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June Features . . .

CORRECTION

In the April 2020 issue of *Bee Culture*, on Page 55 "University of Illinois Bee Research", Alison Sankey should have been listed as co-author of this article.
Our apologies to Alison for this oversite.

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Honey bee on a hydrangea. Photo by Jennifer Berry.

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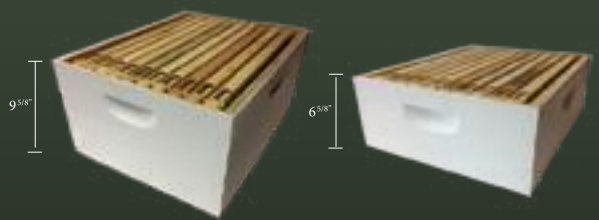

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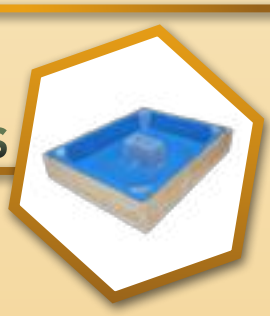

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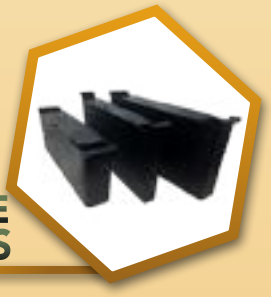

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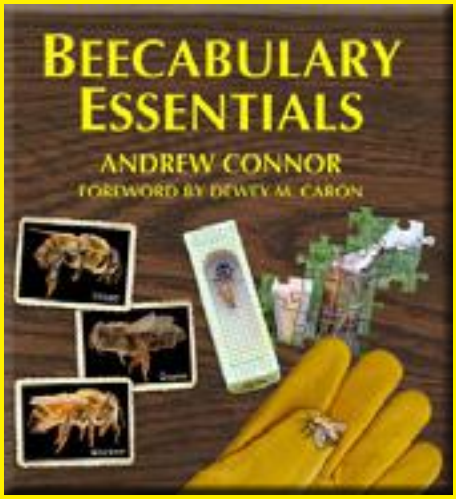

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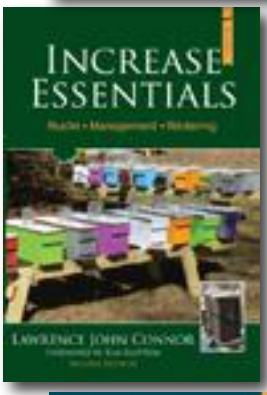

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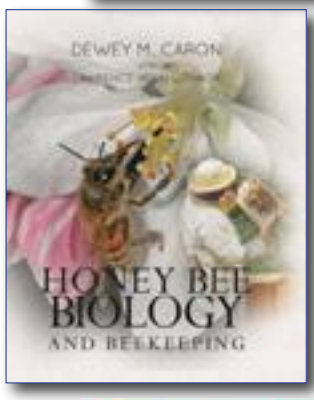

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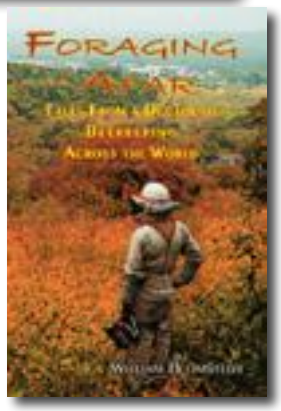

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Beekeeping In The Time Of Corona

A few nights ago, I sat down at the TV to check out the latest zombie thriller streaming on Netflix. After 30 minutes of anarchy, plague, social breakdown, death and destruction, I realized I was watching cable news and hurriedly hit the off button! No doubt a combination of the (hopefully temporary) dystopia we are living in, coupled with the zombie series that I eventually did watch, fueled my imagination to consider just how useful it might be to own beehives in times of disaster.

As I saw shelves being cleared of food by nervous hoarders, my hives began to take on a whole new level of importance to me. I have always viewed the honey as a luxury; something sweet to be enjoyed as a delicacy. But with possible food shortages on the horizon, I began to investigate the other types of sustenance a hive can provide during hard times; particularly those that could sustain my body longer, and more comprehensively, than honey alone.

Bee-bread was the obvious first choice. I had long known it was packed with protein, since bees use it in raising brood. A little deeper research, however, showed me that there is much more to this "superfood" than meets the eye. Rather than consuming their pollen fresh, bees mix the pollen with nectar and digestive fluids and store it in empty comb cells. Sealing the cell with a drop of honey, the pollen has been transformed into bee bread and can last indefinitely. Lactic acid bacteria in those digestive fluids also serve to partially ferment the pollen and, in doing so, break down some proteins into amino acids (which can be more readily absorbed by our bodies) and make certain vitamins more available to us. It has been described as "the only perfectly complete food" due to the fact that it contains all the essential amino acids required for the human body, as well as high levels of unsaturated fatty acids.

Feeling better that I already had one reliable source of fat and protein at hand, my mind turned to the bees themselves and, in particular, the drone brood that many of us cull each year in order to keep *Varroa* mites at a manageable level. Drone larvae and pupae are already eaten as a delicacy in Mexico, Thailand and Australia, and are reported to have a "nutty" flavor. Although it may take a literal zombie apocalypse for me to indulge in some Drone Soup (TM), insect protein has great potential to feed a rising world population, and has very little negative impact on the environment compared to more conventional animal protein sources.

Entomophagy may sound distasteful to our Western sensibilities, but it has deep roots in human history. Studies suggest it played a part in transforming our ancestors' brains into the complex machines they are today, and it is mentioned as a viable food source in all of the Abrahamic religious texts. Sadly, for the ultra-religious among us, only our Muslim friends are officially sanctioned to eat the honey bee. The Bible permits Christians to partake only in locusts, katydids, crickets and grasshoppers, and our Jewish pals may consume four different varieties of kosher locusts, but no bees.

And what of the honey itself, by far the largest product of any hive? It would be a tall order to subsist on this delicacy alone, but in a community facing food shortages, the potential for barter is high. A beekeeper could potentially fill her larder by trading among the local community, with what might be the only available source of sugar during a crisis. Ask people what they crave even more than a sugary fix, and the one answer might be "booze." We beekeepers can provide that, too, along with beeswax candles in the event of blackouts, and bacteria-fighting propolis for medical purposes.

While concerns over personal food security are likely to take on more importance in times of emergency, the wider issue of national food security is relevant at all times. Making sure we are not dependent on imports is vital for the security of our nation, and beekeepers are a vital part of the domestic agricultural system, ensuring we are not beholden to foreign powers for the basic necessities. The resourcefulness of the beekeeper can make for a stronger home, community, and country and should be encouraged and celebrated.

Peter Keilty
BeesForAll.com

Falling In Love With Honey Bees

March of 2018 walking the yard of an Alabama correctional facility, praying, meditating and watching the beautiful ladies hover from clover to clover is where they caught my attention.

I had already been thinking of buying some land and planting a garden, which I've never done nor was I from the country. However, from my childhood I remembered my aunt and uncle had a garden with two beehives, and from biology in school I new honey bees helped somehow. So I told God that I think I need a beehive on my land, but I don't know anything about honey bees. I just did like Mother Mary in Luke 2:19 . . . "kept all these things and pondered them in her heart," I pondered it in my heart.

The very next day I sat at a table to eat with two other guys, Mike (I'd known for six years) and Daniel (whom I did not know very well). Out of the clear blue sky Mike says, "Hey Mark, Daniel wants to open up a honey bee farm!" I almost spit food all over them! Before I could swallow my food, they jumped to another subject. I just smiled in my heart and thanked God for the "eyewink."

Later I saw Daniel and asked about raising honey bees. Daniel, being in the college program had access to the college's library books, and used the opportunity to use it toward one of his economic papers. Therefore I was able to read everything he read. Starting with *How To Keep Bees* by Anna B. Comstock; *A Book Of Bees* by Sue Hubbell; *Dancing With Bees* by Karl vonFrisch; *The Buzz About Bees* by Jurgen Touz, and many other articles. Somehow I got a Mann Lake catalog, which is how I learned about *Bee Culture* Magazine, which I truly love! I bought my own books *Beekeeping For Dummies* and *100 Plants to Feed the Bees*. I cannot get enough and I have so much to learn. I have fallen in love with the ladies! And me being Italian plan on having Italian queens with lots of ladies!

My relationship with the ladies is very precious to me. One early morning reading my Bible, God gave me a name for his honey bee farm (not able to reveal at this time). I will establish His honey bee habitat with 100% of his help, all for His glory and to provide a habitat for His people like myself, needing a new beginning. Thank God for II Corinthians 5:17. His mercy, grace, forgiveness, for His glory! Amen!

Mark Carruba
Alabama

Most of you know that putting together *Bee Culture* is kind of like working on a jigsaw puzzle. All the perfect pieces are before us, great articles, big ads, small ads, Bee Talk, Jim Tew, Jay Evans, the contents page that all have to fit in the right place so you get the best experience, the best picture. That is why we start two months before the next issue comes out, to get it right. I am writing this in early May as I have procrastinated and we are finishing up this June issue. This whole, self-quarantine thing, working from home, social distancing and when will it be over, and when it is over will it really be over is on all of our minds. But, it has given me time to think and mull over lots of things about this industry that I love.

I get the opportunity to talk to dozens of you each week. So I get lots of questions, comments, and suggestions. And, sometimes I get taken to task because you care about Honey Bees as much as I do. I get lots of information and opinion about what you are concerned about and how *Bee Culture* should present it. I want to wander a bit here and share with you some things that have been bubbling in my mind.

You, we, us, are a unique subset of the general population. We love an insect. Everybody else is afraid of insects (entomophobia) and wants to kill them with a spray can of something, or powder of something or hire the people on TV to come to their house and spray stuff outside and inside. Managing this insect we love that lives in a sealed up dark wooden box takes a special suite of KSA's, knowledge, skills, and abilities. If we walk up to a beehive we can see the bees at the entrance, the guard bees or the foragers coming back and forth flying in and out. We don't know what is going on inside becasue it is meant to be sealed and protected. Is there enough honey, nectar and beebread inside? Is the queen doing her fundamental thing and there are lots of eggs developing into larvae the pupae and then new adults? Can we see any bacterial diseases like AFB or EFB, or viruses causing DWV (Deformed Wing Virus) or the other 30+ viruses attacking the bees of different ages? Is there *Nosema apis* or *ceranae*? What about *Varroa* or Tracheal mites. Then if you have all of these interacting with each other causing something worse than each by itself what does it look like and then what the heck do I do?

If you raise cows, or pigs, or chickens or whatever, they are out in the open and the farmer/rancher can take a walk through and see what they look like. Is anything different or doesn't look right? Is growth going well or is it too slow? Or, what is that rash on the chicken, or why did the hair fall off the cow in that spot. But, the most important thing is the farmer or rancher has a toolbox overflowing with tools to help them be as successful as possible. Such as decades of research to identify and recognize pests, parasites, and diseases quickly and easily. Then there are veterinarians who have trained for years and years who know what is going on along with Extension agents, industry reps, and others who want to help. Along with all of this are multitudes of products, like antibiotics, vaccines, miticides, growth regulators, perfect diets, temperature, and humidity-controlled growth environments.

But the most important is that there are lots of diagnostic tools to test for pests, parasites, and diseases, identify them accurately and then have a whole catalog of appropriate treatments and management techniques.

And, I am glad they have those tools to keep these animals healthy and growing so 330 million of us in the U.S. can eat and we and our families and friends can grow and be healthy and contribute something positive.

Honey bees, through pollination of fruits, nuts and veggies are responsible for creating Billions of dollars worth of nutritional plant human food diversity that keeps the big box produce section filled, the canned food aisle and juice section full. But, think about it, what do we have as tools to help us preemptively identify honey bee diseases or give an accurate ID of something that we have a question about as beekeepers? What do we have to help us preemptively ID viral diseases? What do we have to quickly and easily ID Nosema? What do we have to tell us how many *Varroa* are in a colony without tearing the colony apart? What do we have to easily ID Tracheal mites? What do we have to quantify Queen egg-laying? What about larval health and production and will ALL the brood develop and emerge perfectly?

We don't have much of anything. We don't have consistent verifiable diagnostic tools for the majority of honey bee health issues. For the most part, beekeeping is a visual sport. It requires us to open a colony, manipulate it by taking out frames, and looking at the bees on them and what is in the frames to compare and contrast what we know or what we can learn. Then we have to arbitrarily make a decision, a guess, spontaneously. Why don't we as beekeepers have the devices, tools, diagnostics that exist for livestock and pets?

If you have 10 cows and five die, in a perfect world it takes 283 days for all of the five left cows to have a calf. Then another two years for that calf to mature into an adult and get back to the 10 cows you started with almost three years earlier. If you have 10 honey bee colonies and five die you can take the remaining five split them, requeen, feed and in a matter of weeks, you are back to 10 colonies that are big and ready to do the amazing things honey bee colonies do for everything in the 2.5 miles that they interact with the environment in.

Beekeepers and honey bee biology are simply too good, too productive, too adaptable. If we lost 50% of honey bee colonies in the U.S. and it took three years to replace them what would a million acres of almonds do, or apples, or peaches, or pumpkins, or berries or canola or, or, or, do? My question to you is how do we convince industry, government, the universities to develop the diagnostic tools, EASILY used diagnostic tools, to keep us beekeepers informed and ahead of the pests, predators, and diseases that we struggle with continually. Then we need management control products and systems to be successful. I am really tired of keeping bees in the 20s – the 1920s. Send me your ideas, **jerry@beeculture.com**. Thanks for listening. *Jerry*

From The Editor —

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It's Summers Time –

Losing A Hero And A Friend

The beekeeping world, *Bee Culture* and lots of us on a personal level lost a dear friend on May 1. Ann Harman who has written for this publication since the 70s, passed away after a short stay in the hospital. Ann turned 89 just a few days before she passed away. I think in some ways I thought she might live forever. She was one strong lady.

We'd gone through this before over the years. A phone call or an email from Ann's daughter Joyce, saying Ann was in the hospital. She'd fallen off the tractor, off the horse or down the stairs. She had some virus or infection. A broken hip last year. But she always came back, almost seeming to be stronger each time. But this time was more than she wanted to deal with and she was tired. So Joyce took her home and a few days later, after communicating to all of us, she left us, very peacefully and in control. Ann even dictated a very short final article to Joyce, which we will have in the July issue.

If you've been in the beekeeping world for very long or attended very many meetings, you certainly, probably know of Ann. She was a force in our industry. She loved bees and beekeepers. She loved to teach new beekeepers. But she had high expectations also. Ann expected all of us to learn and to do well. She didn't tolerate excuses very well.

I first met Ann Harman in person at EAS 1994 in Lancaster, PA. I had known of her because I had worked for *Bee Culture* for several years by that time. So I got her article every month, early, and placed on the pages. When I first started her column was recipes. I always looked forward to her holiday recipes. One year she wrote about making treats for your horse or your dog for Christmas. I remember being slightly intimidated by her when we first met, because she had such a presence. The only thing tiny about Ann was her stature.

As I became more involved with EAS over the years it gave me the opportunity to spend time with Ann and we became good friends. We would usually see each other a couple of times a year – at EAS or the American Beekeeping Federation meeting or some other state meeting along the way.

Ann always got her articles to us early – not just on time, but early. And sometimes, well in advance because

Ann, Bob Cole and me at EAS 2001.

she was leaving the country, usually with her pal, Bob Cole. We would joke that she was going off to some place that we couldn't pronounce and didn't have any vowels. She and Bob travelled extensely as volunteers going to foreign places, that the rest of us couldn't imagine, to teach people how to keep bees and from that how to have better lives.

Later, she and Bob started selling books at meetings, so we would see her more often. It was always a treat to be with her and talk with her. We'd talk about the cats – she had cats and we had cats. Ann stayed in our home a few times over the years and so she actually got to know our cats. And she met my boys when they were young and over the years would always ask how they were doing.

Kim and Ann had a bond that was wonderful to witness. I'm not sure when their relationship changed into a friendship, but Ann was loyal to Kim and to *Bee Culture* and she would take on any challenge he offered her. Tiny Ann has left a big hole in both of our hearts.

I'm often reminded of the unique opportunity we have as beekeepers to meet some extraordinary people. People we would not cross paths with if we didn't have this common interest. Think about it. At bee meetings I've met doctors, lawyers, pilots, scientists, old, young, rich, poor – all consumed by this tiny creature.

Kim and I have been so blessed to be a part of this industry. We have made wonderful friends all over the world. We've gone places I never would have dreamed I would get the chance to visit.

So a huge thank you to all of you who have been in our lives, who read the magazine and who appreciate what we try to do each month and in between. We're far from perfect, in this not so perfect world, but know that we do our best.

Thank you Ann, for being in my life – for teaching me, being an example of a strong woman, and mostly for being my friend. I miss you.

Ann always signed her emails with a quote. I've saved many of them. Below is the last one I got from her.

We should tackle reality in a slightly jokey way, otherwise we miss its point. Lawrence Durrell, novelist, poet, and playwright (1912-1990)

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ORGANIC	White	$.96		
ORGANIC	Extra Light	$.97	-	$1.00
ORGANIC	Light Amber	$.86	-	$1.02
ORGANIC	Amber	$.97		
INDIA				
Mixed Flower	Extra Light	$.77	-	$.80
Mixed Flower	Light Amber	$.70	-	$.80
UKRAINE				
Sunflower	White	$.84	-	$.97
Sunflower	Extra Light	$.84	-	$.97
Sunflower	Light Amber	$.90	-	$.97
URUGUAY				
Mixed Flower	Light Amber	$.82		
VIETNAM				
Mixed Flower	Light Amber	$.66	-	$.80

Table 48 - U.S. honey imports, by importing country, calendar year *Millions $*

Country	CY2010	CY2011	CY2012	CY2013	CY2014	CY2015	CY2016	CY2017	CY2018	CY2019
(0001) WORLD	113,930	130,764	141,016	153,102	165,777	175,243	166,442	202,449	196,600	188,602
(5330) INDIA	18,462	26,912	21,454	25,867	20,290	36,123	29,364	45,143	44,201	49,691
(5520) VIETNAM	20,738	27,826	20,700	33,586	47,107	36,973	38,494	36,288	39,156	36,980
(3570) ARGENTINA	17,414	33,502	42,482	44,221	36,888	27,081	34,708	35,378	36,219	36,466
(3510) BRAZIL	10,036	14,981	11,303	11,677	19,249	15,440	19,062	24,031	23,604	23,858
(5700) CHINA (MAINLANI	1,547	1,531	19	60	0	98	148	72	9,647	9,611
(4623) UKRAINE	440	453	1,302	3,308	8,876	11,411	11,086	19,362	8,324	8,713
(1220) CANADA	11,053	7,148	15,971	9,385	5,612	8,234	13,510	15,762	15,222	7,870
(2010) MEXICO	3,325	2,846	6,179	5,648	7,254	5,364	4,557	4,783	3,315	3,321
(6141) NEW ZEALAND	1,048	965	966	1,234	1,625	1,992	1,840	4,200	1,673	1,661
(5830) TAIWAN	1,755	903	1,324	1,827	2,523	4,442	1,580	1,649	1,680	1,651
(5490) THAILAND	1,699	1,637	258	846	3,458	10,753	4,238	4,453	4,639	1,583
(3550) URUGUAY	852	7,083	10,877	8,710	5,362	7,243	1,767	4,025	1,326	1,362
All Others	25,561	4,978	8,182	6,735	7,532	10,088	6,087	7,302	7,594	5,835

Source: U.S. Department of Commerce, Census Bureau.
Updated: 4/15/2020.

Calendar Contest 2021

2021 – WOMEN IN THE BEEYARD

We all know many Beekeepers. We want you to share those great photos of Women Beekeepers that you know. Full shots of Women working Honey Bee colonies, putting honey supers on, pulling honey supers, sampling for *Varroa*, putting treatments in, uncapping, extracting, bottling, selling honey ,even your State Apiary Inspector inspecting colonies plus the other 100 things Beekeepers do and have to do to manage successfully. We want to celebrate Women Beekeepers with next year's Calendar. It is for the women who are single, mothers, grandmothers, single mothers, love their family, manage careers, load the kids up for T-Ball and soccer practice and collectively make the world function more smoothly. These Women have also decided to enter the world of honey bees. This insect's world that most people are afraid of. They have found that Honey Bees connect them to a totally new reality and to its intimate relationship with its environment for miles and miles around its home. And they have experienced that the Honey Bee colony tolerates them as a temporary visitor. But, a supremely important visitor in 2021. Managed Honey Bees are no longer wild animals that can live independently. Pests, parasites and diseases have moved honey bees into the realm of pets and livestock. They need managed insightful care. Women are generally much better at connections, partnerships and intuitive awareness that results in a better outcome for those they embrace. At *Bee Culture* we want to recognize "Women in the Beeyard" as the leaders at all levels of Beekeeping. They make it Better.

Look at the shape of the photo on each page. Not quite square, certainly not vertical. We lose excellent vertical photos every year because we simply can't use them. Think of what your photo will look like when framing it with your camera. Then turn your camera 90 degrees and look again. You can take 100 photos to get one good one. Take 100.

THIS IS IMPORTANT.

Submit your photos as a single jpg file, attached to an email, not embedded in the email. Send one photo per email, and include **WITH EACH EMAIL YOUR NAME, MAILING ADDRESS AND PHONE NUMBER**. We got hundreds of photos this year and keeping them all straight when they are not identified gets to be a real difficult task – and there aren't many of us here to do that. If it isn't identified, it won't get looked at, so please label each.

If you send a CD with photos, write ON THE CD (NOT ON THE ENVELOPE OR BOX) YOUR NAME, ADDRESS AND PHONE NUMBER AND EMAIL. The same rules apply – no information, it won't get looked at. We're sorry, but we just don't have the time or people to organize a lot of photos and try and keep them all straight if they are not identified. Make it easy for us and you stand a much better chance of getting your shot in the calendar.

Deadline for submissions for *Bee Culture's* 2021 calendar is October 1, 2020 in our office and on my computer. So mark your calendars now (OH, look! It's already marked on your 2020 Calendar a month earlier!) and get going. Once entered, photos can be used by *Bee Culture* magazine.

As usual, send your photos as jpgs to me at **Jerry@BeeCulture.com**, with 2021 Calendar in the subject line. FOR EVERY PHOTO (1 PER EMAIL) include your name, email, phone and address. If you don't we can't use the photo. And good luck!

BEE TALK

Send us your questions, we'll find the answers. Our regulars and our guests will share what they know. Send your questions to Jerry@BeeCulture.com, with BEETALK in the subject line.

Question

It's June, it's hot and getting hotter, Spring has peaked for the most part, and this may or may not be your honey producing Summer, but what do you do, and what have you prepared to do for June and July really to get the biggest honey crop ever???

A. This is one of the reasons I love horizontal beekeeping, the long Langstroth specifically. Let me explain – it is a well-known fact that a large number of bees working together can far out-perform the same number of bees working in smaller colonies. If a long Lang is divided in the center, it can easily contain two colonies with queens, and the foragers from both work together to fill one stack of supers. In vertical Langstroth two-queen beekeeping, at the end of the season, one of the queens is killed, or the two colonies must be separated, since a queen excluder in a vertical stack of hives means that one queen is eventually abandoned. In a two queen horizontal hive, both colonies are big enough to survive Winter as long as supers are removed in time for appropriate back-filling of the brood chamber with honey. Each queen has 15 frames, 13 of which will be brood during the Summer. This creates a large work force, more than the single deep each queen occupies in a vertical set-up, while also limiting the size of the brood chamber so that all of the colony's resources don't go into raising two deeps worth of brood all Summer as in a standalone colony. ***Tina Sebestyen, CO***

A.In Texas, June and July are the months where beekeepers may see the Spring and early Summer nectar flows start to peter out and will enter a time of year where there is a dearth. I definitely experience this where I keep bees, so I will typically feed my hives sugar syrup to ensure they have enough food to make it to the Fall nectar flow.

In preparation for this time of the year, I will pull off any honey supers that are full from the Spring and early Summer nectar flows (if I my plan is to extract honey). I will then follow up with a thorough inspection of the brood chamber to make sure the queen is doing well and brood is being produced. I will also check on the developing larvae, the brood cappings, and the adult bees to make sure they all look healthy and there are no signs of pests and/or disease. Finally, I'll do an alcohol wash on each hive to sample for *Varroa* mites. Depending on what my results are, I will implement measures to either continue preventing the mite population from increasing, or take steps to control the mite population if they are reaching or exceeding the economic threshold. This is the perfect time of year for many beekeepers in the south to start prepping their hives for fall nectar flows by ensuring their hives are strong and healthy. ***Mary Reed, TX***

A. During June and July Western Ohio can be very hot and dry during Soybean bloom in late July. If the soil is dry, and nights very warm, different varieties will produce a heavy nectar flow for approximately two Weeks. If several local fields with the nectar producing variety are planted A few days apart, the flow will last longer.

To prepare for the possible nectar flow, colonies require proper management in advance. Locally adapted, *Varroa* resistant stock, with a young, large well mated queen and *Varroa* populations below 2%. With proper nutrition the colony must grow without swarming to a population of 60/70 thousand workers To provide a large field force.

The Brood nest must be provided with room for the queen to expand her laying Without being crowded. That requires bottom supering, meaning adding a super immediately above the Brood nest but below the Honey Barrier.

Open up a space Within the honey barrier by moving two or three frames of honey from the honey barrier, replacing With Drawn comb frames. Add another super above the honey barrier putting the two or three Frames of honey into the new super.

