardboard box with ventilation screened holes in a few spots works equally as well. Once the container is under the bee swarm, a quick shake will drop nearly all into the container. I have seen a five gallon bucket fastened on the bottom of a ten foot pole that was used to reach a swarm a bit higher in a tree. Shaking the branch caused most bees to drop into the bucket. If they are on a non-shakable surface a bee brush may be necessary to gently sweep them into the container. Some beekeepers like to spread a bedsheet or tarp under the spot where the bees will drop to better contain those falling outside the container. If the queen fell into the container, most of the remaining bees will join her. If she has not gotten into the container, the bees will return to her and reform a new cluster around her location following her queen pheromones. You will need to give them a little time to resettle down after which the process can be attempted again. If able, leave the container sit until nightfall or dusk to give the remaining bees time to congregate in and around the container. After dark, the bees will have settled down and the ventilated container can be closed and taken to the new hive location. Within a day, they should be moved into their new hive. If you are not interested in capturing a swarm there are eager beekeepers that can likely be contacted through local clubs, government Ag or environmental agencies who will come to get the bees. Feral swarms are most desirable because they are genetically suited to the local area and tend to be less disease prone than those raised in the hundreds by commercial apiaries which are shipped as packages to beekeepers.

A ten frame deep on a barn mounted platform used as a swarm trap just prior to strap down.



Swarm Traps

I have made it a practice to set out a swarm trap or two early in each season of beekeeping. I have attached two hive stands to the rear of a hip roof barn at about eight feet off the ground. A bit higher would be nice but that is the height of an inner beam that made a good attachment point. Nearly every Summer, I have had a swarm move into one of these traps. On occasion, I have simply set a single ten frame deep hive on a stand and occasionally a swarm moves into it. I think the empty drawn comb frames inside are a good draw for the swarm. My home-made swarm traps hold five deep frames with another five or six inch open space below the frames. Research has shown that 40 liters of space seems to be the ideal to draw in a swarm. The open space below, along with the five frames, works out to almost exactly 40 liters. In addition to the five drawn comb frames, I will add a plastic perforated baggy at the bottom with an inner paper towel that had some lemongrass essential oil drops added to it.



A 40 liter swarm trap mounted on a barn stand just prior to strap down.

The plastic baggy is perforated in a dozen spots by poking a sewing needle through the baggy. Only a few drops are necessary and this seems to attract bees that are in a swarm state. My most unusual swarm catch occurred one Summer when I failed to remove an empty hive to storage. Sitting in the middle of my row of hives I had left it there for the other bees to clean out, a small bit of the remaining honey still inside. Every so often I checked it to see that no hive beetles or wax moths had moved in, but always failed to move it to storage. One day, I noticed bees carrying pollen into the hive which I thought a bit unusual for an empty hive. Come to find out, the bees coming and going, which I thought were just gathering the remaining honey, were actually a swarm that had moved in with a new queen that was laying a nice pattern of eggs and already had larva in surrounding comb. Nothing seemed to be missing from any of my other hives. That hive is now coming into its third year and still seems strong.

So, by managing your strong overwintered hives with splits and observance, you may be able to avoid losing much of your bee population to swarms. Use an increase in hive space and/or splits as a swarm management tool to increase your hive count and/or nuc resources for personal use or sell-able nucs. Your swarm experience could vary based on your conditions, environment or state of your overwintered hives. BC

Tina Sebestyen

Control Swarming Without Splitting

It might be tempting to think that it is all right not to worry about whether colonies are going to swarm, since swarming is a natural thing that honey bees do. In fact, we know that our colonies *need* to swarm to help keep mite numbers low, besides the need to keep colony numbers up. They are, in a way, working to replace colony losses before they occur, in the same way we humans do. Many urban backyard beekeepers are happy with their two colonies, and don't want more, so they would rather let the swarm hit the trees than split and deal with excess colonies. There is also the hard fact that splitting intimidates newer beekeepers. There are some significant negatives to this strategy, however.

For one, when a swarm leaves a colony, it will usually find a home within flight range of the parent colony. The bees and mites increase in number until Fall, when, without your help with Integrated Pest Management or treatment, it collapses, your bees rob the failing colony and bring the mite load home, and they die, too. You have seeded your very own mite bomb. Or maybe, your bees are the perfect, mite resistant bees, so you don't have to worry about that. They just move into your neighbor's attic, it costs him $350 to have them removed, and you and your bees have earned an enemy. Or maybe, the swarming bees only take your honey production and pollination work force with them. Allowing colonies to swarm isn't a very good way to help honey bee numbers overall, since only 8% to 24% of swarms survive the first Winter[1]. The bottom line: it is important to control swarming.

The good news is that if you want to have all the benefits of a swarm, without any of the disadvantages, there are ways to control it. The best, for sure way to control swarming is splitting. Even a simple split; three frames of brood, and one of food, with the bees that are on them with the old queen is probably the best. This mimics a swarm, the old queen leaves the colony with some of the bees (but this way, far fewer than would have gone in a natural swarm). You can sell the nuc that you have just created so that you don't end up with extra bees, and help provide local bees for your area. But still, people sometimes don't want to make even this simple split (usually because they can't find their queen, we'll solve that problem later in this article). There are other ways to control swarming without splitting, though some of them may be more work than the split would have been.

One of the reasons that swarms happen when they do is that the queen's pheromones (QMP) are not very volatile, meaning they aren't spread in the air so much. Rather,

they are spread by touch. The bees in the queen's retinue pick up the chemicals from her (her pheromones) as they feed her, antennaete her, touch her with their feet and lick her, and they then pass these chemicals from one bee to the next, so that all of the bees in the colony know that the queen is present. As the queen ages, her pheromones become weaker, and as they are spread throughout the colony, everyone gets a smaller portion. The crowded conditions in a Springtime colony mean that the pheromones get spread even further, and this triggers the swarming instinct in the bees. Young queens have much greater amounts of QMP, and this helps keep the colony from wanting to swarm. So, replacing the old queen (one that has been through even one previous Spring build-up) with a young, well-mated queen can help control the swarm tendency. Re-queening alone will not be enough, even a young queen will swarm when the brood nest is congested. It is definitely important to ensure that there is a lot of space for the queen to lay eggs. Making sure that there is someplace else to store honey is critical. Supers must be added before nest congestion even begins.

Controlling swarming is more work with an older queen. It may be necessary to remove most or all of the brood from the area the queen can access. One way to do this is just to confine the queen to a box of only frames with foundation and two frames of emerging brood, using a queen excluder. It will take time for the bees to draw comb for the queen to lay eggs in, thus creating a small brood break. Full honey supers function very effectively to limit movement of bees, thus creating the same conditions that would be felt after a swarm had already occurred. Emerging brood can be moved to the top of the stack (or behind the other bars or frames in horizontal beekeeping). Once the young bees emerge, the comb is ready for honey. Separating the queen from capped brood is a very effective swarm control strategy.

The queen with her retinue. As they feed and touch her, they pick up her pheromones and pass them throughout the colony. Amazingly, all 60,000 bees know she is gone with 15 minutes, usually, and will begin keening for her.
Photo credit: Tina Sebestyen

Or, frames of open brood can be moved up, and they will attract many of the nurse bees, thus relieving crowding around the queen (this is called the Demaree method).[2] The separation of open brood from the queen and the distance created by the

The queen pushes through bees on the comb while leaving a wake behind her. This works best when the comb is solid with bees, and there are fewer random spaces on the comb. Photo credit: Tina Sebestyen

full honey supers causes nurse bees to start queen cells. These must be killed or moved to mating nucs, and the now-capped brood in the upper chamber moved down while eggs and young larvae from the queen's box must be moved up after seven to nine days. It may be necessary to do this rotation twice during the honey flow to keep the swarm instinct under control. Another idea is to leave one queen cell in the upper box, which should have an exit facing in a different direction than the main entrance below. The virgin queen will hopefully mate and return to the upper hive body, and now you have a very, very efficient honey producing colony with two queens and a huge work force. After the main honey flow, the old queen can be culled, leaving the young new queen to head the colony.

Re-queening a colony in July is a very effective way to ensure that when Spring arrives, swarm control will be simpler, since this queen has never been through a Spring build up and has good, strong pheromones. Two other benefits to mid-Summer re-queening are greater numbers of fat Winter bees and a good brood break for mite reduction. Colonies with young queens raise 3,000 more fat Winter bees than colonies headed by older queens[3]. These bees are better able to survive Winter, produce heat, conserve honey use and feed brood in early Spring. And since the brood break created while the colony raises a new queen in mid-Summer means that all of the brood has emerged, the brood break can be combined with an oxalic acid mite treatment. This is a most effective heat-of-Summer mite reduction when many other treatments cannot be used due to temperature thresholds. When the young queen begins laying eggs (do the math so that this is early enough to raise two brood cycles, or 42 days before it freezes), mite counts will be low, and you have protected your fat Winter bees from them and the diseases they carry.

You may have noticed that all of these strategies for reducing or attempting to manage the swarming instinct require movement of or removal of the queen. The main reason people don't want to do splits in the first place is because they don't know how to find the queen. Admittedly, even seasoned beekeepers may find it a challenge to locate a queen in a super-full, swarm-ready colony. Because this is a skill that should be honed, let's start out by looking for her.

Tricks to help in finding the queen

First, if you want to find the queen, you want her to continue doing what she was doing, which means not smoking the colony before opening it up. In Spring, the bees are happy and non-defensive, so smoke is probably not needed anyway, unless it is a very defensive colony, in which case it is even more important to find that old queen! If you must smoke, then do it, but try to find her without smoking, if possible. Remove the honey supers and set them aside after you have ascertained that there is no brood in them.

As you expose the top of each brood box, look at the bees on the tops of the frames. If it is the box with the queen in it, there will be a five inch circle where the bees are

No queen excluder? Just shake the bees in front of the hive on a pillowcase (not a towel, it catches their feet) and as they spread out and walk in, you can catch your queen. Photo credit: Tina Sebestyen

more concentrated than elsewhere. The queen is under this circle of bees. Remove the outer frame to create room to work, then push all of the frames at once away from the one you suspect may contain the queen. Working quickly will help in finding the queen, since the light coming in will make her want to run. Remove the frame that was in the center of the circle of bees, and, rather than looking for the queen, look at the whole frame. Hold it at arm's length and let your eyes take a snapshot of its entirety. You are looking at the pattern of bees on the frame. There will be bees facing in every direction and going about their business. But, if the queen is stationary, her retinue will be in a circle around her, caring for her. If she is in motion (which she probably will be) she must push her way through the crowds of bees, but behind her there will be a bare space on the comb, a wake like would be behind a boat on an algae-covered pond. This works best in a super-full colony, just what we have in Spring.

Once you see either a circle of bees, or a bare spot on the comb, now look for the queen. Her big, bald thorax is a good clue. Of course, drones have big thoraxes, too, but they are usually still fuzzy. The queen's is bare because as she measures each cell to know if it is for a drone or for a worker, she rubs the back of her thorax, and that makes it bald.[4] Now that you have found her, you need to be ready to capture her. Lay your hive tool on the tops of the frames to act as a stand for the frame, and set the top bar of the frame on the hive tool, this frees up your two hands, and helps keep the frame from crushing the bees on the backside of it.

