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Tom Nolan is the Founder and Past President of the *Urban Toronto Beekeepers Association* and lead Sales Representative for *NOD Apiary Products*. His personal mission: to ensure the sustainability of honey bee health. Tom shares his enthusiasm for honey bees by educating beekeepers on best management practices, Varroa control, swarm catching and by volunteering at an organic farm—all while running his successful beekeeping operation: *Hivetown Honey.*

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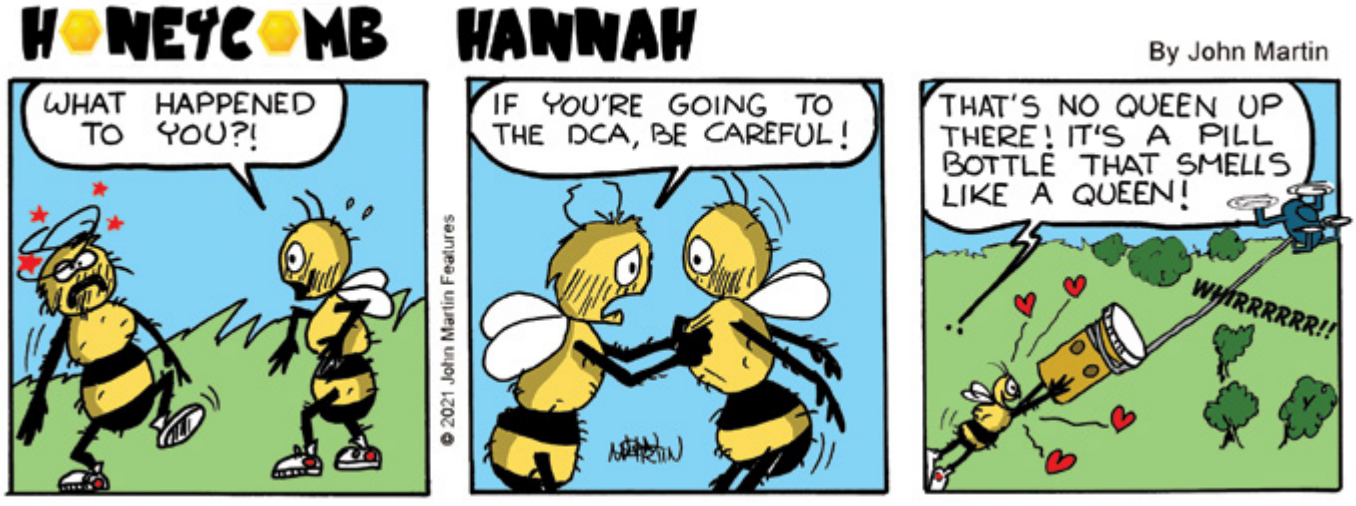

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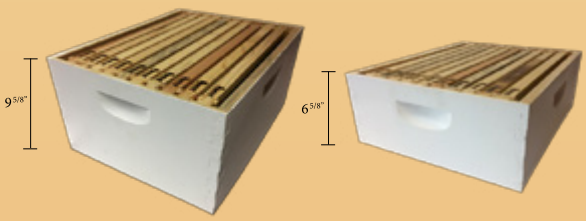

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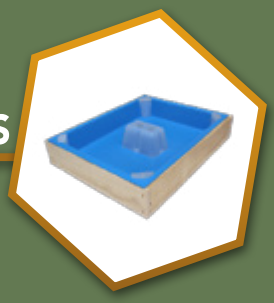

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Mimi Aung during her interview with Jerry Hayes.

From The Editor –

Meeting With Mimi Aung, Lead Engineer On The Mars Ingenuity Helicopter

Jerry – Thank you for taking time to talk to me! I don't want to take your valuable time away from Mars but want to share with you some interesting history. I am lucky to be the Editor of *Bee Culture* Magazine which has been around for about 150 years. The cool thing about it is that A.I. Root discovered the world of Honey Bees and then, founded *Bee Culture* magazine. He was also the founder of the A.I. Root Company that made and distributed beekeeping supplies starting in the 19th century. A.I. Root was an entrepreneur. I was talking with the former editor of *Bee Culture*, Kim Flottum, he said, "Did you know that Ingenuity, the Mars helicopter had a piece of the Wright brothers' fabric in it?" I had no earthly idea! The reason that this is so cool is because A.I. Root helped the Wright brothers, learned what they did, and was a supporter.

When I heard this I thought, well, I will just call the Jet Propulsion Laboratory (JPL), and tell them this story and see if I can talk to somebody. They gave me your name and contact information – which is simply amazing. You are flying something on another planet which is what the Wright Brothers did here as well. A.I. Root was a thinker, a visionary, he did many things that were new to the general public like highly organized managed Beekeeping. He was very interested in a lot of different things. A.I. Root lived in Medina, Ohio. The Wright brothers are from Dayton, Ohio. The Wright Brothers were not engineers. They did not have a formal educational background. They were machinists and bicycle builders and mechanics. They were obviously super smart and intuitive. For some reason they decided, well, let's go ahead and make a flying machine.

Nobody believed that they could do it or anybody could make an actual flying machine. So they worked on it quietly. They went to Kitty Hawk, NC and developed and tested gliders and experimented and learned about aerodynamics. Outside of Dayton is an area called Huffman Prairie. This is where, after they had some success with their glider, they wanted to put an engine on it and see if they could have powered flight. So they did that, and again the media said, nobody can fly, What are you talking about? The only thing people can fly, is in a balloon, but you can't fly with a big heavy engine and you certainly can't turn or go up and come down unless it is crashing if you lose power.

A reporter for a small local newspaper in Osborn, Ohio heard about their attempts but he didn't even go to see the Wright brothers; nobody went to see the Wright brothers, but this reporter put a little article in the local newspaper and somehow A.I. Root found it and decided, "I'm going to take the train from Medina, Ohio to Dayton, Ohio, and see these guys." It wasn't that A.I. Root didn't already know about the Wrights because he was an early adopter of the new invention – the bicycle. A.I. Root took the train to Dayton so he could see firsthand what they were doing in 1904. He watched them and hung out with them. They said, keep it to yourself for right now, we're going to publish something, but we want to have some consistent success first, A.I. Root got to see the Wright brothers, see them fly, see how their invention had progressed, how to maneuver the plane up and down, left and right.

It was amazing and the technology they discovered was new and amazing. A.I. prepared an article for publication in Scientific American. But, Scientific American turned down the article because they didn't believe it. Nobody believed it. So, the first account of the Wright Brothers success was in *Bee Culture* Magazine as A.I. Root wrote about it. A Beekeeping magazine published the first article on what the Wright Brothers had done. When I heard that you had a piece of the Wright brothers' fabric on the Mars Helicopter Ingenuity, I just had to share that story with you and say how much this is in parallel to what they did.

How many people believed that you could make a helicopter to go on Mars? Probably not a whole bunch.

Mimi Aung – You are exactly right. Yes. It was too counter intuitive.

Jerry – You have demonstrated that same entrepreneurial skill. You have that same innate intelligence. You have that same different vison to not only come up with the engineering focus of this, but to organize people who can help make this possible. I got a whole bunch of things here but I wanted to read one thing for you. This is from your Associate Administrator of Science, Thomas Zurbuchen, "Now 117 years after the Wright Brothers succeeded in making the first flight on our planet, NASA's Ingenuity Helicopter has succeeded in performing this amazing feat in another world. These two iconic moments in aviation history may be separated by time and the 173 million miles of space, they now will forever be linked to the innovative bicycle makers from Dayton, this first of many airfields on other worlds, now

will be known as the Wright Brothers Field in recognition of the ingenuity and innovation that continues to propel exploration." So how do you feel about this?

Mimi – Oh, fantastic. Yeah, fantastic. Exactly! The parallelism is incredible, I think when you do something for the first time you will always have folks that are like, "Why?" You know, all of those questions. Hopefully you'll be talking to Bob Balaram who is the Chief Engineer and the Chief Architect, he really gets the credit because in the beginning, in the 1990s, there were a lot of pockets of research that show that there is enough atmosphere at Mars, so that if you spin faster, if you're light enough, you can generate lift and you should be able to fly. So that's been around since the 1990s, but it hasn't been possible to build something light enough that generates that much power to be able to operate autonomously and survive autonomously all the way on Mars. So, the question has been technology. It has always been in the cusp of reality. The big moment came in 2012 or so when Dr. Elachi the previous Director of JPL was on a lab tour and I was fortunate enough to be there. I was a Deputy Division manager for the autonomous systems division. We go through different divisions at JPL regularly to visit and learn. On one of the tours, we were using drones to demonstrate some autonomous capability. He said, the question was very simple. Why aren't we flying a drone, like, a small rotorcraft, why aren't we flying those on Mars?

So he posed that question and he never let go of it. He really had the vision, it all clicked, Right? We connected him with Dr. Balaram, who had done the research in the 90s. Now this is 2012-13. I was on the line management side. I was only involved in, the initial connection. They went off to visit him. Dr. Elachi, said," let's give this a go, and dare mighty things." That's what we do at JPL. Right? Try many things. Let's do it. So there was a low level research and technology development that was kicked off to say, all right, Bob Balaram restart that research. Bob formed a small team and then started sharing the technology that's available around currently and came up with the answer that it might be the right time because we now have much better batteries, we have better solar cells, we have electronics, we have computers, we have sensors, and because of these telephones and autonomous cars are now very reliable. The whole technology is there, the ocean tide raises all boats, right? That is where it was very difficult for the engineering community to believe and ask 'really are you sure?' Bob's belief never wavered, and he's of those people who has thousands of ideas because to him it is never, never impossible. They started this research at a low level and it started to show lift with the blade spinning in a simulated smaller atmospheric chamber with guide rails and saying there is definitely lift. Then the director Dr. Elachi said, okay, this is good. But the next thing we want you to do is now start a demo in a chamber without guardrails, do a small-scale vehicle, and let's really see it lift. That was September of 2014. That's the point when I joined because once we were going, we were moving forward from a small research feasibility analysis to now the first of a very, very early phase of implementation. I came in about that time. Then we started with a one-third scale vehicles that we did. I tend to be more on the "Let's make it work all the way to a hundred percent mode", so this is why I admire the Wright Brothers because there are always design possibility analysis, but it also takes so much, so much work, to really take it to a hundred percent reality. I love it, when it's challenging. Once I joined and saw the analysis says you should get lift, and you should be able to control it I was even more convinced. But here's why we hadn't been able to do it until I saw that separate analysis. So, it was earlier, you know, right after that little one-third scale vehicle where we demonstrated, and we showed lift, but it couldn't be controlled. In fact, it crashed right away because human beings outside, couldn't keep up with it. We didn't have sufficient computer power. So, I think my firm belief came after that lift demo and knowing really why it failed. The thing was that if you spin fast enough, no question you're lifting, but it now is all about fast enough feedback and then building it so that it's in a way that models something that can be modeled. It isn't just about a blade, but like the blades have to be really stiff because the control engineers are saying, yeah, we have algorithms, but we need to test them and make sure that they follow the lift track. And the dynamics that we are assuming are true before we do a control loop around it. But to be able to predict, besides being able to spin fast, blades have to be stiff, which is a very hard requirement to give to somebody. To be really strong, but by the way, we wanted it to be really stiff, not to fly, but so that we can model it. Right? Then there's a fabulous argument with mechanical engineers. Like, are you kidding? So that's where my engineer side comes out is once I understand the basic algorithms and what all this has to come together how are we going to form a team to overcome? So it was around January of 2015, after that little lift demo failed. It was all clear at least in my mind, how we were going to have to be so tight as a team, and we need every single discipline cause every single discipline was going to have to invent something to make that work. That's when I became a full believer. I'm at a little bit of a latecomer so Bob Balaram gets all the credit, he never wavered. I got converted around January of 2015 and never stopped believing since.

Jerry – Wow! There, again, that parallel with the Wright brothers, because they practiced at Huffman Prairie because it was flat and a little

Wright Brothers at Huffman Prairie.

marshy, so they would take off and crash and they would say, Oh, okay, go back and fix some stuff. They would take off and crash again and they would fix something and then finally fly straight. Then somebody said, "Well, what good is that, if you can't turn it, what are you going to do?" So then they started turning and they would crash and they would fix it. This is a whole learning paradigm of how they could do it. Then other people said, okay, so now you can fly. What's good does that do, since we have trains? What difference does it make? You're not going to be able to get anybody in an airplane for goodness sakes.

Mimi what is your vision for what you've done?

Mimi – Oh yes, absolutely. We had to be really motivated because this was a very hard trudge, for many, many years, but the vision is that we are just like you were saying, we know how to use the aerial dimension that is there at Mars. We're not using it today. So we have rovers on the surface and we have spacecraft in orbit, but neither is able to fly, like you said, in a controlled manner. To be able to go to exactly where you want to go, come back the way you want to, that gives us an entire new dimension of space exploration. There are so many places of scientific interest that we now can get to, like their side of a steep cliff. They have evidence of frozen ground, and ice that we want to study or go down deep crevices that a Rover can never go to. When astronauts get there, astronauts are going to want to have something fly ahead to really scout out the place. You can imagine, right? It just opening an entire new dimension that we're not utilizing. So that's really the basic motivation.

Jerry – Yeah. So, who is you're A.I. Root? Who is the one that has discovered you and is reporting on you and advertising you and bringing all the value that you should have and even more?

Mimi – Oh, well, okay. First of all, in terms of program and leadership, its Dr. Charles Elachi definitely. Then when he retired, Dr. Mike is now our current director, supported us strongly. So I think, JPL leadership and then the other centers that are with us, NASA, Ames, Langley, AeroVironment, Qualcomm, Solera, you know, everybody at the leadership level really supported us. And that's really important, because among the people, there were some that said, you know, you guys are going to spin it, but I don't think you're going to see lift. When it really happened, they couldn't believe it. And we're like, what does analysis say?

Technically and organizationally, we were always supported. And then the people were very fair. Once we showed lift, on our course to success, they were converted the next day when we did the free flight. From the technical side, the organizations reporting side, I have to give credit to D.C. Agle, JPL Media Specialist. DC Agle started reporting on this three and a half years ago or so. He is the one that found the material from Dayton museum because we said we would love to fly something from the Wright Brothers, because, and personally, for a lot of us, my personal connection to the Wright brothers is that journey from theory to reality, to me that that's my sweet spot.

And that's who I admire –people who do that, right? Cause it's very, very hard to do that. So for me, the Wright Brothers are right there. We said, is there a small coin that was made to highlight the Wright Bros achievement or, something from the materials of the Wright Flyer? So he looked at coins, there was a wooden piece, I think, from the Flyer, but then we weren't allowed to put it on. And finally, he found it, a small piece of cloth from the wings of the Wright Brothers plane. I have to give all the credit to DC Agle. He has been the one that has told the story for years and he believed in this.

Jerry – I don't want to get too personal, but did you ever go to sleep some night and wake up at two o'clock in the morning and say, oh my gosh, I don't know if we can do this?

Mimi – No, it's funny you say that. I have a question that I love to ask my team. And it's happened every step from the night before, or the few days before we were going to fly the first risk reduction flight, where we had a rotor system, no computers, they were under the chamber. And, we just had the rotor system, but with a computer underneath, with the long tether so that you must close some control, but you know, you don't have to take all the weight, the mass problem yet. That's what convinced everybody that it is possible to do fly in a control power mode. Then we went on to build the engineering development, modern flight model. So every big step, I have a favorite question that I like to ask the team, "Guys, I mean, guys, you know, both men and women, Hey everybody is it going to work?"

And I love to ask this because, you know, I want to see the first reaction. Everybody always said, yeah, it's always been yes for the following reason. Because we've done it as a team, we really formulated a very systematic, incremental steps. We did what the first one third scale told us that we don't have to worry about the lift model anymore because the RPM that the blade spun was right. And when it lifted, it nailed the analysis. We should spin it. I think it was about 8,000 RPM. It was for that one third scale up. And it lived right at the predicted RPM. So we didn't have to worry about lift anymore. The next step we went to was, okay, let's not stay at one third scale anymore.

Now full-scale at 1.2-meter diameter. That's all we can fit on the Rover. So don't worry about going bigger than that. That's all we can fit. So let's go to the 1.2 meter diameter and the blade at core distribution, the twist all was optimized by Ames and Langley. Help came from AeroVironment, they hold the record for the highest-flying aircraft, I think at 118,000 feet or something like that, they hold the very, very highest flight. So AeroVironment has been with us from day one. And then the blade dimension distribution, you know, the shave, the twist, all of that was analytically optimized by Ames and Langley working, with

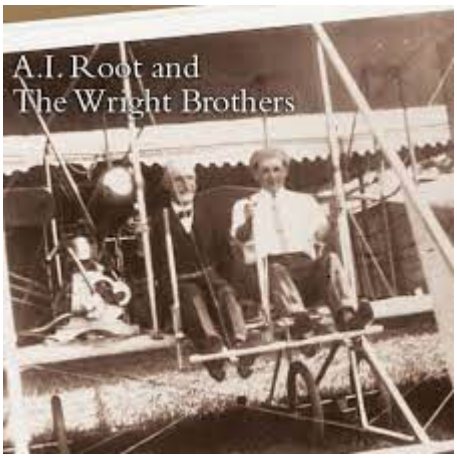
AeroVironment JPL. Once that blade was modeled, then they model the lift and the drag.

If you like cut the blade into 33 analytical pieces and say, okay, each piece is being spun and hitting a Mars – like atmospheric density, right? With that same representative molecules, and primarily CO2, what is the lift? What is the drag? And then it was integrated back. So that now if you actually spin the whole piece, two pairs, counter rotating, what would be the lift and the drag, and that predicted the dynamics. So Ames and Langley did that. And then JPL, we're very good at systems, you know, control systems, autonomous systems… well, our flight control lead then took that lift and drag, which gave the dynamics and then repeated a closely controlled system design around those dynamics predicted by the partners, you know, the rotorcraft experts. And then we say, okay, for this dynamic, we need to sample this fast, it's about 400 to 500 Hertz. I mean, we're sampling the sensor and then commanding the plates back to command. And then we design the closed loop control around it and derived from there, all the requirements now mechanical, you have to build something this stiff, you have to be this light and then this is where Bob Balaram came in. Havard Grip, who's our chief pilot, is also the flight controls and Robotics technologist. He's also the control system, and guidance, navigation and control speed Specialist who actually said, this is how we're going to have to fly. And then, Bob Balaram had the job of saying we can now fly. Right? How does a vehicle stay together?

How much energy do you need to fly? How much energy do you need to survive and how much do all of these components weigh and what is the give and take so that we can make sure we can come under the mass limit? So, wow when you say, how do you feel and how come you knew? How, come you were confident it could work, because we took such systematic steps. Every time we came to the next step, you know, the first step was to fly this system with the computer underneath. We were very confident by then that it should fly because we first took that system and invented, there's another whole set of inventions on structures to hold this rotor system, and make sure that structural frequencies didn't interfere with the structures on the vehicle. I mean, all kinds of inventions that we didn't know we had to do, just do them to test them. We had taken those very gut-wrenching kind of steps in testing the interim steps. So, every time we came to the next step, it came to okay, now we have done the spin, now what? We've looked at that, we've pitched the blades and we get the force we expected. We have the torque cancellation, you know, from counter rotations. Yeah. So we have checked all those things and we've looked at the dynamics, and all of this. By the time we flew, we knew after we flew the risk reduction vehicle, NASA was totally on board at that time. And they go, wow, you've really proven that you can fly. The next thing is we need you to do is go ahead and build a whole system for Mars, but now can you build it all so that the mass is less than 1.8 kilograms?

The thing with Mars is the atmosphere is so thin. Everything had to be 1.8 kilograms, which is four pounds on earth. So it came from a physics, aerodynamics, initial feasibility to now an engineering problem. Now we knew all the equations, but now it's all about building it. And so again, when we overcame that mass constraint and the power constraint, it's all tied together, the mass, the power and the flight time is like a big trade, and that's managed at Bob Balaram's level. When we closed that we felt really great. And we say, okay, let's take that engineering development model now, it came out at 1.7, We beat it. You know, we got it, we flew that in the chamber.

Then, you know, we were confident again, because it was incrementally tested. And then the last part is when they work, NASA says, all right, you are now authorized to build the flight model, which became Ingenuity. The one that we can go to Mars with. Until we got to that engineering development model, it was like, whether, can we get it, you know, can we get it to fly? Can we get it under 1.8 kilograms? And then when it came to the flight model, okay, can we modify just minimum so that we can actually ride on the Rover? Because some things had to be changed, you know, like the blades, we had to add hinges to the



legs, some had to be bent up, or, there was one of the feet that was modified just so it could be held.

And can we do all these modifications and still have ingenuity fly in the chamber, which we did. So once flown in the chamber and we got onto Perseverance Rover and they got launched, the rest all became not can we, it became now the other side of the slope, is this going to survive, right? Given that we had to use very non-space qualified components, which we tested for space environment. Now, do they survive? And it's all about, do they survive? And did we overlook anything in our models? It is all about going backwards and now checking on space environment and Mars environment. We were feeling very good all the way until the first flight because everything has checked, the energy was good. The thermal models were good. We were communicating, the blade was spinning the way we did it. And the first flight was the very last check mark to really say, yeah. So that's kind of the whole story. So that's where the confidence comes from.

Jerry **–** Well, that is all true, you and your team were first. You did things that nobody else has ever done. Just like the Wright Brothers did things that nobody else had ever done. And I just think that's so exciting! It's so exciting! Let me, and I don't want to take up all your time but let me just read the last paragraph. A.I. Root wrote an article about the Wright Brothers in *Bee Culture* Magazine that nobody else would publish, because shortsightedness reigned they all said "nobody can fly". A.I. Root wrote in 1905, January *Bee Culture* magazine "When Columbus

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discovered America, he did not know what the outcome would be. And no one at that time knew. And I doubt if the wildest and enthusiastic caught a glimpse of what really did come from his discovery and life manner, these two brothers have probably not even a faint glimpse of what their discovery is going to bring to the children of men. No one living can give a guess of what is coming along this line, much better than anyone living can project the final outcome of Columbus's experiment when he pushed off through the trackless waters, possibly we may be able to fly over the North pole, even if we should not succeed in tracking the stars and stripes to its upper most end". And that's what you have done. You have done this, you're Columbus, you're the Wright Brothers. And I'm just so proud of you and NASA and JPL and everyone else.

And so my next question is I think your next goal should be to become a beekeeper. What do you think?

Mimi – Oh Yeah? I would like to hear why you say that, you must have a reason?

Jerry – For me and I've been in it a very long time, first, it's amazing because how many positive relationships do humans have with an insect? You know, maybe silkworms, crickets, ladybugs or something else, but it's not very much. And then honey bees if you don't treat them right, they'll will protect themselves. So we Beekeepers have this relationship with an insect that will protect itself. But this insect will forage about a two and a half mile radius looking for flowers to get nectar and pollen from and transport this pollen from flower A to flower B. So that plant can reproduce and make a seed, a fruit, a vegetable or a nut all valuable nutritious food that feeds us, feeds pets and livestock and wildlife while helping plants reproduce to sustain the environment. It is this amazing connection we have and need. I don't mean to be rude here, but a flowering plant, can't pull herself up out of the ground, walk over and mate with that other flower over there. And so, these plants had to figure out a relationship with an insect. I don't know how this happened, how they negotiated all this. I'll give you some nectar and you take my pollen full of sperm over there so I can reproduce. And then I'll let you keep a little bit of the pollen for your food and the sweet nectar. This is two different species, a plant and an insect cooperating..... two totally different species cooperating. We humans are the same species, and we don't cooperate most of the time.

Mimi – And so that's, intriguing

Jerry – Yes, exactly. Well, anyway, congratulations again, congratulate your team. Thank you for taking this time when I know you have 500 better things to do, but I, I appreciate it. It's an honor to talk to you.

Mimi – It's an honor to talk to you. Yes. Especially now I know about A.I. Root's background.

Thank you so much for recognizing our team. It's really nice to hear that you appreciate our work, it looks simple when you look back, it was definitely a journey because there were so many gut wrenching steps, as you progress and we just had to technically, take control of it. Thank you so much. BC

NEXT MONTH

Region 1
- Check Hive Weight
- Harvest Honey
- Sample for Mites/Treat if Needed
- Supplemental Feeding if Required
- Reduce Entrance/Establish top Entrance
- Mouse Guards
- Too Early to Use Oxalic
- Consolidate Weak Hives

Region 2
- Alcohol Mite Wash Survey
- Treat for mites if supers are off
- Feed if colonies are lite
- Combine Weak Colonies
- Inspect colonies for four P's (Pests, Parasites, Pathogens, Poor Nutrition)
- Check Queen Brood Pattern
- Make Winter Nucs

Region 3
- Alcohol Wash for Mites
- Treat for mites if Alcohol wash shows more than three mites
- Combine weak colonies
- Check Colony Stored Honey for Winter
- Do last extraction
- For mites, sample, treat, sample again

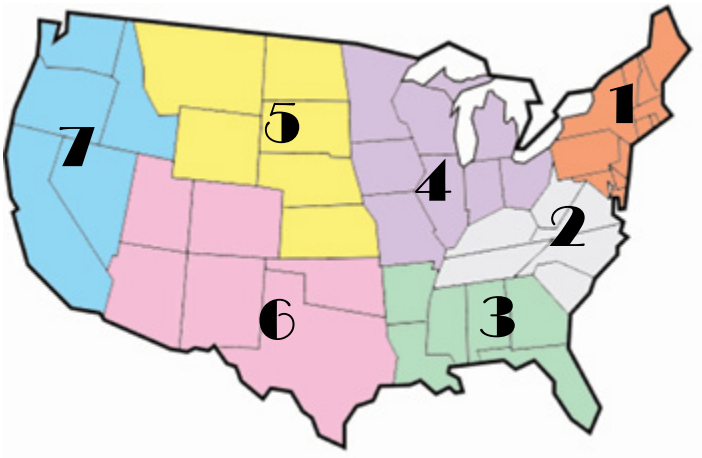
Region 4
- Should have already Sampled and Treated for mites
- Install Entrance Reducers
- Check Colony Weight/Feed if necessary
- Add winter Rims and Mouse Guards
- Leave enough honey on so you don't have to feed.
- Celebrate my 98th Birthday! (Gene Killion)
- Insulate Colonies
- Check Queens
- Cull weak Colonies

Region 5
- Sample, Treat, Sample again to see if Mite treatment worked
- Feed if necessary
- Reduce Entrances
- Combine Weak Colonies
- Put on Mouse Guards
- Check Queen

Region 6
- *Varroa, Varroa, Varroa*
- Sample, Treat, Sample again. Did it Work??
- Check Hive Weight
- Check Queens
- Feed to Get Weight Up
- Oxalic Vap. doesn't work at this time of the Year

Region 7
- Check Mite level for winter
- Are there plenty of Bees to overwinter
- One Last Mite Alcohol Wash before Winter
- Combine Weak Colonies
- Make Nucs to overwinter Queens
- Check Queen Brood pattern

We are expanding our Honey Reporter population and need new reporters in EVERY region. We ask that you fill in most of the wholesale or retail or both sections, most months, and our short survey on the back. We give you a FREE subscription for your service. So if you are interested send an email to **Kathy@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.