Both the brood and honey areas must have room to prevent swarming.

The above hive management system will prevent swarms plus yield large Soybean Honey yields with a side benefit of increasing the farmers bean yields by 15 - 18 percent. Happy Beekeeper, happy farmer. ***Dwight Wells, OH***

A. As Richard Bonney propounded in his classic Beekeeping: A Practical Guide, beekeeping requires preparation, ongoing attention, and commitment… No matter what your goals, the first commitment should be to learning." So what I prepare to do for a great honey crop is read and talk with other beekeepers. I try to bear in mind the "Four Principles of Productive Beekeeping" advanced by Furgala, Spivak and Reuter: have good equipment on a good site, have a young prolific queen in each colony, have adequate food reserves at all times, relentlessly apply best practices for pest and disease control.

As June approaches, I have applied these principles as best I can for 10 months. In early Spring I equalized and split to prevent, and if need be, control, swarming, and

when I'm ready to super, it's like putting the cake in the oven; I have to wait until its done. But even then, I'm not completely passive. Right before supering, I make sure the colony is queenright. (I don't have time to thoroughly inspect each colony for swarm preparations again, this late in the season. If I see young brood, I'm good.) As the flow progresses, I monitor the incoming nectar based on the weight of the supers, and rearrange them to provide more room for the stronger producers. I'll stagger the supers on the boomers a bit in hopes the bees will organize a multi-tiered nectar transfer system throughout the stack. (I don't know if it works that way, but surely the air flow will help cure down the moisture – won't it?) When I find a blowout that swarmed I'll move her supers to one of the boomers. While the bees are bringing in the crop, I prepare for extracting, looking for the newest cool thing to make the job go faster with my terrific crop. ***Bob Sears, MO***

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Tip of the Month – Frame Holder

If you can't take your bees to the office at least take part of the office to the bees. Old metal hanging file folder frames from file cabinets can be modified slightly and made into frame holders for bee hive inspections.

Begin by loosening the screws which clamp the end frame to the side rail, slide the end frame towards the other end until they are 18 inches apart and re tighten the screws. Cut off the side rails with a hacksaw at about 18¾ inches long. File sharp edges down and paint if desired. Check fit by hanging a standard deep frame in. It should fit nicely with ½-inch clearance at bottom.

In the beeyard, place in a inverted outer cover or even on top of the hive next to the one you are working in. While it won't hang on the side of the hive, it does hold more frames, seven as opposed to three or four for the hanging type.

Kenny Brotzge, Shepherdsville, Ky

Tips For Around The Beeyard

Beekeepers are always looking for new ideas to make keeping their bees easier and better.

Bee Culture wants you to share your good ideas with our readers. Be precise and include a photo or sketch if possible, but that may not be necessary. If we use your idea you get a free one-year subscription. The best each month gets $100.

Send your ideas to

jerry@beeculture.com

New For Beekeepers –

New! MicroCloud Applicator is a compressed air tank attachment to inoculate your hives with probiotic bacteria. Beekeepers can now use this sleek applicator to easily measure microbial powder and quickly deliver it through the hive entrance, without opening the hive. Commercial beekeepers who use SuperDFM-HoneyBee every month save time and labor while regularly supplementing beneficial bacteria to their bees. Manufactured by Strong Microbials. Visit **www.strongmicrobials.com/applicators** for more information. Image below.

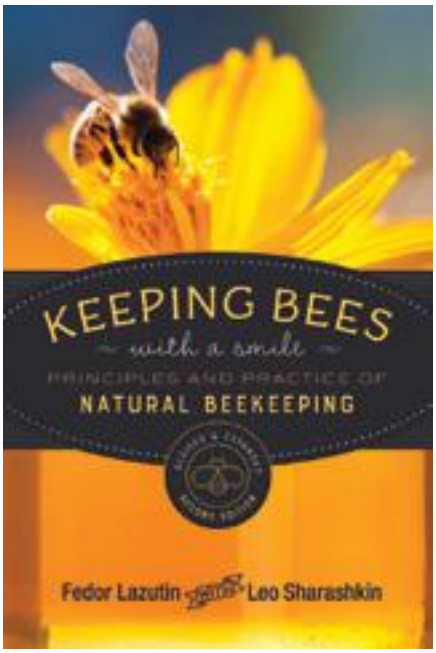
New! **SuperDFM-HoneyBee™** is now available in Canada.

In 2019, at the request of Strong Microbials Inc., honey bees have been added to the Health Canada Veterinary Drug Directorate species list. Shortly after that, SuperDFM-HoneyBee, Notification Number NN.C9G8, became first probiotic for honeybees registered as a Veterinary Health Product in Canada. SuperDFM is available from these retailers: Global Patties, Propolis-etc., and StanAbbey Bee Supplies. Visit **https://www.strongmicrobials.com/distribution** for more information.

Keeping Bees With A Smile. Principles and Practice of Natural Beekeeping. Fedor Lazutin, with Leo Sharashkin. New Society Publishers. ISBN 978-0-86571-927-9. 343 pgs., black and white with color insert. $34.99.

This is the second edition of *Keeping Bees With A Smile* by Russian author Fedor Lazutin focusing on natural beekeeping using horizontal hives with deep combs. It is written, as Dr. Tom Seeley notes, for independent beekeepers. Those who wish to offer little assistance to a hive and want to keep bees without treating them with chemicals or intruding in their lives. It is, however, primarily aimed at those who deal with bees in the environment of deciduous forest areas of European Russia. The principles explained can, however, be applied of any locale and climate.

He first examines natural nests in trees, looking at combs, entrances, ventilation, temperature control by the bees in summer and winter, and looks at some differences between the races of bees you'll encounter. Then this natural hive is compared to a horizontal hive with extra deep frames, which is his home of choice for working with bees. His hives, as he states, are made the way they should be made, without regard to the time and labor that go into them.



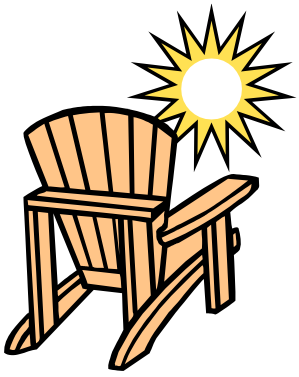
He constructs a box frame using 2" thick boards. This frame is then lined with plywood on both sides and then filled with polystyrene insulation. The outside is wrapped with Tyvek or roofing paper and the whole covered with weatherboard.

This hive is easily moved, resistant to weather and can be easily repaired. Rabbets are added inside for frame support. An entrance is at the bottom, and one half way up the long side. A floor is one piece and has a landing board extending out beyond the bottom entrance. You can either use two frames to make up a large, deep 18" comb, or one large frame, which won't fit in an extractor. A hinged 2" thick insulated top covers all inside equipment. This box holds more than 20 frames. This is the horizontal hive.

The natural part of this natural beekeeping book is pretty straight forward. No feeding, expanding by swarms, no treatments, no requeening, pulling honey very late in the season after clustering takes place leaving ample stores for the bees, not adding supers for additional space. Broodnest frames are moved from the end in the spring to the center upper entrance area and frames added to either side of the brood frames, but other manipulations are minimal.

Natural beekeeping has, by design, many descriptions, and many degrees of what is natural. Not treating, using only local bees, using a well-insulated box that doesn't get moved and having minimal nest manipulation during the season is the definition used here. You can add, or delete any of these manipulations.

Kim Flottum



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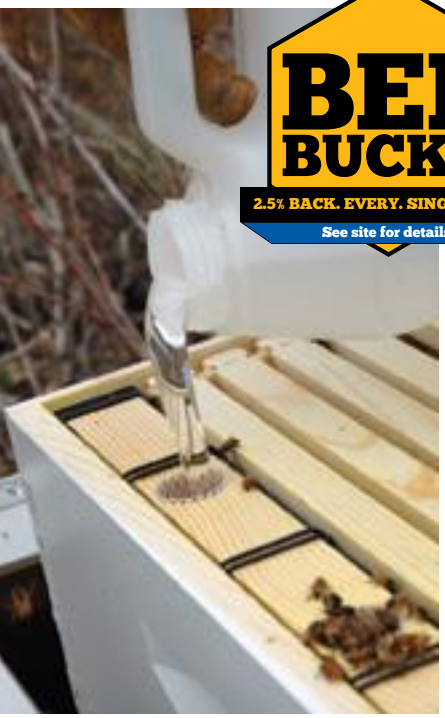

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FOUND IN TRANSLATION

Bee Space In The Time Of Disease

Jay **Evans**, USDA Beltsville Bee Lab

Today, many human societies continue to distance themselves socially to slow transmission of the RNA virus causing COVID-19. Honey bees do the same and researchers are trying to describe the behaviors behind this distancing and the outcomes for honey bee health. Distancing in bees, or more generally 'social immunity', takes many forms and the language to describe it is inherently wrapped up in our own perceptions, with terms like 'hygiene', 'undertakers', 'shunning', and even 'altruistic suicide'. While studies focused on exactly how bees limit disease transmission in the hive are ongoing and complex, there is ample evidence that bees do so. First, honey bee workers are adept at identifying and removing sick or parasitized nestmates from the hive. Normally, there is a power dynamic in this form of hygienic behavior. Removed colony members are larvae or pupae and they tend to be hopelessly sick, or even dead, before they are moved. In this case, brood are not removed kicking and screaming (were they to have legs) and there is little chance for conflict between an individual bee's potential and the 'good of the colony'. But consider the case when super-hygienic worker bees open up cells with active *Varroa* mites, breaking the mite cycle even before a parasitized larva or pupa has suffered disease. Here, the larva might well have survived fine and gone on to be a productive colony member. Still, in the big picture, slowing mite population growth can provide longterm advantages for the rest of the colony, even if the involved larva never recovers from what was, at the very least, the uncapping of her brood cell.

More interesting are interactions between adult worker bees that reduce the spread of disease. When adult bees die, they are soon removed from the nest by undertakers, middle-aged bees that are often specialized on this task. In a fascinating new study of social immunity, Adrian Perez and Brian Johnson, from the University of California-Davis, tease apart what hygienic bees do when they are not pulling dying brood from the hive ("Task repertoires of hygienic workers reveal a link between specialized necrophoric behaviors in honey bees", *Behavioral Ecology and Sociobiology*, 2019, 73: 123, **https://doi.org/10.1007/s00265-019-2731-7**). They confirm that hygienic bees are devoted to that task. Nearly half of all observed hygienic tasks were carried out by 3% of these middle-aged bees. Interestingly, bees seen pulling dead brood from colonies were also far more likely to be undertakers for dead adult workers. Why is that? Cues, including smells, might be the same for dead brood and dead adult workers. Or maybe there is a skill set that needs to be learned in order to pry loose and carry another bee. The authors also suggest that reserving hygienic tasks for a small set of the workforce is one way to reduce colony disease risk, since hygienic workers might be prone to pick up infectious microbes from their quarry and it is best to reserve that risk for a select few colony members. It is even conceivable that individuals who are already sick are recruited to a hygienic role, since their infections lessen the cost of more exposure.

Hygienic removal of a pupa. Photo by Steve Ausmus, USDA-ARS

Some of these experiments can make you reflect on our own sickness behaviors. While 'feeling sick' is generally thought of as a way for the body to rest and focus on costly immune responses like fever and our active set of immune proteins, there is a line of thought that sick individuals, by seeking isolation, might also protect their families from disease. Perhaps this is a universal selective force in humans, bees, and other

animals that live in family groups. And if individuals do not choose to practice social distancing, in some cases their nestmates might force the issue. Sarah Biganski and colleagues in Germany established colonies full of marked bees in order to see how bees were treated when sick with *Nosema ceranae* ("Social response of healthy honeybees towards *Nosema ceranae* -infected workers: care or kill?", *Apidologie*, 2018, 49:325–334, **DOI: 10.1007/s13592-017-0557-8**). When an infected bee was placed in a cohort of healthy bees she had a high probability of being dismembered and, in general, infected individuals received a lot of attention from healthy nestmates. Contact rates increased over time, as these infected individuals grew sicker. In contrast, when *all bees* in a cohort were sick, those with the highest disease loads appeared to be shunned by nestmates, or at least they were less likely to engage in social interactions. Avoiding sick nestmates is an excellent strategy for bees to limit their own exposure. Esmaeil Amiri and colleagues from North Carolina State University wanted to see if social avoidance of sick nestmates applied to the most precious colony member, the queen. In their study ("Israeli Acute Paralysis Virus: Honey bee queen-worker interaction and potential virus transmission pathways", *Insects*, 2019, 10, 9; **doi:10.3390/insects10010009**), queens were readily infected after interactions with attendant bees which carried viruses. These infections occurred even when infected workers had minimal direct contact with queens through a mesh. Interestingly, when queens were exposed to a group containing both clean and virus-infected attendants, these queens tended to associate more with the clean bees. The results were subtle, not perfect, and it was not clear whether the queens shunned these sick bees or perhaps they simply weren't as active as attendants, but this study strongly suggests that barriers can exist between queens and their infected daughters.

From a breeding point of view, hygienic behavior, often quantified as the tendency over time for workers to clean out a patch of dead brood, has proven to be a very useful trait for selection. As tools improve for tracking more subtle interactions among bees, from self-distancing to active shunning, these measures can also be added to selection programs, with an aim for better colony health, even if it comes at the expense of sociability. BC

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HOME HARMONY

Kim **Flottum**

HOME HARMONY . . . One last time.

"Hey, my whatchamacallit is broken. You know how to fix it?"

"Nope".

"What am I going to do?"

"Call Ann. She'll know."

I worked with Ann Harman for the entire 33 years I spent as Editor, and even a bit before I was here. My boss, John Root, knew her before I started, and Jim Tew probably did too, and eventually, probably everybody who has ever done anything with honey bees, been to a bee meeting almost anywhere in the world, read a beekeeping magazine, entered a honey show, did something with a Master Beekeeper program got to know this wonderful, petite ball of fire with a laugh that'd knock you off your chair, and a smile that brought light everywhere she went. But I was lucky because I got to interact with her at least once a month, and often, very often very much more than that for all those years.

And I have the great good fortune to have been able to work with her on all the levels she was active in. Let me start at the beginning.

I was elected President of the Connecticut State Beekeepers Association back in 1985, and at the time the President was automatically the EAS Director. Being from Wisconsin, I has no clue what EAS was, but in the fall of 1985 I went to my first EAS Board Of Directors meeting in Pennsylvania. I didn't know anybody at the meeting, so was the new kid on the block sort of. At that meeting, then Chairman Jack Matthenius, who had served since 1978, abruptly stepped down due to some confusion with the then Secretary/Treasurer, who also stepped down at the same time. Suddenly, EAS had no leadership at all. And not knowing anybody, I was mostly a spectator as the Board grappled with what to do next. What they did late that night was choose Bob Cole to fill some very big shoes.

Everybody was staying in the dorms on the campus where the meeting was to be held the next summer, and walking back to the dorms I caught up with this tiny speck of a lady who was walking alone.

I recall my exact comment. "You guys really know how to have a meeting", I said. To which she replied, "I'm amazed they got it figured out so fast. It usually takes them a whole day to decide what time it is." It turns out Ann pretty much all the time said exactly what was on her mind. That she did not suffer fools gladly was an understatement. But she did it carefully, even kindly, most of the time.

She introduced herself as the Director from Maryland, and had been for some time. In fact, she had been a speaker, the Chair of the Honey Show, a Master Beekeeper, workshop presenter and general all around 'when it's broke, Ann can fix it' EAS Helper, whether for registration, speakers, meals, transportation, rooms, shows or anything else that happens during the week of EAS, anywhere, everywhere.

That next spring I moved to Medina, but was appointed 'EAS Membership Committee of one' by Bob Cole, so I got to stay on the Board, and got to know all of the good people there at the time, Ann certainly among them. I found out later that she had had several articles published in *Gleanings*. A collection of how-to and why to, and some basic management pieces. How to make a skep caught my eye certainly, and using baler twine for smoker fuel were typical. And, coincidences are always interesting, it seems Ann, with her friend Ernie Miner published a cooking with honey cookbook that year, and we started talking about producing a cooking with honey column for the magazine. That started in late Fall my first year on the job, and It was well received by our readers. We called it, really, Home Harmony. She thought it a bit too cute, but it worked, and she became one of the regulars, along with Jim Tew, Richard Taylor, Steve Tabor, Clarence Collison, Glen Gibson and Charlie Koover. Maybe not the first regular female columnist, but certainly one of the best, and absolutely the longest.

When Bob Cole finished his stint, Dewey Caron was elected Chairman, and stayed on for a decade, believe it or not, and Ann was Director, then not, then Dewey appointed her Vice Chairman. She became kind of indispensable, because whoever was in charge knew that if they didn't know something, Ann did, and could help, or fix, or make it better somehow. She organized short courses for EAS, arranged and judged annual Honey Shows, was a Master Beekeeper examiner, EAS Speaker, officer, Board Member, Journal contributor, and Program officer, among other duties, responsibilities and always an 'I can do that' volunteer.

When Dewey stepped down as Chairman there were two nominations for his replacement – Ann Harman, and Kim Flottum. To serve as Chair, you at some time in the past had to have served as a President so there were lots of people who could have, but only a couple that were interested, but when the dust settled, I was chosen as Chair, and I immediately chose Ann as Vice Chair. Who better to step in for a MIA Chair than somebody who already knew the job. And I also engineered the formation of the Chairman's Award for service above and beyond, and the first one was given to Ann, who waits Dewey's Right Hand for all the years he served, and in anticipation for all the years I was to work with her. And thus we stayed for the next eight years, Editor and Columnist, Chair and Vice Chair. I think we did a pretty good job at both all

those years, and we did have a lot of fun. It got to the point where we were finishing each other's sentences sometimes at Board Meetings. And of course, my tenure as Chair ended after eight years, but our relationship with the magazine kept on going.

There were two outstanding qualities Ann had as a regular columnist. She was never, ever late with her work, and she would always ask, what do you need this month? And she always did what was needed. But better, she'd make suggestions about some aspect of what month it was, what season, what holiday, what about that new product, what skill can I teach or technique can I show, or what hole needs filling this time. And over more than three decades, she filled every hole that needed filling and covered the topics needing covering, and did it all, every time, on time. From an Editor's perspective, she was a dream come true.

Adding to her experience was all the international teaching and travel she did. She and Bob Cole went to more countries, more places, and taught more people than you can possibly imagine. All volunteer of course, and all because somebody just has to show them how to do it right, better, faster, easier. And she did. We used to tease her a little, because she kept finding countries to visit that didn't have vowels, or weren't on a map. But she was off again.

There were always animals in her life. Maine Coon Cats, almost bigger than she was. And dogs and more dogs, many Burmese Mountain dogs, that were always bigger than she was. Her daughter is a large animal vet and they lived close, so there was always animal activity, with cats, dogs, horses and more. Over the years those large animals occasionally took their toll. Falling off a horse is no adventure, and falling off a big horse can be nearly deadly. We nursed her through several of these events over the years. And falling off a tractor was more of an adventure than even she wanted, but she always bounced back, tougher and, well, wiser in new ways I guess.

Her last adventure was the result of a fall also, and the complications that arose were just a tad more than she had energy to deal with. That a petite lady of her age was in a position to fall is amazing, and she finished her last column while trying to recover. It was on time, by the way.

You never know who is going to make a difference in your life when you first meet them, and too often we take these very special people for granted – that they should be this good, this kind, this special forever is a given. I often expected things from Ann that no normal, regular person would ever be able to accomplish, but I always knew she was up to the challenge. So now the whole beekeeping world, the whole world in fact, has a hole to fill.

I can only imagine that where she is can only get better because she finally got there. Be careful Ann, and don't ever take fools gladly, but do so with that wonderful smile. Thank you. BC

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BIGGER PICTURE

Jessica **Louque**

Social Distancing

At first, I wasn't going to write about Coronavirus. Hopefully by the time this edition comes out, we will be well on the way to recovery from this insanity and the virus will be under control. Then I thought about it and the majority of what we do as beekeepers, homesteaders, or preppers really falls into this situation. If you ever talk to a real prepper, they are not amused by shows like Doomsday Preppers or shows that portray them as insane. They are setting up for situations just like this. While the zombie apocalypse is much more entertaining, reality that faces all of us is much more in line with what we see now. Looking back at economic collapses like Venezuela, food shortages, and mass hysteria, we are basically allowing our media to control our lives and crash our economy. You can watch news that is biased towards either political side and know it's not the truth. People will agree with whichever side they tend to vote with, regardless of seeing both sides. Nothing these days is separated from a political agenda. President Trump has to be the most hated president in the history of the nation, or at least the most disrespected. Whether or not you agreed with the politics of the standing president, most people still offered a modicum of respect. Instead of dividing our country and letting the media speak for everyone, maybe we should all think about what caused such a majority of the nation to vote for someone that everyone else vehemently hates, and try to reconcile those differences. Instead, there is no more gray area, no more moderate, and no compromise from either side. Say what you will, but getting your information from what is supposed to be a reliable source is no longer a valid option for the truth. If you want to find the truth, you have to figure out what is to be gained by the spin on the story and who profits or benefits from it. What does this mean for everyone? It means trust no one to take care of you and your family but yourself.

As I said before, hopefully a lot of this is behind us by the time you read this. If not, I suspect a lot of people have learned to use something besides toilet paper since it's constantly sold out. Situations like this might make a lot of people reconsider their priorities. Purchasing essentials in bulk is great, but a lot of people can't afford to do that, or don't have the space. We do it because there are six basically adult-sized people in our household and it's just the norm for us. A lot of food products have become scarce, cleaning products, and basic items that come from people being scared and home. To go out to buy things is now risking infection and the health of your family each time you leave your house. The internet is no longer a reliable source of home shopping since they can't meet demand either. It will be a lot harder now, but it's the time to keep in mind that no one is safe from disaster. On one hand, you can take a look around and see who still has a job in the time of economic collapse. Who is important, and who can we do without? Many people who probably thought they had secure jobs are no longer in that zone. On the other hand, everybody going to work right now is at risk of exposure for themselves and their loved ones.

Jessie bass fishing.

The boys fishing with Grandma Joyce.

There's no real winning in this situation. Hoarding is a huge problem right now, as people spend the remaining money they have to try to stock up every chance they get, when they can even find anything on the shelves. Everybody gets mad at the hoarders but that's one of the things that makes people feel like they have some sort of control in a situation that is completely out of our hands. If everyone was a long-term hoarder, aka prepper, we'd all be in a better situation right now. We've had issues at our local grocers and meat market from people from other states driving down and buying hundreds of dollars of food and taking it back with them, presumably for their family or to extort, but it takes away our resources that we counted on, leaving us with empty shelves and resentment. I would do the same thing if I had to for my family, but a lot better planning could have prevented the hysteria in the first place.

If you're already in a *Bee Culture* magazine, you're at least on the right path. Beekeepers tend to disagree on a lot of things, fall across the political spectrum, and live wildly varying lives. On top of it all though, we all come together with at least a healthy respect for nature and a bit of self-sustaining that comes with maintaining a colony (or several) for benefits rendered to the beekeeper. If push comes to shove, a bit of preparation can yield several products from the hive that are useful in multiple situations. Honey is the biggest product we are going after with bees. It is high calorie natural sweetener that can be used to modify most any recipe. Another advantage is pollination of a home garden. Natural diversity is the best for pollination, especially since a lot of our favorite home crops are not actually pollinated by honey bees (think tomatoes, eggplants, peppers, potatoes, corn) but honey bees definitely help out. I know some of you guys are living in cities and having a lot harder time with this than the country people, so finding ways to sustain your family might be a little harder – or make you question where you live. Beekeeping supplies are always running low in the Spring of every year, when thousands of people decide to make beekeeping their new hobby… with or without

Henry squirrel hunting (we do eat them).

Chickens checking out the bees.

instruction. This year in particular, it seems that everyone has decided that they are going to run headfirst into being super farmer, with chickens and bees and gardening and self-reliance. This is not necessarily a good idea.

Obviously, I am saying that you should learn to be self-reliant and resourceful. The craziness running rampant right now is a recipe for failure in all these endeavors. People don't just wake up one day and become a good farmer. No matter how backwards country people seem, it takes a lot of work, skill, time, education, and common sense to manage farming systems. Honey bees and beekeeping is not easy, nor is it cheap. There's a lot of time and effort that goes into managing colonies successfully. Chickens are even more time consuming and costly, and can be wiped out just as easily as bees, while bordering on animal abuse from an ignorant caretaker. Growing a garden is a lot more than just throwing some seeds in the dirt and hoping they'll grow and waiting to harvest. It's even harder now with social distancing because you can't just call up a more knowledgeable person and have them run out to take a look. Most of us have bees in places that don't pick up internet and won't allow for a real-time video chat or diagnosis.

Take a look at your family's needs. No matter what happens, nobody likes to be out of control of their daily lives. Figure out what you can realistically do to minimize your reliance on the government and society. In some

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rural cases, this may even be a community-sized effort. Joining the local fire department and/or rescue squad gives the opportunity to learn life-saving skills and take useful classes for free. It's almost not worth it for most medical issues right now to risk going to a hospital, and there's a chance they won't treat you anyway. Most medical information can be applied in some way even to your pets if necessary.