A queen catcher is a nice thing to have, and I keep one in my pocket at all times. Even better, in this situation, is to pick up the queen with your fingers and put her in a queen cage, then hold your index finger over the hole. Once you get her inside, look at the frame you just set down and find a bee with just its butt peeking out of a cell. This is a nurse bee who is feeding larvae, and she will be able to feed your queen, too. When she backs out of the cell, pick her up by her wings and put her in the cage with the queen. Find four or five of these young nurse bees, and put them all in with the queen. If you don't have the patience to carefully choose nurse bees this way, at least pick young, fuzzy bees, but not newly emerged ones. They need to be at least five days old to have developed hypo-pharyngeal glands for royal jelly production.

Now, you can do whatever you like with this queen. I almost never pinch a queen, unless there is something major wrong with her. Placing her in a cage with four or five nurse bees gives you a week to decide what to do with her. It might be nice to make a small nuc to support her. If your colony will be making their own new queen, there is a 20% chance that she won't make it back from her mating flight, so it is nice to have the old one in the bank. If you have bought a queen for replacement, there is still the chance you'll need this old one, or you can sell her to someone who is desperate and is dealing with a less-than-ideal situation (no brood, laying workers, etc.)

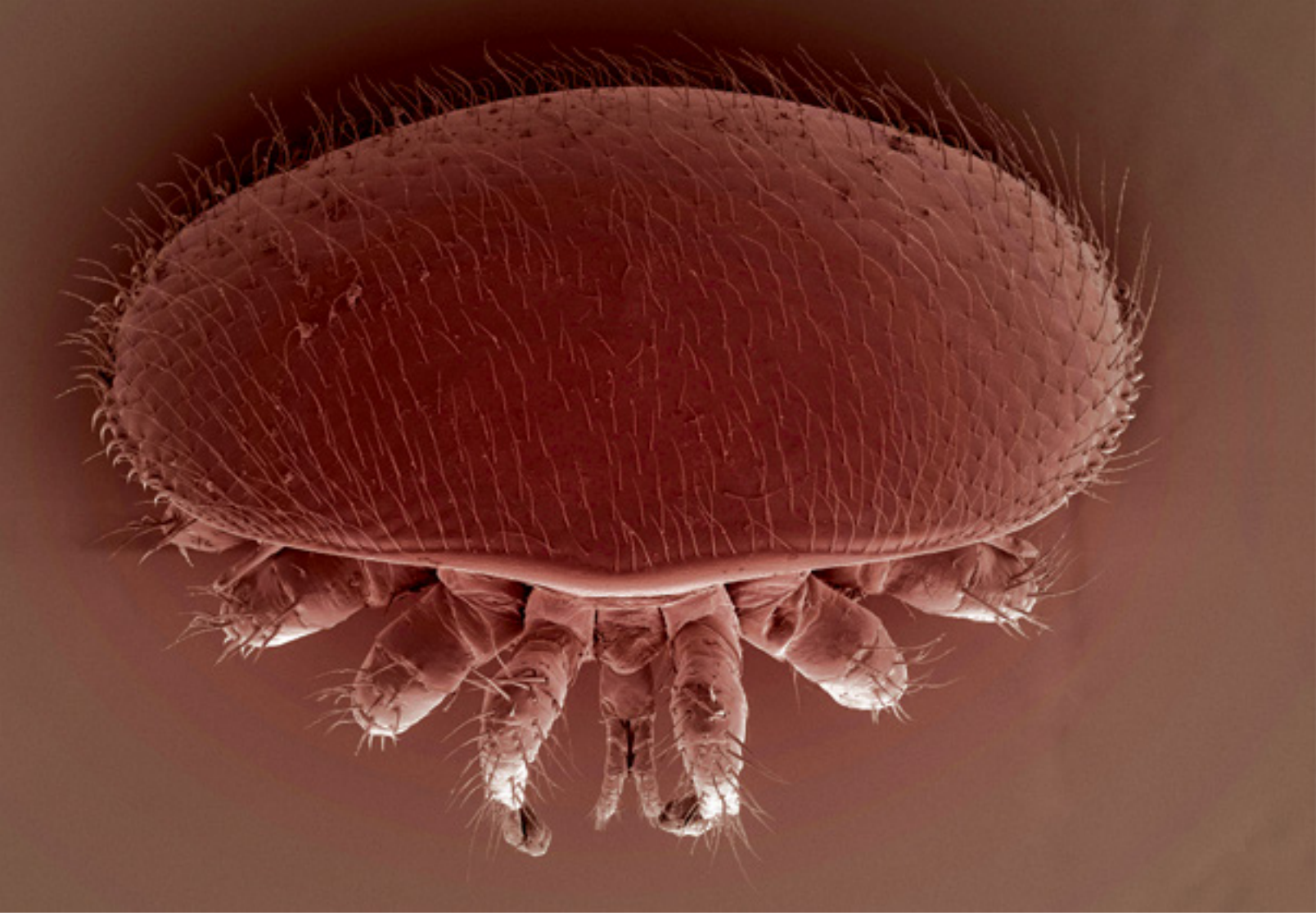
The other way to find a queen, and what you can do if you look for yours and can't find her, is to employ a queen excluder. Since queens can't normally cross through a queen excluder, it is possible to find her using one.

First, set all of the boxes aside, away from the bottom board, and a few feet from one another. In just a few minutes, the boxes that do not have the queen will begin keening for her. It is a sound like no other in beekeeping, and once you hear it, you'll always know what it means. The box that is quiet is the one with the queen (the bees can be a little tricky about this, it is a clue to her location, not a fact).

Set a new hive body on the bottom board, or take all of the frames out of a box and set them carefully where they will be safe. Shake the bees off of the side walls into another box and set the empty one on the bottom board, with the queen excluder atop it. Now, take each frame and shake the bees off of it, over the queen excluder. The worker bees will begin passing through, leaving the queen behind for you to capture. If the bees don't want to go down, you can push them down with a little smoke. Once enough of the bees have passed through to see that the queen was not on that frame, lift the excluder a bit and put the frame into the box. Pick up the next frame, shake it, look for the queen, place the frame in the box. Continue until the queen shows up on the excluder, remembering to shake the bees off of the side walls of hive bodies, and even out of the honey supers until she is found. This method takes no particular skill, nothing but time and patience. You do need to be able to handle the queen once you've found her, so practice on drones until you get really good at catching them by their thorax alone, without touching their abdomens. Go ahead and mark them while you've got them, for practice. Practice makes perfect, just like our moms said, and beekeeper experience is a leading indicator of colony survival. BC

1) Rangel, J., Seeley, T.D. Colony fissioning in honey bees: size and significance of the swarm fraction. *Insect. Soc.* 59, 453–462 (2012). **https://doi.org/10.1007/s00040-012-0239-5**
2) Caron, Dewey and Connor, Lawrence, Honey Bee Biology and Beekeeping, 3rd Edition, pg. 281, (2022) Wicwas Press
3) J. Lloyd Harris (2008) Effect of requeening on Fall populations of honey bees on the northern Great Plains of North America, Journal of Apicultural Research, 47:4, 271-280, **DOI:10.1080/00218839.2008.11101474**
4) Kearney, Hilary QueenSpotting, Meet the Remarkable Queen Bee and Discover the Drama at the Heart of the Hive (2019). Storey Publishing

Using a queen excluder to find the queen is fairly fool-proof, if you are careful to shake every comb and every box as you go. Keep in mind, if you don't find the queen this way, there may not bee one present (the colony may have swarmed already and there is a virgin in the hive, who may be able to cross an excluder). If you find recently emerged queen cells, don't be looking for the queen! It is much too disruptive, and you may cause the bees to kill their own, brand new queen if you go looking for her less than two weeks after she emerges.
Photo credit: Tina Sebestyen



Jeff Kennedy

VSH Traits in Honey Bees

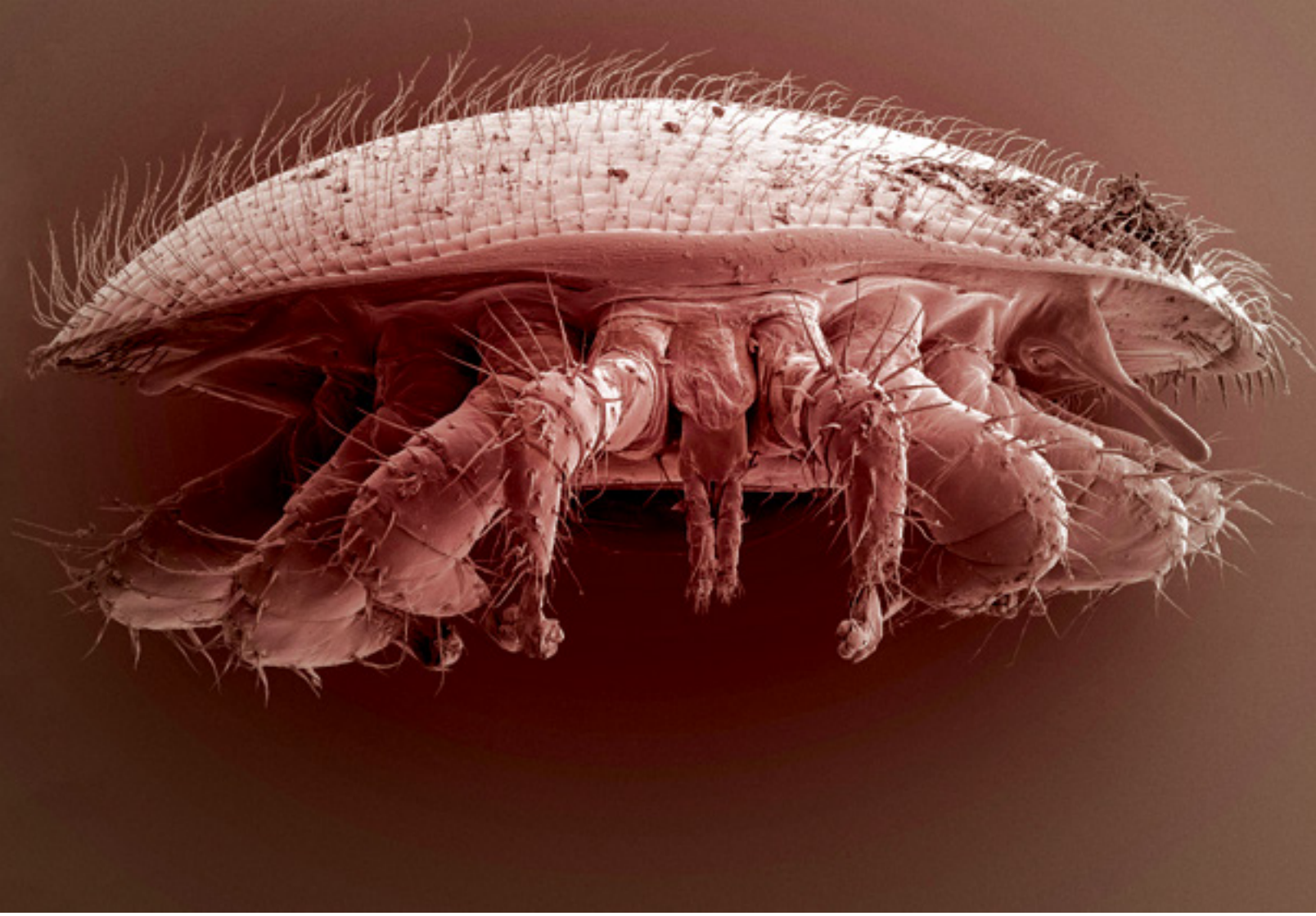
Pollinating insects are critical to sustainable crop yields and their quality. As our ever-growing population becomes more dependent on efficient food production, maintaining healthy pollinator populations has become increasingly more important. Our beloved honey bees are the chief pollinator of crops here in the United States, but over the past several decades, colony numbers have steadily declined due to a myriad of reasons. One of these reasons is parasitism by *Varroa destructor* (*Varroa*) which is typically the culprit for the failures experienced by hobbyist, sideliners and commercial beekeepers alike.