SEPTEMBER – REGIONAL HONEY PRICE REPORT

	REPORTING REGIONS							SUMMARY			History	
	1	2	3	4	5	6	7				Last	Last
EXTRACTED HONEY PRICES SOLD BULK TO PACKERS OR PROCESSORS								Range	Avg.	$/lb	Month	Year
55 Gal. Drum, Light	2.00	2.25	2.21	2.29	2.22	2.18	2.00	1.80-2.65	2.20	2.20	2.29	2.13
55 Gal. Drum, Ambr	1.88	2.18	1.10	2.16	2.50	2.02	1.85	1.10-2.50	2.03	2.03	2.07	2.06
60# Light (retail)	227.78	185.53	200.00	179.25	186.67	153.50	202.50	108.00-290.00	197.62	3.29	185.23	199.53
60# Amber (retail)	223.13	177.07	240.00	170.29	220.00	148.50	212.57	108.00-270.00	197.19	3.29	187.14	208.00
WHOLESALE PRICES SOLD TO STORES OR DISTRIBUTORS IN CASE LOTS												
1/2# 24/case	92.07	80.10	96.00	81.33	86.40	94.79	94.79	66.00-134.40	89.37	7.45	93.11	90.69
1# 24/case	147.40	132.50	122.00	105.82	122.50	119.76	144.00	60.00-211.20	131.19	5.47	126.93	136.00
2# 12/case	136.69	109.25	116.00	96.93	111.84	128.49	132.00	79.20-192.00	121.38	5.06	120.02	118.70
12.oz. Plas. 24/cs	111.56	136.10	108.00	87.54	96.72	106.80	108.00	66.00-172.80	104.27	5.79	106.40	99.39
5# 6/case	153.86	115.00	120.00	100.48	113.16	142.17	142.17	71.50-229.50	133.84	4.46	129.45	136.85
Quarts 12/case	147.48	194.98	162.50	116.46	148.83	155.70	183.00	57.12-264.00	154.65	4.30	149.70	161.58
Pints 12/case	73.48	102.75	90.00	82.71	130.00	108.00	96.00	60.00-168.00	97.81	5.43	92.14	95.53
RETAIL SHELF PRICES												
1/2#	5.63	5.31	5.88	5.65	4.13	5.55	5.55	3.25-8.00	5.48	10.96	5.50	5.27
12 oz. Plastic	7.26	7.53	8.00	6.60	5.03	4.89	5.40	3.79-15.00	6.94	9.26	6.43	6.19
1# Glass/Plastic	8.92	8.73	9.40	7.94	8.82	5.29	8.50	4.79-15.00	8.65	8.65	8.42	8.18
2# Glass/Plastic	17.21	15.55	17.25	13.23	13.90	6.39	14.50	6.39-45.00	15.78	7.89	14.09	13.97
Pint	11.78	11.41	9.49	10.44	10.96	11.00	9.60	6.00-22.00	10.94	7.30	10.95	10.94
Quart	20.12	20.30	16.00	18.11	19.75	16.48	18.07	9.25-42.00	18.75	6.25	19.10	17.88
5# Glass/Plastic	31.61	29.63	37.00	24.00	28.10	17.89	32.22	17.89-50.00	30.50	6.10	31.26	28.90
1# Cream	11.14	8.22	8.00	10.40	7.10	11.10	12.00	6.20-18.00	10.10	10.10	10.13	10.10
1# Cut Comb	14.81	14.17	12.67	13.80	11.50	14.74	14.74	6.00-25.00	13.97	13.97	15.47	13.45
Ross Round	10.44	7.17	15.00	12.00	12.00	11.44	13.75	7.00-16.80	10.98	14.64	11.49	10.63
Wholesale Wax (Lt)	8.63	7.62	6.00	5.38	7.33	4.50	6.67	3.00-16.00	7.21	-	6.60	8.72
Wholesale Wax (Dk)	7.41	5.58	4.50	5.87	6.50	3.80	6.36	3.00-10.00	6.21	-	5.33	5.85
Pollination Fee/Col.	81.11	53.33	102.50	140.00	200.00	104.05	50.00	5.00-225.00	93.10	-	87.60	77.73

National Organic Program: 2021 and 2022 Sunset Review and Substance Renewals

Summary

This document announces the renewal of substances listed on the National List of Allowed and Prohibited Substances (National List) within the U.S. Department of Agriculture's (USDA) organic regulations. This document reflects the outcome of the 2021 and 2022 sunset review processes and addresses recommendations submitted to the Secretary of Agriculture (Secretary), through the USDA's Agricultural Marketing Service (AMS), by the National Organic Standards

Supplementary Information Background

AMS administers the National Organic Program (NOP) under the authority of the Organic Foods Production Act of 1990 (OFPA), as amended (7 U.S.C. 6501-6524). The regulations implementing the NOP, also referred to as the USDA organic regulations (7 CFR part 205), were published on December 21, 2000 (65 FR 80548) and became effective on October 21, 2002. Through these regulations, AMS oversees national organic standards for the production, handling, and labeling of organically produced agricultural products. Since October 2002, the USDA organic regulations have been frequently amended, mostly for changes to the National List in 7 CFR 205.601-205.606.

The National List identifies the synthetic substances allowed to be used and the nonsynthetic substances prohibited from use in organic farming. The National List also identifies nonagricultural substances and nonorganic agricultural substances that may be used in organic handling. The OFPA and USDA organic regulations specifically prohibit the use of any synthetic substance in organic production and handling unless an exemption for using the synthetic substance is provided on the National List. Section 205.105 of the USDA organic regulations also requires that any nonorganic agricultural substance and any nonagricultural substance used in organic handling be listed as allowed on the National List.

The OFPA at 7 U.S.C. 6518 authorizes the NOSB, operating in accordance with the Federal Advisory Committee Act (§ 1 et seq., 5 U.S.C. App.2), to assist in evaluating substances to be allowed or prohibited for organic production and handling and to advise the Secretary on the USDA organic regulations. The OFPA sunset provision (7 U.S.C. 6517(e)) also requires a review of all substances included on the National List within five years of their addition to or renewal on the list. During this sunset review, the NOSB considers any new information pertaining to a substance's impact on human health and the environment, its necessity due to the unavailability of wholly natural substances, and its consistency with organic production and handling. The NOSB subsequently votes on whether to remove a substance from the National List.

The Agricultural Improvement Act of 2018 amended the OFPA at 7 U.S.C. 6518(i)(2) to specify that any vote on a motion proposing to amend the National List requires 2/3 of the votes cast at a meeting of the NOSB at which a quorum is present to prevail. A substance remains on the National List unless an NOSB motion to remove that substance carries with 2/3 of votes cast, and the Secretary subsequently renews or amends the listing for the substance. The NOSB submits its sunset review and recommendations to the Secretary. As delegated by the Secretary, AMS evaluates the sunset review and recommendations for compliance with the National List substance evaluation criteria set forth in OFPA at 7 U.S.C. 6518(m) and other federal statutes or regulations. AMS also considers public comments submitted during the sunset review process.

For additional information on the proposed organic farming act, please see https://www.regulations.gov/document/AMS_FR-DOC_0001-2218

Technology Tips For Beekeepers

Malcolm T. Sanford

THE INSIGNIA PROJECT: ENVIRONMENTAL MONITORING OF PESTICIDE USE THROUGH HONEY BEES. Norman L. Carreck INSIGNIA Consortium; Carreck Consultancy Ltd and University of Sussex; UK; norman.carreck@btinternet.com; https://www.insignia-bee.eu/

Honey bee colonies are excellent bio-samplers of biological material such as nectar, pollen, and plant pathogens, as well as non-biological material such as pesticides or airborne contamination. All material collected is concentrated in the hive, and the honey bee colony can provide four main matrices for environmental monitoring: bees, honey, pollen, and wax. INSIGNIA aims to design and test a scientifically proven citizen science environmental monitoring protocol for the detection of pesticides via honey bees. It is a pilot project funded by the EU and is being carried out by a consortium of scientists from twelve countries. Pollen collected in pollen traps is being sampled every two weeks to record forage on a single day. In contrast, wax acts as a passive sampler, building up an archive of pesticides, so alternative in-hive passive samplers are being tested to replicate wax as a "pesticide-sponge." Samples are being analyzed for the presence of pesticides and the pollen's botanical origin using a DNA fingerprinting approach. Data on pollen and pesticides will be then be combined to model the exposure risks to honey bees and wild bees. The system was tested in four countries in 2019, and this has been expanded to nine countries for 2020. 16 minutes, https://tinyurl.com/5rneucpc

NECTAR TECHNOLOGIES: UPDATE AND CASE STUDY

Maximilian Cherney; Nectar Technologies; Canada; max@nectar.buzz

n Gilbert's team at the USA Pacific Northwest National Laboratory, in 1999, we put the first bees. Small passive tags using nanoblock microchip technology are now employed for l in the medical industry, warehouses, and stores such as Wal-Mart. These tags, produced by , a world leader in volume production of Radio-Frequency Identification (RFID) products, were bert's team. This same team placed the first RFID tag on a bee for us. Combinations of passive ags connected to wireless, cellular, and satellite communications can economically provide and hive recovery and also enable nearly effortless inventory, location, tracking, and tions to the commercial bee industry. In our presentation, we cover currently available for theft protection but also for data-driven bee management. We conclude with this advice to e infra-structure for intercepting loads of stolen hives is already in place and being used by It is time to put in place a well-designed, state, and nation-wide service. If you buy only for the odds are that it will not be working when a theft does occur. Instead, build a system to needs, make it useful for many purposes, and use it to improve your management by providing mation. Theft protection is a bonus. Please contact us for help designing an integrated RFID and system that meets your unique business needs. 19 minutes, https://tinyurl.com/42bpxw2h

WINTER BEEHIVE STORAGE

Kyle and Shannon Christensen; Utah, USA; moroni770@icloud.com

Three seasons ago, our local beekeeper community approached us about wintering beehives in our vacant commercial poultry barns. They asked for a barn that could maintain 40 degrees in total darkness, control the Co2, and provide backup safety measures at an affordable price from Thanksgiving time to February. With 20 years of experience ventilating these barns through the harshest Utah climate, we knew we could help. Much of the equipment needed was already in place. By re-purposing what we had, we could pass the savings on to the beekeeper. Our 15-minute presentation focuses on four main areas: Barn prep. ventilation, temp and humidity control, and safety backups. The program describes how the barns are set up. Then we walk you through the process of what we had to do extra to achieve the four requests from the beekeepers. Along the way, we offer tips on how to size and place equipment, manage problems, and other issues to prepare better the listener to store their hives or be more aware of what topics to discuss with a potential vendor. Ventilation is the heart of winter storage success. We demonstrate a crash course on setting up a negative pressure vent system. Also, we share thoughts on managing the 24-hour swing. We wish you the best success in caring for your bees. 14 minutes, https://tinyurl.com/7pa965w4

https://beekeep.info/vita_details/

It's Summers Time –

Looking At Numbers And Saying Good-bye

So because of COVID and just in general being short-handed in our Publications department for the last year plus, I have taken on the task of calculating the numbers that are sent in by our honey reporters. When I first started with *Bee Culture* (a hundred or so years ago) this all was done by hand and Kim being a guy who really enjoys numbers did most of the calculating. Now days, of course, we have Excel. So I enter the numbers and the program does all the calculating.

What has been very enlightening in doing this task is the fact that as beekeepers we are all over the map. I hope that you at least take a glance at the numbers each month. And if you do you'll see what I mean. The numbers that really tell you a lot are the Minimum to Maximum range numbers. That $5 under Pollination fees is a real number. There is a guy who just charges $5 and another guy who charges $200 and everything in between.

Just to be sure I didn't make an error that scues the numbers, I double-checked this time and there are simply just some vast differences. I know that some of this is regional and you have to know your market. Also some of us are making a living at this and counting on that money and for many of the rest of us it's just a hobby and we're practically giving it away.

I don't know how much other agricultural industries vary, but I think we need to take a close look at our pricing and see if we're being fair with ourselves and other beekeepers. Have a little more confidence in your product, your time, your labor and make sure you're pricing that honey and wax and pollination at a fair rate. Don't be embarrassed to be a beekeeper.

Just some things to think about.

I hope you are all having a great Summer. We're finally getting tomatoes and peppers and squash from our gardens. It takes a while here in Northeast Ohio. And the 'Bee-Bee' tree that I talk about every year is in full bloom right now and has been for almost a month. The bees are covering it and there is a definite hum in the air when you walk under that tree.

The Bee-Bee tree. Hard to see in the photo but it's covered with honey bees.

We're fortunate here in Ohio in that we don't really have much of a dearth. There is something always blooming from early Spring to October. The goldenrod is just starting to show blossoms so we're all hoping for a good crop this year.

Other news from *Bee Culture* land. Nothing stays the same forever. As I told you in the July issue our Amanda DeSimone had a baby girl at the end of May and has been on maternity leave. Well for lots of different reasons Amanda has decided to not return to *Bee Culture* and to stay home with Lilliana and Anthony who is five now. We are happy for Amanda in that she gets to be with those little ones but we will miss her desperately.

If you've been a subscriber for any length of time you've probably spoken to or emailed Amanda. She's been with us for about 10 years. Amanda's main job was managing all of the details of all of your subscriptions which she did with great expertise. But over and above that she did all of our Social Media 'stuff' and worked each year to organize the details of our annual events and our pollinator days and just so much more. And on top of that she made me laugh every day. She's not going away from my life, but I'll miss the day to day joy of having her here. Thank you Amanda.

This year is flying by. Schools are already starting and soon it will be Fall. Take time and enjoy the rest of your Summer.

I don't think our honey bees get anything from Hibiscus, but aren't they absolutely amazing flowers. This plant has about 20 buds ready to pop in the next few days.

New Reading For Fall –

A Natural History Of Insects in 100 Limericks. Richard A. Jones (Author) and Calvin Ure-Jones (Illustrator). Published by Pelagic Publishing (**www.pelagicpublishuing.com**), UK. 5" x 8", 110 pages, black line drawings throughout, soft cover, $12.99 on Amazon.

This distinctly different book looks at 100 different insects and tells a story about each. The line drawing illustrations of each are useful and accurate, and the sound bite of information that is presented on each insect highlights the usefulness, or not, of each, and notes individual identification, value, or not, and some note on individual biology. For instance, for bumblebees, it notes that their fluffy bodies enable them to engage in foraging when other insects can't fly, so they are out earlier in the year, earlier in the day, further north and further up the mountain than other bees. However, when it is too warm, they can overheat. To regulate this to a degree, they can regulate the flow of hemolymph past a hairless patch on the underside of their abdomen to dissipate some of the excess warmth.

But it's the limerick about each that draws you into each of these. Most are pretty straight forward, like the bumble bee's –

The bumble bee got rather hot,
Because she had foraged a lot.
In cold it was good
Having fur coat and hood,
But in sunshine it really was not.

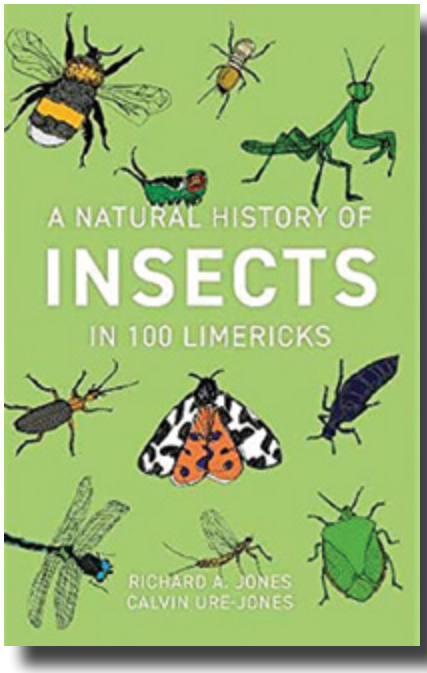
Others are a tad stretched to make a rhyme, but it makes it all the more fun to read. One downside, the author did not include the honey bee. It is referenced to on occasion when compared to other insects, but she does not have her own limerick – so, to balance this out, I wrote these you can copy on the blank page in the back of the book.

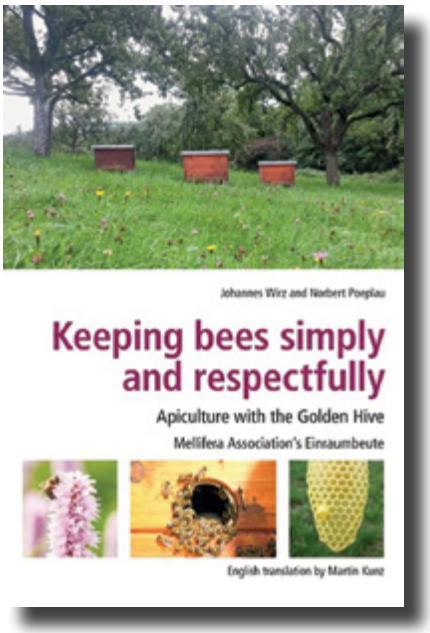
A honey bee drone felt rude,
And thought himself quite a dude.
So off he went flying
Not thinking of dying,
Until meeting a queen not a prude

A honey bee danced through the night,
Sharing the course of her flight.
And all the time smelling
Like nectar compelling,
That would feed her sisters just right

The Queen bee is constantly fed,
By workers carefully bred
To be immune to the mites
That they constantly fight,
And other diseases they dread.

Kim Flottum
Growing Planet Media





Keeping bees simply and respectfully. Apiculture with the Golden Hive. Johannes Wirz and Norbert Poeplau. Published by Northern Bee Books and IBRA, UK. ISBN 978-1-913811-03-7. 6" x 9", 173 pages, color throughout, soft cover, $42.00.

The German Non-governmental Organization – Mellifera – works to protect bees, humans, and nature. The Golden Hive, which has been developed in the teaching apiary owned by Mellifera, provides optimal living conditions for the bees: they build their own comb and they are allowed to swarm, which benefits their health and makes many interventions by beekeepers superfluous. The colony has enough space in one single cavity, which allows it to develop as one contiguous organism, while retaining sufficient honey stores. It is, simply, a long hive, with a single cavity.

Dr. Johannes Wirtz, a board member of Mellifera, and master beekeeper Norbert Poeplau provide an introduction to the concept of bee friendly beekeeping and insights into the fascinating life of the makers of honey. They guide the reader step by step while managing a Golden Hive throughout the course of a year. Important issues related to location, swarming, and winter feeding are addressed.

Varroa treatment is addressed, along with sampling and suggestions for timing treatments. Organic acids are suggested as the chemical treatments of choice if necessary, using any of several techniques. The bacterial diseases are dealt with completely differently than in the US, as German laws differ in notification, destruction, movement and non-chemical treatments. Of course if adhering to natural techniques, drugs are out of the question. Then, destroying the equipment is one way to rid the region of these pests, while artificial swarming is another. But tensions arise when the disease is found, and beekeepers in the 'standstill' zone can not leave, nor can other beekeepers move in. Changing those laws is recommended.

The real value of this book to most beekeepers is that it is yet another look at managing long hives. Frame size is large, and the height

can be adjusted to accommodate the beekeeper.

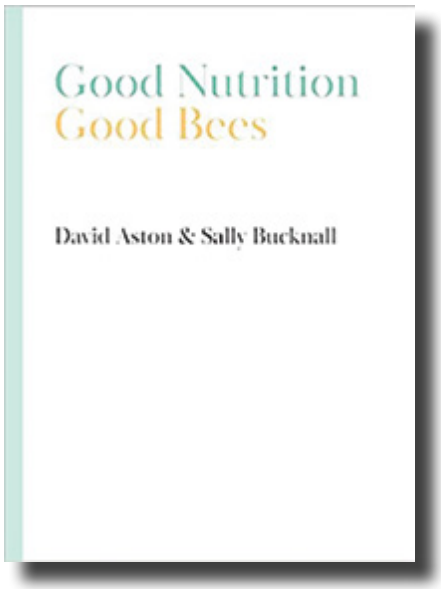
There is some attention paid to basic beekeeping chores – setting up, harvesting, feeding, and using the products that can be harvested. And working with children and bees is part of this. But much is aimed at the natural setting this hives allows, and if this is your goal, this is your book.

Kim Flottum
Growing Planet Media

Good Nutrition. Good Bees. David Aston & Sally Bucknall. Published by Northern Bee Books, UK. ISBN 978-1-912271-95-5. 8" x 11", 428 pgs. Soft cover, black and white. $49.00 from Amazon and others.

This very recent publication is a whole new way at looking at what, and how, the role of nutrition plays in the lives of honey bees. The British authors sum it well in the introduction: "As we shall see, understanding and meeting the needs of the honey bee are, as in any organism, key to their survival and future".

The detail in this book cannot be fully comprehended just by looking at it. Even the table of contents requires study. It fills 13 pages, fully describing the contents of the 62 chapters, including two Annexes that discuss the plants bees use. The references cover 17 pages. Many of them are available, but sadly, many are not, or not easily obtained by anybody other than the closed world of the scientific community. Probably the first thing you will notice is that there is not a single photo in this book. Not one. Interestingly, I don't think one was needed considering the detail used to study each topic covered.



As this was written, primarily, for British beekeepers and scientists, there is the necessary introductory information on the climates of the British Isles, and a short history of the honey bee there. This is followed by a short description of beekeeping and colony management, the structure and biology of the superorganism that is a honey bee colony, and the life cycles, colony size, and colony members. These sections alone would make a excellent introductory book on bees and beekeeping, but next follows the meat of the matter.

To understand how the flow of this book works, imagine all of the things all of the bees in a colony do over the course of the life of the bee, and the life of the colony. Aston and Bucknall have then examined the role of how each of these is affected by good, average or bad nutrition. What happens to foragers if they don't get enough protein in their diets? What happens to immune systems when challenged by poor food choices? And what role does nutrition play in a colony facing all of the pests and predators a colony is subject to – diseases, mites, beetles, wax moths, mice, wasps, viruses, pesticides – and more.

Water. In how many ways is this taken-for-granted nutritional supplement abused, and used, in a colony. And what nutritional requirements are needed for queens, workers, drones, immatures, and what happens if they don't get those required nutrients, or only most of them? Or only for awhile? And how does a colony regulate the collection and storage of all of these, so there's always enough good food?

And what is all of that nutrition based on? Of course, what do bees eat, what do bees collect and store, and what can happen to these sources of vitamins, minerals, and the rest? Of course – bees eat flowers, well, parts of flowers – nectars, pollens, honeydews. And is purple pollen better than yellow pollen?

What are the sources, and eventual uses of fatty acids, lipids, sterols, vitamins, inorganic elements, and the rest of what they need? The detail in this section is eye opening.

And propolis? Is that a food? How is it used? And what about venom? Where does that come from, and how is it produced is explained.

Is feeding a honey bee colony necessary, sometimes, all the time? What do you feed, and how do you feed it are looked at – carbs, proteins, fondants, pollen patties and when and why and how. But you have to know what a frame feeder is when you get to this part.

Finally, a seasonal look at nutrition. The overall year, then the Spring expansion, early and mid-Summer, late Summer and Autumn and just before the onset of Winter. And just for a bit more detail, what about drawing foundation, queen rearing, moving for and recovering from pollination services.

The finale are the two annexes. What plant families are best for bees, and a bit about their nectaries, and some notes on what the effects of different kinds of soil may have on these plants.

This isn't a book you'll sit and read on a quiet winter evening. But you will refer to it time and again when something goes wrong and you don't know what, or, what to do. Your job is to make sure your bees have enough good food, all of the time, for every bee in the bunch.

Kim Flottum
Growing Planet Media

– New Reading For Fall

FOUND IN TRANSLATION

Winter Is Coming

Jay **Evans**, USDA Beltsville Bee Lab

When this column comes out, many in the northern hemisphere will still feel the heat of a long Summer. Nevertheless, your bees will have already started preparing for the deadliest season in beekeeping, surviving the upcoming Winter. Winter for honey bee colonies involves a steady drip of worker bee losses, even when queens, food, and shelter are adequate. If you want your bees to raise healthy new progeny next spring, you either have to build up colonies to tolerate this drip or find a way to patch the leak. Entering winter with a workforce that will still be here in the spring involves equal inputs from bees, beekeepers, and the surrounding environment.

By this time of year, good beekeepers have assessed and acted on mite issues and have doubled down to make sure a healthy queen is in place to produce the young bees that will be vital for surviving Winter. They also, where possible, have given their colonies access to safe and plentiful food. But what are the other predictors of overwintering success? How confident can a beekeeper be, year to year, that their colonies will be among the 60% that survive Winter? And what can be done to reduce those 40% losses, a crazy amount if you are raising bees for profit or not? There has been a tremendous amount of work lately focused on landscape-level nutrition and the impacts of climate on bee health across the seasons. This work benefits from field and lab experiments from scientists such as Dr. Gloria deGrandi-Hoffman, who describes an experimental study carried out with USDA and University colleagues in the open-access journal *Insects* (2021; "The importance of time and place: Nutrient composition and utilization of seasonal pollens by European honey bees (*Apis mellifera* L.)" **https://doi.org/10.3390/insects12030235**). In this study, the impacts of regional and seasonal pollens on bee physiology were measured, showing differences in both pollen categories in the southwestern and midwestern U.S., and in the impacts of these pollens on bee health. There were also hints that bees of different queen lines have different preferences for pollens, perhaps triggered by different protein levels of those pollens. Can your bees be tuned to find and benefit from the pollens available locally? If not, how would a beekeeper provide those resources?

One way to tackle the latter question is to look at what is available from a bees-eye view. Dr. Martina Calovi and colleagues from Pennsylvania State University and USDA's Agricultural Research Service used a survey-based approach to identify the environmental factors tied with colony health, and specially with overwinter survival. This study, part of the Beescape effort (**https://beescape.org/**), merged publicly available environmental data with an intensive survey of Pennsylvania beekeepers and their colony dynamics. Their recent paper, "Summer weather conditions influence Winter survival of honey bees (*Apis mellifera*) in the northeastern United States" (*Scientific Reports*, 2021, 11:1553, **https://doi.org/10.1038/s41598-021-81051-8**), relies on land use data collected by USDA-NASS (**https://www.nass.usda.gov/Research_and_Science/Cropland/SARS1a.php**) alongside super-fine-scale (predicted every 400 meters) weather data to determine which environmental components are the best predictors of colony Winter survival. The former resource, the Cropland Data Layer, has been measuring acreage and land use since 1971, providing an amazing resource for the terrain available to bees, given land use and climate changes over the past 50 years.