Learn as much as you can about sanitization methods and always wash your hands every time you come in your house. A dental hygienist would also be useful, but learning the basics of dental care is a good start. Read up on what's locally available in your area for medicinal and food plants in the wild. Beekeeping helps with this because most beekeepers are usually ready to learn about all the bee forage around their hives. Decide realistically what foods your family will and won't eat, and learn to grow those. You may have to learn to live with alternatives in a temporary food shortage situation, but be prepared. With the social distancing going on, YouTube has a ton of videos on almost any subject that can help you get started on learning a new skill or hobby. If you have water nearby, learn to fish and how to catch and prepare food-sized fish. Learn to hunt wild game and how to process those. If our area is any indication, you won't be able to buy a new freezer anytime soon, but learning to can foods is a staple of rural America and a great way to store food without electricity use.

Take it upon yourself to be responsible for your family without adding undue burden on the rest of society. If you need to stockpile food, do what you can but rotate what you eat every six months or so. Make sure you can appropriately store the food you have without spoilage or infestation. Mice will love some oatmeal and pasta you tuck away in a closet, and beetles will be in your flour and cereal in no time. The most important thing here is that you take the time to educate yourself about how to do the things that will help you and your family. Teach yourself, teach your children, teach your neighbors if you can. To be honest, I like social distancing because I don't like to be around people anyway, especially after seeing how many people don't wash their hands in the first place.

Charlie and a bass.

The reality is that it's not normal for our society, and we need to be able to be ready for times like these when our situations are out of our control. Life is unrealistic – plan for everything. BC

Jessica and her husband Bobby run a business and raise kids and bees and other critters from their home in North Carolina.

Sustainable Cropping Systems

Jeff **Mulhollem, PSU**

By diversifying their crop rotations to create conditions that promote beneficial, predatory insects to combat pests, farmers can reduce their reliance on insecticides to control early-season crop pests, such as caterpillars, and still produce competitive yields of corn and soybeans.

That's the conclusion of Penn State researchers who conducted a six-year comparison of two types of crop rotations under no-till production. One was a standard corn and soybeans rotation in which preventive insecticides were used twice annually to suppress caterpillars and other pests; the other a diversified rotation of corn, soybeans, Winter wheat and cover crops hairy vetch or red clover that used insecticides only as needed.

The study, which is part of a broader, ongoing dairy cropping systems research project, took place at Penn State's Russell E. Larson Agricultural Research Center. Scientists began the larger, interdisciplinary experiment in 2010 to evaluate ecological cropping strategies for Pennsylvania dairy farms.

The results suggest that a high-diversity rotation that supports integrated pest management – often referred to as IPM – can compete with a low-diversity system that includes pesticides, according to lead researcher John Tooker, professor of entomology in the College of Agricultural Sciences.

"The research shows that if insecticides are taken out and we let the system stand on its own, it can be productive, and it can be as competitive as the more input-heavy system," he said. "We have not yet explored the economic side, but if you take the next logical step and consider the costs of applying insecticides, you see that if farmers would rely more on ecological interactions, they would benefit financially because they would have lower input costs."

Using IPM to manage the high-diversity rotation, researchers scouted plots during the growing season, generally looking for damage on corn plants. They made a specific effort to quantify the damage from slugs and caterpillars, the most consistently problematic pests in the Mid-Atlantic region, between corn emergence and growth stage.

Damaged corn. Photo by John Tooker, research group/Penn State.

They set traps to assess slug numbers and analyzed partially eaten caterpillars to estimate predatory ground beetle numbers. If pest populations got too high, they could have applied insecticides, but they needed to use them only once in six years.

The research team documented that yields produced by the two systems were similar; the more diverse rotations promoting predatory insects and not using pesticides averaged about 10% lower yields.

The findings, which were published recently in Agriculture, Ecosystems and Environment, may convince farmers to consider switching to diversified crop rotations that favor predatory insects and using pesticides only when they have to, but Tooker believes it will be a tough sell.

'Sustainable intensification' of cropping systems good for farmers, environment

"Conventional farmers often don't think that the power of the predators in their fields can manifest in this way and make that much of a difference, but our research seems to be showing that they do," he said. "Predatory insects can make a difference if you let them, but you need to farm with them in mind, and that means using IPM. And for a lot of farmers, that would be forcing them to alter the input pattern they are comfortable with."

That pattern, Tooker noted, typically includes insecticide-coated seeds, insecticides sprayed preplanting, possibly applying insecticides postplanting, and maybe even another application midseason. It's not uncommon, he added, that during his activities for Penn State Extension he encounters farmers who apply insecticides four times during the growing season.

This research shows that they're not necessary to grow a competitive corn yield in Pennsylvania, Tooker said.

"In my mind, our research results mean that farmers can reduce insecticide use, but they need to have the right mindset to want to try – something has to push them in this direction. One thing that I've heard from farmers that may motivate them is their struggle with commodity prices.

"Commodity prices aren't great these days, and farmers often are struggling to make a profit. Not having to pay as much for insecticides would help their bottom lines, but using IPM would still allow them to protect their fields when necessary."

Also involved in the research at Penn State were Heather Karsten, associate professor of crop production/ecology; Anna Busch and Margaret Douglas, graduate students in entomology; and Glenna Malcolm, a graduate student in plant science.

Funding for this project came from the U.S. Department of Agriculture's National Institute of Food and Agriculture. BC

Diversifying rotations, using integrated pest management allows reduction of pesticide use, maintains yields

Fall armyworm). Photo by John Tooker, research group/Penn State.

Slug traps. Photo by John Tooker, research group/Penn State.

Whatever we do in production agriculture affects honey bees. Reduced pesticide use is always a plus . . .

Jerry Hayes

Header ground beetle.
Photo by Nick Sloff/Penn State

A few years ago, my wife Natalie and I sold homegrown pumpkins on a hay wagon in front of our farmhouse. On a Saturday morning, Natalie's 10-year-old second cousin, Katie, pedaled up and dismounted her moving bicycle which careened to a temporary resting place. Katie, being a Kendrick, thoroughly enjoyed storytelling. She was also a good student and had mastered the use of the compound sentence, bridging one dramatic event to another with comma and conjunction:

". . . and on Monday . . . but then on Tuesday . . . and after that . . . but we never . . . so then the substitute teacher had to call in another substitute."

After relaying all the events of her school week, she eventually reported on the activities of the present day and said her friend Julia was spending the night. Katie said, finally punctuating a sentence with a period, "I need two pumpkins for carving."

"How do you figure on carrying pumpkins on a bicycle?" I asked, as she caught her breath. She informed me that she would reserve the two best pumpkins. She said Julia and her were going to the Bar-H Haunted Hay Ride in the next town over. She said Bar-H's ghosts were creative and age-appropriate – one even zipped-lined down from the top on an old dairy barn with a nerf gun. She said her mom was letting them stay with her grandma Nell, our closest neighbor. She would retrieve the pumpkins when they got to her grandma's house before the Haunted Hayride. She said not to let anyone steal her chosen pumpkins. She said this all in the same breath before finally stopping for air.

"Sure," I said, "but there's no need to go to the Bar H to find ghosts – two real ghosts live here on this farm."

Natalie felt her Kendrickness boil up and added the required disclaimer, "Don't listen to him – ghosts don't exist." Although Kendricks enjoyed stories about both the living and dead, they always added disclaimers when discussing the living-dead. Any stories involving ghosts, spirits, disembodied voices, footless steps, or flickering lights because of paranormal wiring were worth telling and repeating, albeit with the clause "but ghost aren't real" or its equivalent attached. Katie affirmed her lineage too, "I know ghost don't exist – those people at the hayride are putting on."

"Well, if ghosts don't exist," I asked Natalie, "how come I saw your great grandma standing beside our bed on the very night you were dreaming about her in your sleep? And how come you saw the figure of someone who looked like Uncle Tom in the barn at the very spot he always hid his liquor bottle?"

"Don't be silly – great grandma Kendrick died in an ambulance in the front yard. So you'd be more likely to see her while cutting grass or checking the mailbox than sleeping – if ghosts were real."

"Well, how do you explain Uncle Tom in the barn?" I asked.

"I was just seeing things. The scariest thing in that barn is the skunk family living under the feed room." Days before, Natalie had been chased by a momma skunk and her three skunk pups through the cattle chute. She said, "You know, if the head-gate hadn't been open, I would have been a goner."

"No, the barn is spooky," I said, "with all those cobwebs and decades of dust – not to mention your poppaw Lowry keeps his blank headstone leaning beside the barn."

After a little more talk of ghosts and disclaimers, Katie reserved her pumpkins and pedaled off. It had been a good year for pumpkins with enough rain during August and September to secure a good crop. The timely rain had also delivered another Fall rarity – a Fall honey crop. The only time I could get Natalie to help with bees was when harvesting honey. That afternoon, she put on my bee suit to help lift and carry a few honey supers. Unsurprisingly, nothing went according to plan. First, I forgot the lighter for the smoker. Then I forgot the fume spray. After I finally found that unwholesome concoction of foul-smelling molecules, one bee preferred the smell of my armpit and kindly deposited her stinger there, at which point Natalie said, "I'm glad I'm wearing your bee suit."

By the time we had robbed the last box, we were both exhausted and smelled awful from fume spray and sweat. Natalie and I loaded the last honey super onto the pickup near dusk and then drove back to the barn to put some beekeeping equipment back in the hayloft where we kept our extra bee supplies. At about that time, headlights pulled into the farmhouse driveway, and a Buick parked beside the pumpkin wagon. Katie and Julia exited the car with Grandma Nell in tow. "I stink, and I'm a sweaty mess cause of this bee suit," Natalie said, "go talk to them while I finish here."

"Well, I stink too," I said, "why do I . . ."

"You're a boy. You always stink."

"Alright, but . . ."

"Just go."

I went, but the talk with Katie was a bit one-sided too. Katie was pleased I hadn't sold her two pumpkins. She worried to death thinking they might get gone. She said Julia also thought these two pumpkins were best. Julia nodded. Katie said she was excited about the Bar-H Haunted Hay Ride and that Julia was excited too (Julia nodded), but she insisted the ghosts weren't real though Julia wasn't so sure. She said her Grandma Nell was not excited about the hayride (Nell nodded) but would

Scared Sens

Stephen **Bishop**

tolerate the excursion. She said her Grandma Nell's cat was missing and asked if I had seen it because it likes to visit our barn to catch mice to leave as gifts on Nell's porch. Katie asked if she and Julia could walk to the barn to look for the cat.

"Sure," I said, as the two girls were halfway to the barn. I told her Grandma Nell that the girls would be fine because Natalie was down there putting up supplies. A few moments later, the duo disappeared into the barn. Nell and I talked for a while about the cat.

"One of these days I'll have the mice under control." I promised, "I apologize for all the dead mice the cat leaves on the porch."

"You know, I've never seen her catch a mouse, but she must be good at it."

"Well, a blind cat could catch a mouse in our barn." I said.

At that moment, a chorus of such loud screams erupted that the yowling Guinea fowl were merely background noise. The disturbance coming from that barn would have awoken my neighbor had she not been standing beside me, her hearing aids squealing because the screaming was so intense. However, the good news was I found her cat. It leapt from the barn door to the safety of an oak tree – milliseconds after a scream that sounded like my wife had just realized ghosts were real. Then, out of the back of the barn, what appeared to be a white ghostly figure faded into the pasture. The cows began galloping away from the apparition. The source of the other disembodied high-pitch screams suddenly materialized, as Katie and Julia flapped out of the front of the barn as if they were about to take off and fly away. Four skunks scurried into the woods out of a side stall, too scared to remember to spray.

Eventually, after calming the girls, luring the cat down, locating a bee suit roaming the pasture, and replacing Nell's hearing aid batteries, I was able to piece together what happened:

Katie and Julia were scared senseless by the white ghostly figure with a veiled face walking toward them in the barn. Katie added that I was right – she didn't need to go on the Bar-H Haunted Hayride to find a ghost.

Natalie said while walking down the hallway to speak to the girls she was scared senseless by Nell's cat that leapt from the feed room, believing herself under attack from the skunks.

Nell's cat said it was scared senseless by the skunks while hunting for a mouse.

The skunks later confirmed that they were scared senseless by the ghost of Uncle Tom trying to hide his liquor bottle. But, being Kendrick skunks, they added the necessary disclaimer at the end, "but ghosts aren't real."

eless

A Closer Look

FORAGING ACTIVITY/ ENVIRONMENTAL FACTORS

Clarence **Collison**

Many Factors Can Impact Foraging

"Foraging activity includes bees gathering nectar, pollen, propolis, or water to fulfill colony needs (Abou-Shaara et al. 2017)." "There are many factors that can impact foraging activity, both in-colony as well as external environmental factors (Abou-Shaara 2014). In-colony factors include queen presence, queen mating status, colony strength and brood-rearing activity. Outside of the hive, key environmental factors include: temperature, solar radiation, wind, atmospheric pressure and relative humidity." Not only do these environmental conditions affect foraging behavior but indirectly also affect the availability of pollen and nectar, as well as the quantity and quality of nectar.

"Clarke and Robert (2018) investigated the connection between honey bee foraging activity and local weather conditions in the United Kingdom. They measured bee egress rate along with temperature, solar radiation, atmospheric pressure, humidity, rainfall, wind direction and speed. Data were collected from two hives, over periods June-September 2013 (hive 1) and July-September 2014 (hive 2). They fitted an ordinary-least-squares generalized linear model to the data, using weather to predict bee egress rate. They found that 78% of the observed variation in bee activity was explained by variation in temperature and solar radiation. The contribution of each predictor variable is measured as the average increase in model R^2 when the variable is used as a predictor, compared with when it is left out. The strongest contribution to model fit is temperature followed by solar radiation, humidity and pressure. The addition of pressure does improve the model fit but only slightly. The contributions from wind speed and rainfall were negligible."

"Foraging activity responses to two weather elements, solar radiation and temperature were determined (Burrill and Dietz 1981). While these two elements are naturally interrelated, honey bees appear to respond to each differently. For temperature, the response is positive. Increasing temperatures result in increasing flight departures while decreasing temperatures show decreasing numbers of departures. In the case of solar radiation intensity, the response is both positive and negative. At low radiation levels, increasing intensity is associated with increasing numbers of flight departures but at solar radiation levels greater than 0.66 langleys, increasing intensities are associated with decreasing numbers of honey bee flight departures."

"For three consecutive years, the flight activity from 10 honey bee colonies was recorded for a whole day at the beginning, middle and end of the honey flow. The outgoing flights started at about 9.00 hours, reached a maximum between 14.00 and 16.00 hours and ceased at about 21.00 hours. Multiple correlation coefficients of humidity, temperature, wind speed and light intensity with flight activity ranged from + 0.701 to + 0.978, all highly significant. Correlation coefficients of temperature with flight activity ranged from + 0.532 to + 0.947, also highly significant. There was a significant direct relationship between flight activity and colony weight gain 30 minutes later. This weight gain was correlated with honey bee activity and the above four weather factors (+ 0.490 to + 0.837, all highly significant). The mean daily flight activity of a colony was highly significantly correlated with the total weight gain of the colony at the end of the season (+ 0.766 to + 0.879). This relationship was not significant on a day with no weight gain. Mean flight activity significantly differed between years. Overwintered colonies flew more than package colonies. A single day's activity was related to the total seasonal weight gain of the same colonies (Szabo 1980)."

Increasing temperatures result in increasing flight departures while decreasing temperatures show decreasing numbers of departures.

"Foraging takes place within a wide range of temperatures from 10 to 40°C (50 to 104°F) (as reviewed by Abou-Shaara 2014). Below 10°C. (50°F), honey bees reduce foraging trips (Joshi and Joshi 2010). The beginning of foraging activity has been recorded to be at a mean of 6.57°C (43.8°F), whereas the highest activity was at 20°C (68°F) (Tan et al. 2012). In another study, Woyke

et al. (2003) found that 10°C (50°F) is the temperature at which foraging is initiated. These authors also noticed that the number of foragers increased tenfold when temperature increased to 12°C (53.6°F). Adversely, at a temperature of 43°C (109.4°F), the lowest foraging activity was observed (Blazyte-Cereskiene et al. 2010)."

"Wind is an important yet understudied environmental influence on foraging behavior. Hennessy et al. (2020) investigated the direct and indirect effects of wind on foraging worker honey bees. Bees were trained to an array of artificial flowers providing nectar rewards in a location sheltered from natural wind. To examine the direct effect, fans produced four different wind speeds between 0 and 3 m/s at three different flower spacings: 5 cm (flowers touching) and 10 cm and 20 cm (flowers not touching). To examine the indirect effect of wind moving flowers, flowers were moved 10 cm at three frequencies between 50 and 110 cycles/min at zero wind speed. They recorded the number of successful flower visits, time spent flying, search time on a flower and hesitancy to take off. Bees visited significantly fewer flowers with increasing wind speed which was caused by a significant increase in hesitancy to take off. This difference in flower visits between wind speeds was highest at the 20 cm spacing. Flower movement had no effect on foraging rate; however, there was a significant positive relationship between flower movement and the total time spent flying. This was counterbalanced by a significant reduction in time spent searching for the nectary after landing on a flower at the higher flower frequencies. Their results suggest that it is the direct effect of wind on hesitancy to take off that has the greatest effect on honey bee foraging rate."

"Collins et al. (1997) found no impact of solar ultraviolet-B (UV-B) on the foraging activity of honey bees on two species of mustard, *Brassica nigra* and *B. rapa* grown under controlled conditions. However, Mattu et al. (2012) reported that altitude influenced foraging commencement and cessation time, duration of foraging activity and trips as well as the number of flowers visited per minute (reviewed by Abou- Shaara 2014)."

"Another abiotic factor, air humidity, probably has a limited role in a temperate climate but is important in dry and hot conditions. At a temperature of 35°C (95°F) honey bee workers have been found to survive better at 75% relative humidity (RH), whereas at low RH of 50% to 15% worker survival was negatively impacted, especially at 15% (Abou-Shaara et al. 2012). Feral and domestic honey bees of Arizona showed high body water loss with decreasing RH, especially at 0% RH and 35°C (95°F). The same trend was recorded with increasing temperature (Atmowidjojo et al. 1997)."

"Honey bees are able to forage over a 30°C range of air temperatures largely because they have behavioral and physiological mechanisms for regulating the temperature of their flight muscles. From very low to very high air temperatures, the successive mechanisms are shivering before flight and stopping flight for additional shivering, passive body temperature in a comfort range that is a function of work effort, and finally active heat dissipation by evaporative cooling from regurgitated honey sac contents. The body temperatures maintained differ depending on expected foraging rewards and on caste (Heinrich 1996)."

"Honey bees are heterothermic insects (vary between self-regulating their body temperature and allowing the surrounding environment to affect it) which change from the ectothermic (dependent on external sources of heat) to the endothermic (dependent on or capable of the internal generation of heat) state for foraging. They have to keep their body temperature high throughout the entire foraging cycle to stay ready for immediate flight and to promote fast exploitation of resources (Stabentheiner and Kovac 2014). During a foraging trip the challenge is especially high because not only the ambient temperature but also solar radiation may vary in a broad range within a day and during a foraging season. In order to assess the energetic demand of foraging bees under variable ambient temperatures there have been measurements of metabolism in the shade, both at artificial flowers and during flight. On many flowers, however, or at water sources honey bees are often not airborne for long periods of time. Since they need not to stay airborne their ability of thermoregulation via regulation of heat production with the thoracic flight muscles is much more pronounced than in flight."

Forager bees have specific strategies to regulate their body heat under low ambient temperatures.

"During nectar and pollen foraging in a temperate climate, honey bees are exposed to a broad range of ambient temperatures, challenging their thermoregulatory ability. The body temperature that the bees exhibit results from endothermic heat production, exogenous heat gain from solar radiation, and heat loss. In addition to profitability of foraging, season was suggested to have a considerable influence on thermoregulation. To assess the relative importance of these factors, the thermoregulatory behavior of foragers on 33 flowering plants with dependence on season and environmental factors was investigated (Kovac and Stabentheiner 2011). The bees (*Apis mellifera carnica* Pollman) were always endothermic. On average, the thorax surface temperature (T_{th}) was regulated at a high and rather constant level over a broad range of ambient temperatures ($T_{a)}$, (T_{th} = 33.7-35.7°C (92.7-96.3°F), T_a = 10-27°C (50-80.6°F)). However, at a certain T_a, T_{th} showed a strong variation, depending on the plants from which the bees were foraging. At warmer conditions (T_a= 27-32°C (80.6-89.6°F) the T_{th} increased nearly linearly with T_a to a maximal average level of 42.6°C (108.7°F). The thorax temperature excess decreased strongly with increasing T_a (T_{th}-T_a = 21.6-3.6°C (70.9-38.5°F)). The bees used the heat gain from solar radiation to elevate the temperature excess of thorax, head, and abdomen. Seasonal dependence was reflected in a 2.7° C higher mean T_{th} in the Spring than in the Summer. An analysis of variance revealed that season had the greatest effect on T_{th}, followed by T_a and radiation."

"A heat budget for foraging honey bees indicated that at 30-35°C (86-95°F), all bees are in positive heat balance during flight. Observations of honey bees returning to their hives at high ambient temperatures support the conjecture that honey bees regulate head and thorax temperatures at high T_a by regurgitating droplets of honey stomach contents which are then evaporated. The

proportion of returning bees with a droplet on the tongue increased with increasing shade temperature (T_s), from essentially no bees at 20°C (68°F) to 40% of returning bees at 40°C (104°F). Pollen foragers carry relatively little fluid during the hottest periods, and pollen foraging decreased at high ambient temperatures. Thoracic temperatures of pollen collectors are significantly higher than thoracic temperatures of water and nectar gathers at 40°C (104°F) (46.13 vs 44°C; 115.0 vs 111.2°F). Additionally, water and nectar foragers with extruded droplets have slightly cooler heads and thoraces (38.94 and 43.22°C; 102.1 and 109.8°F) than bees not extruding droplets (40.28 and 44.18°C; 104.5 and 111.5°F). Wing-loading and thoracic temperatures of bees are inversely correlated at high ambient temperatures (35°C; 95°F) and this is probably caused by a higher propensity of heavier bees to extrude fluid, thus reducing thoracic temperature (Cooper et al. 1985)."

"Foraging behavior is a great challenge for honey bees as it often occurs in variable environments. Forager bees have specific strategies to regulate their body heat under low ambient temperatures. Foragers use solar heat to do both, increase body temperature or save energy. They change between an investment-guided and an economizing energetic strategy, depending on whether they can maximize intake rate by a higher body temperatue or not, in the latter case being forced to focus on optimization of energetic efficiency (Stabentheiner and Kovac 2014). Forager bees have a high ability to manage the balance between intake rate and energetic efficiency in their extremely changeable environment (Stabentheiner and Kovac 2016). During flight under different temperatures, worker bees are able to respond to these variations (Roberts and Harrison 1999; Woods et al. 2005). According to Heinrich (1980), head temperature of honey bees was 7°C above and 3°C below ambient air temperature at 17°C (62.6°F) and near 46°C (114.8°F), respectively. When head temperature reached 46°C (114.8°F), bees regurgitated nectar as a droplet from their honey crop and kept it in motion in and out of the body to mitigate head temperatures." BC

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All The Buzzz in...

Hello Friends,
Happy summer to all of you. I think about you all the time!

Bee B.Queen

Bee B. Queen Challenge

Send me photos of any bee related activities you are doing this summer.

Nema Rector, 7, OR

Why was the queen bee's hairdresser upset?
There was no honeycomb.
Madilynn Harris, ID

Martha Mae Kauffman, 10, OH

Larvae Mania!

The life of a worker bee begins when the queen lays an egg. After three days the egg hatches into a larva. The pupa comes next, then the adult bee. Let's take a closer look at the larval stage of a honey bee.

Truthfully, a larva isn't much to look at. Each larva is a white wormlike grub just hanging out curled in a c-shape at the bottom of a wax cell in the comb. Well, actually not just hanging out. A larva is an eating machine!

Being babies, they cannot feed themselves. The nurse bees, which are young worker bees, feed the larvae baby food.
Baby food? What is bee baby food?
Why it is pollen mixed with nectar or honey. Yummy, if you are a baby bee!

Guess how many times a larva is fed in a day?
Five times you say? More.
Twenty times? More.
Give up?
Each larva is fed between 150 and 800 times a day! By the fifth day a larva will weigh 900 times greater than when it was an egg. So if you were born a larva, multiply your birth weight by 900. That is how much you would weigh on your fifth day of life. Wild right?

We are talking crazy fast growth. The skin of a larva cannot possibly keep up with that kind of growth. So the larva molts, which means it pushes out of its skin as it grows. The larva does this four times in its first 4 days. The larva molts another time right before it becomes a pupa and then another time before becoming an adult worker bee. Ta dah!

Pass the Larvae Please?

People around the world eat insects. You can too! Order edible insects and larvae online and dare your family and friends to try them. You can find larvae snacks and larvae lollipops at Teacher Source, https://www.teachersource.com/.

Photo Credits: Cells- Ann Cicarella and
Close up- Scanning Electron Microscope Atlas of the Honey Bee by Elbert Jaycox.

... Bee kids corner

Produced by Kim Lehman -www.kim.lehman.com
www.beeculture.com
June 2020

Larva Break Out

As a bee larva grows, it molts or pushes out of its skin 6 times before becoming an adult bee. Demonstrate this process by using a sock, tissue paper, and newspaper.

1. Find an old sock and roll down the top until you reach the foot part.

2. Cut strips of tissue paper into 6 different lengths.

3. Make the "larva" skin by wrapping the shortest strip around the foot of the sock. Use the smallest amount of tape possible to hold the tissue paper ends together.

4. Stuff your larva with newspaper until the tissue paper strip breaks. As the larva grows, it will break out of its "skin".

5. Repeat this process five more times, use a little longer piece of tissue paper each time. Watch as the larva continues to grow and molt.