For the novices out there, *Varroa* is a parasitic bee mite that has wreaked havoc on beekeepers throughout the world and has forever changed the industry. *Varroa* was first reported in honey bee colonies from Hong Kong in 1962, and then popped up again in 1963, this time in the Philippines. With reports of it making its way to the Port of Newcastle in Australia last year, it is looking as if *Varroa* will now become established on every continent due to the commercial transport of bees and queens, migratory beekeeping practices, natural swarming and drift or carried by ships and aircraft.

Varroa Physiology

The adult, female *Varroa* is oval and flat, measures about 1.1 mm long and 1.5 mm wide, is pale to reddish-brown in color, and can be seen easily with the unaided eye. Males are considerably smaller and are pale to lightly tan in color. Adult bees serve as intermediate hosts when little or no brood is available and as a mechanism of transport. Females will attach to an adult bee between their abdominal segments or between regions of their body (head/thorax/abdomen), making them difficult to detect. It was originally thought that the mites fed exclusively on the bees' hemolymph (invertebrate equivalent of blood); however, recent studies conducted by Dr. Samuel Ramsey, affirmed that the mites damage the host bees by consuming their fat body, a tissue roughly analogous to the mammalian liver. The fat body is integral to proper immune function, pesticide detoxification, overwinter survival and several other essential processes in healthy bees.

The most severe parasitism occurs on the older larvae and pupae, with drone brood being preferred to worker brood. The degree of damage depends on the number of mites



parasitizing each bee larva. One or two mites will cause a decrease in vitality of the emerging bee. Higher numbers of *Varroa* per cell result in malformations like shortened abdomens, misshapen wings, deformed legs or even the death of the pupa. In addition, their feeding on immature/developing bees is a confirmed vector of five debilitating viruses and potentially 13 others.

The adult, female *Varroa* will enter brood cells shortly before they are capped and must feed on the larvae before they can lay eggs. Each mite will lay two to six eggs every 30 hours. The first egg usually emerges as a male and the later ones as females. The development from egg to sexually mature adults occur from six to 10 days. The mites will then mate inside the capped cells, with the males dying afterwards. All immature mites will die after the emerging bee opens the cell, while the young, adult female mites and mature (gravid) females move on, attaching to bees passing by. The mite then enters another brood cell to repeat this process.

Varroa Sensitive Hygiene (VSH) & Selective Breeding

The USDA-ARS Honey Bee Breeding Lab in Baton Rouge has bred bees that hygienically remove mite-infested pupae from capped worker brood. This ability is called *Varroa* Sensitive Hygiene (VSH), and is an important mechanism of resistance to *Varroa*. The bees that express high levels of this behavior are referred to as VSH bees. The best resistance is found in pure VSH bees; however, hybrid VSH bees (e.g., VSH queens open mated to non-resistant drones) are reported to have significant resistance to *Varroa*.

VSH is similar or the same as hygienic behavior that honey bees use to combat other diseases such as American foulbrood, chalkbrood, and towards the eggs and larvae of wax moths and small hive beetles. All colonies likely have individuals that exhibit VSH traits, and it is not yet fully understood how selective breeding has resulted in colonies with greatly improved performance. Hygiene is performed by nest cleaning bees aged 15-18 days old. Removal of a mite-infested pupae begins when a nest cleaner smells the infested brood and chews a pinhole through the cell cap. Subsequently, additional nest cleaners assist in enlarging the hole and removing the diseased pupae from the brood cell.

Removal of mite-infested brood is probably triggered by unusual odors that penetrate the cell cap to the

it Mite be a Solution

outside where hygienic bees patrol the comb surface. VSH bees have been observed responding vigorously to highly infested brood (e.g., 15–25 mites per 100 capped cells) that is transferred into the colony. They uncap and remove many mite-infested pupae quickly. They respond with much less intensity to brood with low infestation rates (one to five mites per 100 capped cells), probably because the chemical signals that trigger removal are less concentrated and harder to detect.

Another characteristic of VSH bees is reduced fertility in the mites, when compared to non-VSH bees. In a colony, mite fertility is reduced several weeks after introduction of VSH queens into non-selected colonies. This led to the original name of the trait, Suppressed Mite Reproduction (SMR). This name describes the trait (or traits) selected in the experimental population of bees. The name of the trait was later replaced by *Varroa* Sensitive Hygiene. This is due to the finding that the primary mechanism of the trait is the removal of infested pupae from capped brood cells.

Is the Proof in the Puddin'?

Currently, there are just a handful of queen producers that are using instrumental insemination to control and isolate pure VSH genetics within their apiaries. So far, it is looking very promising even for the openly mated, hybrid queens that derive from VSH stock. As I alluded to earlier, if we can agree that most colonies exhibit some degree of hygienic behavior, then the addition of a hybrid, VSH queen should enhance the colony's hygienic behavior that much more, right? We began incorporating VSH genetics into our stock years ago and have consistently seen a decrease in infestation rates during peak season, mite washes. However, I am not naïve enough to put all of my faith into or to hope for a silver bullet. I believe that the success(es) we experience within our operations are the result of taking a multi-pronged approach to husbandry. But let's see some data.

A 2011 study conducted by Robert Danka, Jeffrey Harris and José Villa, of the USDA-ARS Honey Bee Breeding Lab, offers more insight.

The lab tested six commercial sources of honey bees, whose breeding practices incorporated the VSH trait. VSH production queens (i.e., queens commercially available to beekeepers) from the six sources were established in colonies and monitored for VSH. The data was compared with data from three other types of queens: 1) VSH queens from the selected, closed population maintained by USDA-ARS for research and breeding/germplasm, 2) queens from the cooperating, commercial distributor of this germplasm (Glenn Apiaries) and 3) queens of a commercial, mite susceptible source.

Glenn Apiaries of Fallbrook, CA maintained a breeding population of VSH colonies through instrumental insemination, adding new genetic material annually from further selections provided by the USDA-ARS Lab. Their operation also combined the VSH trait into multiple stocks that were desired by beekeepers. Glenn's instrumentally inseminated breeder queens were sold to queen producers to incorporate into their own breeding program or to use as mothers of production queens for beekeepers. How much these intermediate breeding efforts affect the expression of VSH

in production queens is unclear. This is due largely in part to the difficulty of measuring the trait which prevents breeders, queen producers and beekeepers alike from assessing it in their own bees.

Harris and John Harbo (also of the USDA-ARS Lab) had previously reported in 2001 that although pure VSH queens yield colonies with the greatest resistance to *Varroa*, daughters of VSH queens that outcross by mating with non-VSH (and presumably mite-susceptible) drones retained a significant level of mite-resistance. Their collective data showed that mite populations in these hybrid colonies remained low during tests lasting a few months in duration. Their study suggested that beekeepers could derive immediate benefits from mite-resistant queens that have free-mated to unselected drones. They offered that the production and distribution of these free-mated queens from many commercial sources may be an effective way to insert beneficial genes into our commercial populations of honey bees without losing the genetic diversity and the useful beekeeping characteristics of this population.

The data collected in the 2011 study showed that the reduction in mite infestation of brood combs differed significantly between the groups. On average, colonies with VSH production queens reduced infestation by 44%. Not surprisingly, the optimum results, or those with the greatest mite removal, were the pure USDA-ARS VSH queens (76%) and the Glenn Apiaries VSH queens (64%). The colonies with the least removal were the commercial, mite susceptible queens (7%).

Colony-to-colony variation tended to be greater within the VSH production and commercial, mite susceptible colonies than the USDA-ARS and Glenn Apiaries VSH colonies. The VSH production queens had variable expression of hygiene against mites, with average reduced infestations ranging from 22 to 74%. In addition, infertility was high among mites that remained in infested cells within the USDA-ARS and Glenn Apiaries VSH colonies, but was lower and more variable in VSH production and the commercial, mite susceptible colonies. Commercial VSH production colonies supply mite resistance that generally seems to be useful for beekeeping, and the resistance likely could be improved upon if more VSH drone sources were available when VSH production queens are openly mated. Dare I suggest that a viable, business endeavor for an ethically sound, entrepreneurial beekeeper with the ability to run a closed breeding population would be to produce excess VSH drones that could be marketed as three pound drone packages? This would assist beekeepers who are interested in building upon the VSH trait to flood their DCA's with VSH drones to help increase the percentage of the VSH trait within their openly mated, hybrid queens.

The Silver Bullet Lacks Gun Powder

I have a source close to me that was the head apiarist for Florida state during the early 2000's when the VSH trait was being developed. He informed me that he was present when Harbo and Dr. H. Glenn Hall, Professor of Entomology for Florida University developed a mite resistant line of *Apis mellifera*.

Harbo was working on his VSH stock and Hall was paralleling him to validate the data. Hall succeeded at breeding honey bees that were resistant to *Varroa*, and found that like *Varroa's* original host *Apis cerana*, resulted in smaller colonies about the size of a soccer ball. The conclusion being that if you bred *mellifera* so that it was not large enough to have a massive amount of brood present during the majority of the year, you could have honey bees that were resistant to *Varroa*. The trade-off is that a colony such as this is of no value for honey production or crop pollination due to its low population.

So, the verdict is still out, so to speak. Over two decades worth of persistent study by universities, agricultural extensions, and beekeepers have all yielded roughly the same results when it comes to VSH. The closer that you stay to a controlled or "pure" line will produce the highest rate of hygienic behavior. As you start to branch away from pure lines (i.e., hybrid, VSH queens) and they begin to openly mate with local, mite-susceptible drones, the traits are less influenced.

When it comes to combating *Varroa*, I am receptive to any possible solution that will tip the scale in our favor. I am appreciative of the extensive amount of work that has and continues to go into developing this trait further. I see potential down the road for incorporating this trait within your apiary; however, I will remain vigilant in my management practices and continue to be a proactive, not a reactive beekeeper. There is no silver bullet. At least not yet. BC

Soils are Important to Honey Plants and Bee Locations

Strangely enough, it is not intuitive to most beekeepers that soil types are extremely important to how well their beehives will produce honey as well as what types of honey will be produced. Our expectations of honey crops depend upon our own past experience or a verbal legacy passed down from more experienced beekeepers.

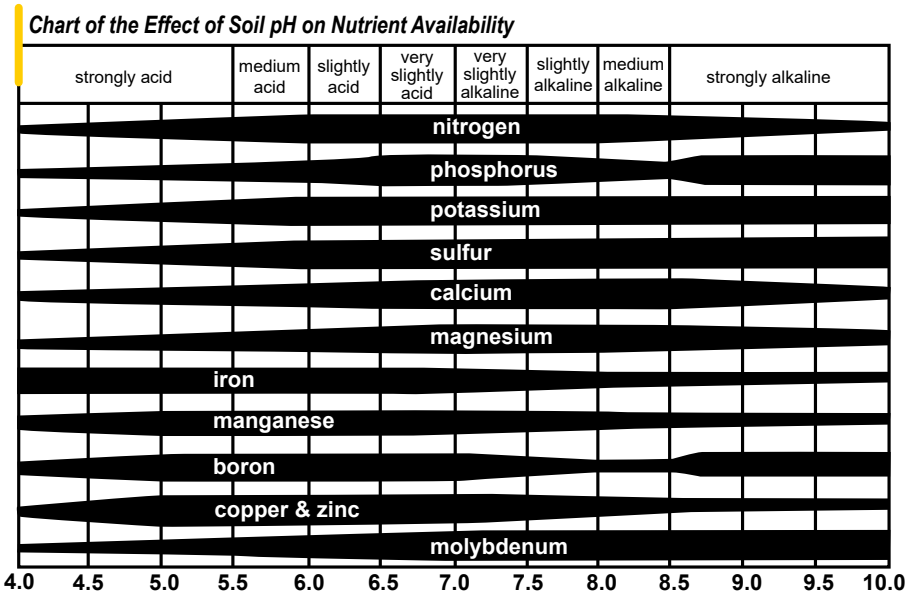
Beekeeping is a form of agriculture. While it is obvious to all of us that soil fertility and pH are vitally important to field crop production, we often do not make the connection that beekeepers are producing a crop dependent upon plants that either will or will not thrive depending upon the soil in which they are grown. I suspect that if our job as beekeepers was more involved with the production of honey plants rather than the production of bees, the connection between soils and honey crops would be more obvious.