In their paper, Calovi and colleagues first reconfirm that Pennsylvania beekeepers who treated for mites fared significantly better than those who did not, so much so that they had to analyze treated colonies separately from the (smaller) set of untreated colonies. Surprisingly, for Winter survival in this study, land use patterns had only a minor effect on colony fates. What really came through was a strong impact of weather patterns months before Winter even started on the abilities of colonies to make it through Winter. The most important variables in Winter survival were the 'degree-days' of Summer and summer precipitation. In a middle-ground sort of way, Summers and regions with moderate temperatures and rainfall supported bees with the highest odds of surviving Winter. Those in Pennsylvania who don't have the means or desire to pick up their colonies and move will be comforted by the authors' discovery that "No part of Pennsylvania was always good or always bad for honey bee survival; there was substantial spatial and temporal variability", i.e., you will take your wins and losses due to a variety of factors but not necessarily your zip code.

I have mentioned it before, but Beescape offers multiple tools for beekeepers and researchers to connect open data for the environment (your tax dollars at work) with bee health measurements. They have now added a predictive tool for winter survival based on some of the work in this paper. Across the country, the main players in providing data on honey bee colony dynamics are the USDA National Agricultural Statistics Service (**https://www.nass.usda.gov/Surveys/Guide_to_NASS_Surveys/Bee_and_Honey/**) and the Bee Informed Partnership (**www.beeinformed.org**), a University-driven effort funded largely by the USDA's Animal and Plant Health Inspection Service (**https://www.aphis.usda.gov/aphis/ourfocus/planthealth/plant-pest-and-disease-programs/honey-bees/honeybees**). USDA-NASS has a decades-old database showing colony numbers by state and the productivity of those colonies. More recently, NASS added survey-based datasets measuring of colony losses and possible causes for large and small beekeeping operations (**https://usda.library.cornell.edu/concern/publications/rn301137d?locale=en**). Both connect management habits and general habitat-level data with colony fates. These datasets are rich and can be mined for insights into local bee hazards, from chemicals to poor forage, and climate factors that push bees over the edge. Using state- or country-wide models and "views-from-above" might not drastically change your beekeeping, but these efforts are slowly capturing the many ways that nature impacts your colonies. It is fascinating to think that, unlike most species with wings or strong legs, bees rely on the small sample of the world they can reach from their tiny painted houses. BC

Chelsea Cook photo.

A Closer Look

COMB CONSTRUCTION AND CELL CAPPING

Clarence **Collison**

Significant Chemical And Physical Changes Occur In The Wax During Comb Building

"Wax secretion is age-related, varies with season, is unaffected by the queen, juvenile hormone or the corpora allata but is enhanced in swarming. Comb building is enhanced by the queen. Nest structure can be explained as a self-organization process as can the patterns of brood, honey and pollen. The comb and its contents provide gross information to the colony as to crowding and space which affect brood rearing, energy consumption and comb building. Significant chemical and physical changes occur in the wax during comb building and during its subsequent use. Comb mediates pheromonal cues for cell capping, repairs and queen cell construction, nectar forage, colony defense and colony odor. Mechanically, the combs transmit vibrational signals in the waggle dance and recruitment of new foragers (Hepburn 1998)."

"Ledoux et al. (2001) examined the influence of the queen and her pheromonal signal on comb construction. They tested four treatments with newly hived packages of bees containing: 1) a mated queen, 2) a virgin queen, 3) no queen but with a dispenser containing synthetic queen mandibular pheromone (QMP), and 4) no queen and no pheromone. After 10 days, the comb produced by each colony was removed, comb measurements made, bees from the comb-building area collected, the size of the scales on the wax mirrors of the collected bees ranked on a scale of 0-4 and the queens removed and analyzed for QMP components. Queenless workers built substantially less comb and the comb they did build had significantly larger, drone-sized cells than for the other three treatments, indicating that both cell size and the quantity of comb built are mediated through the queen, particularly QMP. The observations of wax scale size suggested that QMP influenced comb building behavior rather than wax scale production. These results support the idea that queenless honey bees can adopt a strategy of constructing drone-sized cells in order to increase reproductive fitness through male production following queen loss."

"Colonies of honey bees initiate new comb construction only when two conditions are met: 1) they are currently collecting nectar and 2) they have filled their available comb beyond a threshold level with brood and food. Pratt (1998a) explored how the individual workers responsible for building might use readily accessible local cues to acquire this global information on colony and environmental state. In particular, he tested the hypothesis that comb is built by nectar receivers (bees specialized to receive nectar from foragers and store it in comb cells) that experience increased distension of their crops (honey stomachs). Crop distension could serve as a cue that both conditions for building have been satisfied, because the bees' crops will fill up as they receive nectar from successful foragers and have difficulty finding comb in which to store it. However, two findings led to rejection of this hypothesis. First, very few nectar receivers participated in comb building. Most builders came from another, unidentified subpopulation of workers. Second, potential builders showed no increase in crop size correlated with the onset of new comb construction or with the development of conditions that favor comb building. This was true both for identified nectar receiver bees and for bees belonging to the age cohort at which wax secretion and comb building reach their peak levels. The behavioral repertoire of comb-building bees suggests that these builders come from a pool of underemployed bees that may evaluate colony state by direct inspection of comb cells."

"Wax used for comb building can be found in two forms between the worker's mandibles: firstly, as transparent wax scales, and secondly, as a non-transparent string-like form that is created from existing wax within the colony. Siefert et al. (2021) observed the latter was predominantly seen on urgent occasions, such as quickly fixing the combs to the adjacent glass in the aperture shortly after the setup of colonies. However, the use of wax strings can often be observed later in the colony's development. Since the remodeling of combs includes individuals with undeveloped wax glands, it enables quick shifts in division of labor. To create a string of wax, the worker

moves its head quickly back and forth, similar to a pecking bird, while the string between the mandibles is extended. The wax strings can be several millimeters in length and are extended below the head and thorax. Long strings are folded for transportation using the prothoracic legs and the mandibles.To retrieve a wax scale from the intersternal pockets, the worker uses the basitarsal brushes of the hind leg. Retrieving the scale from the pocket takes about five seconds. The subsequent transportation of the scales to the mouthparts with the same leg takes just 400 milliseconds. The use of wax scales and wax strings for building is the reverse of the process of wax string extension described above, including the rapid head and mandible movements."

"After the main flow, 12 Italian and 12 Caucasian colonies of honey bees were fed, and used to build combs from wax foundation. During a four-day period the most important factor in determining the number of combs built was the weight of the bees in the colony; the relationship was linear. Mean-maximum and mean-minimum temperatures also had an effect. During an eight-day period, colonies weighing six or seven kg (13.2-15.4 lbs.) built the most combs. Fewest were built at 20°C (68°F) mean-maximum temperature with any size of colony. Less sugar was consumed as the mean-maximum and mean-minimum temperatures increased. With small colonies, the sugar consumption increased with increasing mean-maximum temperatures, but with larger colonies it decreased. Sugar consumption per comb built depended on colony size, and on temperatures, in a rather complex way. The lowest sugar consumption per comb built was with colonies weighing 4 to 8 kg, (8.8 to 17.6 lbs.) depending on the mean-maximum temperature (Szabo 1977)."

"Upon entering a new home site a honey bee swarm is faced with the task of organizing the building activities of thousands of component bees so that several straight and parallel vertically oriented combs can be quickly and efficiently built. As a part of this organization process it is necessary for the bees to select and agree upon a planar orientation for the new combs. De Jong (1982) presents evidence that memory of a previously used comb direction influences the building of the new set of combs. Swarms which have recently moved into bait-hives (empty boxes placed in trees to attract feral swarms) tend to maintain the previously used comb direction when removed and forced to build new combs, whereas swarms which have occupied the bait-hives for a longer period (over 9 days) do not. Recent swarms predictably alter their comb building direction within the influence of an applied earth strength magnetic field, indicating that honey bees are able to use the earth's magnetic field as a reference at the commencement of comb construction in a new hive."

"Honey bees have long been assumed to build their comb with the cells in either of two preferred orientations with respect to gravity ("vertical" or "horizontal). Pratt (2000) showed that these typical cell orientations are derived from substrate orientation and a simple building rule, rather than the influence of gravity itself. When bees were induced to build comb on substrates at four different orientations with respect to gravity, they always made cells with one vertex pointing directly toward the substrate. This produced horizontal and vertical cells on vertical and horizontal substrates, respectively, but yielded intermediate orientations on oblique substrates. The apparent preference for vertical and horizontal cells may simply reflect substrate orientation in the rectilinear hives from which cell measurements have been taken."

"Honey bee colonies furnish their nests with two types of comb distinguished by cell size: large cells for rearing males (drone comb) and small cells for rearing workers (worker comb). The bees actively regulate the relative quantity of each type, a behavior likely to be important in setting a colony's sex ratio. Experimental analysis of the information pathways and control mechanisms responsible for this regulation found the following results. The amount of drone comb in a nest is governed by negative feedback from drone comb already constructed. This feedback depends on the workers having direct contact with the drone comb in their nest, but does not depend on the queen's contact with the comb. The comb itself, rather than the brood within it, is sufficient to provide the negative feedback, although the brood may also contribute to the effect. These findings show that drone comb regulation does not depend on the queen acting as a centralized information gatherer and behavioral controller. Instead, the evidence points to a decision-making process distributed across the population of worker bees, a control architecture typical of colony organization in honey bees and other large colony insect societies (Pratt 1998b)."

"In comb building several festoons may begin building at independent sites. Combs are made parallel by manipulating the length of cells but dislocated combs are incorporated into the total nest structure. Parallelism is achieved through passive application of the bee space. Cell size and orientation vary independently and are unique to each festoon and comb. Combs are joined laterally near their mid-sections. Cells are approximately hexagonal within a comb, but poor fit requires the insertion of pentagons, heptagons, and the use of fill and vacancies for the fusion of small combs into a single large comb (Hepburn and Whiffler 1991)."

"The actual construction of comb is performed by older workers, at ages averaging only a few days older than those for brood-tending bees. A typical comb builder might spend some of her time in a comb-building cluster, then move to the brood area and inspect or feed larvae and perhaps do other cleaning or food handling chores before returning to comb building. This alternation of tasks provides time for the wax glands to produce more wax for construction, and for the hypopharyngeal and mandibular glands to produce brood food (Winston 1987)."

"When construction begins, the workers hang together in tight chains, forming a dense cluster in which

they maintain a temperature of 35°C (95°F), the best temperature for wax secretion and manipulation. Flakes of wax are removed by the enlarged first tarsal joint of the hind leg from four paired glands on the underside of the abdomen and passed forward for construction and manipulations by the front legs and mandibles. The wax is mixed with saliva and kneaded to the proper consistency and degree of plasticity at which it can best be molded (Winston 1987)."

"Construction progresses in a seemingly random fashion, since several bees contribute to the building of any one cell, and several cells are under construction simultaneously. Workers begin construction on the roof or side of the nest cavity, with perhaps two or three construction sites initially for each comb. Thick layers of wax are first placed at the base of what will be each comb, and these are gradually drawn out into cells by elongating and thinning the wax into the cell walls. A single worker may add wax or smooth it, moving from cell to cell and building site to building site in no evident order. Apparently, each worker can perceive the stage of construction at each new location and contributes whatever is needed for that cell. As a result of this series of individual actions, each section of comb is linked with the others so that no traces of their separate beginnings are visible. The precision and strength of the newly built comb is remarkable (Winston 1987)."

"The construction period of a worker's life usually has two stages, cell capping by young workers and comb construction by older workers. The early capping behavior is possible since workers as young as two or three days old can produce wax, although the glands are most highly developed in workers eight-17 days old. Also, older wax-producing workers place wax scales on the rims of cells which need to be capped, so that copious wax production by the younger cappers is not necessary and workers can shape and manipulate wax whether or not they are secreting wax themselves. Capping is somewhat unorganized process in which many workers each do a small bit of capping construction in an unsystematic fashion. A typical cell might take over six hours to cap and have hundreds of workers participating in capping construction. Not all workers help to complete the task; often a worker will remove a piece of wax from one partially capped cell and add it to an adjoining cell capping (Winston 1987)."

"Shortly before metamorphosis the honey bee larva turns around in its comb cell and spins its cocoon. At this time the cell opening must already be closed by a capping made of bee's wax, otherwise the larva will fall out and die. Recently Le Conte et al. (1990) reported the isolation and identification of a mixture of pheromones (aliphatic fatty esters) that could induce capping behavior. Trouiller et al. (1991) have analyzed the temporal secretion of several fatty esters and conclude that the role of the above-mentioned esters as pheromone "is now supported by evidence that these compounds are present in the cuticle only a few hours before the cell is capped." Goetz and Koeniger (1992) examined the effect on capping behavior of the distance between the larva and the cell opening. Shortened brood cells (with reduced depth) were capped earlier than normal cells. After capping, larval weight in shortened cells was lower than in control cells. Larvae of elongated cells were heavier than control larvae after capping. These results indicate that mechanical stimuli play an important role in triggering capping of cells."

"In honey bees, methyl palmitate (MP), methyl oleate (MO), methyl linoleate (ML), and methyl linolenate (MLN) are important pheromone components of the capping pheromones triggering the capping behavior of worker bees. Quin et al. (2019) compared the amounts of these four pheromone components in the larvae of workers and drones, prior to being capped, in the process of being capped and had been capped. The amounts of MP, MO, and MLN peaked at the capping larval stage, and ML was highest at capped larvae in worker larvae, whereas in drone larvae, the amounts of the four pheromone components were higher overall and increased with aging. Furthermore, they proposed de novo biosynthetic pathways for MP, MO, ML and MLN, from acetyl-CoA. Besides, stable isotope tracer ^{13}C and deuterium were used to confirm that these capping pheromone components were de novo synthesized by larvae themselves rather than from their diets."

"When larvae reach the stage of pupation, their cells are closed off by workers constructing a thin wax cap over the cell so that the larvae pupate in a clean and stable environment. Four components of BEP are particularly

important in triggering the capping behavior of workers (Qin et al. 2019)."

"During building activity, workers move frequently within the cell, either back and forth or in longitudinal turns. Furthermore, frequent antennal and head movement is present. During cell capping, the worker frequently inserts its antennae into the closing hole of the cell as it is capped and puts its front tarsi onto the extended rim. They presume that the worker does so to measure the thickness of the cap. Capping is carefully adjusted to the larva's developmental state, and cocooning starts before the cell is completely closed (Siefert et al. 2021)." BC

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Meeting Adjourned

Stephen **Bishop**

Some curious readers have inquired about my credentials, and some conspiratorially-inclined question whether I even exist. The same happened with Shakespeare; he wrote all those plays and sappy sonnets and now people question whether a writer from such humble origins as Stratford-upon-Avon was capable of contributing to the Western literary canon. Some believe the Bard was really Francis Bacon or some other hoity-toity, well-educated chap from the big city of London, which is really offensive to writers, Shakespeare and I included, who hail from humble rural origins.

Truth is, I hate to compare myself to some bloke like Shakespeare, who stooped low enough to write rhyming poetry (which is many stoops lower than writing beekeeping humor), but vicious rumors are currently circulating about the authorship of my contributions to the beekeeping world. This gossip implies that a mere member of the Sulfur Springs Beekeepers and Hive Tool Collectors Association, Langstroth Chapter (SSBHTCA, LC), would hardly be capable of spelling, much less stringing together enough sentences to produce such a literary masterpiece as "The Beekeeping Barkeep." Some have suggested that Stephen Bishop is a joint pseudonym that more distinguished beekeeping authors operate under when they tire of writing practical, helpful stuff. (After some consideration, I'm okay with this theory, so long as they write and I get paid.)

But to assure you I'm a real bonafide member of the SSBHTCA, LC, I thought I'd produce evidence of my existence—the minutes of our last meeting, at which I acted as recording secretary and recorded myself in attendance:

The regular meeting of the Sulfur Springs Beekeepers and Hive Tool Collectors Association, Langstroth Chapter, commenced at 6:07 pm on July 23rd at the Sulfur Springs Agricultural Office with a rousing rendition of the Pledge of Allegiance and a unanimous removal of hats.

Stephen Bishop, acting recording secretary, read the minutes from the June 19th meeting. A lively discussion occurred over whether *honey bee* is actually one or two words. Google was consulted to discover *Merriam-Webster* prefers one word, while entomologists prefer two words. Some civil disagreement occurred between members of the science committee and members of the literary committee over which source was more authoritative. Eventually, Hal Stone proposed a solution to appease both sides: The spelling of *honey bee* will rotate between one word and two words, and a coin will be flipped at the beginning of each meeting to decide which spelling is used first each night. Brian Wethers made a motion to approve this new policy, the motion was seconded by Bob Underwood, and the honey bee spelling policy was approved.

Bob Underwood gave the treasurer's report. Unfortunately, proceeds from dues had declined over the previous year. He estimated that the Langstroth Chapter of the SSBHTCA had lost approximately thirty percent of the revenue needed for the operating budget due to members leaving for the Top Bar Chapter, formed after the War of Top Bar Aggression. Mr. Underwood implored members to increase their giving to fight the top bar propaganda espoused by the rebellious faction of the SSBHTCA. Lankford Stanley donated two dollars on the spot.

Edward Tedham, outreach committee member, gave the outreach report. Participating in the Fourth of July Parade produced much publicity as two members nearly

passed out while marching in bee suits. Thankfully, Sulfur Springs Fire Engine 1 followed our marchers, and firemen quickly responded to the slight incident of overheating. A suggestion was entertained to change the outreach to the Christmas parade; however, others noted that marching in bee suits at Christmas might bewilder onlookers who could easily confuse us with a roving troop of snowmen. To allow the outreach committee time to research the implications of the suggestion, the issue of parade marching was tabled until the September meeting.

Dr. Elizabeth Haney, chairwoman of the science committee, reviewed a study from the *Journal of Entomology* that details the effects of alcohol consumption on bee flight patterns. Researchers at the University of Toledo fed forager bees sugar water spiked with alcohol. Bees from the group fed 80-proof sugar water crashed and passed out on blossoms at a rate 52 times higher than the teetotaling control group that consumed only water. The review sparked vigorous story-telling:

- Bob Underwood told a story about the time he accidentally fed fermented grain to hogs, which caused a few lightweights to temporarily stumble around the hog lot, but otherwise he noted no lasting effects.
- Walter Camp told a story about a young calf that came down with bloat, which caused the calf's breath to reek of beer. He then tubed the calf to release the gas, which made the whole stall smell like a beer joint (Mr. Camp wanted it noted that he doesn't approve of beer-drinking and was only guessing the stall smelled like a beer joint). The calf lived, and everyone sighed in relief.
- Charles McSwain told a story about an old-time moonshiner named Lester who hid jars of moonshine in his hives. Though suspected of home brewing, Lester got away with the ruse for a long while until an astute deputy began wondering why Lester's hives were always so tall, even in the dead of Winter. The deputy rode out to Lester's homeplace and asked to inspect the hives. Lester said the bees wouldn't much appreciate that, it being the middle of winter, but the deputy persisted. Lo and behold, when the deputy removed the honey supers from one hive, there were no frames or honeycomb, just stacks of quart mason jars. Lester said, "ain't that some of the clearest vetch honey you've ever seen – I got the bees trained to put it straight it the jars." Everyone chuckled, and a discussion of light types of honey began, with clover, locust, and vetch honey being deemed the clearest on this side of the Broad River.

With great vigor, Catherine Brady, chairwoman of the literary committee, read a poem she had written called the "The Fateful Flight," which ended with a blissful queen flying home, her mating flight over, only to be eaten by a barn swallow. Walter Camp said barn swallows try to nest on the eave of his front porch every year, but he rips down their construction until they decide to relocate their development.

With no further business to discuss, the meeting was adjourned at 8:47 PM and was deemed a great success by all in attendance. BC

Stephen Bishop writes agricultural humor and records minutes for the SSBHTCA, LC, though some believe he is a double agent for the rebellious Top Bar chapter. You can see more of his work at ***misfitfarmer.com*** *or follow him on Twitter at @ themisfitfarmer.*

Comparison Of Treatment-Free Cultural Controls With Formic Acid *Varroa* Mite (*Varroa destructor*) Treatments In Managed *Apis mellifera* Colonies

ABSTRACT

The parasitic mite, *Varroa destructor* is the most widespread pest of the western honey bee, *Apis mellifera*. This mite reproduces in honey bee brood cells, so it parasitizes both immature and adult bees. The mite spreads pathogens throughout a colony's population through its feeding behavior and is considered one of the leading causes of death in colonies of honey bees. While the beekeeping industry has turned primarily to the use of acaricides to control *V. destructor*, there is strong interest in developing methods of control that do not rely on chemical treatments. I evaluated two combinations of mechanical and cultural controls that have potential to lower *Varroa* mite (*Varroa destructor*) population levels and the damaging effects of related viral impacts. I hypothesized that such mechanical and cultural controls, when combined, may sustain the lives of colonies without the use of chemical treatments. I found that the combination of mechanical and cultural controls used in this trial controlled *Varroa* mites as effectively as a popular acaricide (Mite Away Quick Strips). By adopting these treatment-free mite management techniques, beekeepers can reduce, or potentially avoid, the need to apply acaricides to control *Varroa* mites.

INTRODUCTION

The ectoparasitic *Varroa* mite (*Varroa destructor*) is one of the primary challenges to today's beekeepers (Rosenkranz et. al. 2010; Guzmán-Novoa, et. al. 2010). *Varroa* acts as a vector for viruses that can kill colonies (Ball & Allen 1988; Tentcheva, et. al. 2004; Chen et. al. 2006; Gisder et. al. 2009). Additionally the feeding by *Varroa* on the fat bodies of honey bees weakens their immune responses and renders them vulnerable to pathogens and pesticides (Yang & Cox-Foster 2005; Ramsey et. al. 2019).

The beekeeping industry initially turned to synthetic acaricides to control *V. destructor* and this has led to the evolution of resistance to these chemicals (Milani 1999; Elzen et. al. 2002; Rodríguez-Dehaibes, et. al. 2005). The use of acaricides in bee colonies also creates the potential for beeswax and honey contamination which can lead to unintended impacts on the bees (Orantes-Bermejo, et. al. 2010; Mullin et. al. 2010; Calatayud-Vernich, et. al. 2018).

Previous work suggests that the problems of pesticide-resistant mites and pesticide-contaminated hives may be avoided if beekeepers develop mechanical manipulations and cultural controls as part of an integrated pest management approach (Delaplane, et. al. 2005). Anecdotal reports indicate that treatment-free beekeepers have developed effective alternatives to acaricide use (Webster 2013; Conrad 2013). In this study, five mechanical and cultural control techniques were tested. The techniques tested combine the use of localized *Varroa*-tolerant honey bee stock, screened bottom boards, a break in the honey bee brood cycle, the regular culling of old comb, and the removal and destruction of capped drone brood. It was hypothesized that such simple and low-cost techniques, when used in combination, may sustain the lives of colonies without the use of chemical treatments. Long-term colony survival, honey production, and mite population levels were monitored over the course of the trial.

MATERIALS AND METHODS

In this study, forty five nucleus colonies of Russian-based, locally-raised stock bred for *Varroa* tolerance were purchased from Champlain Valley Bees and Queens of New Haven, Vermont. The colonies were divided into three groups of fifteen colonies each, and a fourth group of fifteen colonies was created from the treatment-free group in the beginning of the trial during the process of removing the queen, and frames of bees, brood, honey and pollen to create a brood break: (1) the group (TF) received the five above-mentioned mechanical and cultural control techniques, (2) the group (TFQ) created with the queens and bees from the TF group, received the above techniques but the queen was always left with the colony when bees and brood were removed to make a split without forcing a brood break, (3) the group (QS) received the commercial acaricide [Mite Away Quick Strip (MAQS), NOD Apiary Products], and (4) the control group which received no mite control management (C).

The five mechanical and cultural control techniques tested were:

1. **Localized stock with a genetic predisposition for *Varroa* resistance** - Utilization of innate genetic *Varroa* resistance of the honey bee is recognized as a potential long-term solution to the *Varroa* problem within the beekeeping industry (Harbo & Harris 1999, 2005). Strains of honey bees have been identified that exhibit levels of resistance to *Varroa* (Kurze et. al. 2016). Commercially available strains include Russian (Rinderer et. al. 2001, 2010), Hygienic (Boecking & Spivak 1999), *Varroa* sensitive hygiene (VSH) stock (Ibrahim & Spivak 2006; Panziera et. al.

Note the delayed expansion of the treatment-free (TF) colonies in the rear compared to the Quick Strip treated (QS) colonies in the front. This resulted in significantly decreased honey production during the course of the trial.

2017) and mite biting bees (Hunt et. al. 2016). Locally raised honey bees also exhibit the potential for improved survival over bees imported from outside a region (Pinkiw 2003; Parker et. al. 2010, Hatjina et. al. 2014).