One larva - larva.
Many larva - Larvae

Tasty Treats

1 stick of unsalted butter (room temperature)
1 tsp. vanilla
1 C. flour
2 T. sugar

Blend butter and vanilla. Add the flour and sugar. Mix together to form a dough. Refridgerate for 1 hour. Take small pieces, roll and form into cresents or larvae shapes. Roll in sugar. Bake in muffin tins or on a cookie sheet at 350˚ for 10 - 12 minutes. Make pretend 'bee bread' by mixing lemon zest with honey. Drizzle over the top to "feed the larvae". Enjoy!

Beecome a Bee Buddy

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

Name
Address
Age
Birthday Month
E-mail (optional)

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

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

Why Honey Pollen Is Difficult To Interpret

Vaughn **Bryant**

I have been examining pollen in honey samples for over 50 years and I am just now getting good at it! In spite of that, I still get calls and emails from beekeepers who ask if they can come visit my lab on a weekend and learn how to examine the pollen in their honey. The answer of course is that it actually takes a great deal of knowledge about plants, pollen, honey bees, and ecology. Honey bees can use more than 350,000 plant species worldwide to collect either pollen or nectar. Each of those plants produces a unique type of pollen, which makes honey analysis using pollen difficult. There are also other problems in trying to identify honey types using pollen.

When examining honey samples scientists who use pollen (palynologists) to identify the type of honey encounter many problems. First, we have learned that field observation of blooming plants by beekeepers, who identify those plants as being the source of their honey, is most often incorrect. After examining several thousand honey samples from hives all over the world we have discovered that more than 70% of those field identifications of honey types are incorrect. Second, experimental data reveal that not all honey bees are created equal. Some (56%) are better at collecting nectar and removing vast amounts of pollen during their return flight to the hive. The other 44% of bees in a hive are efficient at collecting nectar but are inefficient at removing the pollen from the nectar. We have also learned that the size and shape of a pollen grain often determines how efficiently honey bees can remove that pollen type from the nectar sources they collect; the larger the pollen grain the more efficient bees are at removing it from nectar. Third, a growing number of beekeepers and honey producers partially or completely filter their comb honey before selling it. Fourth, we have examined various processing techniques currently used to extract debris from honey and found that most techniques also remove various amounts of pollen. Finally, even when honey samples are correctly processed and their pollen contents are carefully noted, the resulting pollen data may not provide accuracy as to the primary nectar sources used to produce the honey. This last point depends on the skill of the scientist examining the honey and the use of pollen coefficient tables.

During the early 1940s, two scientists working for the USDA in California, Frank Todd and George Vansell, examined the relationship between the pollen in floral nectar sources and how that related to pollen in honey. Their research began when they discovered that bee colonies survived, but would not reproduce when fed only sugar syrup. Once pollen was added to their diet, the queen bee began egg laying within 12 hours. Their research began by collecting and examining over 2,600 individual samples of nectar. They had three major goals. Their first goal was to determine the number of pollen grains found in one cubic centimeter of nectar from various plant species. The second goal was to determine if the number of pollen grains naturally occurring in nectar samples matched the number of pollen grains found in the honey stomachs of bees that foraged on those flowers. The third goal was to discover how efficiently honey bees could remove pollen from the nectars they collected. Their published data showed that not all plants contribute pollen equally to nectar and honey. They effectively demonstrated that there is not a 1:1 relationship between a honey bee's collection of a plant's nectar and the percentages of pollen types found in honey. Their research became the foundation for the later development of melissopalynology (study of pollen in honey), and *pollen coefficient values*, which are now used to correct for these many variables.

Pollen can become part of honey in a number of ways. When a honey bee lands on a flower, some of the flower's pollen falls into the nectar that is sucked up by the bee and stored in her stomach. At the same time, other pollen grains can become attached to the "hairs", legs, antenna, and even the eyes of visiting bees. Later, some of the pollen that was sucked into her stomach will be regurgitated with the collected nectar and deposited into open comb cells of the hive. While still in the hive, that same honey bee may groom her body in an effort to remove the entangled pollen. During that process pollen can fall directly into open comb cells or onto areas of the hive where other bees may track it into regions of the hive where unripe honey is still exposed. Airborne pollen is another potential source of pollen in honey. Airborne pollen produced by wind-pollinated plants, not usually visited by honey bees for nectar, can enter a hive on wind currents. These airborne pollen grains are usually few in number, when compared to the

TABLE 1
Pollen analysis of a honey sample produced in central Alaska. *

Pollen Type	Relative Pollen %	(PC) Coefficient Value	(RQ) Relative Quantity	Adjusted Percentage
Apiaceae	00.6	50.0	00.012	00.5
Brassica sp.	62.8	150.0	00.419	01.9
Epilobium sp.	06.3	0.3	21.000	95.9
Melilotus sp.	28.3	75.0	00.377	01.7
Taraxacum sp.	00.6	10.0	00.060	00.27
Other minor types	01.4	50.0	00.028	00.128
Total	100.0%		21.896	100.0%

* Following Sawyer's coefficient values to determine the actual or expected nectar composition of each plant taxon in a honey sample, the relative pollen spectrum must first be calculated. Then the relative percentage of each pollen type is divided by its PC value. The resulting value for each pollen type is the taxon's "relative quantity of nectar (RQ)." Finally, each RQ value is divided by the sum of all RQ values to determine what percentage of the honey's nectar was actually derived from each plant type. Note that the dominant pollen type (*Brassica* sp.) contributed only 1.9% of the nectar to this honey while *Epilobium* sp. with only 6.3% pollen guarantees the sample is a unifloral fireweed honey.

pollen carried into the hive by worker bees; nevertheless, those pollen types regularly enter a hive on air currents and can settle in areas where open comb cells are being filled with nectar.

Pollen is an essential tool in the analyses of honey. The type of pollen indicates the floral sources utilized by bees to produce honey. As a result, pollen frequency is sometimes used to label a honey sample as to the major and minor nectar sources. This information has important commercial value because some consumers prefer honey made from certain plants, which command a premium price (i.e., white acacia, sourwood, sage, tupelo, buckwheat, or citrus honey). Even non-premium grades of honey often need to be examined for legal reasons because they must be correctly labeled as to type before being marketed. Only by identifying and quantifying, the pollen in honey can the full range of plant taxa be known and the honey's actual floral sources be correctly labeled. Another reason that pollen analyses of honey are often required is to determine the honey's geographical origin. The combination of airborne and insect-pollinated taxa found in a honey sample will often produce a pollen spectrum that is unique for a specific geographical region. Because of trade agreements, import tariffs, and legal trade restrictions, most of the leading honey-producing nations of the world require accurate labeling of honey before it can be sold. The United States and Canada are exceptions since neither requires truth in labeling for honey samples. Other reasons to establish the origin of honey is because some prefer to buy "local" honey. The pollen contents can confirm or reject honey labeled as being local!

The honey bee's filtering process is rapid and effective. The bee sucks nectar into a slender tube that ends in the bee's abdomen where it becomes an enlarged thin-walled sac called the *honey stomach*. This honey stomach is greatly distensible and can expand to hold large amounts of nectar. Once in the honey stomach, the nectar flows over the proventriculus that filters and controls the entrance of food into the bee's stomach. The front end of the proventriculus, called the *honey stopper*, projects into the bee's honey stomach like the neck of a bottle. At its back end is an x-shaped opening consisting of four, thick, triangular-shaped, muscle-controlled lips. Nectar in the honey stomach is passed back and forth into the funnel-shaped proventriculus. This process filters the nectar and removes debris such as pollen grains and the fungal spores that cause foul brood. From time to time people get alarmed about a phenomenon referred to as "yellow rain." When large numbers of bees forage on nectars that are full of pollen, the rapid removal of those pollen grains from their honey stomachs and the resulting defecation by those swarms of bees can appear as "yellow rain" spots on leaves, cars, sidewalks, or buildings.

Experiments with caged honey bees, fed only a mixture of pollen and sugar water, revealed just how efficient the proventriculus is at removing pollen. Newly produced honey by these caged bees revealed two things. First, the bees were able to remove vast amounts of pollen before depositing the contents of their honey stomachs into empty comb cells. Second, it revealed that larger pollen grains are removed much more efficiently than smaller pollen grains. Thus, large pollen grains such as those from fireweed, magnolia, tulip tree, and tallow tree are removed much quicker than smaller pollen grains like those of many clovers, willows, chestnut, forget-me-nots, eucalyptus, and mulberry.

Rex Sawyer, was one of the foremost early melissopalynologist (analysts who look at pollen in honey) in the United Kingdom and Europe. He began his lifelong interest in honey pollen studies during the 1930s and published several books on pollen and honey. Included in his last book is a table listing the numerical pollen coefficient (PC) values that he developed for a number of nectar sources found mostly in the U.K. and Europe. PC values are expressed as

the *expected number of pollen grains per gram* of honey. By following Sawyer's formula, and applying his and other PC values to the relative pollen percentages found in any honey sample, one can determine the "*actual*" floral identities and "*true nectar sources*" of many honey types. He also said that he believes PC values can be applied to samples from almost any region of the world in order to "correct" the relative pollen percentages in honey. The basis for our current use of PC values in North America come from the data he generated as well as data from many other published sources. The only problem with PC values is that bees can collect nectar or pollen from more than 350,000 potential plant species worldwide. Unfortunately, we do not have PC values for most of those plants. Fortunately, for many of the primary honey types we do have PC values. For exotic honey types, we can often make reasonable guesses as to the PC values based on the size of the pollen grains that remain in the honey. Granted, in most of those exotic types we are "guessing" rather than having firm scientific evidence.

In the early days of melissopalynology, during the mid-twentieth century, scientists such as Louveaux, Maurizio, and Vorwohl tried to develop ways of classifying unifloral honey types. Their purpose was to help beekeepers market some of the premium honey types and exclude honey that did not meet those criteria. They suggested that for a honey to be a unifloral, it must contain 45% of a single pollen type. Since those early suggestions, we now know that for some types of unifloral honey that amount of pollen is unreasonable. During the last 50 years, other studies and the development of PC values confirm that for some plant species 45% pollen in honey cannot be reached. Several prime examples include fireweed and sourwood honey, which have highly reduced amounts of pollen in honey yet often they are unifloral types.

A final important aspect about examining pollen in honey is to determine the pollen concentration value. Many melissopalynologist know about how much pollen should occur in certain types of honey. Pollen concentration amounts vary among unifloral honey types and in other types such as multifloral or wildflower honey. Those concentration values can also suggest, but cannot confirm, if honey is adulterated with added sugar. Concentration values can also indicate if a honey is filtered or blended. We have discovered that certain types of commercial honey contain no pollen and thus we cannot determine the origin of the honey or the floral types listed on the labels. For example, we have examined commercial honey purported to be "local" yet it contains no pollen and thus we are unable to confirm if it is indeed local.

For those of you who wish to have your honey analyzed I suggest that you do not filter it at all. Our published results show that almost any type of filtering removes some of the pollen. If various amounts of pollen are inadvertently removed by filtering, the resulting analysis may not be accurate. You can find information about filtering honey in past issues of *BEE CULTURE*. If you want more information on pollen coefficients just send me an email (**vbryant@tamu.edu**). BC

Lauren Sara **McKee**

Bee Microbiome Fights Against Fungi

Fungal diseases get less **attention** than they deserve. They are a major cause of **food insecurity** and economic loss for food producers. Huge proportions of **staple plant crops** like wheat and potato are lost every year to disease. Likewise, fungal infections threaten honey production in honey bees by killing huge numbers of the animal, and likely contributes to **Colony Collapse Disorder** (CCD).

Human activity often determines **how far and how fast** a fungus will spread, because we transport crops and livestock long distances and cram **huge populations** of a **single species** together. The plight of the honey bee is a perfect example. In the first episode of the Netflix series "**Rotten**," honey bees throughout the U.S. are transported *en masse* every Spring to California, where they pollinate **the enormous almond crop**. Bringing so many bees together makes the spread of pathogens and disease unavoidable, and beekeepers around the country **have lost hives** as a result.

Fungi can infect hives that are already **stressed**, and cause disease in **larvae and pupae**. It is possible to treat hives with fungicidal chemicals, but pathogens are **becoming resistant**. In addition, chemical fungicides can often kill helpful microbes because they are rather indiscriminate, and may even harm bees directly. Pesticides are **often cited** as a **contributor** to CCD, although there is much **disagreement** and controversy on this point. Regardless, we desperately need alternatives to chemical pesticides.

In work **recently posted** to the pre-print site bioRxiv, scientists show how *Bombella apis*, a bacterium that commonly resides in bee hives, can actively help to protect bees against fungal infection. Rather than spray any synthetic chemicals into a hive, these bacteria appear to secrete their own personal anti-fungals.

Biological control – or **biocontrol** – is the use of living organisms to protect plants or animals against pests and pathogens. Biocontrol to protect crop plants is a well-established idea. The **introduction of the mynah bird** from India to Mauritius in the 18th century is an early example, as the birds kept down locust populations, protecting crops. Some suggest that biocontrol was also used as early as 4000 years ago in **Egypt when cats were domesticated** to hunt scavenging rats, and in **ancient China where ants** were used to control citrus pest populations.

Biocontrol may help bees where other interventions, like chemical pesticides have failed.

In the modern era, ecologist **Rachel Carson** noted in *Silent Spring* that *Bacillus* **bacteria had been used** to kill flour moth larvae in Germany in 1911, and to control populations of the Japanese beetle in the Eastern U.S. in the **late 1930s**. Bacteria are integral to many newly developed biocontrol technologies, and research shows

that we may be able to develop bacterial biocontrol to help honey bees resist fungal disease.

B. apis is a bacterium found in honey bee hives, especially in nectar and royal jelly stores, and in the little rooms called **cells** where larvae live. Scientists at **Indiana University** really **love bees**, and they are working hard to understand the role of the **microbiome** of the European honey bee. Earlier work **has indicated** that the presence of *B. apis* is correlated with increased resistance to the nasty Nosema fungal infections that have devastated honey bee hives all around the world. This suggests that the bacterium has a protective effect.

In **the new study**, a team led by **Irene Newton** showed that *B. apis* can inhibit the growth of two common fungal pathogens, *Beauveria bassiana* that infects 70 percent of all known insect species and is actually used as a **biological insecticide to kill herbivorous insect pests** like mites, and the more relevant pathogen *Aspergillus flavus* that targets honey bee brood and **can also infect crop plants**. When *B. apis* was grown together with either fungus – what microbiologists call co-culturing – the fungi were severely impaired in the ability to form spores. The authors suggest that this not only reduces the occurrence of infection and disease among bees in the hive, but it may also reduce the likelihood that bees who go out foraging could spread the infection to another hive or to other insects.

The protection offered by *B. apis* to honey bees makes it a solid biocontrol candidate. The population of *B. apis* within a hive can be increased by delivering more bacterial cells within a sugar solution that bees feed on. Sugar/syrup solutions are used routinely by beekeepers to supplement the diet of bees who struggle to gather enough nectar during Winter.

In fact, live bacteria are not even needed for this protective effect, according to the study. Molecules the bacterium secretes can be collected and on their own display the same anti-fungal effect observed during co-culture experiments. This is interesting from the perspective of understanding *B. apis* physiology, as it confirms that the anti-fungal molecules are secreted by bacterial cells. The molecules are likely **polyketides**, a known class of antifungals involved in other symbiotic relationships that confer pest resistance. It's possible that these secreted molecules can be applied directly to the hive in concentrated form, to help when a hive is under threat.

These findings complement a recent study from the **University of Texas** where researchers **engineered *Snodgrassella alvi* bacteria from the bee microbiome** to drastically improve bee defenses against the virus DWV, which causes deformed wings and an inability to fly, and Varroa mites, both of which are heavily implicated in colony collapse. The **mite especially has been blamed** for devastating losses in the U.S. honey bee population. The engineered *S. alvi* bacteria were sprayed into a hive in a sugar solution, so the bees took the new bacterial species into their guts. According to that study, the bacteria induces a bee immune response that kills mites and blocks viral infection. The result was a huge increase in survival rate in mite-infested bees, and an impressive reduction in deaths caused by the virus.

The Texas study shows that we can use modern biotechnology to enhance the innate protective effect of symbiotic bacteria. But the Indiana investigation underlines that there are still some interactions between naturally occurring microbes that we do not yet fully understand, but which impact how we should manage our food ecosystems. We now know that *B. apis* has a clear beneficial effect for honey bees, so anti-microbial compounds added to a hive to fight infection **must be chosen carefully** to avoid damaging the beneficial *B. apis* population.

Biocontrol is not expected to replace chemical fungicides entirely, but experts believe it can be part of an **integrated pest management** approach to **sustainable food production**, along with promoting biodiversity and reducing habitat loss for the animals and microbes that keep ecosystems functioning. We will lose a lot more than honey if colonies continue to collapse. BC

Lauren Sara McKee – Microbiology, Biochemistry, and Biotechnology, KTH Royal Institute of Technology.

Photo by Annie Spratt on Unsplash.

Veteran Mike

Sharing Tranquility

Becky **Masterman**

Mike and Diane Roche in their apiary at the end of a Bee Squad management visit. Author photo.

Over an open colony of bees, Mike Roche told me how thankful he was to be alive. He was a man living past the years that his doctors had predicted. With the time limit on Mike's life, he was grateful for the peace that working bees offered him. It was his wish to share that tranquility with military Veterans. Conversations we had while managing his bees were the foundation of the University of Minnesota Bee Squad's beekeeping program for Veterans.

I met Mike and his wife Diane in 2013. They were founding Bee Squad Bee Network customers. The Bee Network was designed for non-beekeepers to hire the Bee Squad to manage their bees. In return, we learn about honey bee health trends and challenges. The Bee Network program initially served a handful of families and businesses and grew to allow the Bee Squad's beekeepers to manage bees across greater Minneapolis-Saint Paul. While most customers do not manage bees, Mike had been a beekeeper since the 1970's and accompanied us to his hives when he could.

Although he was Mike to us, his military title was Lt Col Michael Roche, USMC (Ret). His concern for US service members and Veterans was one of the three topics we discussed in the apiary. His family, including two active service member sons, and the bees were the other two. I remember Mike holding a frame of bees, hearing him talk to the girls and watching him smile, despite getting stung as his large fingers often challenged a worker bee's space.

Mike asked the Bee Squad to create a program that would support Veterans through beekeeping. The Bee Squad delivered a proposal to him and Mike generously funded Bee Veterans. Modeled after our Mentoring Apiary, the yearly budget for the program has been between $10,000-$15,000. The Bee Veterans Apiary was established in the fall of 2015 and we held the first season of free Veteran beekeeping classes in 2016. Mike passed away in the spring of 2017.

From donating bees, boxes, land for an apiary, and seeds, our community has enthusiastically supported Bee Veterans. The Metropolitan Airports Commission provided an apiary space at the Minneapolis-St Paul International Airport. Our 5000 square foot apiary is home to 20 colonies. Pollinator gardens with abundant flowers share the space with the hives that are arranged in a large U shape so students can gather easily around them. People have responded with enormous generosity to the idea of using honey bees to assist Veterans.

The Bee Veterans program has supported over 100 Veterans since 2016. It is still funded by donations, many from Mike's family and friends, and by the sale of honey. Some of the connections we make with Veterans are brief while others have had long lasting impacts. One of the first participants was Christian Dahm. A University of Minnesota undergraduate and retired Marine Corps service member, Christian joined the Bee Squad and managed the Bee Veterans Apiary. He then founded the Propolis Hive Company (**https://www.propolishive.com/**). Mike's vision was for Veterans to have an opportunity to be inspired by honey bees. I have witnessed that the outcomes from Bee Veterans classes range from a memorable family outing to a career working with bees or beekeepers.

We are now responding to COVID 19 related program restrictions. Bee Squad mentors meet online to plan distance beekeeping education. Unable to bring Veterans into our apiary this season, we decided to replace the hive tools that we put into their hands with gardening tools. Instead of working bees, we are going to focus on establishing bee habitat. Through planting challenges and shared photos, we will encourage Veterans to promote bee-friendly flowers. We aren't able to open up colonies together, but planting flowers is another way to get close to the bees.

Bee Veterans was not the first beekeeping program for Veterans and it does not have the biggest reach of the multiple efforts that

exist. Because of a recent generous and anonymous $200,000 donation, we have the honor to create a space with the other groups that support Veterans in beekeeping. We initiated this collaboration with a roomful of Veterans and beekeepers at January's American Beekeeping Federation meeting. Everyone shared their visions for how beekeeping can help Veterans. Some ideas, like using beekeeping as a therapy, still need to be examined with formal research studies. Other ideas, like educational programs and business support, will benefit from sharing resources across groups. We are committed to continuing these connections, exploring critical research, and building support for Veterans. Interested in being a part of Lt. Col Mike's vision? Please sign up and join us. **https://www.beelab.umn.edu/bee-squad/bee-squad-programs/bee-vets** BC

Bee Veterans program meeting held online in April 2020. Pictured from top left clockwise: Farmer Keith Johnson, Minnesota Apiculture Extension Educator Katie Lee, Bee Squad Program Director Bridget Mendel, and Becky Masterman. Katie Lee photo.

Bio

Becky Masterman earned a Ph.D. in Entomology at the University of Minnesota under the direction of Dr. Marla Spivak studying honey bee hygienic behavior and neurobiology. She led the UMN Bee Squad from 2013-2019 and currently alternates between acting as an advisor and worker bee for the program.

Acknowledgements

The author would like to thank both Marla Spivak and Bridget Mendel for their helpful edits and suggestions.

Bee Culture wants to apologize to the author for misspelling her last name in the May issue.

Almond Pollination Math

Joe **Traynor**

Ask an almond grower what was the most useful class he took in school (including college) and if he (she) thinks about it long enough, the answer should be *math,* maybe algebra in high school, maybe arithmetic in the 3rd grade. Growers are faced with math problems daily – calibrating spray rigs, figuring the amount of chemicals to apply per acre, filling out use reports, making out budgets and calculating ROI (if you're fortunate enough to have an ROI).

Virtually every problem facing mankind can be reduced to a math problem, whether landing a vehicle on Mars, projecting the consequences, if global warming is a valid thesis, feeding a growing world population, reducing pollution, returning a Republican to the White House, etc. Little wonder that our greatest scientists – Newton, Galileo, Einstein, Feynman and many others – were (are) primarily first-rate mathematicians.

Rapidly expanding almond acreage coupled with a static, or diminishing supply of bees is causing the almond industry to confront a major math problem: *can growers get by with less colonies per acre?* Here's the original 1947 UC recommendation: *"In general, one hive per acre is ample, even in adverse seasons"* (Extension Circular 103, *Almond Culture in California*). Today, the generally accepted figure is two hives (colonies) per acre, with colony strength rarely defined. Some growers use 2.5 to three colonies per acre as a hedge against poor bloom weather, while others have cut back to 1.5 or one colony per acre but make sure they are getting strong colonies – defined as colonies with eight to 10 frames of bees. Growers that have cut back on colonies have not seen reduced yields, even in 2011, when bloom weather was far from ideal.

Some of the basic math data needed to determine the optimum economical number of colonies needed per acre is given below. Because one can easily get bogged down in this quicksand of data a shortcut (rope) is delivered afterwards. If the heavy dose of figures below is too intimidating, you can cut to the chase further down.

A 3000 lb almond crop has one million nuts (assume 350 nuts/lb). Assuming a 50% set of flowers, it would take 2 million flowers to give a 3000 lb crop (recent work by Frank Eischen, USDA, has shown that percent set can vary from 25 to 75%, requiring four million and 1.3 million flowers respectively to attain one million nuts).

Almond flowers produce 0.7 to 1.2 mg of pure pollen (up to 2.4 mg of bee-collected pollen; bees add "glue" to pollen). Assuming two million flowers/acre, an almond orchard will put out from five to 10 lbs of pollen per acre. (American Bee Journal, April 2001, pp.287-288)

A frame of bees contains about 1500 bees. An eight-frame colony contains about 12,000 bees; a third of these bees (4,000 bees) will be foraging bees.

Pollen-collecting honey bees usually work four hours/day in almonds (10AM to 2PM). Bees will visit 10 flowers/minute (20 or more, if pickings are slim; less than 10 if they can get a pollen load from a few flowers)

Assuming 4000 worker bees/acre and 100 trees per acre you should see 20 bees per tree during bloom if using one strong colony/acre (about half of those 4,000 workers will be flying or will be depositing their pollen loads in the hive).

20 bees per tree visiting 10 flowers a minute will visit a total of 200 flowers in a minute, or 48,000 flowers in 240 minutes (four hours).

At 100 trees per acre, there are 20,000 flowers per tree. 20 bees per tree will visit each flower two or more times in one four-hour day (four or more times in two four-hour days). Although it takes only one pollen grain to set a nut, excess pollen deposited on the stigma of the flower stimulates the growth of that one pollen grain.

Individual almond flowers remain receptive for two to four days but are most receptive the first two days after they open (UC).

The effective blooming period (when all flowers are receptive) can be from three to 10 days. The more the bloom is strung out, the more time bees have to complete the pollination job.

Frank Eischen (USDA) has shown that one strong colony, equipped with a pollen trap, can collect six lbs of pollen in a day (12 lbs over a two-day period at peak bloom; significantly less than six lbs/day on the days before and after peak bloom). This colony had to stray out of its one acre allotted area to get six lbs. in a day; pollen traps cause colonies to collect more pollen than they normally would and they do so at the expense of colonies without traps.