In the literature on beekeeping, you do see references to the importance of soils in apiculture. One such book, *Honey Plants of North America* written by John H. Lovell and published in 1926 does identify the importance of soils in beekeeping.

Mr. Lovell states "Plants growing in soils to which they are adapted are more vigorous and produce more nectar than in soils in which they do not flourish." In his section on New York State, Lovell says "New York well illustrates the importance of a knowledge of soil properties not only to the farmer but to the beekeeper as well."

Soil fertility, the availability of needed plant nutrients, will lead to more vigorous plants. Natural soil fertility is dependent upon texture, organic matter, pH, soil depth and the parent material from which soil is derived. The pH of a soil is directly related to the availability of soil nutrients to plants. The term pH refers to the proportion of hydrogen ions (H positive) and hydroxyl ions (OH negative) in water (H_2O) solution. The measurement scale for pH is logarithmic and goes from zero to 14 with seven being neutral. Soils with a pH under seven are acid and hydrogen ions are predominate and soils over seven pH are basic and hydroxyl ions are predominate. Most soils are acid and can be described as follows:

- 6.5 to 7.2 – slightly acid to slightly alkaline
- 5.5 to 6.5 – moderately acid
- 5.5 and below – very strongly acid



A pH between six and seven correlates to the greatest availability of nutrients in soil solution. Nitrogen is most readily available in soils greater than 5.5 while phosphorus, potassium, calcium and magnesium are more readily available in soils with a pH greater than 6.0. Molybdenum is very unavailable in acid soils and becomes readily available in soils with a pH greater than 6.5. Molybdenum is particularly important to growth of plants in the legume family. When the pH goes above 7.0, the availability of phosphorus, zinc and copper decline rapidly. Iron and manganese are necessary micronutrients for plant growth but when the pH of soil drops below 5.5, there can be so much of these nutrients as well as aluminum in solution that they actually become toxic to many plants.

In *Honey Plants of North America*, John Lovell separates honey plants into two great groups: Calciphiles (lime lovers) – plants which grow best in limestone (sweet) soils with a relatively high pH and Calciphobes – plants which avoid lime soils and grow best in acid (sour) soils. In regard to the calciphiles, he further states some plants grow in high lime soils only, while some prefer lime soils but will grow in other soils. Similarly with the calciphobes, some plants will grow in acid soils only, but some prefer acid soils but will grow in other soils. There are still other honey plants that will yield on a wide range of the pH scale. We will review some examples of all of these groups.

The *Leguminosae* (Fabaceae) is the most important plant family for beekeeping in North America and many of its members are calciphiles. Legumes are extremely important to agriculture and are a basic element of crop rotations. Members of the legume family include alfalfa, white clover, sweet clover, alsike clover, vetch, black locust, peanuts, lupine, acacia, mesquite and redbud. The legume family has 18,000 species and is the third largest family in the angiosperms. Alfalfa and the clovers

Part 1: Honey Plants Differ Greatly in Growth and Nectar Production Depending Upon the Soils in their Locality

Michael Johnston

White Clover (Photo by Peter Borst)

Alfalfa (Photo by Peter Borst)

Spotted Knapweed (Photo by Peter Borst)

have a very strong affinity for soils with a relatively high pH. This is due to their high demand for nitrogen and these plants can actually be grown on soils with a low pH if supplied with large amounts of nitrogen fertilizer. The legumes are famous for their symbiotic relationship with nitrogen fixing bacteria (a.k.a. rhizobia) located in nodules on their roots. Different species of rhizobia are specific to different legumes (with some exceptions). These bacteria will not grow in acid soils because the micronutrients molybdenum, copper and cobalt are required for enzymes used in the nitrogen fixation process. The nitrogen fixing bacteria are even more sensitive to a low pH than the legumes that it supplies with nitrogen.

Some examples of plants that prefer high lime soils but will grow in other soils include spotted knapweed and purple loosestrife. Both of these plants have been spreading throughout New York State, where I live. In areas with high pH soils, these two plants (along with white clover and basswood) contribute to a sustained honey flow that begins in early July and continues through the end of August. Though knapweed and loosestrife are now common in areas with acid soils south of here; beekeepers there still report a dearth from mid-July until goldenrod starts blooming in the middle of August. So these two plants grow on these acid soils but do not produce much nectar there.

The greatest examples of calciphobes are plants that belong to the Ericaceae, another very important family of honey plants. Included are blueberry, cranberry, Manzanita and madrone in North America. Common heather or ling in Great Britain is also in the Ericaceae. All grow in strongly acid soils. For example, blueberry prefers a range of 4.2 to 4.8 pH. These plants rely on their association with mycorrhizae to obtain nutrients that are not readily available in acid soils. Mycorrhizae are ground fungus that are symbiotic with the roots of most plants. Their mycelium reach further than the root hairs of plants and being a fungus, they break down the organic matter present in soil. While the mycorrhizae supplies nutrients, the plant repays with sugars and carbohydrates.

Mycorrhizae translates to fungus root and refers to the association between plant roots and soil fungus.

More than 90% of plant species studied have a symbiotic relationship with mycorrhizal fungi. There are many species of mycorrhizal fungi. Some are associated with only one plant species, while others will work with many species of plants. Some plant species will not survive without mycorrhizae, while others benefit but can live without it.

Soil scientists in the United States realized the importance of mycorrhizae when tree plantings failed in the Midwest during the 1930's. These plantings were meant to reduce wind erosion during the dust bowl era. These plantings were made in soil devoid of the proper mycorrhizae.

Famous calciphobes that prefer moderately acid soils but will grow on higher pH soils include goldenrod (Composite family) and buckwheat (Polygonaceae) and japanese knotweed (Polygonaceae). It is common

Purple Loosestrife (Photo by Peter Borst)

Buckwheat (Photo by Peter Borst)

Japanese Knotweed (Photo by Peter Borst)

plants that have developed that are adapted to those environments. The accompanying table from Purdue University (right) shows how different crop species are adapted to a wide range of pH. It is interesting to note that there is some overlap between the optimum pH for buckwheat and many of the legumes so there will be some locations where both will yield honey crops.

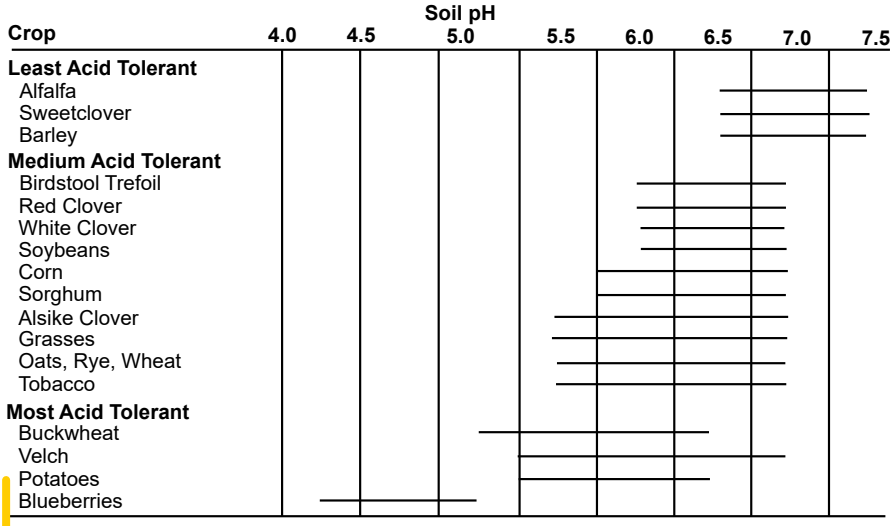
While much of this article has focused on soil pH, there are many other soil factors (edaphic factors) affecting plant growth. Among these factors are texture (the proportion of sand, silt and clay), soil profile and depth, parent material, organic matter and soil organisms, structure, porosity, moisture, soil air, topographic location and soil fertility (either natural or from the fertilizer bin). Environmental factors such as extreme temperatures, humidity, aspect, wind, day length and fire may affect plant growth and honey production more than soils. Biotic factors such as plant competition, disease and herbivores can also affect plant growth more than other factors.

Some honey plant species have an optimum pH for growth and nectar production in the range of 6.5 to 7.0 but still there are significant honey plants in areas outside of this pH range. Growth and honey production are limited more by some of the aforementioned soil, environmental and biotic factors. Some examples are thyme, basswood, black locust, tulip poplar and sugar maple.

Wild thyme, a member of the mint family (Lamiaceae), is an introduced plant in New York and is well known as a honey producer on high lime soils south of Albany as well as lower pH soils in the Catskills. Thyme prefers well drained soils, is drought tolerant and does best in full sun. Another famous mint is sage, also known as salvia. There are as many as 18 species of sage in California, the most notable being black sage. Sage can be found growing in soils with pH ranging from 4.0 to 8.0. It is very drought tolerant and prefers well drained soil. It will not persist in soils that are continually wet.

enough to see goldenrod on high lime soils. It does yield some nectar and there is the associated odor from hives making goldenrod honey. Because of its low yield, a saying among beekeepers with hives on high lime soils is “you can smell goldenrod honey but you can’t see it”. In a similar manner, buckwheat will yield some nectar on high lime soils but prefers moderately acid soil. A few years ago, I had bees placed near hundreds of acres of buckwheat growing on high lime soils; unfortunately the bees only brought in enough buckwheat to slightly darken my nice light honey.

While it is a useful generalization to classify honey plants as calciphiles or calciphobes, the plant world is not just black or white. There is a continuum of plants with preferences to pH. While there is variation in pH’s of soil across the landscape, there are



Range of pH Tolerances for Different Crops (Purdue Forage Information)

California Lilac (Ceanothus spp.) grows on acid or alkaline soil, thrives in full sun and well drained soil but benefits from moderate to heavy rainfall. There are many varieties (or species depending upon whether you are a splitter or clumper) of this plant in coastal mountains of California. Some varieties produce surplus honey while others are worked more by bumblebees. The Ceanothus is one of six genera of the 55 genera in the Rhamnaceae (Buckthorn) family that have nitrogen fixing bacteria on root nodules similar to legumes (Fabaceae).

Black Sage with California Lilac in background (Photo by Peter Borst)

Black locust is a member of the legume family. Before the primeval forest was cleared by European settlers, the original range of Black Locust was restricted to areas with high pH soils in the central Appalachians. Since that time black locust has been widely planted because of its resistance to fungal rot and its use as fence post material. Fortunately for beekeepers, this legume yields nectar everywhere it is grown. We can infer, though, that it probably yields nectar better in high lime soils similar to its natural habitat.