2. **Screened Bottom Boards** – Bottom boards outfitted with a screen have the potential to remove mites that are knocked off bees through honey bee grooming, or lose their grip and fall to the bottom of the hive (Webster et. al., 2000; Harbo & Harris 2004). Screened bottom boards are used to monitor natural mite fall to determine when treatments are necessary (by estimating *Varroa* populations), and test efficacy following treatments. While screened bottom boards have the capacity to remove a small percent of the phoretic mites (mites on bodies of bees) in a hive, it is not recognized as an effective control method for *Varroa* on its own (Rinderer et. al. 2003).
3. **Interruption of brood cycle** - The reproductive biology of *Varroa* is closely tied to the reproductive biology of the honey bee as young mites feed on the honey bee pupae and larvae during development. Successful mite reproduction requires mated female mites (foundress) to successfully raise a minimum of two offspring (one male and one female) inside brood cells. Each invading foundress can produce about 1.5 mated female offspring in worker cells and 2.7 in drones during a single honey bee brood cycle of 21-24 days (Fries et al. 1994; Martin 1998). Mite reproduction along with phoretic mites on foragers entering the hive (DeGrandi-Hoffman et. al. 2016) may lead to rapid *V. destructor* population growth within infested hives (Martin & Kemp 1997; Martin 1998). Interruption of the honey bee brood cycle and associated reduction of brood and colony size may be an adaptive strategy - limiting the reproductive cycle of *V. destructor* and decreasing the speed that mite populations can increase within a colony (Calis et al. 1999). Natural brood interruption occurs through the act of swarming which typically causes a loss of 40–70 % of the adult worker bee population along with many phoretic mites, followed by a broodless period when mite reproduction is restrained (Wilde et al. **2005**). It has been suggested that colonies experiencing an interruption in the brood cycle have an increased capacity to survive Winter, compared to untreated hives that do not experience a similar break in brood rearing (Frey et. al. 2013).
4. **Culling of old comb –** Beeswax contains a large number of components and is primarily composed of esters of fatty acids and various long-chained alcohols which are fat-soluble (Piek 1964; Tulloch 1971). The lipophilic quality of beeswax results in the absorption and accumulation of petroleum-based environmental contaminants such as pesticides (Chauzat & Faucon 2007; Mullin 2010, Calatayud-Vernich, et. al. 2018). Beeswax combs may also accumulate honey bee pathogens over time (Katznelson et. al. 1952; De Guzman, et. al. 2019). Old combs with chemical and pathogen residues have sub-lethal impacts on the health and vitality of honey bee colonies (Yang and Cox-foster 2007; Wu et. al. 2011). It is theorized that honey bees exposed to multiple stressors are less able to handle the additional stress of *Varroa* infestation as compared to colonies with fewer stressors. This suggests that by reducing stress factors such as old pesticide and pathogen contaminated comb from a hive, honey bee colonies are more likely to survive the stress induced by *Varroa* mite infestation (Goulson, et. al. 2015). To reduce exposure to potential contaminants, beekeepers track the age of their frames of comb, and replace the oldest comb with frames of new wax foundation which the bees 'draw out' into fresh comb made of newly produced wax.
5. **Culling of drone brood** – *Varroa* mites demonstrate a reproductive preference for drones, and are able to raise a higher population of young on drone brood larvae compared to worker brood (Fuchs 1990; Boot et. al. 1992; Ghamdi & Hoopingarner 2003). Beekeepers encourage the construction of drone comb within hives by inserting into the brood nest frames of drone foundation, or short frames which encourage the colony to build drone comb in the empty space below the frame. By removing and destroying capped drone comb prior to emergence, significant numbers of reproductive *Varroa* can be removed from the hive (Calderone 2005; Wantuch & Tarpy 2009).

In the Spring of 2016, 45 nucleus colonies were purchased and divided into three groups of 15 colonies each.

1. A cultural treatment group (TF) housed in hives containing a screened bottom board, frames of drawn comb a maximum of five-years old and drawn from small-cell comb foundation, or from one-inch strips of small cell foundation (4.9 mm). These colonies had three frames of bees, brood, honey, pollen and the queen removed each spring and were left to raise an emergency replacement queen forcing a break in the brood cycle. Colonies also received frames of drone foundation, or shallow frames in the deep hive body that

was removed once filled and capped with developing drone brood.

2. A cultural treatment group (TFQ) that was treated the same as the TF group except the queen was left in the hive when frames of bees, brood, honey, and pollen were removed each spring to create nucleus colonies.
3. A treated group (QS) received the same treatment as the control group but were treated annually during the first half of September with a standard full application of Mite Away Quick Strip (MAQS) as directed by the label.
4. A control (C) group outfitted with solid wood bottom boards and frames of beeswax comb that were between five- and 11-years old. The control group did not receive a forced break in the brood cycle, drone brood was not removed, and no acaracides were applied to this group.

Two apiary locations were established .75 miles from each other on the same farm. Group (C) was located in one of the apiaries and the other location contained a total of 30 hives: the 15 TF hives and 15 QS hives. A third apiary composed of the bees, queens, brood and food combs removed from the TF group during year one was established approximately 15 miles from the first two and composed the TFQ Group.

As colonies expanded during the season, all frames added to growing colonies consisted of either sheets of 4.9mm small cell beeswax foundation, comb drawn from small cell (4.9mm) foundation (Dadant & Sons, Hamilton, IL), or natural comb constructed by bees raised on small cell comb and given small cell beeswax or wooden starter strips (Dancing Bee Gardens, Middlebury, VT). Drawn comb used in the C and QS groups was a minimum of six years old while combs used in the TF and TFQ groups was a maximum of five years old.

All other management practices remained consistent across the four groups. *Varroa* mite population levels were monitored in Spring following successful natural requeening of the TF group. Mite populations were monitored again in late August/early September during the 2016-2018 seasons. Counts reflected in graph were taken after the QS group was treated with Mite Away Quick Strips for 14 days. *Varroa* levels in the QS group were also monitored immediately prior to treatment to confirm efficacy of treatment (not shown in graph). Mite monitoring was conducted using the sugar dusting method (Macedo & Ellis 2000, Aliano & Ellis 2005).

Materials and supplies used to monitor mite populations using the sugar shake method

Honey supers harvested from all hives during late Summer were recorded during the study. Colonies were inspected regularly throughout the season for disease, viability of the queen and other health issues, and colony deaths were noted and recorded.

RESULTS

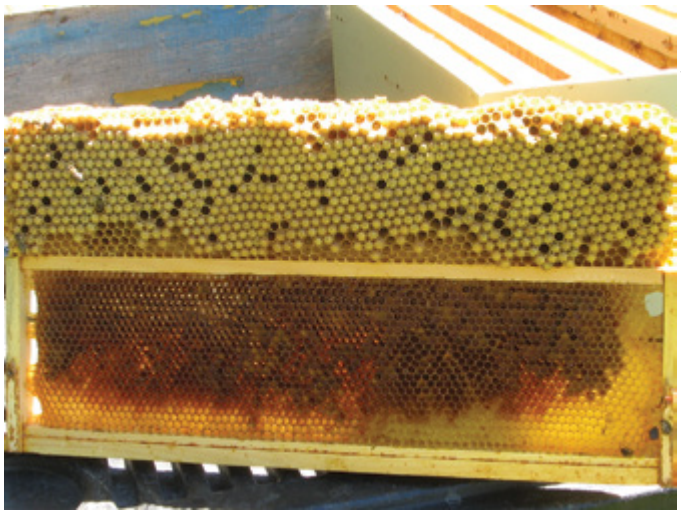
Varroa Loads: In 2016, for both Spring and Autumn sampling events, the Control group had the highest mite loads compared to the other groups ($p < 0.001$). In 2017, there were no differences between groups in the Spring ($p > 0.068$). However, in the Fall of 2017, the Control and TFQ groups had significantly higher mite loads compared to the QS and TF groups ($p < 0.001$). The QS treatment in the fall of 2017 had the lowest mite loads ($p = 0.003$). The Control group died in the Winter of 2017-2018 and was therefore omitted from subsequent data analyses. In the Spring of 2018, once again there was no difference between groups ($p > 0.09$). In the Fall of 2018, TFQ was significantly lower than QS ($p = 0.02$) and TF ($p = 0.02$). With the exception of TF in 2017 ($p = 0.173$), *Varroa* loads increased for all treatments in the Fall for every year of the study ($p < 0.001$).

Honey Production: In 2016, the Control group and QS group had the highest honey production compared to TF and TFQ ($p = 0.0002$). In 2017, QS had the highest honey production ($p < 0.2$) and TF had the lowest ($p < 0.0005$) and there was no difference in honey production between Control group and TFQ ($p = 0.146$). In 2018, QS had the highest honey production compared to TF and TFQ ($p < 0.0001$).

Survivorship: Five colonies in the TF group died in 2016 within the first two months of the trial (four failed to successfully raise a replacement queen following queen removal and one suffered a bad case of chalk brood and went queenless).

DISCUSSION

As expected given our knowledge of *Varroa* mite's reproduction and life-cycle, each year varroa populations increased between Spring and Autumn in all hives and across all treatment groups. The treatment methods (TF, TFQ, and QS) were able to mitigate this increase in colony mite load, although to varying levels. A great example of this was in 2017 when all



Both frames of drone brood foundation and shallow frames were utilized to produce capped drone brood for culling in order to remove Varroa *mites that were in their reproductive cycle."*

groups started the year with similar *Varroa* mite infestation levels.

The results support the hypothesis that when combined, the five cultural and mechanical mite control techniques utilized in this trial are capable of controlling mites and improving colony survival as well as a commercially available acaricide. Such methods when adopted may lead to lower acaracide use, and reduced chemical contamination of beeswax and honey. The trade-off is reduced honey production which was lower for both the TF and TFQ groups compared to the QS and C groups throughout the trial. This observation is likely a result of the slower worker population build up that both the TF and TFQ groups experienced due to mite control efforts that interrupt the brood cycle through splitting colonies. During the 2017 season, the similar honey production observed within the C group compared to the TFQ group was likely a product of the high mite populations experienced by the control colonies. This decrease in honey production combined with the increased labor required to implement cultural controls limit the usefulness of this approach to small-scale and backyard beekeepers.

The fact that the TFQ group experienced reduced survival compared to the TF group suggests that the impact on *Varroa* reproduction from a break in the brood cycle is an important cultural control that should not be underestimated when using treatment-free *Varroa* management, provided colonies are able to successfully raise a new queen. **Compared to the other three groups, the decreased survival of the C group supports the findings of other studies that doing nothing to control *Varroa* mite populations results in poor outcomes** primarily from virus infections. (Chen 2006)

An interesting finding was not just how well the various treatment groups survived, but the apparent causes of colonies death. One third of the colonies in the TF group died within the first two months of the trial and yet after 2½ years, the group's overall survival rate was still comparable to the QS group. While the majority of the Control group colonies died during the winter months presumably from *Varroa* related issues, the majority of the QS colonies all died during the Summer by becoming queenless. While colonies were generally not requeened during the trial, two colonies (one in the QS group and one in the TFQ group) were manually requeened by the beekeeper when the colonies naturally became queenless and a queen from a captured swarm was available at the time.

The apiary containing the QS and the TF group was surrounded by commercially farmed GMO corn that utilized both neonicotinoid treated seed and glyphosate based herbicide during the course of each growing season and potential exposure to these pesticides may have played a role in the queen issues observed *in the colonies located in this yard* (Balbuena 2015, Wu-Smart and Spivak 2016, Chaimanee 2016, Brandt 2017). Pathogen and pesticide residue build up in the old combs used in both the QS and C groups are possible impacted survival. Potential pesticide related health issues were noted in the QS group during the course of the trial and in one case, a seemingly healthy colony collapsed (June-July 2018) and exhibited all the symptoms of Colony Collapse Disorder. (van Englesdorp et. al. 2007) This colony had a mite count of zero per 300 bee sample in June, had been building up well and had two and half supers of honey stored in the hive, but by mid-July it dwindled down to a handful of bees on three frames of brood, and died out before the end of July. BC

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Bee Culture

The Magazine Of American Beekeeping

BEEing Diverse: Inspiring Leaders in Beekeeping

Mark Your Calendars for October 1-3, 2021

The Return Of Bee Culture's Annual Event

We have an impressive lineup of speakers. The meeting will be held in our Bee Culture Conference Room. Watch these pages and our web page for more details as we firm up the details. Register now at www.BeeCulture.com.

Susan Cobey runs Honey Bee Insemination Service and holds a 50% appointment with WA State University. She founded the New World Carniolan Program, now in its 40th generation. Her focus is enhancement of honey bee stocks and improvement of colony health through selective breeding.

Tammy Horn Potter helped her grandfather with his beehives beginning in 1997. In 2006-2010, she worked winter seasons with Big Island Queens in Hawaii. In 2008, she started Coal Country Beeworks, working with surface mine companies to establish pollinator habitat and apiaries in Eastern KY. In 2014, she became the KY State Apiarist, helping create the KY Department of Agriculture Pollinator Protection Plan, the KY Certified Honey Producers program, and the KY Queen Bee Breeders Association.

Geraldine Wright is the Hope Professor of Entomology in the Department of Zoology at the University of Oxford, UK. Her lab specializes in research on the physiology and behavior of bees. She has over 25 years of experience in insect nutrition and has worked with honeybees for the past 20 years. Her research program includes expertise in bee chemical senses (olfaction and gustation), the mechanisms of learning and memory, and bee nutrition.

Kim Skyrm is the current President of the Apiary Inspectors of America (AIA) and the Chief Apiary Inspector for the MA Department of Agricultural Resources (MDAR). Prior to these appointments, Dr. Skyrm received a Ph.D from OR State University focused on the environmental impacts affecting bumble bees native to the Willamette Valley of Western OR, was a Research and Development Scientist for Koppert Biological Systems, Inc. specializing in commercial bumble bee rearing and a Post-Doctoral Researcher at the University of MA-Amherst evaluating bumble bee colonies in the cranberry agroecosystem.

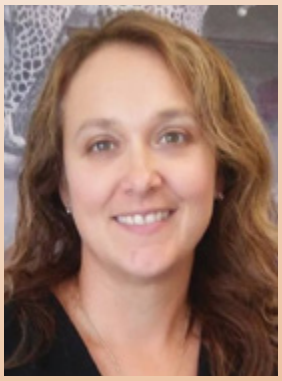
Nina Bagley has been an urban beekeeper for 17 years. Nina worked with a master beekeeper for eight years raising queens. She has several apiaries in the City, and she raises her own Queens. Nina has completed Dr. Joe Latshaw's instrumental insemination class. She completed the Master Beekeeping classes taught by Dr. Jerry Bromenshenk's program through the University of Montana.

Bee Culture would like to thank these very special folks for sponsoring our event –

Barbara Bloetscher has been the State Entomologist/Apiarist at the Ohio Department of Agriculture since 2009, after 23 years at The Ohio State University Extension. As State Apiarist, she oversees the Apiary Program and identifies insects and other arthropods submitted from Ohio Nursery inspectors and businesses. Barb monitors the County Apiary Inspection Program and addresses honey bee issues in the state.

Joan Gunter currently serves as President of the American Beekeeping Federation (ABF) as well as Trustee for the Foundation for the Preservation of Honey Bees. She is also active with the National Honey Board, the Honey Bee Health Coalition and the state beekeeping organizations of ND, MS and TX.

The Bee Informed Partnership (BIP) is a small non-profit organization with a broad reach. Our mission is to improve honey bee colony health across the U.S. We do so by working closely with beekeepers, researchers and different sectors of the industry. We assess colony health and report back to beekeepers so they can make data-driven management decisions in real-time. Seven women support multiple BIP programs including the Annual National Colony Loss and Management Survey, the Sentinel Apiary Program for backyard beekeepers, the Tech Transfer Team program in five regions across the country working with commercial beekeepers and a variety of other projects ranging from IT products to specific product and/or management custom trials.



Tracy Farone is a Professor of Biology at Grove City College in PA. She has worked in various areas of private practice, academia, and research for over 21 years. Since 2016, Dr. Farone has been researching beekeeping and bee medicine. In 2018, she was granted a sabbatical to allow additional time to pursue apicultural studies and develop a teaching and research apiary at her college. In 2019, she worked in the field with dozens of backyard, sideline, and commercial beekeepers. She visited France, where she worked with multiple experts in bee medicine and research at ONIRIS College in Nantes and the OIE in Paris. Additionally, she visited The University of Edinburgh and the Roslin Institute in Scotland, meeting with additional bee experts.

Maggie Lamothe Boudreau is the sole owner of "Rayons de Miel" a 350 hive farm that produces 4000 queens/year. She recently enrolled for a Master's Degree in beekeeping at Laval University in order to keep improving her knowledge of beekeeping sciences with the goal of improving research throughout Canada and more particularly Quebec. All this for the purpose of helping the beekeeping industry in its quest for self-sufficiency in bees and especially in quality queens. Canadian commercial queen breeders are currently unable to supply queens before the beginning of June. Without access to queens early in the season, the opportunities for beekeepers to save their hives or create nucs very early in the season is greatly reduced, if not impossible.

Jackie Park-Burris was born into the Park beekeeping family of Northern CA. She managed the queen rearing portion of her parents' bee business and after the unexpected passing of her beloved father, she purchased the business from her Mother. In 1994 Jackie Park-Burris Queens, Inc. was started. She has concentrated on breeding a healthier, hygienic, honey producing queen, even incorporating genetics from Italy to improve the diversity of Jackie's line of popular Park Italian Queens. Jackie has also continued the family tradition of being active in the bee industry. She has served as President of the CA State Beekeepers Association, the first woman President of the CA Bee Breeders Association and the first woman Chairman of the CA State Apiary Board. She has served on the CA State Beekeepers Association's board of directors for over 25 years.

Julianne Grose is an Associate Professor in the Department of Microbiology and Molecular Biology at Brigham Young University. Her university position consists of 45% effort for teaching, 45% effort for mentoring/research and 10% effort for citizenship. She teaches approximately 12 credit hours of undergraduate courses per year (approximately six courses) and currently mentors three graduate students and 15 undergraduates in her research lab. Her teaching is dedicated to bringing novel research experiences into the classroom through an international program, Phage Hunters (HHMI SEA- PHAGES program). Research in her laboratory is dedicated to two main projects: 1) the study of metabolism and its relation to disease, and 2) the study of microbiomes and their contribution to the health of organisms.

Minding Your Bees And Cues

Powering Your Bee With Flowers

Becky **Masterman &** Bridget **Mendel**

What bees really need are more flowers. Seems easy enough, but like achieving world peace, planting flowers turns out to be complicated, contentious, and very hard to do right on the scale that our bees need.

First, we need to plant the right flowers. But folks disagree on which flowers are the right ones (some people even going so far as to assign moral value – like "good" and "bad" to choice species) to attract the right bees (like it or not, the Battle of the Bees is on, and you can probably guess if honey bees are Davids or Goliaths). And once you figure out what flowers to plant, where to plant them? And are they clean and free of pesticides and other contaminants? Do you have the right cultivars? A long-term maintenance plan? How are you funding your flowers? What programs are there that make it easy for landowners or farmers to initiate or improve pollinator habitat? Let's just admit it, planting flowers is really complicated.

But if anyone can make headway toward flowers for all bees, we think it's beekeepers.

Innovative floral seed mix installations like those installed by the Bee and Butterfly Habitat Fund provide season long nectar and pollen for pollinators. Photo credit: Mark Sundberg

We are members of the Minnesota Honey Producers Association (MHPA) with Becky serving as a board member and Bridget as secretary. The MHPA board voted last December 2020 to initiate a Habitat Committee to help its members navigate the broad topic of food (and land!) for their bees. At our 2021 Summer convention, the topic of habitat was woven throughout the three-day program. From identifying areas of concern and habitat successes to discussing native bee health in relation to honey bees, the membership invested time throughout their July weekend to do a deep dive into fields of flowers. We want to report back on this process to you in hopes that you will join us in making habitat a priority for your beekeeping and within your organizations.

Awareness

The first evening of the Minnesota Honey Producers Association meeting is traditionally a chance for members to share how their bees are doing and how much honey they are producing (the evening is affectionately known as the Liars and Braggers' club). This year, we added a slight twist by asking members to connect bee health and honey production to habitat. The VP of the MHPA shared his observation that where he had added significant flowering habitat--he installed 18 acres in collaboration with the Bee and Butterfly Habitat Fund (**https://www.beeandbutterflyfund.org/**)--both honey production and colony survivorship increased. Half of the site was planted in a butterfly seed mix and the other half was put into a honey bee seed mix. This is a great example of a beekeeper who supports his honey bees with forage, while also supporting native bees and butterflies. More food for more bees = more more food for bees (and for us). It's good math.

We discussed the Battle of the Bees – a conflict in which many beekeepers do not even know they are soldiers. If asked, most beekeepers would probably guess they are on the opposite team as the one to which the public has assigned them. While you, dear beekeeper, who shivers with joy at the sight of dozens of absolutely fuzzy bumble bees enjoying the *Monarda* you planted, may love all bees, others don't enjoy seeing fuzzy honey bees on clover. Some see beekeepers as the mis-managers of invasive species, bent on a one-bee world. Many native bee scientists and enthusiasts (some of whom are beekeepers) are rightly concerned about honey bees outcompeting native bees for food and about the potential for pathogens to move between different bee species. We need to counter the us vs them narrative by making sure there are diverse flowers, flowers, and more flowers for both our honey bees and our many other native pollinators.

And it's important for all beekeepers to understand that not all people are honey bee aficionados and to react to concerns about honey bees with a nuanced and thoughtful approach. There are over 4000 native species of bees residing in North America, and monitoring them has become a national concern (Woodard et al. 2020). This concern can translate directly to a problem in sourcing where to set down your colonies. At our honey producers' meeting, beekeepers described losing bee yards they'd used for decades because of the landowner's or federal agency's concern over honey bee-native bee competition.

Details

The last hour of the convention was led by University of Minnesota's Dr. Marla Spivak. Marla has been a leader in promoting the idea of planting more flowers to support bee health as well as calling attention to issues that could stem from bee competition or pathogen spillover. We spent time identifying state agencies and their efforts to support pollinators. Some state agencies in Minnesota have policies that lean

heavily towards supporting native bees, and others are supportive of all bees. Understanding your state agency policies is an opportunity to find partners that will help you increase flowering habitat but will also help you understand the current trends in public concerns over pollinators.

Most importantly, identifying some of the highest return investments for our planting efforts was discussed. Take cover crops, for example. Marla says that they are back in style. Cover crops are hip and they are multi-taskers, particularly if they are flowering covers, like canola, clover and alfalfa. While casually feeding the bees, they also add nitrogen to the soil, prevent soil erosion, sequester carbon, and filter pesticides to protect water.

Spivak reported on an innovative University of Minnesota program called Forever Green that is trying to change agricultural practices to benefit both the farmer and the environment. One project includes pennycress, camelina and canola as winter cover crops that can be harvested for oil. All three can provide an early season nectar flow for bees and other beneficial insects. Part of the challenge is that supply chains for these oilseed crops need to be established, but this work is getting done and beekeepers and their bees might be benefiting from this project soon.

Next Steps

Spivak cautioned that we should not get negative about the threats of native bee competition issues, but instead focus on planting more habitat. Whether you decide to focus on roadsides, cover crops or some other approach to increase the quality and quantity of your bee forage, having a plan is essential. Diverse bee food plantings will diversify our agricultural, suburban, and urban landscapes, which is a win-win. Asking honey bees what flowers they prefer, one study interpreted their waggle dances and found that foragers often flew over diverse native prairie flowers in search of larger floral patches (Carr-Markell 2020). This could be good for the problem of spreading viruses between species: by planting native flowers for native bees, and other areas that specifically benefit honey bees, we may be able to limit some inter-species competition and virus spread . . .

As noted by Marla Spivak, honey bees like to shop for flowers in bulk at wholesale clubs. Large patches of honey bee favorites make it likely that the foragers will return to the hive and recruit their sisters with an enthusiastic waggle dance. Photo credit: Mark Sundberg

If beekeeping organizations across the country make habitat improvement a priority personally, publicly, and politically, the bees will benefit from this collective effort. We beekeepers love the solitary nature of beekeeping, but for this habitat challenge, we've gotta go full on superorganism: divvy up tasks, and work together to address the flower shortage with determination and creativity. We will literally increase our honey crops in the end. BC

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Cover Crops

(**https://www.forevergreen.umn.edu/**)

https://www.thelandonline.com/news/cover-crops-can-benefit-bees-farmers-bottom-line/article_be4cf79c-eacb-11e4-a0b0-83be98aa4c1b.html

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Authors

Becky Masterman led the UMN Bee Squad from 2013-2019 and currently alternates between acting as an advisor and worker bee for the program. Bridget Mendel joined the Bee Squad in 2013 and has led the program since 2020. Photo of Bridget (left) and Becky (right) pretending to bee habitat.

BEE VET

Fall Planning

Dr. Tracy **Farone**

"Fall Planning"

Tomorrow the calendar will say "July" and many beekeepers are focusing on Spring extraction. It is easy to get caught up in the moment and there is a certain peace of mind that comes from "living in the now". But by the time you are all reading this, Fall will be upon us. **Of all the seasons in beekeeping, I believe Autumn may be the most underrated in its importance in honey bee health**. Much to do is made about "Winter losses" and more currently, "Summer losses", but what about Fall? We hear less about what goes on in a hive during the changing colors of Autumn. Kudos to the beekeepers who have coined the phrase, "Take your losses in the Fall." Seasoned beekeepers, farmers, and other agricultural animal caregivers understand the importance of always thinking several seasons ahead of where they are – to ask where are we going? What are the goals? *Now* is a fleeting moment, but many of the decisions we make now can have lasting effects in the next season/s.

What road are you following this Fall?

Fall flowers equals Fall planning.

Why is Fall so important? Because that is when the major health indicators and challenges to a hive (*Varroa*, nutrition, queen status) are peaking while the colony is entering the Winter season. For many geographical areas in the U.S., Winter is the longest and most harsh environmental stressor to our bees. Fall is also the last opportunity you get to have a meaningful and thorough good keeper interaction with your hive/s for months, (as we tend to not open our hive up for much inspection in the Winter). If you can execute a successful Fall health plan for your bees, you will not only provide them a chance to get through the Winter, but you will also set up your beeyards for success the following Spring. The following outlines key components to include in your honey bee fall health plan. A good time to incorporate the components of the plan is at Fall extraction (if that applies to your situation).

Honey Bee Fall Health Plan

1. *Varroa* treatment and testing.

Take a mite count in October. You must – this is something you need to see. Please do not just take a count in May and think you have checked the box for the year. Fall counts will likely be high. Like 30 in an alcohol wash. Do not panic. This is what varroa mites do. They reproduce . . . *exponentially* . . . and their population peaks quickly in the Fall. Now you have knowledge, and you must treat (even if you treated before).

After any honey supers are removed, oxalic acid is a good go-to for Fall. Dribble or vaporization may be used. Vaporization allows for treatment without opening the hive. Most beekeepers will utilize three sometimes four, once a week treatments in November and even early December (pending the weather) to take advantage of the natural seasonal brood break and cover any late brood emergences. Remember the queen slows and stops laying in late Fall through late Winter. Also, any remaining worker brood (with a 21-day development cycle) will be "hatched" within the three-week treatment period. Oxalic acid is not effective under wax cappings. Be consistent will your treatment in every hive in your operation and your colonies will be off to a good start for the next Spring.

2. Know the Queen status. Take your losses now – combine.

During Fall extraction confirm the hive's queen status and the general health of the hive. If the hive is weak and/or not queen right, it is likely best to cut your losses now. Depending on the situation, you may be able to harvest the honey and combine workers with other hives. Finding a replacement queen at this time of year will be difficult and probably costly, and there is no guarantee a new queen will be

able to "fix" whatever the problem is, especially on a short time table. Obviously if you only have one hive, this can be a problem. Making those Spring splits could now come in handy. Again, planning often starts seasons ahead.