An eight-frame colony will collect significantly more pollen than two 4-frame colonies. (American Bee Journal, Feb. 1977, p.78; California Agriculture, UC, August, 1970).

Bee flight hours and statewide almond yields, 2011 and 2012

2011: 47 hours, 2650 lbs/ac. 2012: 65 hours, 2550 lbs/ac. (est.) Bee flight hours, courtesy of Tom Dunklee, Global Climate Center are for Merced but hour differences for other almond areas are similar (Sacramento Valley stations averaged only 22 bee hours in 2011).

Now, forget all the above data and calculations – here's the shortcut, the rope: Using strong colonies, honey bees collect the daily ration of pollen provided by almond flowers by 2PM (or sooner). Walk your orchard after 2PM and rub the anthers of the flowers between your thumb and forefinger; if the bees have done their job, you should see little or no

pollen on your fingers – the bees have finished their work for the day and are too smart to expend valuable energy for a minuscule reward (to verify this, check the entrances of your hives for returning pollen-collecting bees). If there is still pollen on your flowers after 2PM you need stronger bee colonies or more colonies. Can you get by with less than two colonies/acre? Using the 2PM orchard walk outlined above, it is certainly possible, but make sure you rent eight to 10-frame colonies. The 1947 UC recommendation of one hive/acre (with no strength specification) could well hold true today, but only if the hives contain strong bee colonies.

Almond pollination is a community effort so make sure your neighbor rents colonies of sufficient strength to prevent your bees from seeking bigger rewards elsewhere. Because one eight-frame colony will collect significantly more pollen than two four-frame colonies, paying a premium price for the stronger colonies is a worthwhile investment. And remember that a *hive* is the structure (usually wooden) that contains the *colony* of bees. Hives can contain 0 to 20,000 or more bees. In any given year, there will always be plenty of hives available for California almond orchards, but not all orchards will be supplied with strong bee colonies.

The argument, and it's a good one, against cutting back on bee colonies goes like this: *I know I can get by with less bees most years, but for* that *one year when the bees only get an hour or two to do the job, I want as many bees out there as possible – its good insurance.* 2011 was a year when intermittent rains confined bees to their hives for extended periods. Bee flight hours for 2011 were the lowest in the 10-year period these hours have been recorded – 22 hours in the Sacramento Valley – yet the 2011 almond crop hit an all-time record of 2650 lbs/acre. Even in a poor-weather year, there should always be enough bee-flight hours between storms to allow strong bee colonies to do their job. If there is only one hour of decent bee weather over the entire pollination period, sure, you would benefit from more bees. Such an event is highly unlikely, but in our current era of unlikely weather events, it's certainly possible. If forecasts indicate a prolonged monsoon event with maybe only an hour or two of good weather over the entire blooming period, then ordering more colonies would be prudent. Although there probably wouldn't be any extra bees in California, beekeepers in Texas and Florida often have bees available after almond bloom starts but would need a few days notice to get them here. Even if extra bees did give you good pollination in a one-hour year, there's a good chance that bloom-time diseases would take your crop.

Note: The data figures given above are, in many cases, best guesses; actual figures can vary 100% or more from those given. Hopefully these figures will be refined in coming years and a skilled mathematician will calculate a more exact figure for the optimum number of colonies/acre that almond growers should use.

When the Pollen is Gone

Once bees have stripped the almond pollen from your orchard, the pollination game is over – no pollen, no pollination. A strange phenomenon, perhaps unique to almonds, occurs when the pollen is gone – bee activity often increases! You will often see more bees/tree *after* your trees have been pollinated. Look closely, though, and you will observe that these busy workers are all nectar-collecting bees, pushing their tongues to the base of the flowers to suck out the sweet nectar. Almond flowers release most of their nectar *after* the flowers are pollinated. We learned in grammar school that flowers produce nectar to attract bees to transfer pollen, so what's going on here? At this time, we don't know. Although there is no proof, some have speculated that the sugar-laden almond nectar nourishes the small developing nutlet, helping it to survive post-bloom nutlet drop. Some growers release their bees after all the pollen is gone, but most won't release bees until they see no more flowers. If you decide you want all or most of your bees removed from your orchard when there are still many nectar-collecting bees working (but no pollen-collecting bees) you may find beekeepers reluctant to move them out, as almond nectar is a valuable food source for bees. Unless bees have another flower source to go to (as would Florida or Texas bees) they are better off remaining in the orchard until the last drop of almond nectar has been extracted.

Beekeeper Math

Beekeepers that attempt to satisfy almond growers demand for strong bee colonies are faced with a difficult choice: spend the necessary money to produce such colonies, or rent weaker colonies at a reduced price. According to UC Extension Apiculturist, Eric Mussen, *"four frames of bees is the size a Central Valley California colony is likely to be (if it survives) when it is not fed extra syrup and protein during the year."* (Jan/Feb 2010 Newsletter, *From the UC Apiaries*). Dr. Mussen estimates that beekeepers must spend $120/colony to provide four-frame colonies and $200 to $220/colony to provide eight to 10 frame colonies (these cost figures are likely 10% higher for 2013 than they were in 2010). A beekeeper is better off, probably far better off, renting a four to six-frame colony for $150 than renting an 8 to 10-frame colony for $200. Even with record almond pollination fees, building high bee populations that continue to consume expensive feed during the winter (both before and after almond bloom) does not make economic sense for many bee operations. With varroa mites, viruses and diminished bee pasture taking an ever-mounting toll on honey bees, today's beekeeper feels fortunate if he can cover operating expenses, let alone attain an ROI (a term foreign to many beekeeping operations). BC

Joe Traynor is a long-time almond pollination broker living in southern California.

20 Years Of Commercial Beekeeping Without Treatment

Kirk **Webster**

Presented at Apimondia 2019 in Montreal

It was an honor to be selected to give a presentation at the Apimondia meeting in Montreal last September. This was a good opportunity for me to summarize 30 years of work with bees in one location, and to put forward the unavoidable conclusions that grew out of that experience.

However, most of the talks at Apimondia are just 15 minutes long and, despite some planning and practice, I did not succeed in getting all the important points across in the allotted time. So here, from the quiet and calm of my desk at home, is a more complete rendering of that summary, as I would have liked to present it:

In just a few minutes I'm going to try to summarize 30 years of work with a small commercial apiary located not far from here in Vermont's Champlain Valley. It's a good place for bees and beekeepers – or at least it has been up to this point. The valley is quite different from most of heavily forested Vermont; more closely resembling a piece of Wisconsin dairyland, wedged in between the Green Mountains and Lake Champlain. Addison County, where I live, has a very high percentage of farmland, compared to most other counties all over New England. The Winters are long and cold, but the mix of abundant pasture and hayland, remaining forest and uncultivated margins provides abundant resources for honey bees during the entire warm season.

For nearly 30 years, the structure of my apiary has remained largely unchanged, with three parts – honey production; overwintered nucs; and queen rearing. Each part supports, and is supported by, the others; sharing resources and recycling by-products. For many years, the apiary size has remained nearly the same: 300 honey producing colonies; 400-600 nucs overwintered on standard combs; and 400 mating nucs on half-size combs, and maintained almost year-round. I've always done most of the work myself, with occasional part-time help for queen catching and extracting when a big honey crop has materialized. Here at the beginning, I should point out that the underlying goals for the apiary have always been the same: to have a pleasant, healthy and useful life living in the countryside – close to Nature, organic farming and honey bees – and without the need to have another job, or any other source of income. By this measure the results have far exceeded anything I could have imagined at the beginning.

The inspiration for the apiary came from Nature herself, but also from farmers and scientists who used Nature as a model and a guide. Most notable here were Sir Albert Howard, considered the father of modern organic farming in the English speaking world; and Masanobu Fukuoka, the Japanese farmer and author of *The One Straw Revolution,* who brought Nature and farming closer together than any other well known person.

There was, of course, plenty of inspiration from the bees themselves and other beekeepers. Most helpful to me was the experience and the wonderful articles and books written by the early pioneers of modern American beekeeping – including A.I. Root, G.M. Doolittle, C.C. Miller and my "neighbor" A.E. Manum. They faced many problems just as dire during their time as what we face today, and emerged with their livelihoods intact, and with better methods, bees and equipment. Eclipsing even these however, was the work of Brother Adam. The length and breadth of his experience is unapproachable today, and he did a great service to the beekeeping community by describing that experience so clearly in his books. Much of the apiary structure and methods I use today were lifted from his, adapted to our equipment and climate, and accelerated somewhat to produce more products for sale.

From early on in the *Varroa* crisis, I've emphasized that a good solution to this dilemma can only be achieved by using breeding and management together. Neither one by itself is capable of solving the problem. It's easy to focus on the critical importance of finding and propagating stock that can co-exist with *Varroa;* but looking back I now believe that finding new management suitable to the situation was even more important. Here is the practical path that I followed to rid the apiary of all treatments, and maintain a high level of productivity and profitability over the last 20 years:

During 1986, '87 and '88, I discovered by accident, and then started to utilize, a technique that was well known to some of the early beekeeping pioneers mentioned earlier, but had been completely forgotten when good quality and inexpensive queens and package bees became available from the southern U.S. and California. The realization that nucleus colonies on just four standard combs, or even less, could reliably overwinter outdoors with minimal protection – all the way up to the Canadian border – changed everything for beekeeping in the northern half of the U.S. Now we could raise all our own queens in the midsummer, when conditions are excellent; and have them easily ranked and tested on a minimum of equipment by the following Spring – before they are entrusted with 20 combs and honey production. The income potential of northern apiaries doubled as they became able to produce surplus bees and queens, instead of paying every year to replace old queens and Winter losses. And the stage was set for really serious bee breeding, where outstanding, locally adapted colonies could be rapidly propagated and improved through each generation.

Just in time. The tracheal mites arrived in my area in 1989, and set off the first shock wave to effect the bee industry during my career. Our normal Winter loss of 5% mushroomed to 30-60%, and it did feel like the end of the world was coming soon. But I was already working toward the goal of using one third of my brood combs for overwintered nucs, and these small colonies were for some reason (still unknown) not as susceptible to tracheal mite damage. So, I had plenty of nucleus colonies with my own queens to replace my Winter losses, and many excellent double-story colonies – uneffected by the tracheal mites – to graft from. Over the next five years, by just grafting from the best overwintered two-story colonies, and keeping all the new queens in nucleus colonies over their first Winter, the apiary not only regained its former strength and resilience, bur far surpassed it. This experience also pointed to Sir Albert Howard's rule that pests and diseases should always be viewed as friends and allies, illuminating the way to better stock and practices. The tracheal mites had done a much better job of selecting the bees than I had been able to do without them. This experience made a huge impression on me, and without it I don't think I would have had the courage to go through the same thing with the *Varroa* mites, several years later.

Another vital point became clear during this time: This system of using one third of the brood combs for overwintered nucs (numbering approximately two to three times the number of honey producing colonies) changed completely the population dynamics of stationary honey production in the northern U.S. and southern Canada. After seven years of using this system, and bringing the apiary to its full size, I was forced into a counterintuitive conclusion: The best results were obtained in every important dimension (stability, resilience, constant improvement, lifestyle, economics, etc.) when the Winter losses – from the total number of colonies; honey producers, plus nucs and baby nucs – averaged around 30%. There are at least three important reasons for this:

1)With a very light Winter loss, there are too many colonies for the operators to deal with properly in the short active season – especially in bad weather. 2)The empty combs and frames of honey, freed up from the lost colonies are extremely important for creating the next crop of nucleus colonies. If all the combs for the next batch of nucleus colonies have to be started from foundation, a poor season for drawing comb can create a large setback. 3)With low Winter loss, it can be very difficult to get the best young, tested queens into the honey producing colonies, where they get their final test; and thus interrupts the rapid progress breeding can make within this system.

The inspiration for the apiary came from nature herself, but also from farmers and scientists who used nature as a model and a guide.

Work-wise, a 30% loss in this scheme is not the same as it would be in a traditional honey producing business. With many or most of the nucs in split boxes, the empty combs from failed colonies are soon occupied by their thriving neighbors, and the boxes remain alive right in the beeyard without any extra labor. The most important point however, is that when no economic damage is done to the apiary at 30% Winter loss – and when it can recover easily and still be profitable even with 40-60% losses – then really powerful bee breeding based on natural selection becomes possible, without treatments, and without the never ending, incredibly boring and time consuming extra work of counting this or that in hundreds or thousands of samples. The colonies are evaluated only by their total, unstimulated response to their environment in every dimension. Almost all of that evaluation is done as part of the normal, income-producing work, with very little extra time or labor. I have never yet collected even a single sample of bees for counting *Varroa* mites – or anything else – in my apiary since the *Varroa* invasion.

The use of overwintered nucs has become well known and widely used now in the U.S. and Canada. But the equally important points concerning the optimum size of an apiary, and utilizing this 30% advantage are still not well understood in the larger community, and are only being utilized by a very small number of beekeepers.

Varroa mites were first detected in my bees in 1994, and for the next five years I used Apistan (fluvalinate) strips to protect my colonies – just like everyone else. It was very disheartening to watch our community go from being staunch opponents of pesticides, to some of their most enthusiastic users. (Has any pest problem ever been solved, in a long-term way, by using pesticides?) I tried to use those five years to figure out a way to get off the "pesticide – resistant pest – new pesticide" treadmill as fast as possible.

The missing piece of the puzzle appeared beginning in 2000, when the "Russian" bees first became available to American beekeepers. This brilliant piece of work, conducted by Dr. Tom Rinderer and his cohorts at the Baton Rouge Bee Lab, was more valuable to me than the sum of all other bee research conducted in the U.S. during my lifetime. They carefully imported the mellifera bees with the longest history of co-existence with *Varroa,* and released them in such a way that any beekeeper with 100 colonies or more, and some degree of isolation, could build up a viable gene pool and then develop them further as a local strain.

The Russian bees have a genuine ability to live together with *Varroa* mites without any treatments. These abilities were not perfect or uniform from one colony to another; but they were stable, far better than anything else available at the time, and capable of much improvement over four to five generations.

By plugging the Russian bees into the management scheme described earlier, I was able to continue with my program of gradually withdrawing all treatments from the apiary, which I started in 1998. The last treartment of any kind was applied to a part of the apiary in April of 2002. To prepare for the transition to treatment-free beekeeping on a small, commercial scale, I also established a new, isolated mating yard; began keeping all the nucleus colonies year-round in yards of their own; and started making foundation from my own, clean wax. In those

early days we had almost nowhere to go for advice, and no really good examples to follow. (As far as I know, Ed and Dee Lusby were the first to establish a treatment-free, full-time commercial apiary in N. America – and they deserve at least a monument in stone for the achievement. But their environment was completely different from mine, and the cost of their success was greater than most any commercial beekeeper could withstand.) I tried to prepare for heavy losses at the beginning, and I was not disappointed. Despite bad weather, I pulled through the initial collapse and recovery cycle using experience gained from the tracheal mites. Since 2002, my Winter loss has probably averaged 30-35%; with a range from 5%-60% – not great by the metrics of the current beekeeping advice community, but very close to the best result for me and the system I use. Since I began selling nucs in 1992, there have only been three years when I didn't sell any surplus bees, and I never had two years in a row without nuc sales. Averaged out over the last 30 years, they have supplied about half of my total income.

Between 1998 and 2000, quite a few people suggested that I was brave to follow this path and quit treating my bees. But at that point it seemed equally risky to go where most of American beekeeping was headed. The current situation convinces me that I did the right thing, and I certainly have no regrets. I frankly can't think of anything that I would trade for my beekeeping experiences of the last 30 years.

So, what conclusions have been reached after all the years of work summarized here? There are four that have asserted themselves over and over, and will not go away:

First – Since 2000, when the Russian bees became available, there have been simple and effective solutions to the varroa problem, requiring no pesticides, and available to much of the U.S. beekeeping community. (Please note, I did not say easy solutions.) There could be many reasons why these solutions have not been more widely adopted, but most concerning is the growing number of farmers of all types, unwilling or unable to solve their own biology problems, and looking in the wrong place for others to solve their problems for them.

Second – The really elegant solution to the *Varroa* problem is only possible in countries that 1) allow careful importation of honey bees from other countries; 2) have terrain and circumstances suitable for controlled natural mating – either by isolation or saturation; and 3) have a safe and abundant environment, free of pesticides.

If such a place exists, the bees from far eastern Russia (and/or northeast China) and the high altitude bees of East Africa could be crossed together, and in four or five generations a highly *Varroa*-resistant base stock could be created combining the best qualities of both original parent lines.

Third – As a threat to beekeeping as we know it, *Varroa* mites are a red herring. The real threat to beekeeping is the destruction of habitat and the poisoning of the environment caused largely by the proliferation of industrial agriculture. The very best breeding programs have no value whatsoever if the resulting bees have to live in a poisonous environment that constantly undermines their health. The sublethal effects of poor nutrition and pesticides ensure that *Varroa* and other pest and disease problems will never go away.

And **Fourth** – There will always be beekeepers as long as even a single honey bee remains alive.

But in the future, beekeeping as the wonderful hobby or vocation most of us know is going to either succeed or fail along with organic farming. The human struggle for food, clothing, shelter and fuel now dominates most of the habitable land throughout the world. Managed organically, with diversity, and without poisons, almost all of this land can be a safe home for honey bees – and much of it a paradise. With the industrial model, bees are not even survivors.

In every country, in every habitat, there are examples of farming that simultaneously create high yields, a clean environment and a healthy and happy place for both bees and people to live. These farmers are our natural and most important allies, and the very best thing we can do for our bees is to support them any way we can; and try to help others follow their example. Forget about all the different, competing labels attached to organic farmers now – we need them all. The choice between utter failure and the Garden of Eden is the same for honey bees, and for us. BC

One hundred years ago everyone owned a horse and only the rich had cars. Today everyone has cars and only the rich own horses.

I Asked . . . You Responded

Answers Came From All Over The U.S.

On May 1, Ann Harman passed away after a brief stay in the hospital, following surgery for a broken leg, and several complications following that. In typical Ann Harman style, she had her June article submitted well in advance of the deadline. But she also dictated a short article that will appear in the July issue, to her daughter Joyce while she was in the hospital. So we will have one more submission from Ann.

Remember, back in March I did a survey of *BeeCulture* readers for my monthly article. I provided my home address and also email so that readers had a choice of sending answers. I did have lots of questions since I was trying to cover the many items that appear in the magazine each month. So this month I am sharing with you a summary and comments from the answers I received.

First of all I would like to thank all those who answered. I know that many of you spent time answering so many questions and I and the editor and staff of the magazine appreciate your time and effort for so many thoughtful answers. Yes, all of the information has been passed on to the editor and staff.

Although it may seem a long time between the questions issue and this, the June issue, but I wanted to allow enough time for survey answers to arrive throughout March. In addition I need to follow the magazine schedule. So I am writing this in early April after subscribers have read the March issue.

I did ask where the reader was living. Answers came from all over the U.S. From Southern California up to "the northwest," to Louisiana, with many from the middle of the country such as Michigan, Wisconsin, Ohio, Kentucky. The eastern area responses came from New York and the New England States. Yes, there were a number who did not designate where they are.

It was very nice to "meet" the beekeepers who answered the survey. Quite a few have been keeping bees for very many years. A small number of fairly new beekeepers did answer the questions. Most of the answers came by email; a very small number were handwritten. I did ask if the magazine came by mail or electronically. It seems that the real paper version, by mail, was the chosen subscription. One thing is certain about all readers – honey bees are definitely an important part of all the responders' lives.

I will first give summary answers to the questions, in order of their appearance in the article. However I will save suggestions given and group them at the end of this article. So let's find out what readers do when *Bee Culture* arrives in the mailbox.

Where do the readers start reading the new issue? Most read from front all the way to the back. A few go immediately to their favorite author. Here Ross Conrad and Jim Tew were mentioned by quite a few responders. Something featured on the cover or the pictures accompanying an article will give some readers their start. A few readers will flip through the issue quickly, perhaps stop to read Ed Colby before returning to the beginning to start reading the whole issue. In general each issue is completely read.

What about the editorials, one from Jerry Hayes and one from Kathy Summers? Here were some definite opinions. Jerry's were read and well-received. But Kathy's brought definitely mixed opinions. Most enjoyed her comments on chickens, ducks, gardens and people. But a few, only a few, pointedly said that the chickens just did not belong in a bee magazine. (Well, if you live in small hive beetle areas, chickens are actually a fantastic way to naturally control small hive beetles. Mine do.)

The next question asked was about the balance of articles – practical and technical/biological ones. Basically all the respondents thought the balance was quite satisfactory. A very scientific one may be skipped or skimmed by a few readers but no objections. A how-to-do-it maybe skimmed, but not necessarily ignored, by some who are skilled and enthusiastic about building hive parts and other equipment. Readers appreciated well-illustrated articles, not only for making equipment but also for plants.

Both Jay Evans and Clarence Collison were mentioned as producing excellent articles. Several readers admitted to not understanding the scientific details very well but thought that such articles were necessary. One reader did note that the scientific articles used big words that were not in bee books.

Just about everyone reads the Mailbox, letters to the magazine. Some have sent letters that have been published. So this section is a popular part of the magazine!

Even those who are well-stocked with bee equipment appreciated the information, with photos, of new gadgets. Beekeepers are always looking for ways to make beekeeping better.

The magazine is filled with advertisements, some large covering a whole page, others small. Ads for bees and queens and for equipment. Plus there is an index to advertisers towards the back of the magazine. The readers not only read the ads


Ann **Harman**

but they also are aware of and use the index. Even those who admit to having lots of equipment or those who build their own like to see if there is something new.

Another item at the end is the Calendar that gives the dates and places of events. Yes, this is used by readers who are searching for a nearby meeting, perhaps in a nearby state. Since this is a useful part of the magazine, state and even local associations need to put their information on it.

The Book Reviews are considered very valuable! The beekeepers find out here what bee books are new, what the books are about and whether they are worth buying for their library.

The occasional new equipment reviews are also considered important information. However some readers would like to see a *Consumers Report* type of article, one that gave more information about its value in beekeeping, especially if the piece of equipment is expensive.

In some issues there are two pages for children called "The Bee Kids Corner." Does anyone besides children read these two pages? Yes! They are quite popular with adults, with or without children or grandchildren. As one reader said, "Always something to learn." Another reader pointed out that it is important to teach adults and children about "the significance of responsible beekeeping." So these pages do have use beyond being fun and educational for children.

The Honey Reporter is used by many of the readers as a guide to honey prices and how the honey market is doing. Even if the readers were not selling wholesale they felt it gave a good view of prices. One reader requested that the colors of regions on your numbered map match the colors used for the same regions listed in "Next Month" that appears on the same pages as the map.

The beekeepers are definitely interested in bee plants. Not all would be planting large areas like meadows. The readers know that plants are suitable for a particular area of the country. However the readers would like to see more about bee plants so that their area would be covered sometime during the year. In general readers felt that more about plants is needed.

Although those who responded to the survey represented small-scale and sideliner beekeepers, they all liked reading about the big commercial beekeepers—what they do, how they do it. So an occasional article about the large commercial operations is of interest.

Now you have read this issue of *Bee Culture*, as well as the March one with the survey, it is time to find out the fate of the March issue, and other copies of this magazine. They have NOT disappeared! In fact most of you still have the March issue. Let's see what readers do with past issues. Quite a number of responders have all the *Bee Culture* issues they have ever received. One reader puts sticky notes on the cover to indicate an especially worthwhile article. One reader keeps old copies in a large chest where he can retrieve an issue he needs. Other "keepers" did not reveal where all the copies saved were. Quite a few keep some for a while and then donate to their bee club. One keeps them a few years then gives them to mentees. A few take them to the local library. Others cut out articles of special interest, file those and recycle what is left. It seems that very, very few copies end up in recycle. The magazine is considered a "keeper."

And now – if you were editor for a day – you would always have an article from Jim Tew and one from Ross Conrad. One feature would definitely be "Bee Talk," the popular questions and answers pages. Those were to be "regulars" in the issues. Several suggestions included something about native bees, a recipe (not a whole page), and more about "how to do it" with lots of pictures. Several readers just did not want the job of "editor for a day" since they feel it is a big job that is being done very well.

Again, thanks to all who answered the survey. BC

We think Ann's first writings for Bee Culture *were as far back as 1979, but we're still doing some research. Ann Harman continued to educate us for as long as she could from her home in Flint Hill, Virginia. We'll miss you Ann.*

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The View From The Beeyard

Solitary Beekeeping Continues During Covid-19

One of the things I enjoy about beekeeping is that it is primarily a solitary activity. Most of the time it is just the bees and I. A bright sunny day with the scent of flower blossoms riding on a gentle breeze; my communion with one of my favorite parts of nature occasionally punctuated by the intrusion of mites, beetles, moths, bears, and other critters that appreciate honey bees almost as much as I do. Unless I require assistance with the hives, the ancient craft of beekeeping continues its solitary path mostly unchanged even during times such as this when we are grappling with the current Covid-19 Coronavirus pandemic. When working by myself in the beeyard, it is relatively easy to obey social distancing recommendations that really should be called "physical distancing" given the huge spike in online socializing the shutting down of most economic activity and various shelter-at-home orders have stimulated.

An Essential Activity

Beekeeping like all forms of farming provides the foundation for our modern day food system and as such, is considered an essential activity. This was recently confirmed for me by the state of Vermont, after the governor ordered all non-essential businesses to temporarily shut down and I submitted a request for further clarification on whether beekeeping constitutes an essential activity. I was grateful for this declaration since I had no desire to potentially get arrested leaving home in order to visit the various apiaries I maintain on other peoples farms and properties. But as beekeepers we already know how essential beekeeping is. Essential not just for the precious and unique products our hives produce, but for the valuable pollination services our bees provide.