Tulip poplar, a member of the Magnolia family, will grow on soils with pH ranging from 4.5 to 7.5. It does prefer deep soils that are moderately moist but also well drained.

Sugar maple is a good honey and pollen plant in very early Spring. The pH range for growth is 3.7 to 7.9 but does best in the range of 5.5 to 7.3 pH. According to a U.S. Forest Service fact sheet, it will typically comprise 52% of a mature stand of trees in New York but only 17% of a mature stand in Minnesota and Wisconsin.

It will grow in a wide variety of soils and its range extends from northern Canada to the Gulf Coast. It can tolerate a minimum temperature of negative 46 degrees Fahrenheit. It is not a wetland plant. The greatest limit to its range is droughtiness. It is a shade tolerant tree but will be out-competed by more rapidly growing species such as white ash or black cherry in full sun.

Basswood will grow on soils ranging in pH from 4.5 to 7.5. It reportedly does best when the pH is in the 6.5 to 7.0 range, but large honey crops have been obtained from basswood in areas with acid soils. The range of this plant is very similar to the range of sugar maple and is closely associated with it. It is not quite as shade tolerant as sugar maple. It is a nitrogen demanding species. It is limited by droughtiness and grows better with a north facing or east facing aspect.

So how are some honey plants affected if we just consider soil texture? The optimum soil texture for agricultural crops is referred to as a loam. This is a mixture of the three soil size particles: sand, silt and clay. While sand is helpful in providing drainage, it is not a good source of nutrients. Clay particles are a good source of nutrients but a heavy clay soil is a difficult medium for the growth of plant roots. Silt is intermediate in qualities between sand and clay. Our most important honey plants in the legume family are adapted to a wide range of soil textures. While the optimum texture for alfalfa and sweet clover is a loam, they will also grow and yield honey on all soil textures. White clover will do well on clay or loam soils. Asters (composite family) will do well on soils ranging from sand to clay. Goldenrod (composite family) does well on clay soils. So, soil texture in many cases will not determine what plants will grow on a site. Optimum soil texture will promote optimum growth and vigor of plants.

Admittedly, this article is only scratching the surface of the relation between soils and honey production. There are many more honey plants and environments to consider beyond the scope of this article. For each habitat with different qualities, there have been plants that have adapted to grow there. It is up to the beekeeper to learn the qualities of the habitat where their bees are placed and what plants grow in that particular area. A good start to learning about your situation would be obtaining a copy of *Honey Plants of North America* by John Lovell (it can be found at *Bee Culture's* Bookstore: **https://store.beeculture.com/1926-honey-plants-of-north-america/**). While this article is an introduction to the subject, Mr. Lovell wrote a whole book about it.

In the next article, we will focus on how different soil types influence honey production. The USDA Soil Conservation Service (now Natural Resource Conservation Service) has done a lot of valuable work mapping and explaining the soils of the United States. With this information, it will be apparent why there are great concentrations of commercial beekeepers in certain areas while not so much in others. For the non-migratory beekeeper, a knowledge of soils may be useful in finding better locations not far from home as well. BC

WINNIPEG IN WINTER

A Review of the Manitoba Beekeeper's Association Annual Conference

James Masucci

A cold, February sunrise in Winnipeg. The backdrop of the annual Manitoba Beekeeper's Association conference.

Why would any sane person leave their home on a rare, 70 degree February morning and travel to Winnipeg where the highs are zero degrees Fahrenheit? Yes, beekeepers are crazy, but I had a good reason. I was invited to present some mite control data to the Manitoba Beekeeper's Association at their annual conference. I had done this before, about five years ago, and this remains one of my favorite beekeeping meetings. The two-day meeting is a relatively small gathering of commercial beekeepers, the provincial Apiarist, provincial Ag officials, members of the Canadian Honey Council and honey bee researchers. All the necessary people to dig into the state of the industry.

The agenda of the meeting was driven by the horrible mortality rates that Canada, in general, and Manitoba, in particular, experienced over the 2021-2022 Winter. Mortality rates for the whole of Canada were around 47% and in Manitoba were over 60%. This is for a province that averaged 20% or less mortality for the last eight years or so. Discussions with beekeepers and the report from Derek Micholson, the provincial apiarist, indicate that these losses were caused by the "usual" suspects. A drought in 2021 impacted nutrition, mites and nosema brought disease and weather extended the Winter up to two months beyond their normal extended cold. It's one thing getting your bees through six months of Winter, but try extending that to eight months. One beekeeper told me how he took his bees out of Winter storage for about a week and had to put them back in due to back to back weather fronts that came. In general, the talks/discussion can be classified into two topics: how to get better queens and how to reduce colony stressors. The latter category was heavily focused on *varroa*.

Pests, Pathogens and Other Stressors

The tone of the meeting was set with the first talk, *Industrial Bees – Is High Density Beekeeping Bad for Bee Health.* This was a talk presented by Lewis Bartlett from the University of Georgia and gets to the key question, "are commercial beekeepers shooting themselves in the foot by having large apiaries?" Lewis is akin to a honey bee epidemiologist and his data indicated the answer is "no." In fact, managed colonies are healthier, in general, than feral colonies. Basically, all bees are exposed to all diseases and there are other factors that influence the severity of the disease that you see. I asked him about the advantages of isolated apiaries and keeping diseases out. His response was that the density of hives is so high, that it's almost impossible to have a truly isolated yard. It's okay to place the maximum number of

colonies in an area that the forage can support.

Rob Currie, professor at the University of Manitoba, presented one of the few talks on bee stressors that was free of *varroa*. The presentation, *Virus, Pesticide and nutrition interactions in honey bees in Prairie cropping systems: Death by a thousand cuts* described the work he and several other researchers did to evaluate different stressors in the cropping systems common to the prairie provinces. The study looked at bees on canola used for oil production, canola used for seed production and soybean, and compared them to colonies in the same region but away from those crops. The data represented the "tool development stage" of a more long-term attempt to understand the interaction between stressors on honey bees. Samples were taken pre-flowering, during flowering and post-flowering. Pesticide prevalence in the hives were higher during flowering and post-flowering in all three cropping systems. This same trend held for sacbrood virus and deformed wing virus in colonies on the edge of soybean fields. Interestingly, sacbrood was high at all timepoints in colonies next to canola fields and deformed wing virus started high in canola and dropped as the season progressed. It will be interesting to see how consistent these findings are and if they are able to find interactions within these cropping systems.

There were several talks on *varroa* control. Here I must disclose a potential conflict of interest. I was one of two scientists representing Greenlight BioSciences to discuss the new *varroa* product they are developing. Greenlight is developing an RNA-based product, vadescana, that directly targets reproducing mites. Brian Manley showed data from several trials indicating that vadescana can keep mite levels below threshold levels for more than 12 weeks. He also showed some preliminary data from an overwintering trial (see slides on the next page) where Vadescana-treated colonies had twice the survival rates as Apivar-treated colonies. The overwintering trial also showed how effective rotating modes of action (i.e. Vadescana in the Spring and Apivar in the Fall) can be for mite control and colony survival. Pending approval from the PMRA, Greenlight will be doing trials in Canada this year.

Steve Pernal, a research scientist with Agriculture and Agri-Food Canada, talked about a new miticide that he is working on. The miticide, 3C(3,6), is a plant based compound that has a similar structure to Thymol. It is not as volatile as thymol and it is not clear how much activity comes from fumigation vs topical exposure. The lack of volatility is an advantage over thymol, in that they have not seen brood kill or queen issues with 3C(3,6). Efficacy ranged from 42% in 2021 to 94% in 2022. The difference reflects product development as they are working out appropriate dosing and application methods.

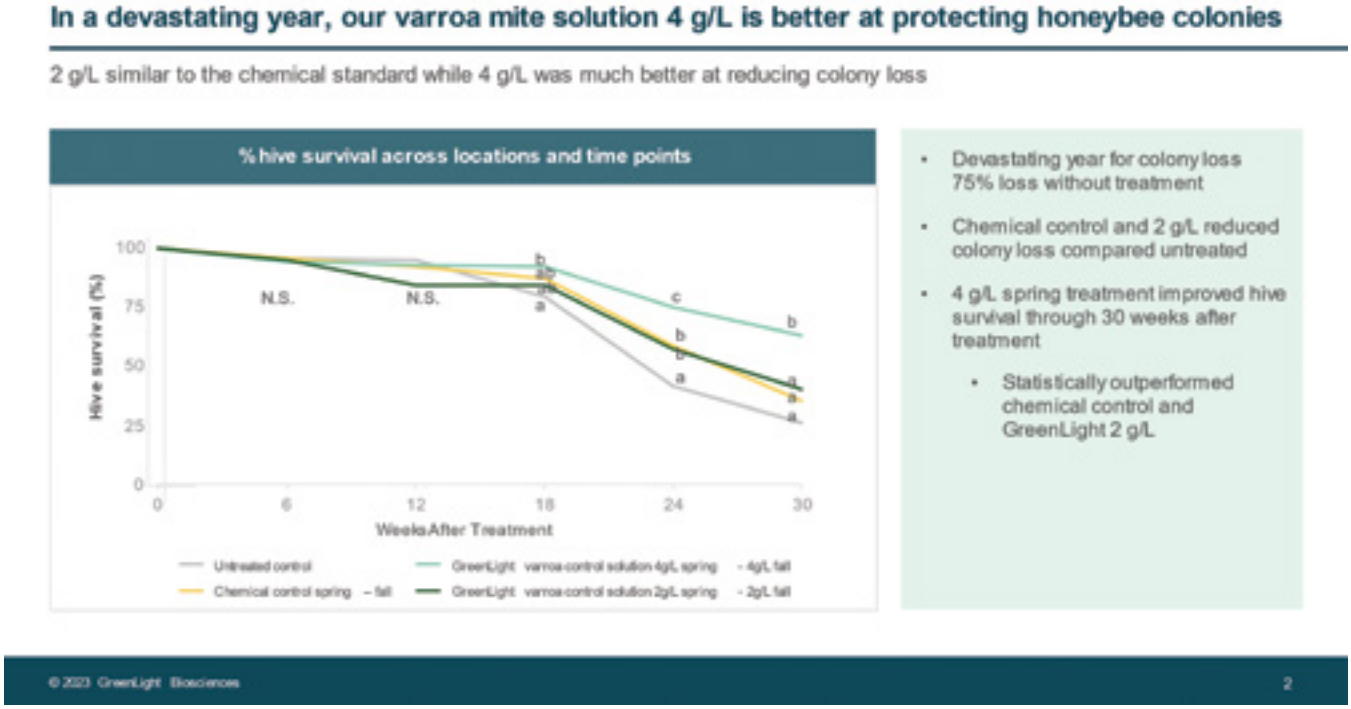
Amber Leach, of Veto-Pharma, spoke on Apivar. She acknowledged that there seems to be pockets of amitraz (the active ingredient in Apivar strips) resistance and talked about the dangers of off-label amitraz use. Following the Apivar label and rotating different miticide treatments is the best way to combat this resistance. One of the beekeepers pointed out a potential flaw in the design of the Apivar strips. When you use the tabs to keep the strip in place, one side of the strip is pinned against the frame. Thus, you are only treating with half the dose that you should be. It may be more effective to hang the strips using toothpicks, matchsticks, etc. so that both sides of the strip are accessible to the bees.