Remember honey bee populations within a hive normally fluctuate over the year, peaking in the Summer and diminishing in the Winter. Hives can follow the same pattern. Strong colonies have a much better chance to making it to Spring and by April you will be able to make multiple splits from one overwintered hive.

3. Provide proper nutrition – leave some honey.

Depending on where you live in the U.S., honey bee colonies need 40-80lbs of honey to have enough energy and nutrition to get through the Winter. Assure that you are giving it to them. Honey is their perfect food. This means leaving one or two supers on a hive for Winter. I understand many honey operations cannot afford to do this, but if losses are primarily attributed to "starvation," perhaps some economical math should be done to evaluate the situation further. Are the hive losses, supplemental feed, and additional labor worth it? I cannot imagine a cattle farmer providing half the hay needed for Winter to their herd and then coming to terms with a 40% loss over the Winter.

Certainly, you can check on your bees in late Winter/early Spring, as possible, to see where they are and perhaps provide sugar or pollen supplements, but setting them up well in the Fall will go a long way.

Check the hive's nutritional status.

4. Good shelter.

Fall is a great time to inspect hive boxes to be sure they will make it through the Winter. They should be sturdy and free of cracks or leaks that could let rain or snow melt into the hive. Maybe they just need a quick paint job. If you find any defective boxes, Fall is a last opportunity to switch them out so you can have cozy bees before the weather turns cold. Consider adding insulation to the top covers at this time. Constructing a wind block to be in place before winter winds set in should also be in your on-going plans.

5. Last/less inspections.

Your last hive inspection should be done in the Fall, again at Fall extraction is a good time. If your colony is queen – right and looking strong, say a prayer, get out, and stay out until Spring. Now is not the time to smash the queen. If she is present in October and you take care of the previously mentioned items above, she will almost always reign through the Winter. Your biggest problem will be catching her swarm in the Spring.

6. Other pest/disease control.

While not practical for large beekeepers, I would recommend that smaller scale backyard beekeepers invest in a chest freezer (or plug the one in that has been sitting in the basement), to store extra frames over the Winter. Freezing frames kills and prevents a wide variety of pathogens including hive beetles and wax moths. If you do not use mouse guards all year long, Fall is the best time to install them.

So this Fall while enjoying some Autumn honey, incorporate a Fall health plan for your colonies, and set your bees up for success next Spring. BC

Apiary Inspection Arkansas

Zac **Wellman**

The Arkansas Department of Agriculture's Apiary Program's mission is "To protect honey bees in order to maintain a viable honey bee population for the purpose of pollination in Arkansas."

This mission is accomplished by (1) administering laws and regulations to minimize and slow the spread and negative effects of honey bee diseases, harmful pests, and unwanted species, and (2) educating beekeepers in modern apicultural techniques, as well as informing the citizens of Arkansas of the importance of honey bees.

The program consists of two regional apiary inspectors and a Program Manager. Anyone selling, moving, or transferring the ownership of bees must be inspected and issued a health certificate. Arkansas has mandatory registration. There are currently 3,410 active beekeepers with 5,851 active yards and approximately 48,590 colonies in Arkansas.

The majority of beekeepers are found in Central and Northwest Arkansas and are primarily small-scale and sideliners. There are about eight or nine commercial beekeepers that leave the state each year to fulfill pollination contracts in other states. Along with providing regulatory services, the Apiary Program also provides educational outreach opportunities for beekeepers and the citizens of Arkansas. Festivals, schools, and bee clubs are just some of the functions where you can catch our inspectors giving a talk or demonstration.

Most years there is a great Spring honey flow and in the Summer months, mainly July and August, when pollen is scarce, cultivated soybeans and cotton can provide much needed nutrition. In Arkansas, honey is considered a farm product, and is exempt from sales tax when sold direct-from-farm (this may include an urban beekeeper's home). A farmer's market or roadside stand is also considered an extension of direct-from-farm sales. This pertains to wax and other bee produced products well. BC

BIGGER PICTURE

Jessica **Louque**

Beekeepers And Hoarding

For those of you who listened to our podcast with Kim Flottum and Jeff Ott, we got quite a bit of correspondence about the surplus of bee equipment we have stored. We have three barns of leftover bee supplies from years past. We had people from all over the place offer to come help us lighten the load. Normally, we are pretty content in our hoarding because you never know when you'll need equipment. Once, we had to pull 200 top feeders out of storage and bleach them down and use them when an order didn't arrive on time and we had packages come in. Sometimes though, things change . . . or we just need the space.

My son Henry wanted to learn how to drive a stick shift so he bought an older Miata and parked it in our ag barn, but it was really tight so he ended up moving it to my mom's barn. It's close quarters even there because we have so much stuff. Then, I found Lucy, who is now my 1967 F100 with a replacement 351W engine and is mint and cream. She cannot fit in any barn and has to park under a carport. It's time to clean out the barns.

Our Farmfest was forever changed with the pandemic, but I think for the better in the long term. The sunflower trail actually worked out well for us and made things a lot easier. This year, we planted even more sunflowers – I hope. Henry was in charge of the seed throwing while his girlfriend Angel drove because he thought she was throwing too much. I'm not happy with what came up so I'm throwing more out. Either way, we have more land that could have sunflowers instead of leaving it in hay. Since we will have more people out and about, it seems like a good time to try to sell equipment and make some space. We have some boxes with frames in them that have never been used, just stacked and painted. Lids, feeders, bottom boards – you name it. Some of it is stacked way over my head on pallets. Some was used just to install failing packages and was in the field for maybe a month. Either way, it's more than we will ever use.

For the sunflower trail, we set up at our old stable that my mom renovated and sold flower bouquets and honey, with trips to the sunflowers to take your own pics with the request of a donation to the fire department. This year, I think the sunflowers will be easier for people because they were a little difficult for some of the older visitors to see due to driving through the field and this year, they are closer to the highway. We would also be able to put all the bee equipment out like we did with the pumpkins last year and have it out to go through. Most likely, everything will have a set price and be organized by type of equipment.

My Lucy (the F100) is in really good shape but there are a lot of things that I want to change, because I am female and I like shiny things. It just goes that way sometimes. I got her because she was revamped enough to be safe to drive, but old enough that I don't need a computer engineering degree to work on her and there were plenty of parts to play with. I want to open the hood and have astronauts have to shade their eyes from the shine. It's going to take a lot of space to do this kind of work. Hopefully I can at least replace the alternator and radiator before Farmfest and have her parked in the sunflowers for pictures. Maybe even set up an empty hive or two in the field for a backdrop.

Lucy.

If anybody is in the area, Farmfest will be September 18, 2021. Our Communities of Northwest Stokes will have information if you search it. My plan is to clear out most of our barns of equipment and organize the ag barn so there is more usable space and it can be more useful to our needs. We have several hundred painted lids, bottom boards, robbing screens, queen excluders, feeders, and deep boxes with and without frames, plus some pollen traps that have either never been used at all or were only used for failed packages. I have a friend named Beamon who has bought some of our equipment and he filled an entire trailer and it honestly didn't leave a dent. I'm thinking we will probably charge a flat rate of $10 (maybe $30 for pollen traps) for every piece of equipment and the frames are just in it because I'm not guaranteeing condition. It will all be dirty because it's been sitting around. We may find more stuff to bring out depending on how much has been forgotten totally.

In addition to this, I will probably be selling some of my plant collection. It's a lot of plants and I really like to grow smaller plants large and then propagate or split the larger plants. I plan to sell a lot of my bigger plants, like my massive banana tree

Beamon with a full trailer.

that has vanilla bean bananas, or whatever is just not my absolute favorite so I don't have to figure out how to overwinter them. I may even do some splits on my ultra-rare plants, although most of those are alocasias or cacti and succulents. I may have some philodendron pink princess cuttings, and some alocasia bagindas. It depends on what it looks like when Farmfest rolls around, but I'll have at least thirty to fifty plants for sale.

Since I have so many plants on my plantstagram (Instagram account for my plants) I've been able to work a deal with HardyGro fertilizer, which is an organic fertilizer for plants. I'll do a write-up on them later when it's only about their stuff, but they've given me a 10% off code if you want to order fertilizer off their website, which is HONEYBEE10. I'm going to see if they will let me set up some of their smaller bottles to sell with the plants at Farmfest for a nice display with the plants. If you want to see what plants I might have for sale, or request something, you can find my plantstagram at PlantsThatLiveHere on Instagram. Surprisingly enough, it's literally only plant posts or plant oriented. People who follow plant accounts do not appreciate honey bee posts. I was pretty surprised but I keep that to my personal page now.

The current plan is to set up at our stable like last year for parking and purchases. People can drive around to go to the sunflowers, and make a donation to the fire department in payment for visiting sunflowers and taking their own pictures in them. Hopefully I can park Lucy somewhere that people can take pics with her but where I can keep an eye on her (some people suck, which is unfortunate). We'll try to have photo ops set up for people. Then, we'll have the bee equipment organized by type so it's easier to go through, with price listed on a poster at the front. Plants will be on a table or hangers, along with sunflower bouquets and vases. I think we'll be able to sell pumpkins again this year too if we can keep the weather accommodating.

I'll ask *Bee Culture's* social media people to post the Farmfest map once it's official so anybody that's interested might be able to come out and look around. It won't be just us on the sunflower trail, and there might be something else people are interested in. The apple farm that I wrote about last year with Brittney Kordick is on the list, and there's always good food at the stops. We should also have a tractor show for people to enjoy, and there's still time for more vendors to add themselves to the map. The origination point will be the Francisco Volunteer Fire Department at the community building. This is where you can pick up maps and buy food. Everyone is still working out the details, but if you find the Our Communities of Northwest Stokes on Facebook, they will most likely post updates. Our bee equipment will be on a first-come, first-served basis so once we sell out, it's done. We won't have a limit on how much you buy, so if you come in and take it all, by all means it's yours! There won't be a discount for mass purchasing though since it's already pretty cheap and barely used. I guess some people might see the rainbow paint as a downside, but painted always holds up better than unpainted no matter the color choice.

I'm hoping to put some of this money towards working on Lucy and getting her "restored" to full shine. Anything I can get in polished chrome or aluminum is going under that hood. I want to replace the suspension in the back and I need to repair some spots in the floor from rust. Whitewalls would have been good if Lucy was teal and white, but the color is an off-white cream, so I think I'll go solid black instead. Tires and steel wheel baby moons are going to be easily $1,500, plus another $1,000 easily to replace the exhaust and intake manifolds. The suspension alone will probably be around $3,000 to replace. I need to sell a lot of bee equipment I think! BC

Jessica and her husband, Bobby stay busy with bees and beekeeping, kids, trucks, animals and more at their home in North Carolina.

Teaching Old Colonial Williamsburg's Wild Honey Bees New Tricks

Joel **Voron**

Wild honey bees are usually not a problem here at Colonial Williamsburg. However, one voicemail was about to change that. In June of 2021, I received a voicemail over the weekend saying there was a trail of honey bees hovering at eye level on a busy sidewalk next to a tree. Traditionally, if a swarm happens to land somewhere near a popular tourist location, we cordon it off and the swarm graciously moves along when the "scouts" find a new home. That Monday, I found the closed sidewalk. The hive entrance was seven feet high in a knothole of one of our mature, stately trees. There were indeed a lot of honey bees coming and going and at a level too low for comfort. With the location at the center of town, I knew this was going to be a complex case. I spent the better part of the week calling local beekeepers and meeting with a few to learn that we had a massive hive that had quietly been growing for quite some time.

The recommended solutions from local beekeepers were not ideal for our circumstances. A "trap out" would take weeks. Cutting the tree down to facilitate relocation of the hive seemed too drastic. I wanted a better solution. I wanted something that would be ecologically responsible for the tree AND the honey bees. This issue had been buzzing around my mind for seven days now. Usually, my resolution time with stinging insects is swift, and the whole village has seen this cordon up for a week. The pressure was on to get this resolved quickly as a sidewalk renovation was heading down the street. Also masses of guests would soon fill the area for our annual Fourth of July celebration. I begin thinking the real safety issue is that the entrance hole of the hive is too low and of course pointing in the wrong direction. What if I can manipulate height and direction, has anyone ever attempted such a thing?

Now into the second week of ugly, red, "do not enter" tape strewn around mother nature's "crime scene" is getting a lot of attention. The vibrations from the sidewalk renovation equipment approaches and the bees do not seem to mind so much. I rule out Africanized Bees; that is one positive glimmer of hope. I come up with the idea of building the bees an escalator of sorts. The material I envision is a PVC pipe chase to raise the elevation of their entrance, with an elbow at the top to point them away from the sidewalk and protect them from rain. I must get this right. Back to calling local beekeepers and asking them if they think the idea would work or endanger the honey bees. I get positive feedback that they think it will!

I begin collecting materials needed: pipe and fittings, some type of flange, screws, and washers. I ordered a hive smoker and researched how and why they work. I decide I will dry fit the PVC as I did not want any PVC cement to off-gas and hurt the bees or disrupt their pheromone communications. It took me a few mornings of being on the scaffolding to fine tune the seal around the flange with low odor caulk. Some of the bees kept going to the

Unsightly cordon and sidewalk renovation heading my way.

First time chase was attached.

Day two. Single file please.

Day three. Getting the program.

Day five. Traffice jamb is over.

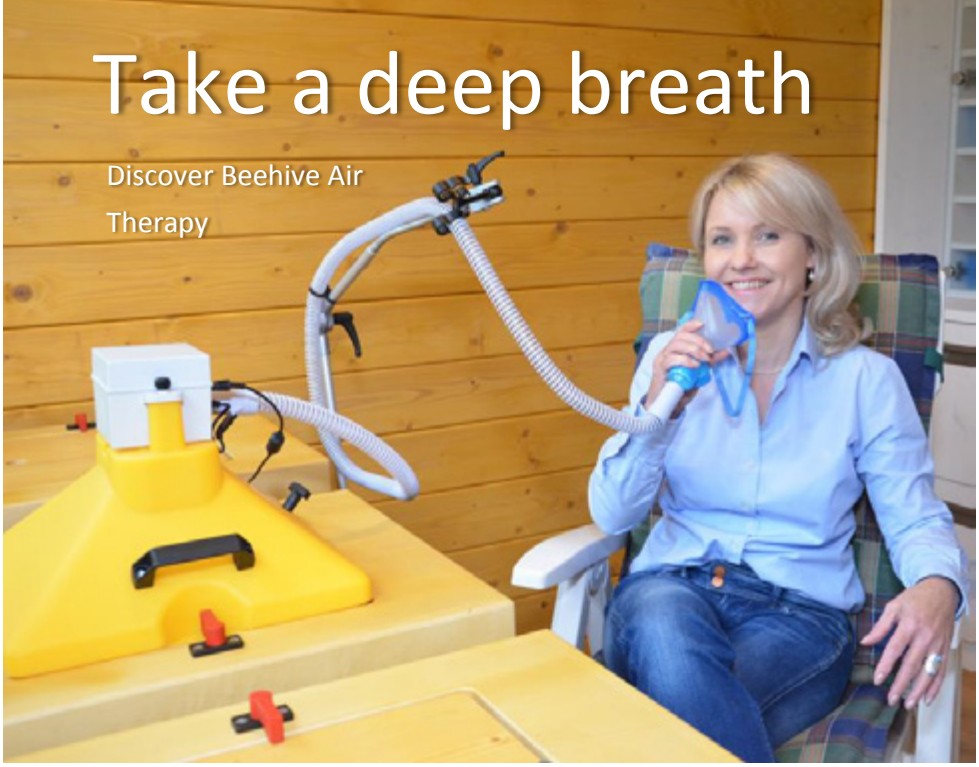
Day six. 3D bark.

Finished tree escalator.

old entrance, probably because of pheromones on the tree. After a good rain, more were using the new entrance. After four days the new entrance was a success. I used 3-D rubberized bark to hide the new "bee escalator" and it blended in with the tree beautifully. If you didn't know it was there, you would never even see it. I look back on this case and realize that as IPM Specialist, we really do go to great lengths to protect our pollinators. BC

Take a deep breath

Discover Beehive Air Therapy



Beehive Air Therapy is recommended for respiratory diseases or allergies, like hay fever. Photos: Christina Meier, Dirk Jäger

APITHERAPY

Compared to other beehive products that are used for therapeutic use, beehive air therapy is one area within Apitherapy that has gradually prevailed as a form of therapy over recent years. The good air from within the beehive is growing in popularity. The list of health conditions, where beehive air therapy can be used is getting longer and longer: Asthma, hay fever, bronchitis, chronic obstructive pulmonary disease (COPD) - to name a few. However, the effect and effectiveness of beehive air therapy have been researched only a little so far. But it is changing gradually. Medical professionals as well as more and more science teams are increasingly interested in this form of therapy.

Start in May

In Spring, when the bees gain their strength and fly again to collect nectar, bee pollen, bee propolis, then the Beehive Air therapy season also begins for Dr. med. Antje Jäger-Hundt in Kreischa, Saxony (Germany). The paediatrician operates an Apitherapy Centre for beehive air. Her husband is a "Bio" beekeeper and he takes care of the beehives. During bee season from May to September patients come to the Apitherapy Centre in Kreischa to improve their health conditions. They inhale beehive air straight from the beehive during their therapy sessions. A therapy session is 30 minutes long. The frequency of the therapy sessions depends on the patient's health issue. With hay fever for example, patients often feel an improvement of their symptoms after just six treatment sessions per bee season. With chronical conditions like Asthma and COPD you will need significantly more therapy session.

No More Running Noses

The subjective descriptions of those treated are mostly positive. "With consistent beehive air therapy sessions lots of patients can reduce their medication over time or even stop them altogether! Of course, in consultation with their medical professional or GP." explains Dr. med. Antje Jäger-Hundt. "It is particularly noticeable in hay fever patients. I hear from patients regularly that the irritating symptoms like itchy eyes or running noses noticeably decrease after the first treatment session. " Last autumn she even had a patient who came to her with subsequent symptoms of a COVID 19 infection. "The patient was already over 70 years old and suffered as a result of the infection from severe symptoms of exhaustion. Many of her everyday activities were exhausting her enormously. After just a few treatment sessions, her discomfort was reduced noticeable and sustainable", reports Dr. Jäger-Hundt.

Dr. med Antje Jäger-Hundt runs a Apitherapy Centre in Kreischa, Saxony (Germany)

Not Enough Scientific Research

As impressive as the success stories are, Dr Jäger-Hundt knows how to realistically classify this form of therapy: "So far, we still have only patients' feedback, which are, purely subjective sensations of the treated patients. There are only very few secured scientific studies. On the other hand, I can clearly see how the beehive air helps my patients. As a general practitioner I would like to know, why and how it works."

It is therefore fundamentally important for Dr Jäger-Hundt that beehive air therapy is done to the highest standard: Each patient gets a thorough check-up before the first treatment session takes place, the Dr tests for any allergic reactions to the beehive air. The Equipment for beehive air therapy corresponds to technical standards for medical devices. Dr Jäger-Hundt is in direct contact with the world's only manufacturer of such devices in order to continuously improve beehive air therapy. Together they maintain contacts with the Technical University of Dresden and the outpatient clinic for naturopathy of the Charité in Berlin. The TU Dresden did a study in the past on the exact Composition of beehive air. A follow-up study will now help to find out what influence the location of the bees, that respective flora and fauna as well as the time of day has on the composition of beehive air. This could shed some light on which ingredients play a role in the treatment of certain diseases, and create a foundation for further research and clinical studies. Until that happens, For Dr Jäger-Hundt from Saxony continue to rely one thing above all: the wellbeing of her patients.

Author: Philipp Senge

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How Does Canada Grade Honey?

Although the ***Safe Food for Canadians Regulations*** (SFCR) came into force on January 15, 2019, certain requirements may apply in 2020 and 2021 based on food commodity, type of activity and business size. For more information, refer to the **SFCR timelines**.

This document is incorporated by reference into the ***Safe Food for Canadians Regulations*** (SFCR). Any changes to this document must be made in accordance with the **CFIA Incorporation by Reference Policy**.

Interpretation

1. The following definition applies in this volume.

"color class" in respect of honey, means its hue or shade of color as set out in Table 1 Color Classes for Consumer Prepackaged Honey and Table 2 Colour Classes for Prepackaged Honey Other than Consumer Prepackaged Honey as determined by the use of a honey classifier or by the use of the Pfund honey grader. (classe de couleur)

Grades and Grade Names

2. (1) There are three grades of honey produced in Canada with the grade names Canada No. 1, Canada No. 2 and Canada No. 3 (see **Volume 9, Import Grade Requirements** for grade names used for imported honey).

(2) There are three grades of honey that is a blend of imported honey and Canadian honey with the grade names No. 1, No. 2, and No. 3.

Canada No. 1

3. Honey graded Canada No. 1 must

a) be the food derived from the nectar of blossoms or from secretions of or on the living parts of plants by the work of honey bees;

b) have a consistency that is fluid, viscous or partly or wholly crystallized;

c) meet the composition requirements set out in section 10;

d) have a diastase activity, determined after processing and blending, as represented by a diastase figure on the Gothe scale of:

(i) not less than eight if the hydroxymethylfurfural content is not more than 40 mg/kg; or

(ii) not less than three if the hydroxymethylfurfural content is not more than 15 mg/kg;

e) have no deterioration seriously affecting its edibility, appearance or shipping quality;

f) contain not more than 17.8% moisture or, if its container bears the word "pasteurized" or "pasteurisé", not more than 18.6% moisture;

g) be free from any foreign material that would be retained on a screen having a sieve opening of 0.1778 mm and made of wire having a diameter of 0.09 mm;

h) contain not more than 0.1% water insoluble solids or, if its container bears the word "pressed" or "de presse," not more than 0.5% water insoluble solids;

i) have a flavor characteristic of its color class and be free from any objectionable flavor, aroma or taint;

j) if its container bears the word "liquid" or "liquide", be clear, bright, uniform in color and free from visible crystals; and

k) if its container bears the word "creamed", "en crème" or another word indicating that the contents are granulated, have a smooth fine texture and complete and uniform granulation.

No. 1

4. Honey that is a blend, referred to in subsection 2(2), graded No. 1 must meet the requirements set out in paragraphs 3(a) to (k).

Canada No. 2

5. Honey graded Canada No. 2 must

a) meet paragraphs 3(a) to (e) and 3(h);

b) contain not more than 18.6% moisture or, if its container bears the word "pasteurized" or "pasteurisé", not more than 20% moisture;

c) be free from any foreign material that would be retained on a screen having a sieve opening of 0.2489 mm and made of wire having a diameter of 0.125 mm;

d) have a flavor that may be slightly off but with its honey flavor being not substantially impaired;

e) if its container bears the word "liquid" or "liquide", have a color that may be dull and cloudy or turbid or slightly uneven and show not more than slight signs of crystallization in the form of a light suspension or minor sedimentation of crystals; and

f) if its container bears the word "creamed", "en crème" or another word indicating that the contents are granulated, have a texture that may be medium coarse or gritty, but not extremely coarse or gritty, and have a complete and fairly uniform granulation.

No. 2

6. Honey that is a blend, referred to in subsection 2(2), graded No. 2 must meet the requirements set out in paragraphs 5(a) to (f).

Canada No. 3

7. Honey graded Canada No. 3 must

a) meet paragraphs 3(a) to (e), 3(h) and 5(d); and

b) contain not more than 20% moisture.

No. 3

8. Honey that is a blend, referred to in subsection 2(2), graded No. 3 must meet the requirements set out in paragraphs 7(a) and (b).

Color Classes

9. (1) There are four color classes of consumer prepackaged honey: "White", "Golden", "Amber", and "Dark".

(2) There are six color classes of prepackaged honey other than consumer prepackaged honey: "Extra White", "White", "Golden", "Light Amber", "Dark Amber", and "Dark".

(3) The color class, referred to in subsections (1) and (2), set out in **Table 1 Color Classes for Consumer Prepackaged Honey** or **Table 2 Color Classes for Prepackaged Honey Other than Consumer Prepackaged Honey** must have a designation on a Honey Classifier set out in the table or a reading on a Pfund Honey Grader set out in the table, as applicable.

Table 1: Color Classes for Consumer Prepackaged Honey

		Designation on Honey Classifier		Reading on Pfund Honey Grader	
Item	**Color Class**	**Darker Than**	**Not Darker Than**	**More Than**	**Not More Than**
1.	"White"		White		30 mm
2.	"Golden"	White	Golden	30 mm	50 mm
3.	"Amber"	Golden	Amber	50 mm	85 mm
4.	"Dark"	Amber		85 mm	

Table 2: Color Classes for Prepackaged Honey Other than Consumer Prepackaged Honey

		Designation on Honey Classifier		Reading on Pfund Honey Grader	
Item	**Color Class**	**Darker Than**	**Not Darker Than**	**More Than**	**Not More Than**
1.	"Extra White"		Extra White		13 mm
2.	"White"	Extra White	White	13 mm	30 mm
3.	"Golden"	White	Golden	30 mm	50 mm
4.	"Light Amber"	Golden	Amber	50 mm	85 mm
5.	"Dark Amber"	Amber	Dark	85 mm	114 mm
6.	"Dark"	Dark		114 mm	

10. The compositional requirements set out in the **Table of Composition of Specific Kinds of Honey**, for a kind of honey specified in the table, must meet the requirement set out in the table, as applicable.