This pandemic has greatly expanded those for whom I am grateful to for their service to society and indirectly, to me. Historically it has been primarily the military that receives our consistent gratitude for the risks and sacrifices they make for our country. While the National Guard is actively assisting in the response effort in many states, it is not the familiar face of our military that will lead us out of this crisis. Rather the entire medical community from MDs, EMTs, nurses, therapists, PhDs and even retirees are being mobilized to fend off this unseen enemy that threatens to overwhelm our way of life. Thanks to Covid-19 it is clear now that many who went unseen in our culture and were too often taken for granted, are also proving to be absolutely critical for keeping the hidden gears of society functioning. The pandemic has shown me that now, among those that I need to extend my gratitude to, include grocery store workers, mechanics, postal service employees, teachers, child-care workers, sanitation personnel, road crews and utility workers all of whom are being asked to risk their lives as they ensure the continuity in mine is maintained.

Dealing with stress

The possibility of being unable to access my bees when I need to along with the perpetual challenge of keeping my bees alive and healthy are not the only stressors I face as a beekeeper during the worldwide pandemic. Today many people are rightfully worried about getting sick and possibly dying. There is concern about for our families, friends and neighbors. Folks are hoarding toilet paper, hand sanitizer, food, guns and ammunition all in preparation for quarantine, or worse situations both realistic and imagined. Rather than hoarding supplies with each person out for themselves in competition with their neighbors, the view from the beeyard suggests that our best chance for survival during such difficult times is through cooperation, working together for the benefit of our entire community and by promoting our common interests. Rather than think of the world in terms of maps that locate where hotspots of infection are worst, we need to acknowledge the true and inescapable lesson of the pandemic, that humanity is invariably interconnected. This means in part that we should be following the recommendations from our health care professionals and experts instead of those who are simply looking to score political points.

I find my concerns about the pandemic are tempered by the many things that can normally kill me as I go about my daily activities, from driving in a car to cancer, heart disease and an anaphylactic reaction to bee stings. Unlike the annual influenza virus (flu) for example, Covid-19 is new, unusual and more virulent so people are responding with a heightened sense of fear, panic and stress all aggravated by our federal government's lack of preparedness for dealing with this situation efficiently,

Getting out into the beeyard when possible, provides a wonderful break for those who have been cooped up inside under voluntary quarantine for an extended period.

effectively and competently despite having a couple months notice that the pandemic spreading to U.S. shores was a distinct possibility. Fear and stress are known to compromise the immune system and lead to sickness and death, so I take a deep breath and work to find ways of keeping the stress in my life at a minimum during this difficult and unprecedented period.

One way that I find is helpful is to remind myself that material objects are not permanent and therefore not as important as they are sometimes made out to be. As long as I have the basic necessities of food, water, shelter and my health, I will survive. Additionally even though I may not be used to doing so, there are often numerous alternatives to the "necessities" I often think I can't live without. For example, facial tissue or paper towels can easily substitute for toilet paper in a pinch. Unless you have a composting toilet, these items will have to be disposed of in the garbage rather than flushed down the drain in order to prevent clogging septic systems. Washing hands with soap and water for at least 20 seconds is far superior to using antibacterial hand sanitizer that is sold out in stores anyway. I have even been forced to discover the wonders of Zoom Video Communications remote conferencing services, which prevent me from traveling to meetings and potentially violating the six-foot distancing requirement. With a little imagination and creativity many substitutions for so-called necessities can be realized.

In this day and age of smart phones and ubiquitous social media, the idea of staying home ensconced with one's family, for weeks or months at a time can be challenging but doesn't have to be an isolating and stressful experience. It can also be a time to strengthen family relationships.

Those who live alone may find that solitude is a chance to learn about themselves and catch up on projects around the house. And while, I may not be able to maintain my friendships in the same way I have in the past, so what. Real friends are understanding, and the most important part of any relationship is acceptance. Friends are friends until they prove that they are not so why stress about them?

Channeling concern into action

Acting out of fear and panic seldom leads to good decisions and actions. While it may be difficult to keep your cool when others around you are freaking out, it is precisely in such times that I need to remind myself to stay calm. After all, as a beekeeper I have learned that "it is always something." Prior to the Covid-19 outbreak, regular tick checks and battles with Lyme disease were constantly shadowing me in the bee yard. Lyme along with Ebola, West Nile Virus, ZIKA and SARS have all become a part of the new reality as novel viruses and diseases appear and spread due to our constant encroachment upon ecosystems and the melting of permafrost worldwide. Given the profound environmental changes that are manifesting in our world we can expect to see many more exotic diseases, pandemics and other life-threatening crises in the future

Observing your bees as they go through their annual cycles is a great way to relieve stress and forget, at least temporarily, the troubles of the world."Photo Credit: Todd Huffman,Phoenix, AZ

and yet there is some cause for hope. We live in a time of overlapping and intersecting crises with the pandemic and climate destabilization. The current situation proves that when we recognize a real emergency, we can make all sorts of drastic changes within a very short period of time no matter what the cost. Covid-19 has shown the world that early drastic interventions can go a long way to preventing things from getting really bad, a lesson I hope we apply to the climate once the pandemic has passed.

Learning how to avoid and cope effectively with stress during these times will be required for health and happiness. The current pandemic can be used as an opportunity to practice staying calm, centered and mindful. Some are finding a more peaceful state of mind by taking up yoga or meditation.

I am also encouraged that so many have found a way to tap into the better part of themselves and deal with their stress by responding to the pandemic with generosity and bravery. Like worker bees, people who are not even considered essential workers are stepping up and unselfishly volunteering to help friends, neighbors and total strangers in whatever way they can. Stress can be relieved when it is used to focus on being of service to others.

Beekeeping stress relief

Mounting research indicates that interactions with nature lowers blood pressure, and decreases levels of the stressor hormone cortisol, which calms the body's flight or fight response. When we can't get outside, even the sounds of nature can have the same positive physiological impacts. Beekeeping is a window into the natural world, whose steady rhythm can bring solace and peace in times of upheaval and confusion.

An often overlooked fringe-benefit of our vocation is the stress reduction that is experienced when the gentle hum of a colony combined with the sweet fragrance of ripening nectar and the purposeful comings and goings of the bees, signal that all is right within a hive and our efforts to act as caretakers for these wonderful pollinators appears to be paying off. It is easy to lose oneself when we spend time with the bees, temporarily forgetting all our troubles and those of a self-quarantined world striving to fend off the worst possible outcomes.

The grounding, calming and meditative effect of beekeeping comes at least in part from the fact that the direct support and nurturing we supply our honey bees, ripples out into the world through the act of pollination, and in turn provides an abundance of food and habitat supporting and nurturing all of life itself. As beekeepers, meaning is found in the work we do since it is for something far greater and larger than ourselves.

There is a quote making the rounds on the internet lately from J.R.R. Tolkien's book *The Fellowship of the Ring* that made it into the movie with the same title and succinctly embodies a concept we might do well to keep in mind during these trying times.

"I wish it need not have happened in my time," said Frodo. "So do I," said Gandalf, "and so do all who live to see such times. But that is not for them to decide. All we have to decide is what to do with the time that is given us." BC

Ross Conrad is author of Natural Beekeeping *and the newly published* Land of Milk and Honey: A history of beekeeping in Vermont.

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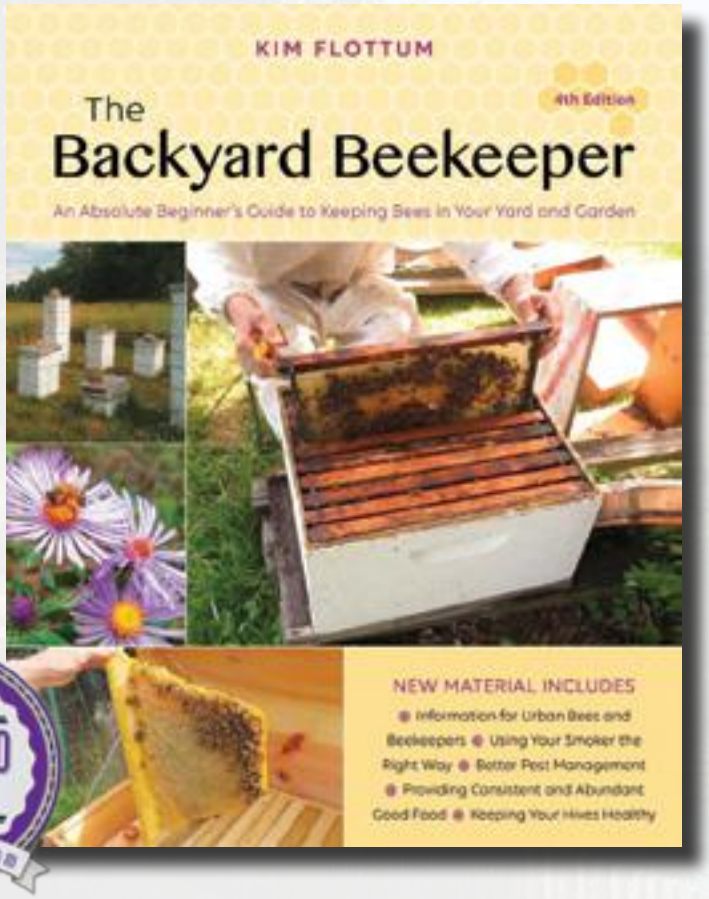

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HORIZONTAL BEEKEEPING – PART V

Tina **Sebestyen**

June is a wonderful time in the beekeeping calendar. New colonies are growing well, and established colonies have been split. The honey flow is really coming in, along with plenty of pollen. As a horizontal hive grows, whether top bar or long Langstroth, management is important, but also easy and fairly minimal. Our goal as beekeepers is to ensure that there is plenty of room for the brood chamber to grow, and that there is plenty of room for incoming nectar and pollen to be stored. The perfect configuration for any horizontal hive has one sheet of honey at the door, followed by one sheet of bee bread, then frames or bars of brood, followed by the main honey stores. If there are empty bars or frames that need comb drawn on them, I place them right behind the last brood frame, so that the bees can choose whether to raise more brood or to place honey in them. By continuously moving full honey frames toward the back of the hive, we also make it easier and more efficient for the bees to fill honey combs, since they don't have to walk as far. I like to have five empties between the brood and the honey at all times.

Most of my colonies seem to like to have about 12 frames or bars of brood going. As previously described, my top bar hives are deep, about 12 inches, and contain about the same number of square inches as a deep Langstroth frame. In colonies with smaller dimensions, management will be more important, and more difficult. Because of the constricted size of these smaller bars, the brood chamber may take 20 or more out of the 30 available bars. This means that there is no room for honey production, and all of the resources coming into the colony go into raising brood. In places such as where I live in SW Colorado, there is only one real honey flow, and if the bees use all of it for raising babies, once they start to reduce the brood area later in the summer, it is too late to store enough honey for winter, much less produce any extra for the beekeeper. In this case (a small top bar hive and limited flow), a queen excluder should be used to limit the brood area so that there is room for honey.

Even in the larger-sized top bar hive or in a long Langstroth hive, limiting the brood chamber to 10-12 bars or frames is fine for the bees, helps the queen last a bit longer, and encourages honey production. As long as there is room for the bees to store honey outside of the brood chamber, so that they do not back-fill it, no harm will be done. This is another reason to requeen in the Fall, rather than in the Spring. Young queens are much less likely to swarm than older ones. Queens that have been through even one Spring build-up are more likely to want to swarm, and harder to manage to discourage swarming. Confining the queen to a smaller brood area

Draw the cup lightly down the comb, over the backs of the bees, and they will fall right in. This can be done with a glass jar, it just takes a few more passes due to the smaller contact area with the bees.

means that more surveillance, and more management, may be necessary to keep the colony from swarming. Doing so in these smaller interior top bar hives ensures room for honey to be stored. This should encourage the queen to slow down production, but if you see any signs of swarming or crowding, brood can be moved from this colony to one that could use a population boost.

A queen excluder can be made quite simply for any shape of hive. Buy the plastic type, without a wooden frame. If there is a follower board that fits really well, just cut the queen excluder to the same shape. If not, here's how to make one. Make a space for yourself to work behind the cluster, in the center of the hive, if it is possible to work there without disturbing the bees. Sometimes the lumber warps from one end of a long hive to the other, and something that is bee-tight at the end of the hive isn't so bee-tight where it is needed, usually somewhere in the middle. Start with a large piece of newspaper, making sharp creases where it fits against the walls and floor. Fold it at the creases to check the fit. This is the template. Make a trial run out of cardboard, just to be sure, before cutting the plastic queen excluder. It is difficult to make a loose excluder fit, if your template wasn't exactly right. A pair of tin snips works great for cutting the plastic queen excluder.

Once there is ½ cup of bees in the jar, add a good scoop of powdered sugar (1-2 TBSP), let stand for a couple of minutes, then shake over a white plate for 90 seconds. Spritz with water, and viola, mites dislodged from bees.

If the colony fills the hive front to back with honey, it will be necessary to harvest some honey to prevent back-filling of the brood chamber. Take one or two or five frames at a time out and harvest the honey, then place them back in the hive for re-filling, always keeping in mind what their winter needs will be. If you practice crush and strain, the bees will need to draw new comb. Leaving the bit of comb at the top of the bar, over the guiding strip, helps get them started and ensures that they go in the right direction. Top bar combs that are two years old or more can be spun in a honey extractor. If they are extra deep, like mine, the tips will probably need to be cut off to allow them to fit. Place the bar at one side, not at the top or bottom. Start spinning slowly, gradually increasing speed, until you learn what the comb can take. In Langstroth beekeeping, frames of honey are often warmed to about 90 degrees before spinning, but this may not be a good idea for foundationless or top bar combs, as it may make the comb too fragile to endure the centrifugal force, depending on the age of the comb. Three to five-year-old comb is quite tough, and can take some warming along with the force of spinning. The ability to extract honey and preserve the comb easily, as wooden frames allow, is another benefit of long Langstroth beekeeping over top bar beekeeping. For those that especially value comb honey, top bar beekeeping is perfect. Simply cut out the pieces you want and return the rest to the bees for repair and re-filling.

Monitoring for mites is really no more difficult in horizontal beekeeping than it is in vertical beekeeping. It is no different at all in the long Lang with frames and foundation. But if the frames are foundationless, or as in top bar beekeeping, totally free-form, a different method of collecting bees is needed, since we may not want to bang the frame onto the bottom of a tub to dislodge the bees. First, select a sheet of open brood that is not quite ready to cap, with the C-shaped larvae not quite filling the bottom of the cell. If they look fat, they are too old, and the foundress mites will already have moved into the cells and be hiding under the larvae. By doing this in the same way every time, I strive for consistency in my monitoring and treatment thresholds, so that I can learn from my own history what works for me.

Once the correct brood frame has been located, we need to collect a ½ cup sample of bees. As long as the bar or foundationless frame is kept vertical to the ground, it is still possible to rap the edge of the bar on the bottom of the tub to knock the bees into it. This gives another

chance to look for the queen, as she can be seen fairly easily walking around in the tub. It is just fine if some of the bees fly out of the tub, those are foragers anyway, and it is the nurse bees we want. Tip the tub, and measure out the ½ cup of bees, and proceed as usual. I probably wouldn't do this with a new comb, but an older one will be fine.

If there are any concerns about the fragility of the comb, there is a better way to attain the bees needed, and that is to drop the bees directly into the cup from the frame, skipping the knocking them off part. A square measuring cup works really well for this, and they can be ordered online or often found in feed stores for measuring minerals and medicines. Hold the frame sideways, resting the bar on one that is still in place, so that any bees that fall outside the cup will fall back into the hive. Start at the top of the comb, and lightly resting the cup on the backs of the bees, draw it downwards. The bees will fall right off of the comb and into the cup. Shake the cup a bit to make sure you have enough bees, and if not, turn the comb to the other side and go again. It's a bit counter-intuitive to go downwards, but dragging the cup up doesn't catch as many bees, it is slower and more awkward, and seems to be harder on the bees. Once a half cup of bees has been obtained, proceed as usual, with powdered sugar or alcohol.

The trickier part is figuring out how to treat, if necessary, using modes meant for Langstroth hives. For one thing, in horizontal beekeeping, honey supers are always on. For another, it is more difficult to change ventilation amounts in a top bar or long Lang. Mite Away Quick Strips and Formic Pro can be used with honey supers on, and pass through brood cappings, but can lead to queen mortality and brood death. The directions state that screened bottoms should be left open, and most top bar hives and many long Lang hives do not have screened bottoms. They also state that for a small colony an empty super can be added for more ventilation, not possible in horizontal beekeeping. If your hives do have screened bottoms, open them. Remove any entrance reducers. In top bar hives, separate the bars by ¼" or so, and lay one strip, not two, above the brood chamber. Consider propping the top up a tiny bit to increase ventilation and decrease high temperatures. Prepare yourself for the fact that the queen may die. Remembering that the reason mites are high is because this queen does not have resistant genetics. It might even be prudent to order a queen in advance for placement after the treatment is over and you have found and removed all queen cells. Be sure to follow temperature recommendations for this product.

Crease and then fold a piece of newspaper to fit exactly inside the middle of the hive body to make a pattern for trimming a queen excluder to fit.

Apiguard is made from Thyme essential oil, and works by fumigation in the hive, meaning that the bees don't need to come in contact with it, just with the fumes that it produces. It has the same temperature recommendations as the Formic Pro, but is a bit less likely to kill the queen and brood. However, it cannot be used when honey supers are on. We can overcome this by removing any honey combs that will be for human use, leaving only the ones nearest the brood chamber. Store the extra combs in a cooler that supports the bars in an area that cannot be found by the bees. Spread out the brood combs by ¼". Place the follower board behind the colony. This works very well for the bees, and is just a bit of hassle for the humans in dealing with the honey combs. Don't think that you can cut corners on this. The honey will taste terrible if exposed to the thymol, and the scent will be absorbed by empty comb, tainting future honey stores.

I haven't tried Hopguard II because of its possibly low effectiveness, but it is a contact treatment on cardboard, which could be ripped into smaller strips and hung between bars, or laid on tops of frames in long hives. It

can be used with supers on. I also haven't tried any of the hard acaricides like Amitraz because of the possibility of carcinogens and the fact that they can't be used with supers on.

Oxalic acid dribble can be used in top bar hives. In colonies with lower populations, I pulled each brood comb, and delivered a half dose to each side of the comb (2.5 ml) with a syringe. In colonies with good-sized populations, I separated the bars just enough to insert the syringe tip, trusting that there were enough bees to catch and disperse the 5 ml of liquid. Oxalic acid does not pass brood cappings, so should either be done when no brood is present, or at repeated intervals. I caught two colonies with 7% mite infestations last summer, and dribbled them three times at seven to nine day intervals, depending on when I could get back to the outyard. I chose this method because of the possibility that it might be effective against nosema. Both colonies recovered well, and survived the Winter.

It can be dangerous to vaporize oxalic acid in a top bar hive because the comb is so close to the floor, and beeswax is quite flammable. Regular Langstroth hives and the long Lang have extra space under the bottoms of the frames, so as long as bur comb is removed, the vaporizer is not as dangerous. In top bar hives, lift the five or six frames where you think the brood chamber probably is, numbers six to 12 for me. Use a half inch thick stick to prop them up a bit. We are creating space between the bottoms of the combs and the floor/vaporizer. Use a wet sock to keep the area under the elevated bars air-tight, as well as in the entrances on both ends and in any open ventilation holes. Follow timing instructions. This should be done mid-Winter, before the colony begins raising brood. I think the OA towels will be wonderful and life-saving for use in top bar and long Lang applications where the climate is not too humid. We just need to wait for Randy Oliver to get this process approved.

Beekeepers in general are an innovative lot, and top bar beekeepers more so. These little inconveniences are just that, don't let them stop you. You can figure this stuff out with some good thinking. We'll discuss queen-right queen rearing and the two queen system next month, and I expect it to be the last installment, so I'd like to hear about any particular topic you want discussed, or innovations you would like to share. You can email me at **bee.seeking@gmail.com**. Thanks for reading!

https://honeybeehealthcoalition.org/wp-content/uploads/2018/06/HBHC-Guide_Varroa_Interactive_7thEdition_June2018.pdf

***http://scientificbeekeeping.com/* Randy Oliver's web site**

Not The Murder Hornet

Kathy **Keatley Garvey**

Ridiculous' to Call Asian Giant Hornet "the Murder Hornet' – UC Davis Professor

It's "ridiculous" to call the Asian giant hornet recently found in British Columbia and Washington state "the murder hornet," says noted UC Davis wasp expert and researcher Lynn Kimsey, director of the Bohart Museum of Entomology and professor of entomology, UC Davis Department of Entomology and Nematology.

"It's no more likely to sting and kill a human than a honey bee," said Kimsey, a two-term past president of the International Society of Hymenopterists, an organization that studies bees, wasps, ants, and sawflies.

"Actually it's less likely, as honey bee venom packs quite a punch and it is exclusively designed to defend against vertebrates," she said.

"The colony everyone is hyperventilating over was actually found on Vancouver Island, British Columbia, last September when it was destroyed and then a single, dead hornet was found in December in Blaine, Wash.," Kimsey said. "There is no evidence that there are any more hornets in the vicinity of Vancouver or anywhere else on the West Coast."

A colony of the Asian giant hornet (AGH), Vespa mandarinia, was found and destroyed Sept. 18, 2019 in Nanaimo, Vancouver Island, and the single dead hornet was found Dec. 8, 2019 in Blaine.

These were the first detections of this species in North America, but there may be more, according to the Washington State Department of Agriculture (WSDA). Beekeepers have reported "observations" (which may or may not be the same species) dating back to October 2019, WSDA says.

Twenty Asian giant hornet (AGH) specimens are housed in the Bohart Museum of Entomology, home of a global collection of nearly eight million species. The largest one, a queen, measures about an inch and a half long, Kimsey said.

Meanwhile, entomologists are bemoaning the name, "murder hornet" and the sensationalism and fear-mongering ensuing.

"It's a bloody dumpster fire," said entomologist Stephane De Greef, administrator of a newly created Facebook page, "Is This a Murder Hornet?"

"Some poorly-worded media reports about Asian Giant Hornets have triggered a veritable avalanche of nonsense online, but I can help set the record straight, wrote senior museum scientist and hymenopterist Douglas Yanega of UC Riverside Entomology Research Museum.

"One colony was found and exterminated in Nanaimo on Vancouver Island in September of 2019, with a few sightings associated," Yanega wrote. "One wasp believed to be from that colony was found--dead--on the U.S. side of the border near Nanaimo in December. Right now, all the authorities are doing is asking people to keep their eyes peeled JUST IN CASE there were queens that escaped the destruction of the Nanaimo nest, and established their own nests nearby. I was one of the authorities brought in to consult on this case, and to my knowledge there have not been any sightings in 2020 that would suggest the eradication attempt was unsuccessful. Put bluntly, as far as we know, there are no Asian giant hornets alive in either the U.S. or Canada as of 2020, and if there are, then they would be in the immediate vicinity of Vancouver Island (about a 50 mile radius or so)."

Lynn Kimsey, director of the Bohart Museum of Entomology, UC Davis, with an Asian giant hornet specimen. The Bohart is the home of a global collection of nearly eight million insect specimens, including 20 of this hornet.

Said Kimsey: "A decade or more ago there was a colony of another species, Vespa asiatica, reported near the Port of Long Beach but nothing ever came of that either. A European species, Vespa crabro, was introduced into the East Coast perhaps a century ago and it is now fully established in the southeastern U.S."

Kimsey says insects often come in cargo boxes from Asia to U.S. ports, establish colonies, and expand their range.

A soon-to-be-published article in the Entomological Society of America's journal, Insect Systematics and Diversity, promises to shed more light on the genus and the history of introductions in the United States. Kimsey and colleagues Allan Smith-Pardo of the USDA and James Carpenter of the America Museum of History, New York, co-authored the review article.

In the abstract, the authors define Vespa as social wasps that are "primarily predators of other insects, and some species are know to attack and feed on honey bees, Apis mellifera, which makes them a serious threat to apiculture."

"Vespa nests can be physically large, with over 1,000 workers, but usually with hundreds of workers," they wrote. "Nests can be aerial, attached to tree branches or in shrubs, in crevices, under eaves or underground depending on the species. Depending on the latitude, nests can be either annual, started by a new queen every spring, or perennial, where young queens take over from old ones. Colonies in

warm tropical climates tend to be perennial."

Washington State University Extension has published an AGH fact sheet, the work of the husband-wife team of Susan Cobey, bee breeder-geneticist and Timothy Lawrence, county director of Island County Extension (both formerly of UC Davis), and also Mike Jensen, county director of Pend Oreille. (See **https://bit.ly/2SA3TxS**)

The WSU scientists wrote that AGH "is the world's largest species of hornet, native to temperate and tropical Eastern Asia low mountains and forests. The hornet is well adapted to conditions in the Pacific Northwest."

"The primary purpose of venom is defense against predators by inflicting pain and damage," they wrote. "Vespa mandarinia is one of the two most venomous known insects in the world.. The amount of venom each wasp delivers (4.1 µl/wasp) has designated V. mandarinia as the most venomous insect. In comparison, the honey bee has about 0.6µl/bee. When foraging for food in spring, the AGH is not highly defensive – unless its nest is disturbed. Late summer and fall, with the high demand for protein, they become very aggressive when attacking or occupying a honey bee colony."