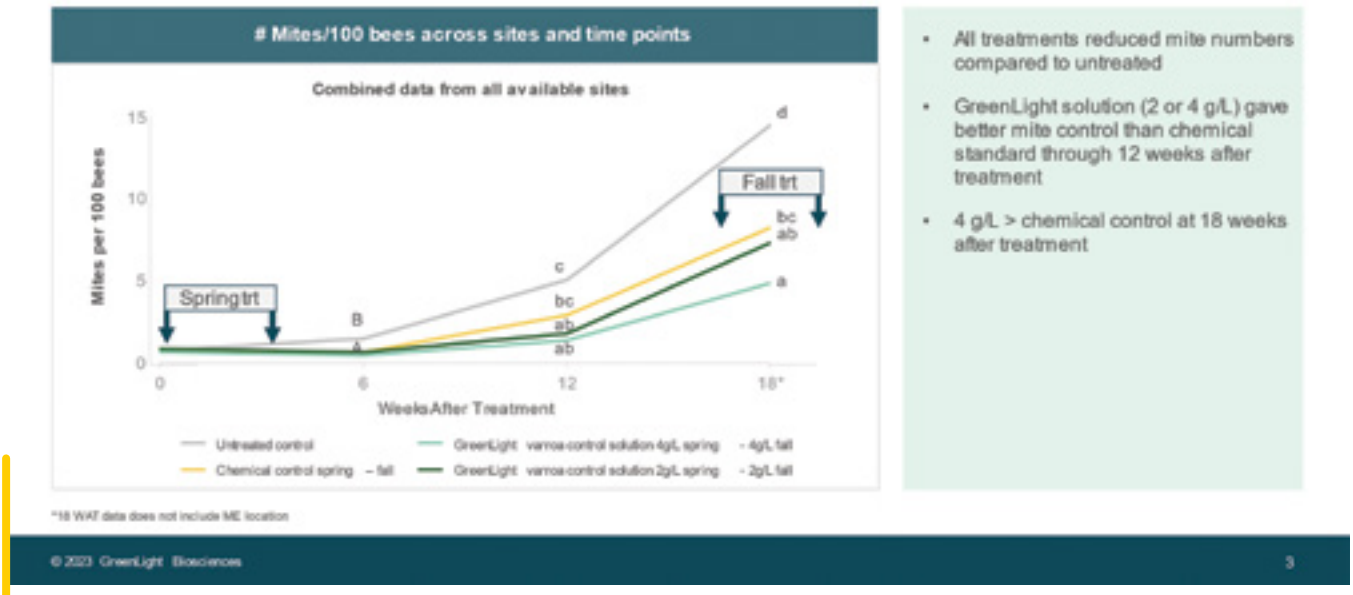
Breeding for Better Mite/ Stress Resistance

Last year in *Bee Culture* (*Bee Driven Mid-Life Crisis Part 2: What's in a Queen?* **https://www.beeculture.com/bee-driven-mid-life-crisis-p2/**), I talked about the difficulty of queen breeding. Uncontrolled mating and the lack of easy trait selection has resulted in very little improvement in queen quality over the years. There were a couple of presentations that showed we are making baby step improvements in our ability to breed.

Steve Pernal gave a talk entitled *Colony phenotypes for breeding and insights into Winter losses*. He showed the drivers for colony survival were sealed brood, colony weight and cluster size and showed that hive weight increase from 29kg to 30kg resulted in a 30% increase in probability of colony survival. He also showed that *varroa* and DWV levels were predictors of mortality. The critical piece to this presentation for me, was that he successfully used marker assisted breeding to increase hygienic behavior in three generations. Marker assisted breeding is where you have a molecular marker, either a protein variant or DNA variant, that is closely associated with a trait of interest. It's a technique widely used in the rest of agriculture but lacking in honey bees. Steve has a panel of proteins (many are antenna proteins) that are related to hygienic behavior. Steve successfully used these proteins in a breeding strategy to increase hygienic behavior. He compared using no selection, marker assisted breeding and the freezing brood kill assay (liquid nitrogen). After three generations of selection, marker assisted breeding produced the highest level of hygienic behavior, followed by the freeze kill selection. To me, it just emphasizes the need for a good molecular map if we really want to breed honey bees.

In the absence of a molecular map, Kaira Wagoner, of the University of North Carolina – Greensboro, has developed an assay for hygienic behavior that appears to be better than the traditional freeze kill assay. The problem with the liquid nitrogen assay is that it kills the pupae. Therefore, it is selecting for bees to recognize dead pupae. Are the signals produced by dead pupae the same signals that are produced by sick pupae? We want hygienic behavior to target sick pupae. Kaira spent several years identifying 10 chemicals that are elevated in unhealthy bees and developed the correct ratio of these chemicals to mimic what she calls the "unhealthy bee odor" (UBO). She has developed a two-hour assay, where she sprays capped brood with UBO and counts the number of uncapped cells after two hours. She showed that 60% uncapping in this assay was enough to control mite levels. The hygienic bees (those doing the uncapping) had high virus levels, but the hygienic colonies as a whole had lower virus levels than non-hygienic colonies. The system is not perfect. New queens can only be tested after seven weeks past emergence. As with all multigenic traits, maintaining the trait will be difficult. However, the assay is relatively simple, so for people willing to put in the effort, it will be feasible to select for hygienic behavior.





Mite control and preliminary survival data for a novel, RNA-based mite treatment being developed by Greenlight BioSciences. Assessment 1 was at the start of the trial with the chemical control treatment lasting six weeks and the vadescana treatment happening at week zero and week three. Assessments were done six weeks apart. The yellow line represents the untreated control. The red line shows mite data from hives that received a 42-day Apivar treatment at the start of the trial. The light green line shows mite data from hives treated with a high dose of vadescana. The dark green line shows mite data from hives treated the low dose formulation of vadescana.

Queen Quality

In the absence of true queen breeding, what can be done to increase queen quality? Medhat Nasr, working for the Saskatchewan Tech Team, assessed queens from several Saskatchewan queen producers and four queen producers from California. This is important to Canadian beekeepers because they import a lot of queens. He looked at queen size (head and thorax), nosema counts and sperm counts. On average, he found three million sperm in the Saskatchewan-made queens and 1.8 million sperm in the imported queens. To put this into perspective as to what this means, he did a back-of-the-envelope calculation. A queen produces 2,000 eggs a day and each egg induces the release of three to four sperm. Therefore, the queen needs about 1.1-1.4 million sperm per year. When the sperm runs out or gets low, you either get a drone layer or supercedure. When he showed the data for individual queens, 20-50%

of the imported queens (depending on producer) had less than a million sperm, indicating they could not last a year. I asked him why he thought this was the case and he felt it was due to the mating yards being too dense without sufficient drones.

Provincial Apiarist Report

Manitoba's beekeeping industry suffered in 2022. Over 60% losses over Winter had several effects. The number of beekeepers declined for the first time in about 15 years (from 925 to 905). The number of colonies dropped from around 115K to 103K. Honey production dropped 15-20%. The saving grace was an increase in honey prices, which greatly buffered the impact of the losses.

Manitoba's Knowledge and Research Transfer Program (KRTP) did some testing for amitraz resistance. They used both the four hour Apiarium test and the 24 hour Pettis test. They found that amitraz efficacy ranged from 15% to 100%. There is definite evidence for pockets of amitraz resistance.

Derek also reported on the priorities of the National Industry-Government Bee Sustainability Working Group. This is a large group made up of both government and industry representatives. Their top priorities are to support the Tech Transfer Programs. These programs are in every province and they perform locally relevant, applied research as well as extension services. They are also coordinating at the national level to work on common beekeeping issues. Top priorities of the working group also include accelerating the development of new *varroa* control solutions, actions to maintain and increase domestic bee supplies and actions to address long-term challenges to importing bee supplies. Their secondary priorities are to improve the overwintering of queens (which will ease the need to import queens), business cost analysis of the industry and the opening of the U.S./Canada border to package bees.

Opening Up the Borders

Opening the U.S./Canada border to package bees is a hot topic. I had a few conversations with beekeepers over this. In the U.S., beekeepers in the northern states buy nucs, queens and packages from the southern states. Some beekeepers are concerned where their bees come from. For example, the bee club I belong to only orders queens from Northern California, because of a concern of bringing in Africanized bees. (I, on the other hand, get queens from TX, LA and GA). The same holds true in Canada. They need bees and queens, just like the Northern U.S. states do. But the U.S./Canada border has been closed to bee traffic since tracheal mites in the 1980s. Canada brings in bees from Australia, New Zealand, and now Italy and Ukraine. They do get some queens from HI and CA, because they have established safe zones where there are no Africanized bees within 100 miles. In CA, this safe zone was recently reduced to 50 miles due to the detection of Africanized bees within the 100-mile zone.

So, do we bring in bees from across the ocean and potentially bring in a new pest or pathogen from there? Or do we treat North America as one isolated domain and move bees within that domain knowing there are Africanized bees in the south? The Canadians worry about Africanized bees and about antibiotic resistant AFB in the states. The U.S. is worried about viruses and don't allow the importation of Canadian queens.

The Canadian Honey Council has provided the CFIA with the data necessary to redo a risk assessment for the importation of packages from the U.S. This issue now rests with the CFIA. Whether they act on this will likely depend on the pressure they get from both Canadian beekeeping organizations and the U.S. I am sure this issue is as much political as it is biological.

What does Canadian beekeeping have to do with me?

Having attended beekeeping meetings in both countries, I realize that beekeeping is a global industry. We are all dealing with the same beekeeping issues. I've learned a lot about beekeeping from both Canadian colleagues and U.S. colleagues. I take the best of both worlds and apply them to my own operation. A case in point is Lloyd Harris. I bet most beekeepers in the U.S. have not heard of him. I met him about five years ago and he changed the way I think about bees. He closed out the conference with his presentation *The Winter colony and its formation.* The talk was based on his graduate work he did back in the 70s. He painted cohorts of newly emerged bees every 12 days throughout the year to determine their longevity. From this data he draws incredible insights into the dynamics of the hive throughout the year. Is this data still applicable and useful? Of course it is! If any of you have heard Randy Oliver or Ian Steppler talk about beekeeping, they both show a graph of the colony age distribution throughout the year. It's Lloyd's graph. It doesn't matter how long ago or where he did the study. We have a lot to learn from each other.

One aspect of the Canadian industry that I really like is how closely tied the Canadian Honey Council is to the beekeeping problems of the industry. They don't just lobby for funding and legislation but get into the weeds to help solve problems. For example, the CHC owns the registration for formic acid and Fumagillin. Currently, the CHC is working with the Ontario Tech Team to get Oxalic Acid/Glycerin strips registered. By doing this, they ensure the beekeepers get the tools they need. The path to registration is expensive and complicated. Unless you are a company with millions of dollars to invest in the product, you won't be able to afford the registration process. And the beekeeping industry is too small for it to be an incentive to large companies. Once a company does go through the process, they need to charge a lot to recover the costs. Because the CHC owns formic acid, the beekeepers can mix their own treatments (probably a double-edged sword), and likely, will make their own OA strips as well. I wish our beekeeping organizations took a similar approach.

To go even further, wouldn't it be nice if there was international cooperation between our beekeeping organizations in this regard? Registration packages are relatively similar in various countries. By sharing resources and costs, a path can open for special cases; emergency needs, individual discoveries, etc. We wouldn't have to be dependent on Randy Oliver doing all the work himself or we wouldn't have to worry if Steve Pernal's product would ever get registered because he doesn't have the funds. I think there is an opportunity here. We can get a lot more done by working together on common problems. BC

Swarm Trap Base

Mike Champlin

Spring has arrived along with swarm season here locally. My approach to building swarm traps is to give the scout bees an easy choice and best of all – make it simple for me to move the swarm onto a permanent spot in my apiary. These swarm box adapters are easy to build, inexpensive and take up little storage space when not in use.