Table of Composition of Specific Kinds of Honey

Item	**Composition of Honey**	**Honeydew Honey**	**Lavender, Rubinia, Alfalfa or Banksia Menziesii Honey**	**Blossom Honey other than the kinds named in Column 3**
1.	Apparent reducing sugar calculated as invert sugar	not less than 60%	not less than 65%	not less than 65%
2.	Moisture	not more than 20%	not more than 20%	not more than 20%
3.	Apparent sucrose	not more than 10%	not more than 10%	not more than 5%
4.	Water-insoluble solids if not pressed	not more than 0.1%	not more than 0.1%	not more than 0.1%
5.	Water-insoluble solids if pressed	not more than 0.5%	not more than 0.5%	not more than 0.5%
6.	Ash	not more than 1%	not more than 0.6%	not more than 0.6%
7.	Acid	not more than 40 milliequivalents per 1000 grams	not more than 40 milliequivalents per 1000 grams	not more than 40 milliequivalents per 1000 grams

BC

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- USING TOP BAR HIVES
- HARVESTING THE PRODUCTS OF A BEEHIVE AND COLLECTING AND USING HONEY
- BEE PROBLEMS AND TREATMENTS

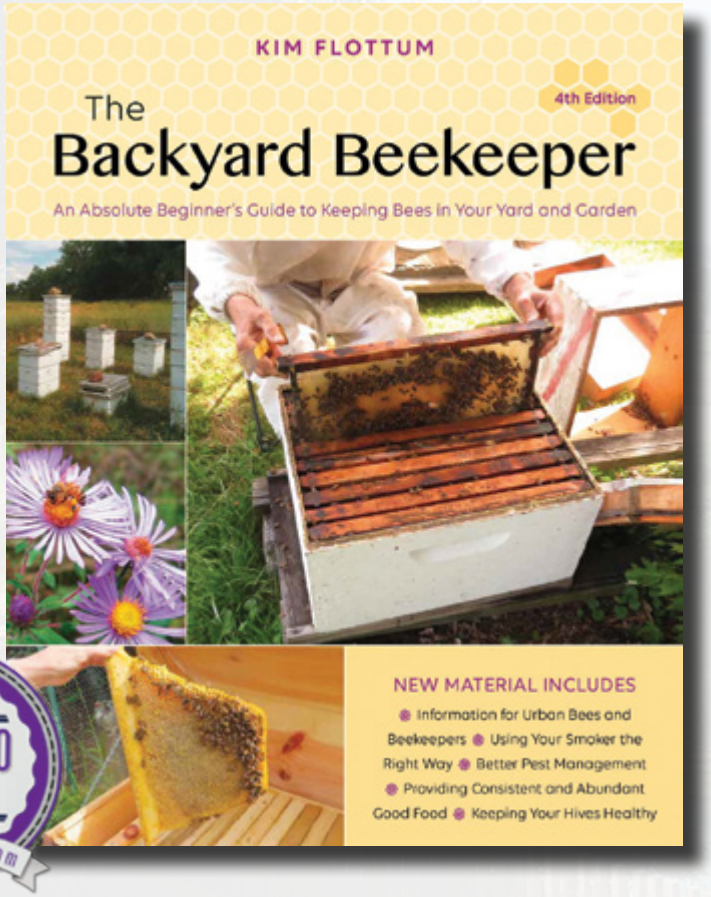

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Figure 1. *A honey bee vectoring biological control agent to a strawberry flower.* Photo credit Lorne McClinton, used with permission.

Bee Vectoring

Bees Working With Farmers

Charlotte **Coates**[1], D. Susan **Willis Chan**[1], Erica **Shelley**[1,3], Saira **Espinosa**[2], Peter **Kevan**[1]

Can you imagine a world where bees are working with farmers to protect food crops from pests and disease? The exciting potential of apivectoring (the use of bees to transport beneficial particles) provides a new role for bees and beekeepers in agriculture.

As bees industriously labor, carrying pollen from flower to flower, they also act as vectors, transporting other living microscopic particles. These hitchhikers can be harmful, such as plant or insect pathogens. However, the bees can also carry beneficial fungi and improve the health of the plants they visit.

Many microscopic natural competitors or predators, known as biological control agents, are used to control pests in both conventional and organic farming systems. These biological control agents can be formulated in a powder designed to adhere to bees temporarily. As the bees visit a flower to gather pollen and nectar, the powder falls and can combat any unwanted insect pests or disease organisms that may be living on the flowers or leaves. The use of biological control agents is increasingly popular as they provide an alternative to pesticide use, reducing the likelihood that pest populations will become resistant to chemical pesticides.

Compared to conventional applications such as spray or dusting, apivectoring offers an incredibly efficient way to distribute biological control agents to flowering crops as the bees deliver directly to the flower, which eventually becomes fruit (Figures 1&2). Apivectoring can be used in any bee-pollinated crop system and, of course, provides the layered benefits of pollination to the crop, improving both the health and the yield of the crop. Which type of bee is best suited for the apivectoring (e.g. honey bees, bumblebees, or mason bees) depends on many factors, including the type of crop, field or greenhouse conditions, or temperature at blooming. The research will continue to expand and explore options for a multitude of crops. Already successfully tested and used on orchard, berry, vegetable, seed, and oil crops, the possibilities for apivectoring are numerous[2].

The first step in successful apivectoring is to choose a living natural competitor or predator that targets the pest in question. The pests and diseases controlled by apivectoring are molds, bacteria and insects that live in or on the flower or fruit where the bees deliver the biological control agent. The biological control agents that target insect pests are known as entomopathogenic. Others, known as fungal or bacterial inhibitors, occupy space on the plant, preventing harmful phytopathogens from establishing on the flower or leaf.

Bee-delivered biological control agents are diluted into a powder formula that can consist of many ingredients, chosen specifically for the health of the bees and the pest that is being targeted. The concentration and particle size of the powdered formula are optimized to control the pest and enable the bees to carry it easily. Additionally, if the particle size is too small, bees may asphyxiate. If they are too large, particles will not adhere to the bees' bodies. Diluting commercially prepared biological control agents is necessary if concentrations of the agent provided by the manufacturer are too high and may impact the bees' health[4]. Vegetable-based powders such as corn flour are often used as a diluent. Further research into other types of additives could provide more options or improve the efficiency of delivery.

After preparation of the biological control agent powder, it is placed into a dispenser within the bee

Figure 2. *The development of a strawberry from flower to unripened fruit. The process begins with pollination of the flower by bees and/or wind. Grey mold spores can infect the flowers causing the fruit to rot as it develops and matures. Biological control agents can prevent grey mold spores from infecting the flower.* Photo credit Lorne McClinton, used with permission.

[1]University of Guelph, Guelph, Ontario, Canada
[2]Universidad Nacional de Colombia, Bogotá, Colombia
[3]Best for Bees Ltd., Kitchener, Ontario, Canada

Figure 3. *Dispenser for a honey beehive showing the exit where the biological control agent is picked up by the bees and the entrance where they enter the hive without contacting the biological control agent. The dispenser slips into the front of the bottom board.* Photo credit Beatrice Chan, used with permission.

Figure 4 *Researchers change the tray of* Beauveria bassiana *formulation in a Flying Doctors® bumblebee domicile to prevent a western flower thrips infestation of strawberry flowers. Experimental greenhouse located in the commercial Sunrite Greenhouses Ltd., Kingsville, ON facility.* Photo credit: Charlotte Coates, used with permission.

colony, pictured in Figure 3**.** The design of crop protection dispensers allows bees to contact the powder formulation as they exit the hive and avoid contact with the formulation as they enter. This two-way design provides maximum delivery of biological control agents to the crops while minimizing product loss. As they carry out their normal foraging activities, the bees carry microscopic particles which will be deposited on any flower they visit continuously throughout the flowering period.

Apivectoring research originally began and continues to this day in Dr. Peter Kevan's lab at the University of Guelph. In 2019, Dr. Kevan's lab expanded on the existing research on protecting greenhouse crops against thrips in Ontario by conducting the first trials on controlling insect pests on greenhouse strawberries[2,3,4,5]. Figure 4 pictures the team changing the trays of the powdered fungal biological control agent *Beauveria bassiana* to control insect pests on greenhouse strawberries.

Starting in 2020, the Kevan Lab began a new apivectoring project using honey bees to control grey mold on field-grown strawberries on Ontario farms (**https://www.facebook.com/2020BeeVectoring**). The project is measuring how well the biological control agent controls grey mold, how far the bees can disperse it, and whether wild bees are picking it up inadvertently as they visit the strawberry flowers. These questions are answered by carefully taking flower and fruit samples in the field (Figure 5).

Figure 5. *Small veils are put around strawberry flowers to prevent access by the bees. This creates a control treatment where no biological control agent is delivered. We can then compare disease prevalence in the untreated control with the unveiled flowers that are treated with a biological control agent to determine if the biological control agent works.* Photo credit: Susan Willis Chan, used with permission.

In addition, more research on the construction and the design of dispensers to optimize the delivery for different types of bees and hives is ongoing in Dr. Kevan's lab. A good design disrupts the normal movement of bees as little as possible, is easy and cheap to construct and store, and maximizes the delivery of the biological control agent.

Given the benefits of apivectoring to protect against crop pests without leading to pesticide-resistant populations, we will surely see more research solving some of the remaining challenges that are preventing apivectoring from reaching its full potential in both conventional and organic farming systems. To learn more, please contact the International Organisation for Biological Control (IOBC), the International Commission for Plant Pollinator Relations (ICPPR; **https://www.icppr.com/**), the Kevan Lab website (link) or **visit 2020 Bee Vectoring page**. BC

Research Acknowledgment

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Beekeepers Are Like Bees – Tom Theobald's Everyday Impact

Kathryn **Thompson**

Last Fall, I volunteered to visit with Paul Limbach and Tom Theobald to write some Colorado beekeeping history. The two long-time beekeepers, both in their twilight, had just been granted lifetime memberships to the CO State Beekeepers Association. These beekeepers have been written about before, but as I visited with them, I came to realize the honor it is to have been granted a bit of their time and listen to their stories myself. Something Tom Theobald said to me last Winter has really resonated: "If you want to have say in what goes on in the smoke-filled room, you have to be in the smoke-filled room." That resonance amplifies as I find more and more people that regularly read Tom's "Notes from the Beeyard" column published in the Fence Post for nearly three decades.

Tom grew up in Southern Wisconsin with absolute freedom which, he says, "ruined him for adult responsibilities." As an older kid, Tom was meant to spend the Summer of 1953 with his father in Colorado and after four years, made it back to Wisconsin to graduate high school with his pre-school friends. After attending the University of Wisconsin, Tom worked for IBM for a decade. He found the work interesting, made friends, and was well-compensated for his work, but realized a serious aversion to working indoors. In June of 1975, Tom left IBM. Finding inspiration outdoors in social insects and remembering the "arrow of bees" that issued from hives Tom had once thrown green apples at in a Wisconsin orchard as a child, he casually mentioned that he might like to try beekeeping. Through mutual acquaintances, this led to a meeting with lifelong beekeeper Ted Johnson and his wife. After two hours Tom and his wife Barbara were thoroughly impressed by the passionate beekeepers and wanted some of that zeal in their own efforts. Tom worked honey harvest with another Boulder County, CO, beekeeper, Harlon Henderson. He learned that one could make a living as a beekeeper and when the opportunity to buy half of Ted Johnson's colonies as Ted began retirement, Tom was fortunate to have Barbara's support. He started with 40 colonies, bought another 25 new packages, and ended his first season with 100 hives.

Initially, Tom struggled to find profitability in beekeeping and Barbara maintained a full-time job as well as helping in the springtime apiary and honey harvest. In the early 80s Tom began to experiment with double-queened colonies and was able to boost his honey crop and make small-scale beekeeping sustainable off honey production alone. At the time, Tom had no idea he was one of the few that had found that balance with no more than 200 colonies and has recently understood the notoriety his double queen colony management garners. He would move his colonies to catch honey flows to maximize production but kept his colonies primarily in Boulder County and the generally accessible mountains above the front range – including Doudy Draw. While he consistently had hard work to keep up on, Tom loved the feeling of being free and outside for a living and had additional work as a big game guide in the Flat Tops area of the National Forest and gardening. He noted that gardening in CO was a constant effort to "grow dirt" that matched the productive soils he knew in WI.

Over 45 years of beekeeping, Tom has imparted significant knowledge and experience to many beekeepers through his leadership in the Boulder County and CO State Beekeepers' Associations, as well as mentoring and his involvement in a well-established beekeeper education program through his local association. His reach extends far beyond the beekeeping community, as well. Tom has been vocal about pesticide use as it presents new challenges in beekeeping and worries about what the decline in feral colonies in his area heralds.

He served his community of Niwot as it was steered towards small town rather than sprawling city much of the CO Front Range has turned into and has had a long-term and lasting impression on a wide-range of folks in agricultural communities receiving the Fence Post. His "Notes from the Beeyard" column was meant to be a journey through a year of beekeeping and turned into just short of 1400 columns over 27 years covering beekeeping and any manner of topics a beekeeper might contemplate "from the beeyard." Reaching readers on a personal level and encouraging consideration of the implications of everyday choices – from planting choices to how a lawn might be managed and how that impacts that natural world we depend on.

The importance of showing up goes beyond the smoke-filled room. Beekeepers are like bees. Our collective energy, efforts, and communication determine what we accomplish. But more importantly, people in general notice those that share their thoughts well and with enthusiasm – just as individual members of a swarm respond to scouts that bring corroborating reports or particularly exuberant new reports. Passing flame amongst each other every day, we listen to those we resonate with and those that motivate us to think in new ways. BC

Acknowledgements: Thank you to Tom Theobald for agreeing to interview for this article and posing for a picture.

Tom Theobald standing by his first extraction equipment, which he bought used and has now donated to the Boulder County Agricultural Heritage Center – including a four-frame A.I. Root Honey Extractor, steam-powered uncapping knife, and cappings processing tank.

A "Dutch Uncle" Talks Beekeeping

Ernie **Schmidt**

The dictionary says the definition of a Dutch Uncle is – "1. A counselor who admonishes frankly and sternly. 2. One who reproves in a blunt, stern manner intended for the benefit of the recipient."

I wish I would have had a Dutch Uncle mentor when I started beekeeping. An unvarnished unromantic overview of bees and keeping them would have given me a clearer perspective of what I was about to get into. It would not have dissuaded me personally from becoming a beekeeper. Quite the contrary, my mind was made up and this information would have emboldened me to the challenge. It would have given me a deeper, clearer, realistic understanding of caring for the bees and knowing more of what to expect. Even under the best of conditions, successful beekeeping is hard and at times disappointing. I think that at least knowing that, it is one more piece of knowledge in helping one become a successful beekeeper.

My Intention

Francis Bacon's quote, "Read not to contradict nor to believe, but to weigh and consider." This is the best way to explain this article. It's not my intention to dissuade or discourage anyone from keeping bees. My intention is to share a knowledge of realist expectations. Beekeeping can be heart breaking, devastating, and riddled with pitfalls and difficulties but still be a fulfilling and blissful endeavor. I know that sounds strange but being aware of the possible difficulties and disappointments from the beginning will make the learning process less stressful. After reading what you are about to read- it can go one of several different ways- don't believe it, disregard it, attack it, gather a few nuggets of knowledge that will help you- to list a few. What I write might discourage someone and they might decide not to keep bees but if you really have your heart set on keeping bees, do it! Just remember at times it will be difficult and disappointing.

Beekeeping is Different

Beekeeping is unlike any other form of animal husbandry that humans are involved in. It cannot be compared to anything else we do with plants or animals. It requires an entirely different mindset, knowledge, and skill set to understand before becoming proficient at it. One can be experienced raising chickens, goats, fish, dogs, anything else- nearly all that knowledge wouldn't apply to bees. I don't know of a creature in animal husbandry more difficult to be successful with that the honey bee. There is a good reason we don't hear the phrase "Master Chicken Keeper."

Generally speaking there isn't even a consensus that the honey bee is actually a domesticated creature or not.[1] Mankind has been working with the honey bee for 1,000's of years and they are still a challenge to work with. Much like a wild creature they don't respond well to being forced to do anything. Many times when feeling pressured or forced to do something they will simply abscond or in worst case, die. They are a creature the keeper learns their behaviors and works with those behaviors.

A famous beekeeper, F.E. Moeller once said, "Beekeepers in managing and manipulating colonies, are merely facilitating normal biological colony changes to suit their purposes." The way I personally describe this philosophy is, "The secret to managing bees to do anything you want them to do is get them to think it was their idea to do it."

Life Expectancy

This an area of beekeeping that really requires a high level of that reasonable expectation. By their very nature as insects, honey bees have very short lives. Workers live about 40 to 45 days in the Spring and Summer. Winter bees can live up to six months and queens one to three years.[2] To make this age thing even more confusing, a queen's age really doesn't depend on her age in years. It depends on her level of egg production. When she runs out of viable eggs, she is old. That can happen in months with some queens and years with other queens. The most important mindset is that the life spans of individual bees is very short compared to other forms of animal husbandry. Inexperienced keepers will start a colony then expend time and energy expecting a specific colony to live longer that it's normal life expectancy. In human terms and

compared to other forms of animal husbandry the life span of a specific individuals in a colony are very, very short. In the first year of beekeeping the learning curve is pretty much straight up. It's not just learning the method of managing bees that is difficult, it is learning the mindset of how age and life span works with bees. Some sources estimate that up to ¾ of all new keepers quit in their first year.[3] Many of the people that fail think it's their fault. They did something they shouldn't have or didn't do something they should have and they killed their colony. Honey bees can die from a plethora of reasons, but many times in reality that specific colony just reached the end of its life span. In nature under good conditions the mortality rate of wild honey bee swarms would shock the average beekeeper. About 80% or four out of five new wild swarms die in their first Winter and that is normal.[4]

So we are working with creatures which by nature have short life spans and high colony mortality rates. Though humans with domestic management methods are able to reduce much of that high natural colony mortality level of swarms in nature. We cannot change the fact they have short lives. There is nothing you or anyone else can do to create individual bees that live longer or manage them to live longer life spans. As a beekeeper one is preventing the death of a colony by appropriately understanding and managing the life spans of the individual bees in that colony.

Anthropomorphism:

"Is the attribution of human traits, emotions, or intentions to non-human entities. It is considered to be an innate tendency of human psychology. People have also routinely attributed human emotions and behavioral traits to wild as well as domesticated animals." The complex communications of a colony largely depend on chemicals and pheromones. If bees had the luxury of independent feelings and emotions the unquestioned cohesion of the colony would fail. When a specific stimuli is produced, an "on mass" specific behavior must result, without question, feelings, or emotions from individual bees.

Many times, the very survival of the colony will depend will it. There can appear to be honey bee behavior that we as humans may consider a sign of emotion or feeling, but are merely normal bee behaviors that don't require emotion or feelings. Colonies that are not stressed and going about normal behavior may appear "happy" as opposed to stressed or harassed colonies being "mad". A single bee or colony attacking a threat is not happy or mad, merely responding in a normal survival behavior to a perceived or real threat. A colony of bees attacking is not particularly a swarm of mad bees, but a swarm of bees responding a specific chemical or pheromone. A bee doesn't need to be angry to sting, a chemical or pheromone triggers an emotionless, unfeeling, unquestioned, instinctual behavior in the bee. Basically it is us as humans that process the complexities of bee's behaviors by comparing it with human emotions. It is easier for us to understand honey bee behavior and feel closer to our bees by concluding the bees are acting with human emotions. Bottom line here is that if one wants to attribute human emotions to honey bee behavior it wouldn't bother the bees. Being a human and emotionally connected to our bees is more for our benefit. I have a personal saying; "It is a delicate dance between the honey bee and mankind. However the honey bee has been dancing just fine all by itself for millions of years."

A little about luck

Luck in working with bees is usually when something good happens and you can't really document what you did to cause it and not sure exactly how to make it happen again. Depending on luck shouldn't be a management method in beekeeping. One cannot do nothing, get lucky and hope it happens again.

The problem with depending on luck is that eventually it will run out. That's not to say that sometimes luck doesn't come into play as a beekeeper. As long as I have been a keeper, there are still times when something happens with my bees and I realize it was total luck and not my skill. Those times I don't expect it to always happen again, I was lucky that time. What I am saying here is don't let luck seduce you into thinking you're good. It's good to be lucky, but it takes more than luck to be good.

In Closing

My plan when I first conceived this article was not to make it a "how to keep bees" as much as a "heads up about beekeeping". Talking openly about some of the challenges that aren't always addressed. However, I would be remiss, after all this Dutch Uncle'ing, if I didn't leave you with some hope. After all my years of keeping bees if I had to decide the one single most important skill every beekeeper should master- it would be the skill of "making more bees." Don't manage your bees with the unrealistic expectation they are going to live long lives. Manage them like you are going to have to constantly make new generations of bees. Learn methods of making splits, requeening, and chasing swarms. Even buying new packages and Nucs every year is a method of "making" more bees.

Understand that the reality of beekeeping is the ongoing replacement of your current bees with new bees. A successful beekeeper once said, (I forget who) "A truly successful beekeeper is the one that is selling bees when everyone else is buying bees." BC

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When wandering around in nature on Ibiza, if you are lucky, you will discover massive, partly dilapidated, wood-lined stone mounds in remote places, mostly in the forest or at the edge of the forests.

They once served the indigenous people as beehives and are testimony to the long history of honey on the Mediterranean islands of Ibiza.

This form of traditional, ancient beehives, "unique in the world" for their construction, may have been used "from the Phoenicians until the second half of the last century," explains Vicent Marí, chairman of the "Asociación de Apicultores" of Ibiza.

The first historical evidence dealing with beekeeping in relation to how humans domesticate bees is found in murals in the Temple of the Sun in Egypt from around 4,400 years ago. There are depictions of beehives and several men extracting the honeycomb, filtering the honey, and then packing it.

Also in Egypt ceramic fragments and limestone were found on which notes about honey were made. On an ostracon from Deir el-Medina from around 3,500 years ago, an inscription appears as a recipe for the use of honey for the eyes.

The Egyptian knowledge of honey and wax was carried over to the Greek and Roman cultures.

Today there are papyri with references to honey such as cookbooks, recipes for cosmetics, wound healing or home and personal hygiene.

In ancient Greece, the doctor Hippocrates prescribed honey to heal lung and cardiovascular diseases, but also as a laxative, for intestinal diseases or to heal wounds.

HEALING PROPERTIES

The doctor Maimonides administered honey in the 12th century to prevent Winter diseases. The Romans valued its effects as an aphrodisiac. Both the Bible and the Koran speak of the use of honey to maintain health.

In the Qur'an one reads that honey makes hair long, beautiful and smooth and that it improves vision when it is applied to the eyes. If you rub it over your teeth, they become white and shiny and keep your gums healthy.

With the advent of antibiotics, the medicinal uses of honey decreased after World War II. Regardless, it is back in trend today as part of the return to natural products due to its proven effectiveness against bacteria, including those that are resistant to antibiotics.

We know that the traces of beekeeping in the Spanish islands of Ibiza and Formentera were never lost in earlier times and that the use of honey and wax continued uninterrupted until the Arab colonization of the islands.

The Catalans began to populate the islands after conquering the Pityuses in 1235. They brought their knowledge and experience with them, as a result of which the knowledge of beekeeping by the Arabs in Ibiza was forgotten.

This led to the deplorable destruction of many beehives, which at that time consisted of fixed chambers, the interior of which was not as easily accessible as beekeepers know today. The few remaining archaic "caseres d´abelles" on Ibiza consist of reeds, clay, stones and hollow tree trunks.

Beekeeping declined significantly in medieval Europe when cane and beet sugar was introduced around the 16th century. At that time only monks kept bees in their monasteries to supply the churches with wax and their congregations with honey.

Ibiza honey.

But the "beekeeping crisis" did not affect Ibiza and Formentera, however, as their isolated situation forced farmers to continue caring for their bee colonies. No decline was recorded on the islands because the islanders were dependent on self-sufficiency.

THE PHOENICIANS

Beekeeping in Ibiza, as in the entire Mediterranean area, experienced an important development with the colonization by the Phoenicians. In Ibiza they laid the foundation stone in 654 with the settlement in the bay of Sa Caleta, where they first settled until they later founded the Acropolis and Necropolis of Ibiza Town.

They were excellent seafarers and merchants. In Ibiza they grew vines and olive trees and refined beekeeping. They also made weapons and supplied some of the armament that Hannibal used against the Romans in the Second Punic War.

Beekeeping in Ibiza looks back on Arabic, Punic, Catalan and Roman traditions. The quality of the "Miel de Ibiza" and wax is highly valued today in gastronomy as well as in medicine.

"Although we don't have any documented or archaeological data to confirm this, it can be assumed that the indigenous people of our islands have practiced beekeeping since the Phoenicians," Marí sums up the story.

Some of the ancient stone apiaries are from the 7th century BC and have survived on Ibiza to this day. A few were used to make Ibiza honey until the second half of the 20th century. There is currently one beekeeper in Santa Agnés de Corona who keeps six colonies in the antique models and produces excellent honey.

Ibiza, Spain

Beehives Made Of Stones and Logs

Friederike **Diestel**

Ibiza stone hive.

They are most common in the North of the island. In the rest of the island they have almost disappeared as a result of the relentless construction progress in rural areas.

CHRONICLES

A reference to honey in Ibiza can be found in the lines of the work "Liber Maiolichinus de Gestis Pisanorum Illustribus", written around the year 1125, in which it says: "Rocky mountains surround the entire landscape, countless grasses and fruits, honey in sufficient quantity sprout from their soil and fresh water flows from the springs. The country produces a lot of barley and also fertile vineyards."

The second oldest historical reference to beekeeping in Ibiza dates back to 1242. It is a lease for some land that includes everything needed for its use, including "all the bees that can be found there".

In the Chronicle of Frare Marsili from 1300, who was commissioned to translate Jaime I's "Llibre dels fets" from Catalan into Latin, it says about Ibiza: "melis habet satis" ("there is enough honey") .

A court document from 1328 deals with the sale of 77 beehives. There is another text from this period in which a number of provisions are put together for the market traders who regulated the sale of their goods, including the "miel de Ibiza", on todays Plaça de Vila.

Advances in beekeeping, the use of new techniques and materials did not reach Ibiza until the 1880s.

Stone hive.

The Archduke Ludwig Salvator of Austria promoted this activity together with his friend Francisco Andreu Femenías, an excellent beekeeper of the royal family. Salvator wrote about it in a chapter in his seven-volume encyclopedia "The Balearic Islands" (1869-1891).

POLLEN

In 2017, the "Asociación de Apicultores de Ibiza" carried out a palynological examination (pollen analysis) of honeys from Ibiza and Formentera, divided into Spring, Summer and Autumn harvests. "Miel de Ibiza" is usually multifloral and is a mix of nectars from different flowers, such as citrus, rosemary or pine.

The pollen that came out strongly in the investigation was from the carob tree (*Ceratonia siliqua*) and heather (*Erica multiflora*). These special notes make the taste and aroma of this honey characteristic of the island. BC

A spectacular view of the mushroom cloud from the distance. Notice the nature art that traces a man's face and curly hair beyond the rain clouds. This was one of the early eruptions on the morning of April 9, 2021 taken south of the La Soufriere.

AFTER THE VOLCANO

Beekeeping Resilience

Allan **Williams**

An apocalyptic scene in the red zone (Orange Hill) after the volcanic eruption.

On New Year's Eve 2020, while a church was climaxing its end of year celebrations, there was a declaration heard from the preacher of an impending eruption of the La Soufriere volcano located in the island St. Vincent off the coast of Venezuela. The preacher had witnessed one week earlier, the early signs of a volcanic eruption when he had gone on a hike to the volcano with some of his friends. That expedition reminded him of familiar signs that he had seen on a similar hike in 1979 when he had also climbed to the summit before the volcanic eruption of that year. The popular and amusing cliché, "me nah go back ah Soufriere," echoed from his lips – and the congregation chuckled – but his facial expression betrayed the gravity of his thoughts. Before the end of his sermon, he declared a more precise prediction that was seemingly based on his previous experience. He boldly declared that sometime in April 2021, there would be a volcanic eruption. And it was so. The preacher, being one of the persons who ascended to the summit and had made his own verifications, offered special prayer that night on New Year's Eve for the nation that there may not be any loss of lives, and that the destruction of the volcano, if any, would not be as expansive and devastating as the previous 1902 and 1979 eruptions.