"It is critical that we identify, trap, and attempt to eliminate this new pest before it becomes established and widespread," they wrote. "Attempts to contain the spread and eradication of this invasive insect will be most effective in trapping queens during early spring before their nests become established. Finding the nests can be a bit of a challenge. Their nests are typically in the ground though they can also be found under overhangs and within wall voids. The AGH is a strong flier and often will fly up and away and have an extensive flight range. Thus tracking can be difficult."

They advise residents to "proceed with extreme caution and contact WSDA immediately. Do not try to exterminate the nest yourself."

Cobey,. who examined specimens in Japan last December and shipped some to WSU, commented this week that "I see they have already taken on the media name, murder hornets."

The sensationalism on the media is a concern, said Lawrence, "but...we need to find out just how extensive this infestation is."

Facebook users are posting images of so-called Asian giant hornets that are actually such species as cicada killers, European hornets, southern yellow jacket queens, sawflies, hoverflies, a beetle, and a moth.

"Yes, it is possible this species could establish," wrote entomologist Sloan Tomlinson. "Has it yet? No. Until concrete evidence is presented about any further establishment by this species, it's simply conjecture. Additionally, even IF this species is established, their infamy is overhyped and sensationalized. In Japan they do indeed kill around 30 people a year. Around 40 people are killed annually in the US by domestic dogs."

Doctoral candidate and researcher Ellie Field of Iowa State University wrote on Facebook that "the murder hornet articles are making the rounds quickly and they seem to be doing more harm than good. Yes, it is awesome to track insect populations (particularly staying watchful for non-native and potentially invasive species). But no, the Asian giant hornet (Vespa mandarinia) is not going to destroy America. The one nest and individual that was found around Vancouver last year was destroyed, and this doesn't indicate any establishment. Introduction events happen all the time, all across the world! That region should continue to keep a watchful eye, but for everyone else this is not going to be relevant. There is no invasion, just a small possibility that some may have overwintered in that area."

Those unsure about insect identification can email an image to Lynn Kimsey at **lskimsey@ucdavis.edu** or contact the Entomological Society of America at **https://www.entsoc.org/** or **https://bit.ly/2W2jRmi**.

Entomologists also identify insects on such Facebook pages as "Insect Identification," "Entomology," and "Spider and Insect Enthusiast."

(Editor'sNote; Also online at **https://bit.ly/3doMSPb**) BC

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Website: **http://entomology.ucdavis.edu/**
Department News: **http://ucanr.edu/blogs/entomology/**
Bug Squad blog: **http://ucanr.edu/blogs/bugsquad/index.cfm**

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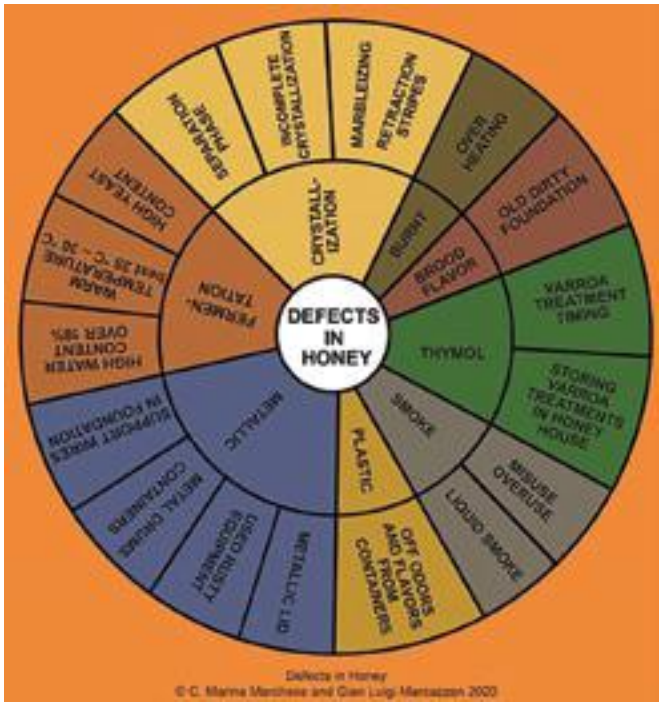
*If you want to know more, listen to the folks in Washington on the front lines, on Bee Culture's sponsored Beekeeping Today Podcast at **www.beekeepingtodaypodcast.com**.*

SENSORY ANALYSIS IN HONEY CAN MAKE YOU A BETTER BEEKEEPER

C. Marina **Marchese** and
Gian Luigi **Marcazzan**



Honey is a product of nature and is defined by the Codex Alimentarius as "the natural sweet substance produced by honeybees from the nectar of blossoms or from secretions of living parts of plants or excretions of plant sucking insects on the living parts of plants, which honeybees collect, transform and combine with specific substances of their own, store and leave in the honey comb to ripen and mature."

This definition designates that honey is a raw and living food. Due to its chemical composition, all honey will deteriorate – for example over time; fluctuations in temperature, high moisture and even sunlight are natural factors that will compromise a honeys quality. That is to say, honey does not improve with age like a fine wine and from a sensory perspective, honey is extremely fragile if not handled with care. Notably, it's color will turn darker and the organic compounds derived from the nectar source will change or evaporate diminishing its organoleptic properties.

Separately, there are other factors directly related to the beekeeper's management of their colony, from the method they bottle their honey and all the procedures in between including harvesting and storing that will influence the quality of their honey. Careless practices can result in off odors and flavors that honey sensory experts define as defects. Many of these defects cannot be detected through laboratory testing and for this reason the skills of a trained honey taster become necessary. Once a specific defect has been correctly identified in a honey sample, management practices can be adjusted by the beekeeper to avoid them, resulting in a higher quality product. On the consumer side, beekeepers can educate their customers on what to expect in a good quality honey and its diverse characteristics.

Here are some of the common defects found in honey that beekeepers can be trained to identify through sensory analysis. The accompanying wheel of honey defects is designed as a quick reference tool to identify defects and their causes. The defects are listed on the inner circle of the wheel and their causes are on the outer edge of the wheel. (See figure above)

BURNT HONEY:

Burnt flavor in honey is caused by over-heating it. A beekeeper's attempt to make the labor of bottling quicker or to re-liquify it, over-heating honey can quickly spoil a perfectly good batch.

At 104/113°F (40/45°C) small crystals begin to dissolve, above158°F (70°C) honey begins caramelize. To an untrained palate, burnt honey can taste very similar to smoky honey, but there is a difference from a sensory point of view. Burnt honey resembles a caramelized flavor that is complex and turns bitter, it can become sickly sweet and viscous from losing moisture during the heating process.

BROOD FLAVOR

Old, dark beeswax comb can produce an unpleasant flavor in your honey so it is important to swap them out when they become dark, about every three years. Honey produced from old combs may be characterized by an offensive animal aroma that is reminiscent of the beehive, old beeswax, especially when invaded by the wax moth.

THYMOL

Honeys with aromatic characteristics are somewhat common, if you are familiar with Linden/Basswood or Chestnut honeys you have experienced this intense smell and flavor that are best described as Vick's vapor rub or Tiger Balm. However, when beekeepers overuse chemical treatments for *Varroa* mites or treat during a nectar flow they may end up with the smell and taste of Thymol in their honey. Thymol is a highly aromatic compound that acts through vapors which bees move around the hive and if not used properly, very likely will affect honey. Other treatments for *Varroa* mites are composed of not only thymol but eucalyptol, menthol and camphor also highly aromatic compounds.

SMOKE

Your bee smoker is a necessary tool for routine hive inspections, whether it is used for removing bees from a honey super or keeping a hot hive in check, new beekeepers and experienced ones alike can over-use smoke. Since beeswax and honey are porous they act like a sponge and excess smoke will damage your honey especially if uncapped cells are present. The result is honey that smells and tastes like smoldering wood, in extreme cases a bit ashy and reminiscent of BBQ sauce. Liquid smoke requires the same amount of caution.

PLASTIC

How you store your liquid gold is as important as how you harvest it. Food grade glass containers are the best option for honey especially for long term. Honey stored in plastic pails or bottles made of polyethylene terephthalate (PET) for extended periods of time (2 years or more) will eventually absorb the residue odors and become unpleasant.

Eventually honey will crystallize in plastic containers then heat must be applied to remove it, thus increasing the potential of absorbing the smell of plastic. Also, reusing food jars or lids that previously contained food will leave residual smells or flavors in your fresh honey.

METALLIC

Your great grandfather was a beekeeper and left you all his equipment, including his prized extractor. However, it's become rusty as have the uncapping tools and tank. Using rusty equipment will impart a defect called metallic. The sensation is sharp and perhaps the most unpleasant defect of honey. It is also common in honeys stored in metal drums and can be difficult to define until this defect pointed out to you. Another surprising way metallic can turn up in your honey is leaving honey in frames with metal support wires or jars sealed with those popular two-piece aluminum mason jar lids.

FERMENTATION

If you ever tasted fermented honey you already know that honey can spoil and go bad.

It is essential to keep the water content of honey at < 18%. Harvesting immature honey before it is capped or ripened can lead to elevated moisture levels. A rule of thumb, it is advised to harvest frames where more than 80% of the cells are fully capped or if you can hold the frame horizontal to the ground and shake it, if no liquid drips out, then it should be safe to harvest. If you are still unsure, purchase a refractometer to check the water content of your honey. Fermented honey can have a fruity aroma and warm taste due the high alcohol content. Often in the beginning stages it could be taste acceptable but overtime will smell yeasty and taste like mead.

CRYSTALLIZATION

Most honey will naturally crystallize over time and as it is a supersaturated solution: almost 80% of sugar (glucose and fructose) in less than 18% water. After a few weeks or sometimes months, the glucose molecules will separate from the water as they are less soluble in water than fructose by binding to particles (catalyst) of pollen, dust, beeswax or even air bubbles that are always present in raw honey forming crystals. Temperatures between 41°F (5°C) to 77°F (25°C) will permit honey crystallization, 57-59°F (14-15°C) will accelerate the process. However, all phases of crystallization do not necessarily reflect a good quality honey. Here are the three phases of defects in crystallization.

- Incomplete crystallization: when a jar of honey exhibits large coarse chunks of crystals floating in liquid honey there are a few things to know. The honey was most likely exposed to high temperatures, it was ultra-filtered or it has aged poorly.
- Retraction stripes: they are identified as lighter colored crystals and appear to be separated from the inside edges of a jar giving the honey a marbleizing pattern. This happens when honey crystallizes consistently and firmly and due to dehydration those crystals could have a low water content and higher glucose content.
- Separation phase: honey that has crystallized (even if homogeneously) is not considered a defect however, over time and if/when exposed at high temperature (> 86°F (30°C)) will eventually separate into layers. The crystals will separate from the liquid phase and will precipitate forming a crystalline layer at the bottom of the jar, while a liquid layer rich in fructose and water will appear at the top. This honey can be stirred however will separate again or can be re-liquified and at this point will have lost its flavor.

These are the most common issues that can turn a perfectly good quality honey into an inferior tasting product. In order for beekeepers to remain competitive in the marketplace and produce the best quality honey, it is important to understand these issues. BC

C. Marina Marchese has 20 years-experience as a beekeeper and running the nationally recognized brand, Red Bee Honey. She is the co-author of The Honey Connoisseur and the founder of the American Honey Tasting Society as the leading resource for honey sensory education in the United States. She is a member of the National Register of Experts in the Sensory Analysis of Honey where she received her formal training. Marina wrote the chapter on honey for *Beekeeping for Dummies*.

Gian Luigi Marcazzan is a Researcher at CREA (Research Center for Agriculture and Economics), in Bologna, Italy. He is the President of the National Register of Experts in the Sensory Analysis of Honey and leader of the honey sensory working group of the International Honey Commission as well as the panel leader of international honey competitions. He is a co-author of Conoscere il miele (*Know Honey*) and scientific papers related to the honey sensory analysis and quality.

For information about training courses in the sensory analysis of honey please visit ***americanhoneytastingsociety.com****.*

When To Recycle Or Discard Tired Beekeeping Equipment

The Corona virus caused this.

I have recently cleaned and organized my wood shop. To show off my accomplishment, at some point, I will produce a video based on beekeeping and wood tool needs. I should do this project in the near future before my shop degrades again. It will degrade.

I completed paneling my back porch. My wife has waited more than four years for this to happen. Honestly, without the required sequestration caused by the virus, I don't know when I would have gotten to the task. After completion, I had to clean my woodshop again.

Then there is my beeyard. In my mind's eye, my home apiary is always clean and mowed. Hives are level and colonies are thriving. However, my reality is that something is always amiss in my apiary and whatever that amiss thing is only gets worse as time passes. Like cleaning the house before guests arrive, I need an event to push me into addressing my beeyard needs – maybe a video is to be shot or other photographic needs are at hand. What to do with all that old, unusable equipment? Hide it? Stack it neatly? Heaven forbid that I actually restore it. Is this virus-restricted period a good time to address this need?

Beekeepers and old bee equipment

Fact – if you keep bees long enough, you will generate aged equipment.

Paint finishes *will* fail. Hive body corners *will* rot. Wax moths *will* leave their marks. Like a cancer, the needy equipment stack starts slowly and grows. Along with the promises to address the issue, the needy equipment stack becomes a prominent yard feature.

Years ago, my daughters had this plaque made for me. It hangs on the wall in my shop But the question is begged, "should it be?"

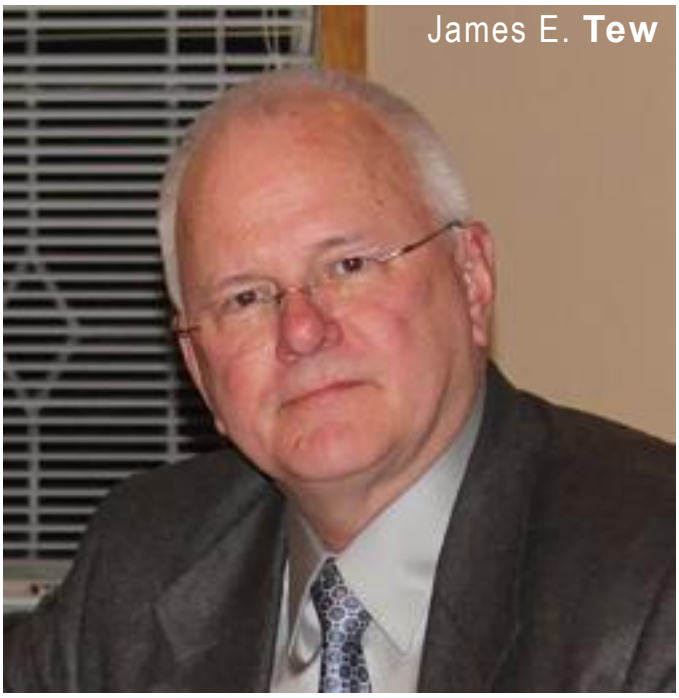
Then mice start nesting in the old equipment. Then a strong wind blows the stack over. Then you get into an equipment crunch and rummage through this old stuff – reevaluating one more time – whether or not some unloved hive part can be used again. Yes, I should have made repairs, but there are always other tasks at hand. The stack continues to grow.

Fact – hive equipment is not designed to be refurbished.

I have no idea if plastic inserts can be recycled. I have no idea if plastic hive equipment can be recycled. In Wooster, Ohio, where I live, my recycling company will not accept foam plastic, and I doubt that plastic inserts would be ultimately recycled. I suspect they all end up at the trash dump. Neither can I open burn. *(The stack continues to grow.)*

My wife always tells me to simply use new equipment and discard the old (*She wants the porch paneling finished*). But I must refer to my woodshop that I discussed above. I have the necessary equipment to refurbish and repair. What I do not have is adequate desire to accomplish the messy, endless task.

When I repair old equipment, I am only putting off the inevitable. Just like me, old repaired equipment will



What do you do with this kind of equipment? Rotted corners and useless frames.

Mystery custom-made nail-pulling pliers.

never be young again. The best it can be is only repaired, old equipment – destined to fail again. At some point, repairing and refurbishing is truly not worth the effort. Breaking down and discarding or burning is the only option. Use a magnet to pick up nails after the burn.

The box joints on hive equipment are solidly double nailed. De-assembling is a poor option. On a table saw or dangerously using a power hand saw, deeps with lower rotted areas can be cut down to super-size, but the hand hold is then oddly positioned, and box joint junctures are misplaced. If you do cut down equipment to a smaller size, use carbide-tipped blades and wear eye protection. The occasional nail can go flying. *(Go ahead. Try removing those hive body nails beforehand. Get that out of your system.)*

Fact – frames are not truly reversible

Repairing frames is absolutely miserable, but believe it or not, the repair of modern frames with foundation inserts is easier than repairing the old wired frames with embedded wax foundation. At least the plastic foundation insert can be popped out, but then what?

A frame top bar I repaired using a piece of an expired car license plate. Bee supply companies sell these frame repair parts. Note the wax moth damage from a previous venture.

The wax coating will need to be replaced. If I just dip used foundation inserts into molten beeswax, an air pocket forms at the bottom of every cell, so I do not get a good coating. Later, this is not lost on the bees and messy comb construction is the result. I have no idea how a backyard beekeeper can spray hot beeswax, so that has not been an option for me.

Bottom bars are the bane of equipment repair. While top bars and end bars are essentially standardized, bottom bars are not. Even two pieced bottom bars are not quite the same dimensions. I have oftentimes used a pocket knife to trim just a bit from a replacement two-piece bottom bar to make it fit.

Did you make these?

Many years ago, for a few dollars, I purchased these specialty pliers at a bee meeting. They came in a plastic zip bag with no name nor instructions. I had never seen pliers like these, and I love tools. It helped greatly that the price was low.

These custom-made pliers have been immensely helpful to me when pulling small nails from soft wood (i.e. frames). Once the nail head is captured, the welded stub is used as a fulcrum to pull the nail out. In soft wood, the tip of the pliers can be pushed into the wood. Otherwise my trusty, three-bladed Stockman Case pocket knife is used to trim wood away until the plier tips can grab the nail.

I have no idea who made this tool or what the original intent of the pliers were. I have nothing but compliments for the function of the tool and the creative person who made the device. Are you out there? Let me hear from you.

Over time, a beekeeper will accumulate a collage of different frame types and those frames, over time, will become mixed within hive boxes.

Again, over time, a solid bottom bar will become firmly stuck by the bees to the top bar just beneath it and – even if glued – will pull from the end bars. Oddly, simply pushing the bottom bar back into place is difficult or even impossible. At that very moment the beekeeper

Repaired equipment. Note the top deep hive body that was cut down to a super. The equipment is stacked on the white cut-off. Note the upper repaired right corner on the deep and the bottom repair strip. The frame has a repaired top bar lug. Paint makes the repairs look even better.

Bottom bars are not standardized.

must decide whether or not to continue to use the frame. The results are that the occasional frame does not even have a bottom bar. In fact, once the comb is constructed, bottom bars are not 100% essential. However, there is a clear creep toward messy beekeeping. Old repaired hive bodies housing a collection of mixed frame types is the result. This is all normal and common. It is a feature of advanced beekeeping that is nearly impossible to eliminate.

Question – a bit like grating cheese, if I simply dragged a chunk of beeswax across the dry foundation insert, are enough wax particles left on the insert for the bees to rebuild combs? Maybe I could then take a heat gun and liquify the wax remains, but would that distort the plastic insert? I don't know. *Well, why don't you try that? I will. I will. Just as soon as I take on the project of restoring my unloved equipment pile.*

Summary, please.

If you keep bees long enough, tired equipment will be generated. Your operation will never look better than when you are a new beekeeper with new equipment. At

A swarm box fashioned from retired equipment positioned on a retired deer stand. (J. Hurst photo)

An improvised flower planting made from retired bee equipment and a tree stump.

An improvised utility stool made from a retired deep hive body.

A simple tool caddy made from a hive super.

a considerable time investment, hive equipment can be rejuvenated. But it will always look like restored equipment. Old equipment is a fact of bee life. As veteran beekeepers, we must all deal with it.

Alternatives to equipment disposal

Use old hive bodies as swarm traps

Either use retired tops and bottoms or improvise them to build swarm traps. Put a few retired frames in them and reduce the entrance to bee-size to keep out squirrels and birds. Position off the ground as high as possible. Then just wait and wait. But a single swarm will make it all worthwhile.

Improvise a tiny flower garden

This is not my idea and I do not remember where I took the (bad) photo, but here is the concept. If you don't have a tree stump handy, I suppose a 4x4 post could be used or set nearer the ground. I would suggest using a reciprocating saw and cut yet another deep to form four legs. In this way, two deeps are re-purposed.

Improvise a small work stool or plant stand

I used a retired deep to improvise a small stool. It could have multiple uses and is simple to assemble. Mine is well-used and has taken considerable abuse. The handhold has been useful for holding small parts. On several occasions, the simple stool has served as a jack stand for my mower and my utility trailer. Of course, putting a flowering pot on it makes it look intentional.

Make a caddy from old bee equipment

Okay, it's true. I used a good super to make this caddy. My original intent was to use it to carry my hive-working paraphernalia, but it has proven itself to be a better flower gardening tool carrier. However, using a repurposed hive super would have worked just as well. Be warned, it is a heavy box, but stout.

Finishing up . . .

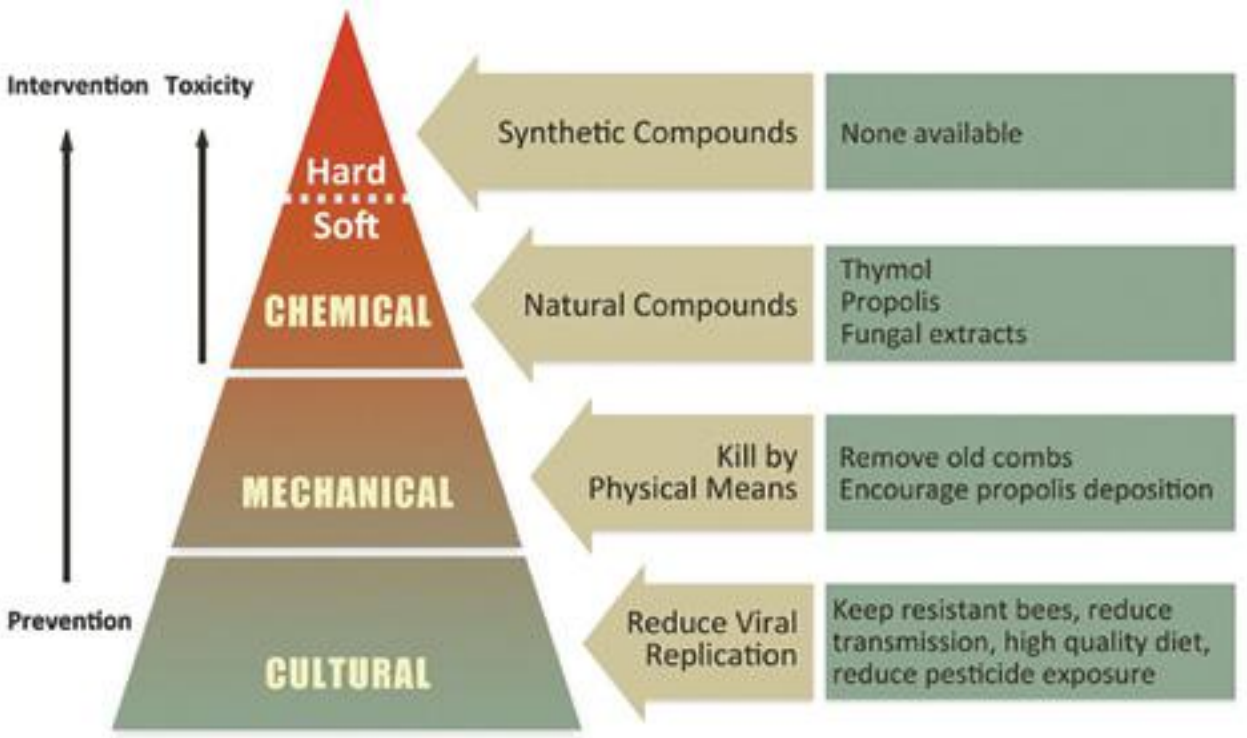
There is no shame or neglect is accruing old equipment. Everything ages. We should know that it will happen. For those of you so inclined, repair the equipment when practical and rid yourself of it when impractical. There will be a time for both. There is a brief middle ground and that is to repurpose old equipment into something else, but even then, there will come a time when the repurposed equipment has once again aged. I suppose that the final fate for all wooden bee equipment is kindling for a Winter fire. It does a great job at that and is easy to split. It's all part of the bee keeping cycle.

Again, thank you for reading. If you have novel alternative uses for wooden beekeeping equipment – or any kind of beekeeping equipment for that matter – I would like to hear from you. You're a clever bunch. BC

Dr. James E. Tew, Emeritus Faculty, Entomology, The Ohio State University and, One Tew Bee, LLC; ***tewbee2@gmail.com; http://www.onetew.com***

https://youtu.be/q1j_IdlgpQY

Integrated Pest Management For Honey Bees



BEE VENOM

Ed **Simon**

All beekeepers hear about a long-time beekeeper who was a friend of a friend of a friend who within a short time became severely allergic to bee venom. Are these old wives' tales or is there a truth behind the story? It happened to two people I know. Here are Amy's and Ron's stories. They include the events, symptoms, realization of the problem and the outcome. These stories are not meant to scare but to inform. But as a beekeeper you need to know the symptoms of a standard response to a sting and a serious reaction to a sting. We'll start with the standard definitions so everyone will be on the same page. Then the sting stories will be related with their symptoms and treatments. A list of symptoms, and treatments for three levels of sting severity are then listed to give you an idea of the toxicity of bee venom and what to be aware of if you get stung.