I make custom swarm trap bottoms (a universal base) out of 1x4 boards with a fixed plywood floor. It's essentially a four-inch feeder shim with a plywood base attached. Each side has metal brackets for attaching either a deep or medium brood box on top of the swarm base, along with screened vent holes. This approach gives the swarm trap an optimal sized (40-60L) cavity that the scout bees find attractive. I load my traps with two frames of empty brood comb and two empty frames with beeswax starter strips. The comb is an added attractant and the empty frames give the swarm's wax building machine someplace to build out. With only four or five frames in the trap, the box appears to have lots of space which also entices the swarm to move in and start building.

The plywood bottom extends near the front opening for an integrated landing board, and there is a swiveling door to close off the wide opening when relocating the trap. I use the elongated entrance openings to give the swarm plenty of room to enter, but it's small enough to avoid those pesky squirrels or birds who want to explore the unoccupied traps too. Once back at my apiary, I can remove the four screws on the braces and easily shift the fully loaded hive box with frames and bees over onto a new permanent bottom board and hive stand. I will then finish loading the transferred box up with empty frames or a couple of resource frames to further anchor the swarm into their new home. Now I can grab another empty deep box and reload my universal swarm trap base to set up for another swarm capture.

The key benefit of this approach is by using a regular deep hive box for the trap; I have a one-step process to re-hive them in my yard. This transfer method is less stressful on the bees because the colony is hardly disturbed at all in the relocation process and they quickly

reorient to their new hive location. The swarm trap bases take up very little space when stored over Winter, and I can use my existing hive boxes without making dedicated swarm boxes. If you have any questions or comments about building your own swarm box adapter, I can be contacted at **blindbeehoney@gmail.com**. BC

Swarm Trap Mount

Mike Champlin

Here is a DIY swarm trap mount that is easy to attach, adjusts for any tree's lean angle, folds flat for storage and doesn't damage the tree. Your dimensions will vary with whatever size boards you choose to use and also the size of your swarm traps. For mine, I used some scrap pieces of 1x5 boards (22" long) that were in my barn. The back and bottom center support pieces are hinged together so the trap mount can be folded up for easy storage without taking up a lot of space. The swarm trap mount is attached to a tree using a ratchet strap that runs underneath the upper cross brace. Support chains on each side just thread through holes on the bottom board and are connected together with an "S" hook. This allows me to level the bottom platform board for whatever size tree I'm using – whichever way it leans simply by adjusting the chain lengths accordingly. Chains are attached to the upper cross brace using eye bolts and S hooks.

I like this approach because it doesn't damage the tree by using nails or screws and is easy to install or remove... especially helpful if you're placing traps on someone else's property (with permission).

If you have any questions or comments about building your own swarm box adapter, I can be contacted at **blindbeehoney@gmail.com**. BC

BEEYARDS COME AND BEEYARDS GO

An apiary location is just for the moment

Listen along here!

An unusual topic

A strange topic this article has – *Beeyards that I no longer have*. Old, abandoned beeyards have played a major part in my personal beekeeping history and development. They are like long departed friends. Many of you have your old beeyard memories, too. I'm not special in this regard.

As the years have passed, I have steadily cut both the number of hives I manage and the number of yards I keep my bees in. Throughout my career, I estimate that I have had – at one time or another – about 45-60 permanent bee locations. At my peak, I (with help) maintained about sixteen different locations. Now, I have reduced my yards to only two apiaries, both reasonably near me. Yep, that's quite a change for me.

My emotional attachment to some of these phased-out yards has surprised me. They have names that are totally meaningless to you, but they have been part of my life for years; the Metz yard, the Shreve yard, the Chipley yard, the County Home yard, Matt's yard and the Fredericksburg yard are some of the many names of places that have now reverted to non-bee areas.

Specifically, the Metz yard and the Fredericksburg yard were locations that I personally established as a brand-new entomology professor at OSU in 1978. It seems impossible that I had some of these locations for 40+ consecutive years only to close them out. As a young man, I guess I just assumed that these yards would somehow continue forever.

In the case of the Metz yard, it was located off Metz Road, right here in Wooster, Ohio. At that location, through the years, I survived stuck trucks, swarms, American foulbrood, tall grass, the introduction of mites and ground hogs, but on the positive side we made a lot of honey there. Being located near a stand of pines, I, and my help, would gather bags of pine needles for our smoker fuel needs. At the time, it was a major part of my beekeeping psyche.

We were there so long that many years ago, the Senior Mr. Metz died

Figure 1. The Metz yard, twenty-five years ago

requiring us to get permission from Mr. Metz's surviving son to continue the use of the yard. He allowed us to stay so I passed into my second generation at this location. Then after decades of use, I finally gave it up, too.

Where is this reminiscing going?

Eliminating these yards made me realize that I have evacuated far, far more yards than I will ever again maintain. Yet each of those now abandoned locations was, for a while, a part of my beekeeping life. Stories and bee events came and went. Now nothing of a bee nature remains at these locations. In fact, there are only a very few people who could even remember the hives were ever there. That's okay. It's only important to me anyway.

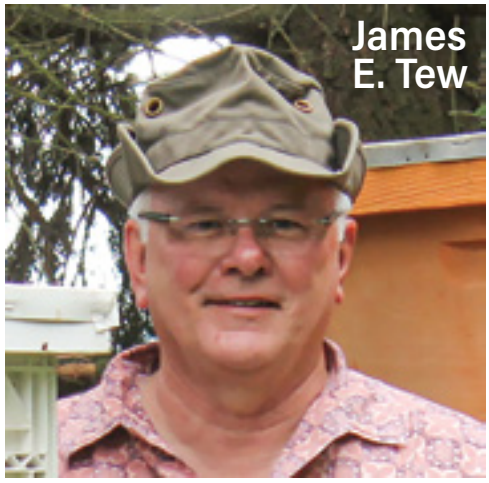
Memories of some of my long-gone yards

Not all the memories that follow are specifically my yards, but they all contribute to my beekeeping memories. Here are some examples.

The Unit-Two Yard

The reason for the clumsy yard name is unimportant, but the now long-beeless yard has several significant memories for me. It was in this yard that I had the very personal experience of having a mouse run up inside my pant leg as I was removing supers from a hive. I have relived the story literally hundreds of times at meetings across the country, and I choose not to relive it again here, but you can believe that I will NEVER forget the experience I had in that yard (and neither will the mouse).

Reason for giving up the Unit-Two yard. Pesticides. The yard was located near university field plots and every year, the hives located there were seriously damaged by pesticide kills. I now wonder, in light of decreased



pesticide use, if that yard could be reoccupied.

The Eck Yard

Mr. Clarence Eck was the grand old beekeeper in Wooster for many years. He was keeping bees long before I moved here. Mr. Eck is no longer with us, but he and others, including Jim Thompson, a frequent contributor to *Bee Culture* and longtime beekeeping friend, initiated a small beekeeping workshop for helping new beekeepers. This past March, the 44th annual version of this workshop, with hundreds of people in attendance, was conducted. Mr. Eck's home beeyard, and one in which he conducted early beekeeping classes, was north of Wooster. That yard, too, is now gone.

Reasons for Mr. Eck giving up this apiary site. Concerns from the local Ford Motor Company dealership was the reason for abandoning the yard. The newly located dealership could not figure out where all the *"birds"* were coming from that defecated on their fine, new cars. It took them a while to figure out that it was neighboring bees – not birds – causing the issue, but when they did discover that it was bee poop on all their cars, under threat of lawsuit, a historical bee location was forced into oblivion.

The Sawmill Yard

In fact, the sawmill and the beeyard are now both gone. About thirty-eight years ago, I wrote a series of articles for the old *Gleanings in Bee Culture* under the mast head, *The Solitary Beekeeper,* from experiences I had in this yard. It was from this apiary, that I took a good friend to the hospital emergency room after he had a systemic reaction to multiple bee stings. His tongue was swollen and had become bluish. He recovered in good order, but he won't ever forget this bee place. Neither will I.

This yard was located on the property of a large, creepy, abandoned state mental hospital. While moving beehives past midnight one dark, quiet night, I inexplicably became spooked – one of those sixth sense things. I couldn't talk myself out of the threatening feeling. I unhooked the bee trailer from the truck and left some of the hives open and in disarray. When I returned the next day – nothing. No Big Foot – no monsters – no nothing. I recently did a podcast describing this recollection. Now, nothing remains there but memories.

Reasons for giving up the Sawmill Yard. American foulbrood outbreaks and agricultural encroachment. The yard is now a soybean field and the sawmill building is standing derelict.

The Chipley Yard

During the early '80s, I kept a yard of about 80 hives of Ohio State (OSU) hives in Chipley, Florida. At the time, I had a thriving international beekeeping program made up of people who wanted to learn more about migratory beekeeping. I wintered OSU bees in Florida and produced Springtime queens there.

I have many, many memories of driving trucks to Florida, loaded with palletized beehives, dead tired, stressed, but being a real migratory beekeeper. It was a spectacular amount of work. No one got hurt. We kept good bees and we all had a good experience. To this day, this yard makes up the bulk of my migratory beekeeping experience. I have a life-long collection of memories of "*stuck trucks and late nights*" from this yard. As usual, I wrote about my experiences.

Reasons for giving up the Chipley Yard. Bee program redirection, transportation costs and mud (accessibility). I understand that watermelons are now planted where our beeyard was once located.

Multiple Ohio State University Beeyards

I don't even know how to review all the Ohio State University honey bee program yards that have come and gone. One of the most famous was beside the football stadium. If I put bees that near the stadium today, people would freak but in the 1940's, it was fine.

The first beeyard here in Wooster at the OSU Research Center where I worked is now a parking lot that I frequently drive past. While looking at several hundred cars in that parking lot, who would ever believe that it was once a grassy beeyard?

Reasons for giving up these various Ohio State yards. Civilization encroachment in nearly every case.

The Bee Barn

In an earlier life, the Bee Barn was a university swine facility, and then a turkey facility. Then in its later life, and after a thorough steam cleaning, it became the Bee Barn. It had everything – even a restroom and was partially heated. It was absolutely filled with eighty years of beekeeping equipment and supplies. In 2010, a tornado utterly destroyed it – completely. Today, nothing remains of the bee barn, the beeyard or any of the equipment that it stored. It's an open, grassy field. Nothing but memories remain.

Reason for abandoning the yard was complete destruction of the facility and the hives.

My oldest remaining yard

I have kept bees at the back of my home property for forty consecutive years. One of the primary reasons that I moved north of town was to be able to keep bees on my property. From that apiary, I have produced multiple videos, written tens and tens of articles, made several thousand photos and produced podcasts. I have sat in that yard, watching my bees, for thousands of hours. It was my haven during the COVID pandemic. It was my private, quiet place.

Figure 2. The Ohio State University football stadium, circa 1940s. There are no bees there today. This photo shows how much society has changed.

Now, as I have written before, within twenty feet of my colonies, a new housing subdivision with multiple housing units is being built this Summer. Heretofore, the area behind me was a soybean field. The

Figure 3. The Bee Barn and Beeyard in 2002.

Figure 4. The Bee Barn and Yard after the 2010 tornado. Today, nothing remains but an open field.

Figure 5. Jim Tew, with some of his bees in his home yard that will have to be relocated.

access road to the division will be hardly ten feet from my some of my current bee hives. It does not matter that I was here long before the housing project. I will surely get complaints from construction people and subsequent home owners.