Meanwhile, sometime earlier in December 2020, an alert was given by the authorities that the experts had detected increased seismic activity from the La Soufriere volcano and that it was soon to erupt. The last three eruptions of the La Soufriere volcano on mainland St. Vincent all curiously occurred between the months of April and May in the years 1902, 1979 and 2021. All three explosive eruptions left persons in awe. Having lasted for weeks and even months, the volcanic events have posed a direct threat to rural livelihoods, domestic animals and wildlife, including honey bees. The first report of an explosive eruption of the La Soufriere volcano in 2021 took place on the morning of April 9th, around 8:45 am. Subsequently, there were approximately 30 additional explosions over a 14 day period.

Access road to an apiary site in the red zone (Orange hill) that was a very rough path before the ash-fall.

The expansion of the local beekeeping industry within the last five years had led to new apiary establishments being extended to the northern communities on mainland St. Vincent. These areas were located in the red and orange zones of the volcanic map. These were the hives that suffered the most during the eruption.

A week after the first explosive eruption on April 15th, a preliminary damage assessment was conducted by Mr. Allan Williams – Apiculture Extensionist of the Ministry of Agriculture who was accompanied by Mr. Marcus Richards, Senior Agricultural Officer, also of the Ministry of Agriculture. The assessment within itself was a risk and could have only been done on the North Windward side of the island which is located in the red zone. At first glance, the apocalyptic results of ash-fall even before reaching apiary sites were overwhelming. There was as much as six to eight inches of ashfall observed in the red zones.

Torrential rain that was induced by the volcanic eruption condensed the ashfall on the ground, to four or five inches. The condensed ashfall in those areas especially on feeder roads resembled as if they were just finished paved with grey asphalt.

Torrential rain also caused massive and multiple lahars that

Main road severed by lahars where there was once a small bridge in the red zone.



Hives in the red zone (in Trinity – the closest apiary from the volcano) that were severely affected as well the shed.

destroyed roads and bridges in its path. Therefore some apiaries could have been only accessed on foot. From the preliminary assessment and direct reports a total of 45 hives were damaged which accounted for 42% of the hives that remained in the danger zones. There were two newly erected apiary sheds that had also collapsed on domesticated hives under them due to the weight of the ash-mud on the roof. The hives under these sheds suffered double calamity; not only have they been toppled by the collapsed shed but both the shed and ash smothered the hives. As a result there was little or no hope for their survival. Other domesticated hives in the open field were covered with thick ash.

There were still greater challenges after the eruption. The whole red zone became a desert of ash. Therefore, there were no sources of pollen and nectar for the honey bees. In addition, most natural water sources were contaminated with the minerals from the volcanic ash. These challenges were also extended to those apiaries that were found in the orange, yellow zones and some parts of the green zone (to a lesser extent). This was a serious threat to the health and sustenance of the surviving hives. A total of 350 domesticated hives were under this immediate threat.

At the end of March there were 702 domesticated colonies recorded throughout St. Vincent and the Grenadines but by the end of April after the La Soufriere volcanic eruptions domesticated colonies were reduced to 595 among 93 beekeepers. Within one month there was a 15% decline in the total number of hives in SVG.

Honey bees themselves are very resilient by nature. Many lessons of life can be learned from them. For example, the strong bee hives capitalized on the falling ash-mud and sealed up their entrances until the surroundings were clear again. Also, on reflecting the day or two before the volcano bee hives were vigorously collecting pollen stores, more than normal.

Some hives were able to be relocated after the red alert was given – 18 hours prior to the first actual volcanic eruption. These hives were moved to the green zone where most of the domesticated hives in SVG are located. 80% of the domesticated hives in SVG are located in the green zone of the volcano.

As a result there is a response needed for the domesticated and feral colonies that somehow survived the volcanic eruption in main affected zones. Under the rubble, debris and ash few hives had miraculously survived. As soon as some beekeepers were able to pass emergency check points to enter into the danger zones they tried their best to salvage whatever they could reuse and bees that might be able to survive the drought of nectar and pollen sources in the upcoming months. The surviving hives were in need of clean drinking water, and in the interim they were also in need of nectar and pollen substitutes. All of which in some cases have to be

Removing ash from the top and the entrance of a hive that remained in the red zone but survived the La Soufriere volcanic eruption.

One month after hives were relocated from the red zone to the green zone. The mesh-top covers were just replaced with solid-top covers.

An apiary in the green zone one month after the La Soufriere volcanic eruption.

transported manually to the apiaries in order to reduce further loss of hives. These are the challenges that the beekeepers will have to endure until the natural vegetation is rehabilitated or when vehicular access is regained to relocate apiaries further south of the mainland.

Queen Rearing and hive breeding is another response that has to be done locally for building resilience of the thriving beekeeping industry in SVG, so that beekeepers will be able to replenish hives efficiently. A local apiary has to be primarily designated for this activity in order to support beekeepers in regaining their livelihood and continue to build the beekeeping industry in St. Vincent and the Grenadines. The experience of the volcanic eruption in 2021 has left long lasting memories among the beekeepers.

Amidst these challenges, the SVG Beekeepers Association (SVGBA) in association with the Association for Caribbean Beekeepers Organization (ACBO) are still proceeding with plans to host the International Caribbean Beekeeping Congress in September 2022 under the theme: *"Building the Resilience of a Beekeeping Industry after a Volcanic Eruption."* BC

Western Growers Association

John **Miller**

Just after mid-August, 2021, Western Growers Assn. sponsored a virtual meeting with their members and Silicon Valley investors interested in Agricultural assets.

The challenge was to lead a broad discussion about technology and beekeeping.

"Seeds of Our Future 2021: The Flight of the Honey Bees."

I helped frame up ideas for the event. I did not present at the event. This is an idea I want to share with folks who think they support Honey bees through donations – but don't.

Western Growers Assn. is an enormous outfit, some of the largest production agriculture outfits on earth. Their customers [pretty much everyone who eats] shop for safe, nutritious food.

Western Growers are challenged by a rapidly changing environment in many areas. To attract investors, and to grow the business of growing food for a hungry planet, Western Growers increasingly employs technology. The technology sector has the ability to improve farm performance.

Where do honey bees and technology fit into the picture? Beekeeping is an ancient practice based on learned experience with a social insect, our Western Honey bee.

Of the 4,000 or so identified species of solitary bees – beyond confined vegetable growth facilities – none of the solitary bees perform like the Western Honey bee. There is a reason our honey bee is widely regarded as the most beneficial insect on earth.

Western Growers: Pause before dashing off the next Save the Bees donation. What impact does our Western Honey bee have on Western Growers and their customers? How many in the audience use pollination services?

Quite a few. How many use solitary bees for pollination services?

How many use the Western Honey bee for pollination services?

What impact do the solitary, largely unmanageable, immovable bees have on Western Growers and their customers? What impact does our Western Honey bee have on Western Growers and their customers? The Western Honey bee is a generalist forager, able to pollinate a huge variety of plant blossoms. Our bee is manageable, flexible, the unquestioned global pollination champion for time immemorable. Humans picked the best bee – and the best bee picked us. Great deal, Best Deal Ever For Humans! Bees? Well, not so much, sometimes.

Project Apis m. is a bee research non-profit founded in 2006 when honey bees were in peril. Founded by Blue Diamond Chairman Dan Cummings, and Beekeepers – driven by peer-reviewed research supporting our Honey bee. There are a million non-profits in America. One non-profit is devoted to our Honeybee.

Where is Tech improving Beekeeping? Western Growers members contracting for pollination services on their crops can now engage with Beekeepers or Brokers for hive strength analytics. Almond fields can be mapped to optimize beehive placements. Hives can be monitored for a number of conditions.

Tech is not replacing benchmark truths shared by beekeepers and almond growers. Take the Number 2, for example. More and more growers know beekeepers with TWO or fewer *Varroa destructor* mites per 100 bee sample have better, healthier hives. More and more beekeepers know growers with TWO or fewer 'stick-tights' or post-harvest mummies per tree know those hygienic orchards are safer places for bees, fewer stick tights means fewer Navel Orange Worms means a lower risk of a pesticide application, and bee kills.

Hygienic beekeepers and Hygienic growers seek each other.

Tech will improve bee genetics. Honey bees mate openly, with some instances of instrumental insemination. Thus, it is difficult to predict a Queen Bee's performance – she mates with several drones before her reign commences as the beehive's mother. We know there are differences in these sub families – but we know nothing about optimizing the performance in honey bee families.

A cattleman can take a snippet of tissue from a cow or bull and technology can predict Expected Progeny Data. This does not harm the bovine. In Beekeeping, for us to analyze a queen bee – we must kill her, dissect her, and then ledger the data. Beekeeping genetics is a field ripe for technical solutions.

Before dashing off a donation supporting the insect Western Growers and their customers rely on – consider the Return on Investment. A donation made to a non-profit specifically supporting the Western Honey bee will support the Western Honey bee, and other species of bees rather than scattershot supporting all invertebrates. No one can support all invertebrates.

Western Growers carefully support improvements to production agriculture. Project Apis m. carefully supports the beneficial insect Western Growers and their customers rely on.

Pitting one bee against another bee is not conservation.

I have no real power; I am a beekeeper.

I am a witness to immense power; I am a beekeeper.

Support for Project Apis m. supports the bees that support Western Growers and their customers. BC

John Miller is a retired beekeeper and volunteer Project Apis m. Board Member. Board members are tasked with fundraising.

CRITICAL T

Earl **Hoffman**

Seasonal Beekeeping Management

Please consider these critical thoughts to guide your beekeeping management –

- Now that Summer solstice is over, and we wind down Summer to Fall we need to change our thoughts and beekeeping tasks
- Each Apiary visit monitor the hive entrances for flight activity and make these observations.
- Does each hive have guard bees at the hive opening challenging each bee that enters?
- If you do not see guard bees, open the hive and investigate as soon as possible.
- Do some bees look black and or greasy? coming in or out of the hive? They have lost their body hair because they are robber bees plundering the hive that is too weak to defend itself. They fly in a zig zag pattern and dart in and out of weak defenseless hives.
- If you can capture a forager bee at the entrance, look at the edges of her wings. If they are torn or have rough edges, she is an older forager that will only survive another week or two. Open the hive and verify that the hive still has capped brood in the frames. The hive is going to have a population reduction soon because bees are dying faster than they are being replaced. Natural hive population cycle.
- Look for wasps and other insects entering the hive entrance. If so, consider using an entrance reducer shim to help give the guard bees a smaller area to defend. 3/8 inch gap and a few inches wide opening may help the hive defend itself from the robbing that happens during a nectar dearth.
- Look for Foragers bringing pollen back to the hive. No pollen collection? Open the hive and look for eggs or young small larva to verify that the hive is still Queen right. Is Mom home? If the hive is queenless many times the hive will stop collecting pollen.
- Is the hive honey bound? Open the Hive lid/cover and look at the spaces between the honey frames. Is there bur comb everywhere? Have the honeycombs become full during the nectar flow? Did they have enough empty honey supers during the flow?
- Pull off the honey super(s) and observe the brood frames. If the bees had nowhere to store the nectar, they move the honey storage into the brood nest. Soon, the queen will not have clean empty cells to use as brood cells because all of the cells will be filled with honey. This is a critical event.
- If the Queen has no place to lay eggs because the brood nest is full of honey, The process of making winter bees is significantly impacted.
- The bees can move honey to other areas of the hive, they can move the brood nest area either up or down in the hive, but they do not move pollen.
- If the hive is honey bound, two possible actions are suggested. 1) Remove the honey and extract it and give the wet empty combs back to the bees. 2) Place a super of clean drawn comb either above or below the brood nest area to provide empty cells for the queen to lay eggs.
- The rule of thumb for the amount of equipment to have on the hive is percent utilization. Best to have some slack room, but not too much to defend from wax moths and other predators. Sometimes you need to remove equipment because the hive can not use that much space. I target 80 % utilization in the summertime. Add and remove equipment as you see fit.

Hairless Black Syndrome.

Wasp Eating a Bee.

THOUGHTS

- So, before we shift gears to the next area of concern, lets recap one more time.
- Does the hive flight activity look normal? Investigate as you see fit. Do you have entrance reducers on the hives that need a smaller opening? Did you give the girls enough empty honey supers during the nectar flow? Is the hive honey bound? Does the queen have empty cells to lay eggs and create the all important winter bees? Is there pollen and pollen frames in the hive? Last, is the hive queen right?
- Shifting to the next critical area of hive health is the parasite – *Varroa* mites. Late Summer as the hive population has peaked and now is in a natural decline, the Varroa mites have been reproducing at an exponential rate in the hive.
- One *Varroa* in 10 brood cycles can turn into over one thousand mites. Each Varroa mite feeding not only on the brood, but also the young nurse bees, is vectoring viruses and shortening the life span of each bee it feeds on.
- I know that this sounds challenging, but you really, really need to learn to perform an alcohol wash test to determine your level of *Varroa* mite infestation. Use a Mason jar, place fine screen in lid-ring or buy the Plastic *Varroa* EasyCheck device. Pick a few hives in the apiary and perform a mite count.
- Open the hive, Remove the honey supers by setting them to the side with a cover over them to keep the robber bees out of the honey. Remove brood frames and verify that the Queen is NOT on that frame. Flip the frame several times to scan quickly for the queen.
- Take the frame of nurse bees that are feeding open larva that does NOT have the queen on it and knock it into an open pail or plastic tub. Scoop ½ cup bees out of the container and place into your Mite wash device that has been loaded with alcohol ahead of time. Place the lid on the jar/device, replace the frame to its original location and dump the extra nurse bees back into the hive. Close up the hive and repeat the process for each hive that needs a Mite wash. You do not need to mite wash every hive in the apiary.

Open Brood.

Varroa mite.

- After the Bees and mites have soaked a few moments, start the agitation cycle of the jar back and forth to dislodge the mites from the bees. After a few minutes stop shaking the jar/device and count the number of mites floating to the bottom. They look like small round reddish-brown spots. Try not to count the debris.
- This critical Summer Seasonal task of washing Varroa Mites gives us the data we need to determine our level of *Varroa* mite infestation. If we are fortunate, our count could be as low as a few *Varroa* in ½ cup (300 bees). Any Number above three (3) should bring alarm bells and sirens screaming that action is necessary now to save the hive.
- Many *Varroa* mite treatments require that all consumable honey be removed from the hive prior to the *Varroa* Mite Treatment. Other Treatments may be applied while the honey supers are still on the hives.
- Study the types of Legal mite treatments and follow the directions and guidance given. Your single goal during the next two months is to get your *Varroa* mite counts down to below three (3) in a half a cup of bees (300).
- Since this is a critical time during which the Bees are creating winter bees that will live 120-150 days in the hive. The Winter Bees are the heater bees that keep the hive alive. I suggest that several methods be used to reduce the number of *Varroa* mites in the hive. Back to back treatments work better because fresh generations of new *Varroa* mites are created with each brood cycle (21 days).
- Many Beekeepers use Formic Acid or Oxalic acid to initiate a mite drop and follow that up with either a thymol-based product or a synthetic chemical based miticide.
- Try not to remove too much honey during the honey harvest, and wash your *Varroa* mite hives every four (4) weeks to monitor the efficacy of your treatments – Good Luck! BC

Dronings From A Queen Bee

Charlotte **Hubbard**

Settling In

Photo of us 'keeping bees' after I proposed to him by leaving a note in a hive. (Queen Bee is supposedly in charge, right?)

My friend Rob is a private pilot. He flies for fun on the occasional weekend, and flies (pre-pandemic) internationally on business several times monthly, reluctantly buckled in far from the in-charge nose position. Straight from a 1970s movie, Rob harbors the secret fantasy of all the pilots suddenly becoming ill, and he must step forward to land the plane. He's ready to save the day.

Rob travels with his beekeeping veil because whenever possible, he visits with local beekeepers. He also travels with his veil because of his secret beekeeping fantasy of hearing an airport public service request that "the jetway/plane door/fuel truck can't be operated because there's a swarm of bees on it. Is there a beekeeper available?" Rob's again ready to save the day.

Rob's beekeeper desire reminds me of another fantasy, perhaps more common among this group of beekeepers. How many of us hope to find a swarm voluntarily settled in our unused equipment?

I've never been lucky enough to have a self-installing swarm, although I've certainly tried. Each bee season, I have stored spare equipment in the apiaries – hoping to entice the little darlings by placing a vacancy sign on the outside, a few drops of swarm lure on the inside, and the wifi password prominently posted along with a map to nearby forage. I've read the research and set out swarm traps of the right size and height in a dozen places; no luck. My bee-loved husband Marshall would gently tease me about checking the traps every day (pointless exercise) but this gave me the right to gently tease him about his endless biking should a professional cycling team call and need him to take a spot on a Tour de France (his fantasy).

While never experiencing a self-installing swarm, I have captured dozens of swarms. There was the memorable swarm removed from the entryway of a junior high school – 12 hours before school started, as torrential rains fell. And there was the day I caught six swarms. OK, really it was the same swarm five times before they stayed in the box, but I'm still counting it as six captures in one day.

Marshall and I entered winter of 2020 with 40 colonies – too many for two hobbyist folks to handle, especially as one of us was secretly training for the Tour de France.

And at the end of March 2021, which I feel is the earliest date when you really can claim overwintering survival, we still had 40 colonies very much alive – except there wasn't a "we". Marshall died unexpectedly late March. As I grieve his loss with perhaps too much dark humor, the irony of 100% survival – except for the beekeeper so vital to that success – doesn't escape me.

I've sold off the majority of the bees, unsure of my future now with bees – or anything for that matter. The spare equipment sits stacked by

. . . the irony of 100% survival – except for the beekeeper so vital to that success – doesn't escape me.

Marshall wasn't a fan of long-pants-beekeeping and never got stung because of it.

Nothing like a cut-out on an 85°F day to strengthen a marriage.

Marshall loved the unusual bee removal situations. I was ready to catch him.

the garage as I clean out Marshall's woodworking projects that will never see completion. Puttering about recently, I picked up a deep body and several bees flew out. I didn't think much of it and stacked the box and its lid too precariously atop other equipment. I puttered (and cried) some more, swept, rearranged stuff, stubbed my toe, and a few hours later relocated the deep box to a new position. More bees flew out.

You don't have to tell this experienced beekeeper twice that lots of bees unexpectedly in a box might mean a swarm. Nope, apparently you need to tell me at least three times. A few days later I picked up just the lid – only to find several hundred bees peering at me from between a couple of should've-tossed frames.

Marshall Beachler.

The Author.

Still in dis-bee-lief that I could actually gain a self-installing swarm, especially when trying to reduce the number of colonies under my management, I pulled out a frame. A long, golden queen waved a wing at me as she continued laying eggs, one per cell. Plump larvae sparkled in the sunlight, I think. Sometimes tears get in my way.

I gave her majesty a couple frames of resources and a feeder. I promised her she gets to sit undisturbed for a while outside the garage. (I also promised her a mite check in a few weeks.)

I don't know what my future holds and am unsure what I should be doing about practically everything. But—a self-installing swarm? I'm taking this as a sign that, at least for now, I am meant to bee. BC

Charlotte Hubbard has been keeping bees since 2009 upon the death of her first husband Tom. She's currently president of the Kalamazoo Bee Club, Michigan's 2018 Beekeeper of the Year, an active instructor and presenter, wandering about opening lids on unused equipment hoping for more signs, and missing Marshall dreadfully.

QUALITY VS. QUALITY VS. QUALITY

Jeremy **Barnes**

I need to have some paving done here at home. My neighbor was having asphalt laid in his driveway so I walked over to see the work being done. The crew was surly and uncommunicative, to the point that I would not choose to have them on my property irrespective of the quality of their work. They did not realize that they were representing their company, nor did they understand the importance of communication.

In May and June of this year, Steve Repasky, President of the Pennsylvania State Beekeepers' Association, wrote two lead pieces in the state newsletter exposing 'the elephant in the room,' namely how beekeepers interact with the non-beekeeping public, particularly in the swarm season. "Many raise the flag of 'save the bees' when it comes to rescuing swarms or relocating a colony in a hive" he wrote. "I've had numerous calls from members of the public who have reached out to beekeepers who don't have the time nor do they want more bees, yet we have a responsibility as beekeepers to be good neighbors, especially to those many nervous non-beekeepers with a fear of stinging insects."

The publicity surrounding CCD lead to a significant increase in the numbers of new beekeepers, the upside of which is the public awareness of the role and importance of honey bees, even as ignorance as to the role of wild bees and other pollinators continues.

The downside is that the attrition rate among new beekeepers is high. Let's assume it is 25% per year, which is probably an under-estimate but includes those well intentioned romantics who want to save the bees by starting a hive. That means that out of a class of 20 new-bees, eight will still be active by the fourth year. So the question is, what damage might be caused by those 60 per cent who do not continue? And this is not just the environmental damage that can come from neglecting a colony and the associated spreading of pathogens. It includes the societal neglect that Steve describes, with all of its potential consequences for those who do persevere.

In an interview by Dr. Tracy Farone in the June issue of Bee Culture, Dr. Margarita López-Uribe is cited as saying that "... honey bees are domesticated animals that need food, care and treatment. This takes training, equipment and understanding," and that establishing a honey bee colony without the necessary understanding may not be helping anyone, including the bees.

Her advice is to become an informed steward of the environment by becoming knowledgeable about good management of all pollinators as well as of the forage and habitat in the extended area (circa 10,000 acres) in which the colony will be situated. After all, we call ourselves beekeepers, not specifically honey bee keepers.

So the issue moves from one of quantity to one of quality. Most local associations are proud of their increased numbers – in York County, PA, for example, the paid membership has increased from 20 to over 240 in the space of 12 years - and welcome anyone who shows an interest in taking the Introduction to Beekeeping classes. But an open door policy is a welcome mat to neuroses. I cannot imagine a way in which we could somehow pre-select new beekeepers, as do professional vocations like medicine, law and engineering, but perhaps we can be more rigorous, both at the state and local levels, in spelling out the responsibilities and commitments involved. While not actively discouraging new-bees, we need to clarify what is involved and the consequences of non-compliance. Putting this upfront in the slide presentation for the first class is relatively ineffective in the face of the naive enthusiasm of the beekeeper-in-waiting; perhaps the year needs to start with a face-to-face meeting (more easy now we have Zoom) between a few experienced beekeepers and those who want to start a hive focusing on the realities and accountability of this wonderful hobby. For those who want to 'save the bees', for example, one can suggest that developing a pollinator-friendly environment is just as valid as starting a new hive. And the classes need to end with responsible ways to unload a colony if one decides to discontinue as a beekeeper, besides neglect and abandonment.

At the same time we can make every effort to contact those who dropped out early and find out the vital factors that made them do so, perhaps the first question being, "What information at the outset did you not have but, if you had, might have led to a different decision on your part?"

Then there is the role of the inspectors in those states fortunate to have them, stretched and under-funded as they are. Can they possibly report on neglected hives, even if only to the local beekeeping association, who can follow-up with an offer of assistance?

Clearly none of this reaches those beekeepers who are not associated with the state or local associations, nor those who have not registered their hive with the relevant authority, if required to do so. But if we are serious about the impact of the neglect that Steve describes, we need to start somewhere.

Like company laborers, we represent the beekeeping industry in what we say and do, not least because honey bees cannot speak for themselves. To start and then neglect a colony is a form of abuse and we have an obligation to do everything possible to prevent it. That is part of the stewardship that comes with responsible beekeeping. BC

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Dealing With A Case Of European Foulbrood

An old disease with no new solutions.

Tempus fugit

Time flies. Since 1974, I can document publishing more than 600 beekeeping articles for the popular media. This collection does not make me special, nor am I a record-setter. Others have written and accomplished much more. But what my multitude of published bee article contributions makes me understand is how much time has passed and how quickly it passed – and how much things have changed – or not.

In 2011, I wrote a piece that I have always remembered. I hope you, the reader, will not take offense, but most of my articles are *"for the moment."* A year later, or so, I have few specific memories of many of my articles. Forgettable – right? But "*Keeping Bees as best we can – with what we know,"* has been one article that I have always remembered. In that article, I wrote that we had, *"lots of questions with few real answers,"* and that as beekeepers we were, *"keeping bees in the gap."* By *"gap,"* I meant that we were being forced to routinely make management decisions in the gap between a question and its answer. I find myself in this reminiscing state-of-mind because one of my colonies has European foulbrood – again. Different year. Different colony. Same disease. I'm back in the *gap.* I am in the space between the question, *"What do I do about European foulbrood"* and that question's mostly non-existent practical answer.

European foulbrood then

When I began beekeeping in the early 1970s, European foulbrood (EFB) was a prominent "legacy" disease that was well documented in the beekeeping literature. During those days, the primary concern about EFB was distinguishing it from American foulbrood (AFB) which was (and continues to be) a much more serious malady. At that time, the answer to the question, *"What do I do about European foulbrood?"* was to treat EFB colonies with three doses of Terramycin and the gram-positive, non-spore forming, bacterial disease would clear up. If not, treat with three more doses and it would either clear up or Winter would be approaching, and the self-limiting disease would fade away on its own. If the disease reoccurred the next season – you know the drill – treat with Terramycin. The antibiotic was cheap and was readily available from bee supply sources. Antibiotic application was a routine beekeeping procedure.

European foulbrood now

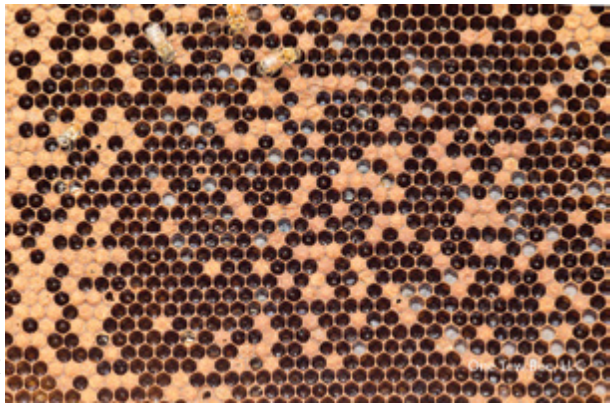
As you know, Terramycin, and antibiotics in general, are now much more restricted within beekeeping and within society in general. To use them, beekeepers are required to get a prescription from a veterinarian. I've never done that, and I don't really know how to tell you how to find such a beekeepingly-educated person. Currently, I don't see that as my purpose here.