Do you recall Mr. Eck, the Wooster beekeeper, who I wrote about earlier in this piece? He had a beeyard behind his house, too – just like me but even closer to his home. The City of Wooster built a grade school on the property that joined the rear of his house.

For years, Mr. Eck, the bees and the school kids lived together agreeably. Only a wire fence separated them. Quite a while ago, Mr. Eck passed and his bees were sold. Then, recently, the school was permanently closed. A *Caribou Coffee Shop* stands on the location now. In this case, everything is gone – the beekeeper, the bees, even the school, but for many years, that was a hive hot-spot. I cherish the memories.

But times have changed. Now, I don't think I can have bees so near new homes that could possibly have children – especially curious ones who go exploring. So, yes... I am making plans to move my colonies until the construction phase passes. Apparently, in my life, no beeyard location is sacred.

But again, times have changed. I am now much older. In the past, I kept 20+ colonies in my back yard – far more than I should have. But I lucked out and nothing ever happened. I no longer want nearly that many colonies there. Maybe... just maybe, I can put two to three colonies there again. I have some fencing up already and I will install even more.

Figure 6. C. Eck and Jim Tew forty years ago (1982)

So, the beekeeping humor here is that, due to aging, and passing time, I have reduced my apiary locations to only two sites. Of the remaining two locations that I now have, one is having a housing property built nearby and the other is apparently home to a roving bear that destroyed one of my colonies this past year. Readers, presently, I have zero good locations. Beeyards are weird like that. Good for a while and then not good.

Here's the truth

If you have hung on to this point, you must have figured out that I am writing this piece for me as much as for you. I must have several hundred slides, digital photos and videos of various beekeeping events in yards that are now beeless. Most of these pictures recall good memories of bee times past.

Though not the only reason, but a primary reason for me evacuating most of the yards that I have deserted was some kind of encroachment—not just urbanization. In some instances, farmers wanted their land to put back into cultivation. For example, watermelons in Chipley and soybeans in Ohio. The Ford dealer causing Mr. Eck's yard to be move is an instance of commercial encroachment. I am now experiencing housing encroachment.

Secondly, a common reason for giving up yards was accessibility – mainly mud and narrow gates – that

would trap my bee trucks. Here's the oddity. I have never once left a yard because of a lack of bee food sources or limited water supply or a damaging frost pocket or because my hives couldn't be faced to the east or some such. I left all these locations because of encroachment, mud and in a single case – pesticides. It doesn't help that I am aging. I gave up some locations for that reason. When I pass by these abandoned apiary sites, I usually have a look and think, *"I used to have bees there."*

A beeyard is a bit like the circus coming to town. Lots of planning, preparation, activity and work, only then to be gone. All that remains is memories of the circus. Some yards last much longer than others, but sooner or later all beeyards give it up only to become memories for unique people like you and me.

You just wait

If you keep bees long enough, you will get your own *"abandoned yard"* memories, too. But shake them off. No doubt, right now you should be out in your present yard doing bee stuff. Let the future take care of itself. Thank you for reading. BC

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Favorite Sourdough Sandwich Bread

Fay Jarrett &
Lexi Nussbaum, Power Pose Nutrition

Ingredients

- □ 2 cups (400g) active and bubbly natural yeast starter
- □ 2½ cups (580g) warm water
- □ ¾ cup (255g) honey
- □ 1 egg, beaten
- □ 1 tbsp (20g) salt
- □ ⅓ cup (68g) avocado or coconut oil
- □ 8-11 cups flour (unbleached all-purpose, bread flour or whole wheat flour is suggested)

Directions

Step 1
In a mixer or large bowl, combine the natural yeast, water, honey, salt, egg and oil.

Step 2
Add the flour, one cup at a time, mixing and kneading as it is added.

Step 3
Be careful not to add too much flour. When the dough starts to pull away from the bowl and there are places the flour is not mixed entirely, let the dough rest for 10-20 minutes.

Step 4
After the rest, continue to add flour. If you are using a Bosch mixer, the dough will become lopsided – at that point, you know you've added enough flour. You want the dough to be tacky, not sticky.

Step 5
Knead the dough for 10 minutes.

Step 6
Cover the dough with a clean dish towel or with the lid to the mixer. Allow to rise until doubled in size (approximately six hours). You can also let it rise longer if you're wanting a more fermented taste or to reduce the gluten. I often let it rise overnight for 10 hours or so on the countertop. To speed up the rise, put it in the oven (off) with the oven light on.

Step 7
When the dough has doubled in size, empty onto a lightly oiled surface and divide into three to four equal portions. With practice, you will learn what quantity of dough works best for the size of your bread loaf pans. Form the dough into loaves and put each loaf into a greased or parchment lined bread pan.

Step 8
Cover again and let loaves rise until doubled. Anywhere from three to five hours.

Step 9
Once doubled, bake at 400 degrees for 28 minutes, or until the internal temperature reaches 180 degrees.

Step 10
When the loaves come out of the oven, immediately remove the loaves from the pans and set on a cooling rack to prevent condensation. Add butter to the tops if desired.

Step 11
Let bread cool before slicing.

Step 12
Enjoy!

May 2023

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/**

♦IOWA♦

The **Iowa Honey Producers Association** will be holding the 2023 Field Day on June 17, 2023 at the Red Shed in Clarion, Iowa.

Speakers include Tom Montavon and various breakout speakers on topics for all ages.

Additional information can be found on the IHPA Website at: **https://www.iowahoneyproducers.org/**

♦PENNSYLVANIA♦

Delaware Valley University, Doylestown, PA

Queen rearing intensive weekend *Saturday and Sunday, May 13-14, 2023. 9am-4pm; queen cell pickup, Tuesday May 23, 2023, 4pm-6pm.*

The benefits of raising your own queen include: having queens adapted to your environment, avoiding southern queens that may have mated with Africanized drones and establishing your own nucleus colonies. Designed for the experienced beekeeper, this course will include the basics of queen rearing, grafting larvae and using the Mike Palmer method of queen rearing. You will have the option of taking your queen cells home. Prerequisites: Attendees must have some beekeeping experience.

Taught by Master Beekeeper, Vincent J. Aloyo, PhD

For more information or to register, see: **https://vince-masterbeekeeper.com/courses/**

CLASSIFIEDS

FOR SALE

- For sale: New, heavy duty 4-way pallets. All treated wood with HDO decking. Call Lester **715-644-5588**, Boyd, WI 54726
- 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

TRAVEL

- Slovenian Beekeeping LLC offers Beekeeping Tours to Slovenia, the Beekeepers of Europe! May 10-25 Beekeeping Tour & Oct 6-20 Discover Slovenia. We have been offering these amazing tours since 2014. Contact Suzanne at **beeslovenia@gmail.com**

Contact Jen Manis to place an ad: Jen@BeeCulture.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/**.

If you are having a beekeeping event, we are happy to send back issues to give to your attendees and students. Please email Emma at Emma@BeeCulture.com with the number of magazines needed, a complete mailing address and a contact person.

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Image Contest – Apiaries

This month, we want to see any and all pictures you have of your **Apiaries**. How is it organized? Do you put them on stands? On the ground? Are your boxes extra colorful or have a fun design? We want to see it all! 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.

The road to my billionaire's bees was buried in nearly a foot of snow, virgin but for a couple of pickup tracks. It somehow didn't look that deep to me. So of course, I got my all-wheel-drive Subaru Outback stuck. I have great snow tires, but it looked hopeless nonetheless because it was uphill all the way back. While I alternately kicked myself and searched for my AAA card for a tow, my beekeeping mentee Megan and my billionaire's gal – Friday Maria shoveled out my wheels.

Finally Megan said, "Get in, turn this thing around and drive out of here!" This was not going to work, but I had no other options, so I did what she told me, and guess what?! I drove right out.

You see? Sometimes we just need a little help from our friends. I learned this when I was president of the Colorado State Beekeepers Association. I'd find myself in some seemingly intractable situation, and I'd throw up my hands and call Tina. She almost always had a workaround, or a radically different approach, and together we'd charge ahead into the fog. Two heads are almost always better than one.

After we got unstuck, Megan and I started popping hive lids and checking honey stores. Pretty soon a snow plow truck roared by. Megan said, "How'd they get a plow here so fast?" to which I replied, "Billionaires generally receive excellent service!"

This particular billionaire owns five colonies, down from seven last Fall, when *Varroa* mites had their way with three of them. I got the mite numbers down before Winter, but not before most of the bees in those three hives died. I rolled the survivors into one hive, queens and all, because I couldn't see any prospect of overwintering four-framers weakened by *Varroa*-induced viruses.

And now? All five remaining colonies look great, even that combination hive. That's a colony I need to re-queen. But I failed to mark it, and I can't remember which one it is. I guess I'll have to re-queen 'em all, which might not be such a bad thing. But there's a lesson here: Keep better records than I do.

It feels weird writing to you today, in early March, since you won't read these words until May. By then my billionaire's snow should be gone, and if all went according to plan, those colonies all got re-queened. But you can't know this for sure. In beekeeping, everything changes constantly, and with the publishing time lag, "today" is never really today. This makes me feel like a time traveler.

I expect to receive my first shipment of Carniolan queens in mid-April, with a second two weeks later, and then some Russians in late May. My re-queening strategy:

- From my strong colonies, i.e. those with both brood supers more or less full of brood and bees, make splits or pull nucs. Re-queen the mother colony if its queen is more than a year old.
- Re-queen colonies not strong enough to split or nuc.
- As for weaker colonies, say eight or fewer frames of bees on May 1, execute their queens (like Mary, Queen of Scots!) and combine these bees with another hive, or simply re-queen them.

Not all queens survive in a new hive, and in the past, this made me reluctant to replace perfectly good old queens with unproven new ones. But beekeeping's a gamble. Plus, a hive that rejects its new monarch is not necessarily doomed. It will most likely make a new queen all on its own, and the ensuing broodless period creates a break in the *Varroa* mite reproduction cycle. And if natural re-queening fails? All's not lost. Simply add these bees to a colony that could use some help.

What I most like about new queens is their extraordinary reluctance to swarm. With this problem out of the way, powerful newly queened hives can get started early and fill lots of honey supers.

Now, powerful colonies that produce lots of honey also produce lots of mites. This is why your best hives are the ones that crash in the Fall, when mite numbers are still on the increase, just as honey bee populations naturally decline.

My new strategy is to hit the mites before they get the upper hand. The little monsters are about impossible to test for in the Spring when they're reproducing under the brood cappings and not out in the open where you can count 'em. So, instead of waiting for *Varroa* to show up in my mite tests in June, this year I'll hit all my colonies with an early mite treatment – like oxalic acid for broodless colonies, or – for colonies with brood – Apivar (amitraz), Formic Pro (formic acid), or Apiguard (thymol). All depends on the temperature, whether I have honey supers on my hives and what treatments I have on hand.

This isn't the way I want it to be. I'd rather treat only those colonies that absolutely need it, and leave the rest. But I've got 75 hives, no help, and there're only 24 hours in a day. Plus I'm old, and I sometimes take naps in my out yards. The bees buzz me lullabies, the little darlings! So I'm not that efficient on the job. But all the while, *Varroa* keep sneaking up on me. One way or another, this has to stop. BC

Gentle reader, did you find this piece amusing, heartwarming, even instructive? If you'd like to read more of Ed Colby's beekeeping adventures and misadventures, contact him at **Coloradobees1@gmail.com**. Ask him to promptly mail you an attractive signed copy of *A Beekeeper's Life, Tales from the Bottom Board*. Price: $25. Satisfaction guaranteed or your money back!

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