For several decades, we had an imperfect solution for controlling EFB. Antibiotics. The clear reality is that I ***do not*** have access to bee antibiotics now. *(As a hobby beekeeper, I sense that I probably never should have had such access.)* So now, I am in the EFB gap. I have the question, but I do not have the answer.

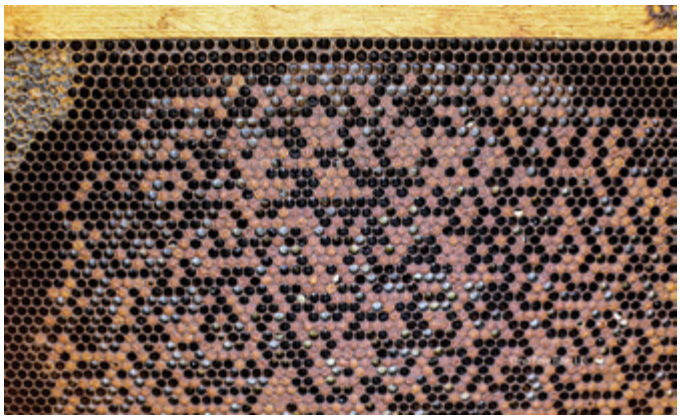
The diagnosis

This season, I knew one of my package colonies had a drone layer. The last time I checked the other packages, they were all thriving. One package colony almost immediately replaced its queen, but it did so successfully and was now rushing to catch up. All seemed good this Spring and Summer.

As I opened what had heretofore been a thriving package colony, I was met with the characteristic smell of decay and spotty brood pattern of a failing colony. This is a beekeeper moment that only comes with experience. My first thought was, *"Oh my stars, is this American foulbrood!"* I admonished myself to



American Foulbrood comb.



European Foulbrood.

stay calm and to form an enlightened diagnosis.

Essentially only larvae were affected. From this characteristic and from other symptoms, I voted against AFB. But now, there is a new kid on the bee disease block – *Bee Parasitic Mite Syndrome (BPMS).* It was a reasonably quick call to decide that, while varroa mites may have been the EFB vector, this colony was not collapsing from a massive *Varroa* infestation. Nope. This is a case of European foulbrood – again. I had an outbreak in two colonies three years ago. Both died.

At that moment, as I stood by the colony, I did not care that the name of the causative agent had changed multiple times in the past decades. As I stood by the colony, I did not care (much) at what stage the larvae is in when it dies. As I stood by the colony, I did not really care that it could have been infected bee bread that caused the illness. I wanted one clear thing – just one thing. I wanted to know what to do help this ailing colony recover – right now. Yet, that information was not available, but I was given some suggestions (guesses) that were thought to help. Thanks. *Welcome to the frustration of decision-making in the gap.*

The modern-day EFB treatment conundrum

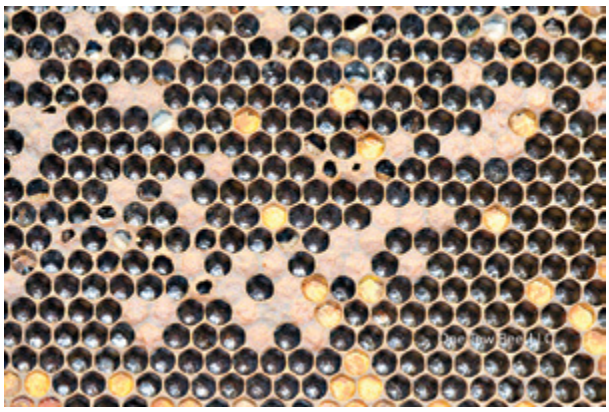
This colony's EFB case was advanced. Part of the colony's problem was that it had a beautiful, productive queen. She was producing major amounts of brood, and much of it was diseased. The brood patterns were nicely formed. Multiple frames have been filled with brood. This was a good queen that was producing copious amounts of diseased brood.

Antibiotics

In the old days, I would most likely have had some antibiotic product on hand. Back then, having a powdered sugar mix at the ready, was perfectly normal colony management. During the halcyon days of antibiotic beekeeping, the procedure was: (1) See the disease – (2) Treat the disease with antibiotics – and (3) End of the disease story (so to speak).

But this is today. The procedure would go something like this: (1) See the disease. (2) Stop everything. (3) Contact a veterinarian who participates in the bee health program. (4) Wait for a return call. (5) Get a prescription (I suppose). (6) Get the script to a supplier. (7) Mix and apply material. (8) Wait and watch. Days have passed – maybe even weeks. From my view, for hobby beekeepers, antibiotics are no longer a quick fix. They probably never really were.

So, for a EFB gap beekeeper, I'm comfortable writing that antibiotics are not practical. But the use of antibiotics is still possible. For full instructions, see: Dr. Chris Cripps' thoroughly written *Bee Culture* article at: "*Do I need a vet for my bees?*" **https://www.beeculture.com/do-i-need-a-vet-for-my-bees/**



Bee Parasitic Syndrome (BPMS).

Requeen the EFB afflicted colony

Of course, requeening the sick colony is a common suggestion. For most of us, blaming (or praising) the queen's performance is a universal approach to many modern bee colony management recommendations.

In this instance, for EFB management, it is thought that the break in brood rearing gives worker bees in the sickly colony time to remove diseased larvae and to clean the cells in preparation for new healthy offspring.

Additionally, it is suggested that the queen's progeny was genetically susceptible to European foulbrood – to a greater or lesser extent. Ideally, the new queen would fortuitously produce future progeny that was more resistant to European foulbrood – but there is no guarantee. So, while this is a rational plan, you are going to be out of time and money for buying and installing the new queen – all without a promise of improved EFB genetic resistance.

To get a grip on the huge picture of typical annual bee colony management, I sense that beekeepers break that big picture into smaller ones. So, in one instance, maybe I am worrying about swarming, while in another smaller picture, I am concerned about controlling robbing behavior. Even later, I wonder what to do about *Varroa* populations. As are most management topics, these examples are all interconnected. They do not truly stand alone.

When I replace the queen in my EFB-infected colony, I am addressing EFB pathogens, but I am also unintentionally affecting this colony's ability to gather stores for Winter. Its worker population will have been stunted by the queen replacement procedure. But this colony would have had foraging problems anyway – too much of the queen's brood output is already undersized or outright

dead. Adding to the morass, there is yet another variation on the disease control theme – by replacing the queen and causing a brood break, I have unintentionally set back the in-hive *Varroa* population. While I was trying to control EFB, I did a pretty good job of lowering *Varroa* populations. Am I practicing queen management or am I controlling varroa? Oh, wait! I'm supposed to be trying to control European foulbrood.

Emergency queen cells on EFB brood comb. Note abundant uncapped larvae.

Destroy diseased brood combs

Another common recommendation is to destroy all brood combs in the sick colony. While I am inclined to implement that recommendation, that does not mean that I do not feel some pain as I destroy six or seven brood frames with a beautiful pattern of sickly brood. Good queen, but bad brood results.

A perfunctory review of the function of a burn pile in the apiary rarely gets mentioned, but it should. The typical burn pile is an important beekeeping tool. Destroying diseased frames of combs, destroying old combs with too much drone comb, burning broken frames, or disposing of spent hive bodies, are some examples of the usefulness of the *"burn pile."* No bee disease can contend with fire. Burning diseased combs is usually a good idea.

My EFB – my problem

I know. My EFB challenge is actually my bees' problem but seemingly my bees are losing this battle. I need to step in. It's what I do. I'm a colony manager, but exactly what should I do?

1. I will destroy about eight brood frames and reduce the colony to a single deep.
2. I have already been feeding thick sugar syrup to simulate a nectar flow.
3. The queen. What to do with her? In order to stop brood production, I removed (caged) her from the colony and have allowed the colony to start the process of emergency queen production. That is the cheapest move I can make.

I can't take credit for #3 above being all my doing. Yes, I caged the queen and left her in the colony. I only wanted to see if the colony's level of hygienic activity would quickly go into high gear with the queen out of circulation.

I returned five days later, mentally prepared to find a dead caged queen. She was fine, but with the colony still showing signs of diseased larvae, the nurse bees had started numerous emergency queen cells on a small amount of remaining brood. It was a "*humph*" moment for me in the yard. Rather than release the queen back into her own colony, I would permanently remove her and allow the bees to finish what they had started – building a new queen and cleaning the final remnants of the EFB infection. That would require me leaving a couple of diseased brood frames in the colony on which the queen cells were developing.

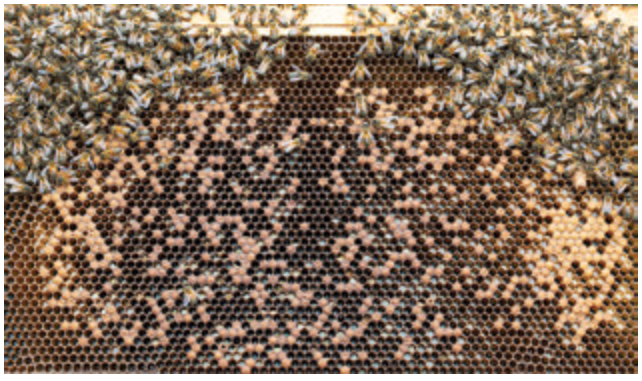
My ulterior motive

In yet another of my package colonies having an entertaining story, is a colony that has a beautiful, marked, drone-laying queen. Classic. Just classic. In some ways, like the EFB queen, the drone layer is producing prodigious amounts of brood – but it's all drones. I should have addressed this issue several weeks ago, but honestly, I kept it for photographic purposes. How about I try this move – I replace the drone-laying queen with the EFB queen? *Gasp! Gasp! Choke!*

White[1], in his classic EFB bulletin produced in 1920, wrote, *"European foulbrood is not likely to be transmitted by queens or drones. Whether they ever do so has not been demonstrated."* While I did nothing that could be called a thorough EFB literature review, what I did perceive in my web-based review is that other than making antibiotics nearly impossible to use in my hives, few advances have been made in managing this disease. As antiquated as I might sound, returning to classic, pre-antibiotic scientific information has practicality.

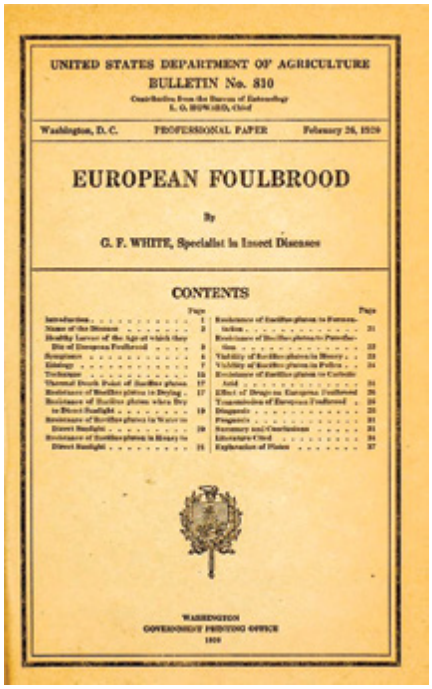
It's not just EFB . . .

European foulbrood is not the only bee disease with an uncertain course of action. In reality, beekeepers do not have a definitive protocol for any bee disease or pest. So bottom-line, when I find European foulbrood in my colony, I can plan on that colony being a marginal player in my apiary. In fact, it has a good chance of dying. I can requeen and fiddle with combs. I can feed. I might even resort to antibiotic use, but when all is considered – for this season – this colony will not be a producer this season. I sense that the most I can



A comb from a colony infected with European Foulbrood.

[1]White, G.F. 1920. European Foulbrood. United States Department of Agriculture. Bull. No. 810. Government Printing Office. Washington. 47 pp.


UNITED STATES DEPARTMENT OF AGRICULTURE
BULLETIN No. 810
Washington, D.C. PROFESSIONAL PAPER February 26, 1920
EUROPEAN FOULBROOD
By
G. F. WHITE, Specialist in Insect Diseases
CONTENTS

White's publication on European Foulbrood is digitally available at: ***https://archive.org/details/europeanfoulbroo810white/page/n1/mode/2up***

hope for is for it to be strong enough to survive the looming Winter.

My saga is not new. EFB issues have always been like this. During recent decades, it could be said that we have gone a bit backwards. The upside of my situation is that at least my colony had EFB and not American foulbrood (AFB). That would have been much worse. See – things are not all bad. BC

Dr. James E. Tew, Emeritus Faculty, Entomology, The Ohio State University and One Tew Bee, LLC
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https://www.honeybeeobscura.com

For a short video on **"Dealing with a Case of European Foulbrood"** and more comments on this month's article, hover your smart device QR app over this code....

https://youtu.be/P-W2EniF840

OBITUARY

Hillsboro, WI – Leland R. "Lee" Heine, age 73 years, of rural Hillsboro, Wisconsin, passed away on Sunday, August 1, 2021, peacefully after fighting a 2+ years courageous and valiant battle with Pancreatic Cancer.

He was born November 19, 1947 in Waverly, Iowa and was raised in Parkersburg, Iowa. He was the son of Raymond and Marie Heine, both of whom predeceased him, as did grandson, Cody Schmidt.

Lee married his wife, Nadene on February 5, 1968. They were blessed with three children, Todd (Cass) of Chilton, WI, Vincent (Seung Ju) of Little Neck, NY and Leah (Hari) Aiyer of San Pedro, CA. Lee was also blessed with four grandchildren, Cody, Vincent Jr., Sophia and Benjamin.

He worked in the finance business prior to joining Dadant & Sons in 1978 in Hamilton, Illinois. He transferred to Watertown, Wisconsin in 1984 and managed the branch until retirement in 2012. During this period, he also started the largest honeybee package distribution outlet in the USA. He operated this until 2016. Lee gave back to his industry and was well known by many in the industry. He served as President of the Wisconsin Honey Producers and held many other positions. He was appointed by two Secretaries of Agriculture to serve on the National Honey Board. He served as Chairman of this for three consecutive terms. He was a member of several organizations and was honored with many awards over the years. He was very proud of his achievements.

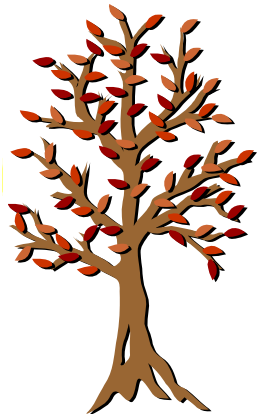
Lee was also an American Legion member and a proud Veteran of the U.S. Army.

He loved his sports as a participant, fan and coach. He coached football and baseball for many years and was a longtime Badger season ticket holder.

Lee is survived by his wife, Nadene and his children and grandchildren. He loved them all very much.

No funeral services will be held per his request. All Memorials can be made to Agrace Hospice Foundation – 5395 E. Cheryl Parkway, Madison, WI 53711 **www.agrace.org/donate** or Pancreatic Cancer Action Network – 1500 Rosecrans Ave., Suite 200, Manhattan Beach, CA 90266 **www.pancan.org.**

The family would like to thank all his supporters during this battle. A special thank you to the nurses at Kraemer Cancer Center in Richland Center.



Looking For A Different Perspective

Tracy **Farone**

Looking for different perspectives...

As I write this at the end of June and the dawn of July, it is berry picking season. I love berry picking season! Blueberries, raspberries….blackberries. The season brings back fond memories at my grandparents' small farm to current analogies I share with my students. I show my students struggling with career choices pictures of blueberry bushes from different perspectives. It is amazing sometimes what is hanging out on the "deeper branches". Many of my biology students take similar classes which help them find their way into all types of health and research careers. Similarly, raw berries can turn into so many fantastic things, raspberry pie, blackberry jam, blueberry muffins, blueberry wine… One trick I have learned is to look at the tree from all perspectives. Do not just pick the berries on top, look under, change your perspective. This same principle can apply to many situations.

After writing for more than a year for *Bee Culture* from a veterinary perspective, I would like to hear more from you! **Got questions of a honey bee medical nature? Like to hear more about a certain topic in bee health? Put me to work!** Please submit specific queries or topics to: **tsfarone@gmail.com** I have always found that dialogue and consult are key tools in sharing the best information BC

Any questions?

Blueberry baskets.

Raspberry pie.

Blueberry bush.

Honey Recipes –

Shana **Archibald**

BROWN SUGAR & HONEY BACON

1 lb. bacon
2 c. brown sugar + additional ~1 c.
1 tbsp. red pepper flakes
Honey to drizzle

Mix the two cups brown sugar and red pepper in a ziploc bag. Drop in the bacon – a couple of strips at a time – and shake until coated. (This is easier and cleaner than coating with your hands, but you can get all hands on if you want.) Place each coated slice onto the broiler pan. Drizzle the slices in honey – you really can't put a wrong amount on.

Place in the oven and set a timer for 25 minutes. After every five minutes sprinkle some additional brown sugar, if desired. And that's it! Enjoy.

HONEY LEMON POPPY SEED MUFFINS

2 cups of white or whole-wheat flour (or all purpose flour)
1 teaspoon baking soda
1 teaspoon baking powder
½ teaspoon salt
½ cup honey
½ cup vegetable oil or olive oil
½ cup Greek yogurt or sour cream
1 teaspoon vanilla extract
2 eggs
2 lemons (juice from 1 + zest from 2)
3 tablespoons poppy seeds

Preheat your oven to 360°F

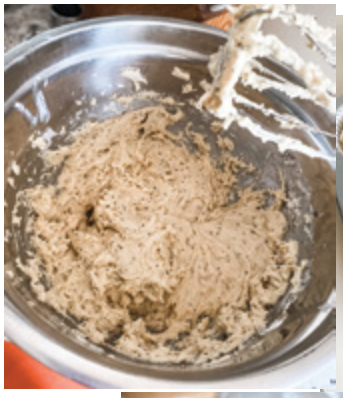
Zest two lemons using a microplane, and squeeze the juice out of one lemon. Measure and prepare the other ingredients.

Combine all the wet ingredients in a bowl; eggs, Greek yogurt, olive oil, vanilla extract, honey, lemon juice.

Then, add the dry ingredients; baking powder, baking soda, salt, flour and lemon zest. Mix the ingredients together until just combined.

Place muffin liners in a muffin pan. Fill the liners about 2/3 full with the batter.

Place them in the oven, and bake for about 17 min, or until a skewer or toothpick inserted in the middle comes out clean. BC



CALENDAR

♦INTERNATIONAL♦

2021 Beekeeping Tour To Slovenia September 9-24.

Prices are based on a minimum of 10 people. $3600, $200 deposit due by August 1. Remainder due August 15. Price includes everything with a few exceptions.

For information contact Suzanne Brouillette at **beeslovenia@gmail.com**.

Alberta Beekeepers Commission Conference and Trade Show will be held November 25-26 at Fantasyland Hotel, Edmonton.

For information please visit **www.albertabeekeepers.ca/about/2021-agm-conference-trade-show**.

♦ARKANSAS♦

Arkansas Beekeepers Association Fall Conference will be held September 24-25 at Ozark Folk Center in Mountain View.

For information please visit **arbeekeepers.org**.

♦GEORGIA♦

2021 Geogia Beekeepers Association in person conference will be held September 24-25 in Gainesville.

Speakers include Tom Seeley, Victoria Soroker, Geoff Williams, Jonathan Lundgren and Jim Tew. Welsh Honey Judge classes and Master Beekeeper certifications will be offered on Thursday September 23.

For information visit **gabeekeeping.com**.

♦ILLINOIS♦

IL State Beekeepers Association will hold its annual meeting November 13 at the Northfield Inn, Suites & Conference Center in Springfield in celebration of their 130th year.

Registration is $20/members and $30/non-members. Pre-registration will include lunch. Speakers include Jim Tew and Adam Dolezal.

For information please visit **ww.ilsba.com**.

♦INDIANA♦

Beekeepers of IN Fall Conference will be held October 29-30 at Blue Gate Inn/PAC in Shipshewana.

Speakers include Ana Heck and Selina Bruckner. Cost is $40/members and $50/non-members. Children 15 and under/$25.

For information visit h**ttps://indianabeekeeper.com/events/fall_conference**.

♦IOWA♦

IA Honey Producers Association Annual Meeting will be held November 13 at West Des Moines Marriott Hotel, West Des Moines.

Speakers include Bob Binnie and Kamon Reynolds.

For information please contact **IHPAtreasurer@gmail.com**.

♦LOUISIANA♦

The LA State Beekeepers Association and the USDA Honey Bee Breeding, Genetics and Physiology Lab will hold the 25th Annual Field Day October 30. It will be held at the lab, 1157 Ben Hur Road, Baton Rouge.

Pre-registration is $35 for 12 and above. Children 11 and under must stay with their parents. Walk-in registration is $40.

For additional information please visit l**abeekeepers.org** or contact Frank Rinkevich, **frank.rinkevich@usda.gov**.

♦MISSOURI♦

Missouri State Beekeepers Fall Conference will be held October 8-9 at the University of Central Missouri in Warrensburg.

Speakers include Bob Binnie and Cameron Jack as keynote speakers.

For pre-registeration, hotel accommodations, and information visit **Mostatebeekeepers.org**.

♦OHIO♦

BEEing Diverse: Inspiring Leaders In Beekeeping Event sponsored by *Bee Culture* will be held October 1-3 at the A.I. Root Company in Medina.

Speakers include Tammy Horn Potter, Sue Cobey, Geraldine Wright and more. See page 46 of this issue for all of the details.

For registeration visit **www.beeculture.com**.

♦TENNESSEE♦

Tennessee Beekeepers Association Fall Conference will be held October 8-9 at MTSU in Murfreesboro. Early registration is $40/members and $60/non-members.

There are 35+ speakers including Chris Werner, Gary Reuter, Kamon Reynolds, Randy McCaffrey, Jay Williams, David Glover, Jennifer Tsuruda and Kent Williams.

For information see **https://tnbeekeepers.org/tba-2021-conference/**.

♦WISCONSIN♦

WI Honey Producers Fall Convention will be held November 4-6. at Hotel Mead Wisconsin Rapids.

Sue Cobey is the keynote speaker.

For information contact **Liz9120@hotmail.com**.

♦VIRTUAL♦

Honey Bee Veterinary Consoritum will be viewable On-Demand September 18 - December 31, 2021..

Online registration coming soon.

For more information see **www.HBVC.org**.

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If you are having an annual meeting or teaching a beginning beekeeping class, we are happy to send you magazines to give to your attendees and students. BUT – we need to receive your request four weeks before your event so that we have time to process your request. Please email Kathy at Kathy@BeeCulture.com with the number of magazines needed, a complete mailing address and a contact person.

It's early July as I write, and hot enough to make a beekeeper cry for mercy. Our western Colorado highs range in the high 90s. We did have 103 a few days ago.

Some of our ditches have run dry. We suffer from extreme drought in this part of the state, so you'd expect that honey yields might be down. Flowers need water to be healthy and produce the nectar that honey bees miraculously convert to honey, right? Not so fast. Paul explained to me that he's getting a bumper honey crop from alfalfa at a drought-stressed location. He offers that alfalfa, with its 15-foot taproot, can survive with little or no rainfall or irrigation, at least for awhile, and that the plants sometimes respond to this by putting all their energy into nectar production, at the expense of growth.

I'd call that a silver lining.

One way to stay cool when the beeyard feels like a blast furnace is to jump in the river with all your clothes on. If you've never tried this, you'd be astonished how makes it possible to continue working, even in the most oppressive heat.

After fishing, Paul and I generally stop at the fly shop. The shop guys drop everything to greet Paul. Fifty years on the river, and you earn some respect. On our last visit, the manager grilled Paul on his day, before he turned to me. "Oh, I'm just Paul's bodyguard," I explained.

With two replacement hips and one replacement knee, you might call the gal Marilyn "bionic." Bad hips run in her very large Irish Catholic family, and I suspect some German shepherd in her genetic makeup. But she still has the right knee she was born with. On the Fourth of July weekend, I heard a scream from up by the barn. I found my darling angel lying on her side. She'd gotten between Pepper the blue heeler and his nemesis, the mean golden rooster. When the rooster attacked, Pepper slammed into Marilyn, and there she lay. She couldn't put any weight on her right knee.

We located some crutches in the basement. I passed up fishing on July 4 to help Marilyn set up for the Farmer's market in Palisade. It reached 100 degrees, and poor leashed dogs were burning their pads on the pavement, but Marilyn did all right at the market.

After we packed up that day – two days after Marilyn's accident – she visited an urgent care facility. The diagnosis? "Age-related degeneration of the right knee." We already knew she had that. She started feeling better a day or two later, and when she took off the next weekend to visit her sisters in Denver, she left her crutches behind.

Last night I had dinner with some shirt-tail relatives. Chuck used to own bees, and when I was president of the Colorado State Beekeepers Association, I once talked him into attending one of our winter meetings in Castle Rock. He later described it as "something like a Mafia confab." I never asked how he came to that assessment, but I do recall a riotous meeting. At one point, when someone made what I considered an absurd proposal, I, the president, simply said, "No, we're not going to do that." I cut that motion off at the knees. This was not exactly Robert's Rules of Order, or democracy in action.

My *Varroa* mite counts this summer have so far been consistently low, as in typically zero or one mite per 300 bee sample, using a sugar shake. I've been giving colonies showing three or more mites per sample a treatment – either Formic Pro or Hopguard Three. Both treatments are approved for hives with honey supers. I only recently began treating, so I have no report on efficacy. I use Formic Pro when I can, but at most yards temps have been too high, i.e. above 85 degrees.

Heavily mite-infested colonies succumb to any number of viruses, and this can spell Fall and Winter losses. It's the strong hives you want to be wary of, because *Varroa* breed and thrive in colonies with lots of brood. I generally don't even bother checking my dinks. *Varroa* numbers naturally double every 30 days or so, so the mites are a moving target. Whatever treatment I apply, my goal is to keep mite numbers under 20 per 300-bee sample by late November or early December, when colonies go brood-less, and I can burn the mites' little legs off with an oxalic acid dribble.

I had one outlier – a colony that tested 30 mites at the end of June. I can't explain this. There are to my knowledge no managed hives within flight range. I ruled out these bees having picked up mites by raiding nearby colonies. But I could be wrong. In any case, I was surprised to see such a high mite count so early in the summer. Thirty is a *Varroa* count I expect in August or September, not June. This hive was at 9,000 feet, where temperatures have been topping out in the mid-eighties, so I was able to use Formic Pro. I gave this colony Hopguard as well. I'm not sure you're supposed to use two treatments at once. But that's what I did.

So how are the mites faring on your bees? You say you've never seen any? Did you treat? Have you done a sugar shake test, or an alcohol wash? You say you suspect *Varroa* might be somebody else's problem? You poor innocent! You'll just have to learn the way I did, the hard way.

Ed **Colby**

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