The definitions, symptoms, treatment and expectations listed is a conglomerate of multiple web sites. Each of these web sites contain some or part of the information. Each has its own version of symptoms, sting severity and treatment which may or may not correspond with the other web sites information.

This information has been paraphrased and/or reduced in length. For a full definition please reference the individual websites.

The sites used were in alphabetical order are:
Allergy-symptoms.org - **https://allergy-symptoms.org/bee-sting-allergy/**
Drugs.com - **https://www.drugs.com/epipen-auto-injector.html**
MayoClinic.org - **https://www.mayoclinic.org/diseases-conditions/**
Wikipedia.org - **https://en.wikipedia.org/wiki/Bee_sting**

Note: All the following information references bee stings. Much of this information is also applicable to any insect sting. Especially the wasp family.

Adrenaline, also known as epinephrine, is a hormone and a medication. It plays an important role in the fight-or-flight response by increasing blood flow to muscles, output of the heart, pupil dilation response and blood sugar level.

Anaphylaxis is a serious allergic reaction that is rapid in onset and may cause death. Symptoms typically appear in minutes to hours. The primary treatment of anaphylaxis is epinephrine injection into a muscle.

Bee Venom

Bee stings are acidic, whereas wasp stings are alkaline, so the body's reaction to a bee sting may be very different from its reaction to a wasp sting. For most people a bee sting is painful but otherwise harmless; in people with insect sting allergy, stings may trigger a dangerous anaphylactic reaction that is potentially deadly.

EpiPen

Generic Name: epinephrine injection

Epinephrine autoinjectors are hand-held devices carried by those who have severe allergies; the epinephrine delivered by the device is an emergency treatment for anaphylactic reaction.

Some brand names are: *Adrenaclick, Adrenalin, Auvi-Q, EpiPen, Twinject, EPIsnap*

Ron's Story

Here in his own words is the tale of a beekeeper who after years of normal reactions to bee venom became highly sensitive to bee stings.

I am currently a 75-year-old male. I have been a beekeeper for about 15 years. From day one of beekeeping, whenever I got stung, I would swell up around the sting site for about three days accompanied with itching. About two years ago, I was stung in the face about five times. I took an antihistamine and had the typical swelling, redness and itching. Then a year ago last September, I was extracting honey, got stung on the hand, and shortly after that passed out. The EMTs examined me and said I was dehydrated. I went home and rested. Later that evening I checked on my bees and was stung four more times. This resulted in the usual swelling, redness and itching. Later that Fall, I was stung on my chin. It was a little more painful than usual, but I reacted as normal. Within a few weeks of this, I began to itch all over my body. It lasted until Spring when I began taking a daily antihistamine, which stopped the itching.

At that time, I went to my family doctor who referred me to the allergy specialists. During the time I was seeing the specialists, I was stung on my wrist. That arm swelled up from my fingers to my elbow. In addition, I got blisters over most of my hand. The specialists said **no more beekeeping** and they started me on bee venom shots.

Everyone's shot regime is different. I started on a very low dose venom concentration; one shot a week. I take an antihistamine before every shot and am required to have an EpiPen available for each shot, in case my body has an anaphylactic reaction. After a set number of shots without any adverse reaction, the shot venom dose was increased. This sequence was continued; set number of shots with no reaction and then an increased dosage, until

100% venom dosage was reached.

After a set number of shots without a reaction at 100% potency, the time between shots was increased to two weeks, three and then four. After the second four-month interval, I was allowed to resume beekeeping. In the last eight months, I have had about 30 shots.

As the shots progressed, I started to react, with redness, swelling and itching. For each shot I was required to test my breath outflow before and after the shot – to show that I wasn't having an anaphylactic reaction. I have never had an anaphylactic reaction. I suspect if I had, I would have to repeat the dosages until the reaction went away. I will continue to get my 100% venom dosages once a month for the next year to eighteen months. The doctors expect this treatment procedure to be 90% effective in eliminating my anaphylactic reaction to honey bee stings. I hope it works.

Amy's Story

Here in her own words is the tale of a beekeeper who after two years of a little above normal reaction to bee venom became extremely sensitive.

From the moment I took up beekeeping, I was enamored with bees. I loved tending to the hives, searching for the queens, watching the workers return home with their colorful pollen baskets and best of all I loved keeping bees with my mom. We tried to be gentle with our girls, but when we were stung Mom and I would compare stings and found that mine were always a bit larger, a bit redder and that they lasted longer than my mom's. I did what I could to prevent getting stung but found it to be an unavoidable part of the job.

We loved beekeeping and over the next two years we grew from two hives to seven hives and as our beeyard grew so did my number of stings. My reactions continued to be a bit larger, darker and more painful than my mom's stings were, but we had always been told that if I had a true allergy to bee stings we would have known right away. I was told that as long as any swelling and redness occurred at the site of the sting and not on a different part of the body, I had nothing to worry about, I was fine, and I was fine – **until I wasn't**.

One day, after over two years keeping bees, I was outside working

in the garden near our hives when a worker bee got caught in my hair and stung my back. Immediately I told my mom how much it hurt and that it just didn't feel the same as my previous stings. We went inside and I headed straight for the bathroom where I thought I would throw up but instead had diarrhea and painful stomach cramping. I felt so sick I couldn't stand up, so my mom called the doctor's office and they told us to get to the ER. I didn't want to overreact and had been stung many times before, so I wasn't worried. After a couple minutes I began to hear myself whistling as I was breathing and felt my chest start to tighten. Mom drove me to the ER as quickly as she could and when we got there, they sent me past the packed waiting room and directly to a nurse. The nurse asked me to lift my shirt and show her where I'd been stung, and I was surprised to see I was covered in big red hives. The nurse put me in a wheelchair and pushed me down the hall yelling, **"Anaphylaxis"** and for the first time I became concerned I could actually die. They gave me an EpiPen shot in my leg, put IVs in both of my arms and an oxygen mask over my face. I began to shake uncontrollably and had to stay in the ER for hours but thankfully I was okay.

The doctors performed a vespid [venom protein] allergy test and found that my allergy to honey bees was "off the charts" and told me that I had a 60% chance of dying if I was stung again. I was so sad to have to give up beekeeping, but my bee stings have continued albeit in the highly regulated form of immunotherapy shots. I was prescribed an EpiPen and started immunotherapy shots every three days and over the last four years they have been spaced out to every two months which will continue indefinitely. My reactions to the shots have lessened and now my arm swells, I have hot flashes, stomach pain and depression on the day of my injection but find the discomfort to be well worth it for my peace of mind.

I believe it is incredibly important for beekeepers to know that an allergy can develop and become life-threatening even years into keeping bees.

Let's examine these stories with a relationship to the symptoms and treatments defined by the medical establishment.

Normal or Minor Sting Reaction

For the first years of this man's beekeeping career were normal and expected.

The symptom of a normal non-allergic reaction to a bee sting are:

- Pain – There is no doubt about it. A bee sting hurts. It can be excruciating but is goes away and eventually gets replaced by swelling, redness and itching. The initial pain usually lasts for a relatively short time. My stings last only twenty seconds to a minute. Just long enough to loosen a nasty word. Then the remaining symptoms take over.
- Swelling – As the pain subsides the local sting site swells. Normally this is not a problem. But it depends on where the sting is. A sting near the eye can close the eye for a couple days.
- Itching or burning at areas affected by bee sting. As the sting ages the immediate sting site starts itching and possibly turns red.
- Redness – This is normal and goes away as the sting ages.

Normal or minor sting treatment

- Remove the stinger, and gently wash the area using soap and water
- Use a cold compress to reduce the swelling, inflammation and pain. Applying a hydrocortisone cream or calamine lotion will help to ease redness, itching or swelling.
- Antihistamine – If itching or swelling is bothersome, take an oral antihistamine that contains diphenhydramine (Benadryl) or chlorpheniramine. More than one application or dose may be necessary before you start feeling comfortable again. You might try ibuprofen (Advil, Motrin IB, others) to help ease your discomfort.

Moderate Sting Reaction

Some people who get stung by a bee or other insect have a bit stronger reaction, with signs and symptoms such as:

- Extreme redness
- Swelling at the site of the sting that gradually enlarges over the next day or two
- Itching around the site, generally the second and third day after the sting

A moderate reaction tends to resolve itself over five to ten days. Having a moderate reaction doesn't mean you'll have a severe allergic reaction the next time you're stung. You may develop similar moderate reactions each time you are stung. If this happens to you, talk to your doctor about treatment and prevention, especially if the reaction becomes more severe each time.

Severe Sting Reaction

For about two percent of people, (Amy's and Ron's situation) a hypersensitivity can develop after being stung, creating a more severe reaction when stung again. This sensitization may happen after a single sting, or after a series of stings where they reacted normally. A highly allergic person may suffer anaphylactic shock from the venom, which can be life-threatening and requires emergency treatment.

As these stories relate, the reaction to bee stings became increasing severe. In each case it took less than two years to develop a severe reaction to bee stings.

Each of these symptoms are possible. Either as a single symptom or in combination with other symptoms.

- Headache
- Diarrhea and abdominal cramping (One of the stories symptoms.)
- Dizziness (One of the stories symptoms.)
- Swelling of the face, lips and throat. (One of the stories symptoms.)

- Vomiting and nausea (One of the stories symptoms.)
- Hives (One of the stories symptoms.)
- Swallowing or difficulty in breathing (One of the stories symptoms.)
- Pale skin
- Weak and swift heart rate
- Decrease in blood pressure
- Loss of sensitivity
- Stomach cramps
- Rashes, swelling or redness away from the area of the sting. (One of the stories symptoms.)
- Difficulty breathing (One of the stories symptoms.)
- Increased heartbeat

Severe sting immediate help!

If you or someone with you is stung and develop any of the symptoms of anaphylactic shock, such as trouble or difficulty in breathing or swallowing, then immediately call 911 for emergency help. If you were prescribed an emergency epinephrine autoinjector (EpiPen, Auvi-Q, others), use it as your doctor directed.

Severe sting treatment

If you begin to experience severe symptoms, immediately see your doctor. An evaluation of your situation may require testing for sting allergies.

Diagnosis

If you've had a reaction to bee stings that suggests you might be allergic to bee venom, your doctor may suggest one or both of the following tests:

Skin test. During skin testing, a small amount of allergen extract (in this case, bee venom) is injected into the skin of your arm or upper back. This test is safe and won't cause any serious reactions. If you're allergic to bee stings, you'll develop a raised bump on your skin at the test site.

Allergy blood test. A blood test can measure your immune system's response to bee venom by measuring the amount of allergy-causing antibodies in your bloodstream. A blood sample is sent to a medical laboratory, where it can be tested for evidence of sensitivity to possible allergens.

Prevention and Precautions

People who have a severe allergic reaction to a bee sting have a 25% to 65% chance of anaphylaxis the next time they're stung. Talk to your doctor or an allergy specialist about prevention measures such as immunotherapy ("allergy shots") to avoid a similar reaction in case you get stung again.

Allergy Shots (immunotherapy) – A long term series of venom shots, increasing in volume until the resulting symptom is in the normal range or less. Then maintenance shots at specified intervals. Both stories describe a version of this treatment.

Precautions – Keep an EpiPen handy. One in car or house and if possible one near your bees. Be sure you know how to use the autoinjector. Additionally, make sure the people closest to you know how to administer the drug. They could save your life. Consider wearing a bracelet that identifies your allergy to bee or other insect stings.

Knowing the symptoms and the emergency response to a bee sting or other insect stings may save yours or a friend's life. Beekeeping is a great hobby and it needs all the LIVE practitioners it can attract. Please be careful. BC

Get a copy of Ed Simon's book Bee Equipment Essentials *with detailed drawings, construction hints and how-to-use instructions for dozens of beekeeping tools and equipment from* ***www.wicwas.com****. Ed can be contacted through* ***SimonEdwin41@gmail.com****.*

ORIGINAL ARTICLE

Indirect effects of oxalic acid administered by trickling method on honey bee brood

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SUMMARY

The effects of oxalic acid administered by the trickling method on brood development of honey bee colonies were evaluated (a) by observing the development of marked cells of young (< 3 days old) and old (> 3 days old) larvae, and (b) by measuring the area of open brood for several weeks post application. Oxalic acid, dissolved in a 50% sugar solution, with an end concentration of 3% w/v oxalic acid, was applied twice by the trickling method during summer to 10 colonies. A high percentage of young (12.6% and 9.5%) and old honey bee larvae (10.6% and 5.6%) were removed from their cells after the first and second oxalic acid applications, respectively. The surface of the open brood area was also reduced by 17.5% after the two oxalic acid applications and stayed low for about two months. For the same period of time the open brood area in 10 control colonies increased by 34.5%. The two oxalic acid applications removed 60 ± 12% of varroa mites adhering to adult honey bees, while the natural fall of mites measured in control colonies (for a period of 40 days) was 32 ± 4%. Combining the detrimental effect on brood development with the low relative effectiveness on varroa removal, oxalic acid application by the trickling method when open brood is present is not as safe as has been regarded in the past. Consideration needs to be given to the use of different sugar and oxalic acid concentrations in the treatment solution in order to minimize its adverse effects on open honey bee brood.

Keywords: oxalic acid, varroa, *Varroa destructor*, trickling, open brood, larvae, detrimental effects, efficiency, control methods

INTRODUCTION

Oxalic acid is a naturally occurring substance used in the treatment of honey bee colonies against parasitic varroa mites throughout the world. Numerous experiments have been conducted to evaluate the efficiency of different oxalic acid concentrations and application methods used to control varroa in broodless or broodright colonies. In broodless colonies, the spraying of weak solutions of oxalic acid onto bees had very high efficiency (> 95% mite mortality) (Nanetti *et al.*, 1995; Imdorf *et al.*, 1997; Bahreini, 2003) and the trickling of solutions of sugar and oxalic acid onto honey bees had an efficiency higher than 90% (Charrière & Imdorf, 2002; Bahreini, 2003). In broodright colonies, efficiencies of 39% and 48%, according to acid concentration, were achieved after three treatments (Gregorc & Planinc, 2001) administered by trickling, while an efficiency of 24% was reported after one spring treatment (Brødsgaard *et al.*, 1999) using the trickling method.

Oxalic acid application by the trickling method, in which 5–6 ml of sugar solution containing oxalic acid is trickled onto the bees between adjacent frames, is regarded as a reliable, simple, cheap and quick method of varroa control (Charrière & Imdorf, 2002; Nanetti *et al.,* 2003) compared to spraying it over bees and brood (Imdorf *et al.*, 1997) or allowing it to evaporate within the hive (Radetzki & Bärmann, 2001). It has also been shown that the spraying of oxalic acid inside the hive can have detrimental effects on brood development; Gregorc *et al.* (2004) reported a level of 82% of midgut epithelium cell death in honey bee larvae 50 h after spraying oxalic acid directly onto them, while Higes *et al.* (1999) reported a long-term effect of spraying oxalic acid on brood development. Therefore, trickling has been regarded as a 'safe' method because it is not applied directly onto the brood. Moreover nothing has been reported on the effects of trickling on brood development. Some side effects of trickling that have been reported mainly concern the overwintering capacities of honey bee colonies, especially when concentrations of oxalic acid were higher than 3.2% (Charrière & Imdorf, 2002; Nanetti *et al.,* 2003).

It is widely accepted that pre-winter treatment of varroa is critical for the survival of honey bee colonies and the build-up of their population during the following year. However, in many cases a spring or a summer treatment is necessary in order to reduce the varroa population till the winter treatment. This is important especially when migratory beekeeping is practiced and one honey flow is followed by another. Treated colonies may then be brought into the vicinity of untreated ones, the result of which is the reinfestation of the treated colonies (Tsellios *et al.*, 2002).

Oxalic acid is a natural constituent of honey (Nozal *et al.*, 2000) and is allowed for use in biological beekeeping (according to EC Regulation 2377/90, and EC Council Regulation 1804/99). Since December 2003 it was also included in ANEXE II of EC Regulation 2377/90 and regarded as a 'Generally Safe Substance'. Its applications do not leave residues in the wax or honey (Mutinelli *et al.*, 1997; Bernardini & Gardi, 2001) and this is another advantage for its use between two honey harvests, when brood is also present in the hive.

The aims of this study were to investigate the effects of trickling oxalic acid for varroa control on brood development of honey bee colonies and to evaluate the efficiency of the method under conditions of a typical summer, between the honey flows.

MATERIALS AND METHODS

Twenty honey bee colonies not treated against varroa for at least one year were used, located in the Chalkidiki peninsula, Greece, and the experiment was carried out during the summer,

between honey flows. The ambient temperature was 35 °C and the relative humidity was 47%. Colonies were equalized after examination of their brood and population and separated into two groups: 10 experimental and 10 control colonies.

Seventy grams of oxalic acid dihydrate (containing 71.4% oxalic acid) were diluted in a 1:1 sugar solution (1 kg sugar and 1 litre water), giving an end concentration of oxalic acid of 3% w/v. The oxalic acid solution (5 ml per between-frame space) was applied twice to the experimental group with a 13-day interval (20 July and 2 August), using the trickling method. A similar sugar solution, but without oxalic acid, was applied to the control group on the same days.

Transparency sheets were used to mark a number of open brood cells in three colonies of each group just after the two applications. The development of young larvae (< 3 days old) and old larvae (> 3 days old) was observed for seven days following each application, and the number of empty brood cells of each category was recorded. The open brood area of all colonies was also measured (on 20 July 2004) prior to oxalic acid application using a comb frame divided into 2 × 2 mm squares. Measurements were repeated again after 13 days (on 2 August, prior to 2nd application) and again on 20 August, and 30 August. Finally open brood area was recorded on 20 September, almost two weeks after the application of a chemical acaricide (active substance coumaphos).

Special varroa floorboards with removable inserts were used in all colonies for counting varroa mites that fell to the bottom of the colonies. Measurements were taken every second day. A chemical acaricide (active substance coumaphos) was applied to all colonies on 1 September in order to remove the remaining mites adhering to adult bees and evaluate the efficiency of the two oxalic acid applications. The number of dead honey bees in front of colonies was also recorded across the experiment.

RESULTS

A high percentage of young (12.6% and 9.5%) and old honey bee larvae (10.6% and 5.6%) were removed from their cells after the first and second oxalic acid applications (10 young larvae out of 79 and 20 out of 210; 8 old larvae out of 75 and 9 out of 160 for the two applications, respectively). At the same time only 1.4% and 1.5% for young larvae, and 1.0% and 0.8% for old larvae marked in the control colonies were removed across the same period (1 young larva out of 71 and 2 out of 193; 1 old larvae out of 64 and 1 out of 115 for the two applications, respectively). The difference between treatments in the total number of larvae (young and old) removed is highly significant (Fisher Exact test, $P < 0.001$). We assume that the removed larvae were cannibalized, as no trace of them was found on the floorboards of the colonies. It is of significance to note that some brood from oxalic acid treated colonies was removed after having been capped.

A gradual increase in open brood area was observed in control colonies during the experimental period, while the opposite trend was observed in experimental colonies. Specifically, in experimental colonies treated with oxalic acid, the open brood area reduced by 15% over the 13-day period following the first oxalic acid application (fig. 1). A further 2.5% brood reduction occurred during the 10-day period following the second application; in total a 17.5% reduction in open brood area was still evident 40 days after the first application (fig. 1). For the same period of time the brood area in control colonies increased by 34.5% (fig. 1; Repeated Measures ANOVA, time × treatment: $F_{1,11} = 3.96$, $P < 0.05$). The main effects of 'treatment' and 'time' were not significant ($F_{1,11} = 0.2$, n.s.; $F_{3,9} = 2.5$, n.s., respectively), possibly due to the large standard errors associated with the measurement of brood area (large between colony within treatment variance). However, on 20 September, 60 days after the beginning of the experiment, the open brood area in the experimental colonies had increased slightly compared to the previous measurements for the group (fig. 1).

High numbers of mites were found on the removable floorboards of the treated colonies immediately following oxalic acid application. Their number gradually decreased over the next 10 days (fig. 2). The two oxalic acid applications removed 60 ± 12% ($n = 10$) of varroa mites adhering to adult honey bees, while the natural fall of mites measured in control colonies (for the period of 40 days) was 32 ± 4% ($n = 10$). Though oxalic acid treatment by the trickling method removed more mites than otherwise fell naturally onto the floorboard (ANOVA $F_{1,18} = 5.02$, $P < 0.05$), 40% of the mites were still not killed by the treatment.

No difference was observed in the numbers of dead honey bees found in front of the experimental colonies compared with the control colonies just after the two oxalic acid applications (ANOVA $F_{1,18} = 1.29$, n.s.) (fig. 3). An increasing number of dead honey bees in front of all colonies (experimental and control) was observed 25 days after the second oxalic acid application; it is believed that this was a result of poisoning caused by plant protection products applied to the neighbouring flora.

DISCUSSION

To our knowledge, this is the first report on detrimental effects of oxalic acid via the trickling method on open honey bee brood. During the application of oxalic acid by the trickling method, oxalic acid is poured onto adult bees yet it does not come into direct contact with the brood. However, drops of oxalic acid solution are distributed among the adult honey bees and although they do not have any effect on the adult bees probably fall upon or touch larvae in open brood cells. Nozal *et al.* (2003) have found oxalic acid in several anatomical structures of adult honey bees after topical or oral application, a fact that could explain the high – 'toxicological' – effect on brood as has been shown here. Even larvae in colonies treated with oxalic acid and managing to reach the capping stage were occasionally removed 2–3 days later.

Our observations on individual brood cells were only performed for seven days following treatment, but it is our hypothesis that oxalic acid has longer-lasting effects. The decrease in the total surface area of open brood in treated colonies for almost two months (while a significant increase was observed in control colonies for the same time period) demonstrates the negative effects of oxalic acid application on brood development and reinforces the above hypothesis. While direct (spraying) application of oxalic acid can have a detrimental effect on brood for about four months (Higes *et al.*, 1999), the indirect one (trickling application) has an effect for at least two months, the duration of our observations.

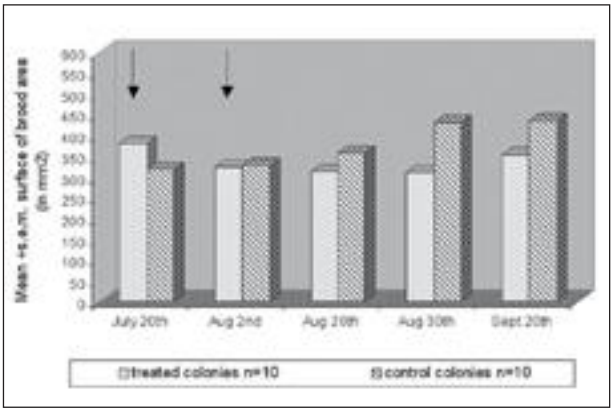

FIG. 1. Average surface area of open brood before and after oxalic acid treatments. The arrows show when treatments were applied to the experimental colonies.

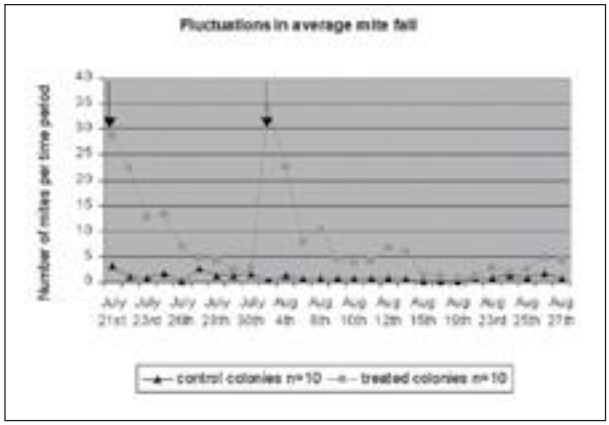

FIG. 2. Average number of falling varroa mites after two oxalic acid treatments. The arrows show when treatments were applied to the experimental colonies.

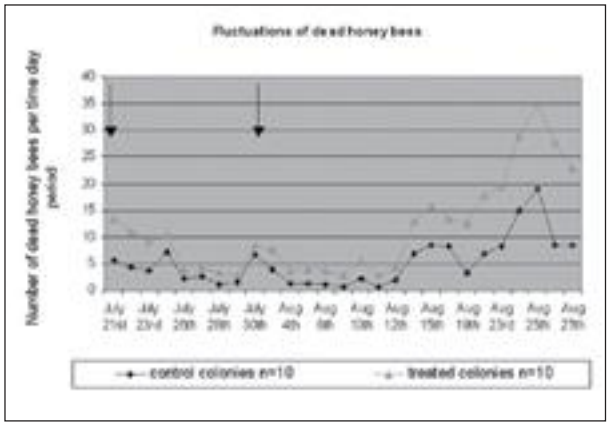

FIG. 3. Average number of dead honey bees found in front of colonies after two oxalic acid treatments. The arrows show when treatments were applied to the experimental colonies.

Combining this detrimental effect with the low relative effectiveness on varroa removal found here after two applications, it is our opinion that a 3% oxalic acid application by trickling is not a safe treatment against varroa when open brood is present and under summer conditions. However, the need to control varroa during spring or summer is important, and the effect of the repeated use of lower oxalic acid concentrations and/or lower sugar concentrations needs to be tested in broodright colonies; Charrière & Imdorf (2002) have shown that lower sugar concentrations can be tolerated better by honey bees. It will also be important to determine the target organs of larvae upon which oxalic acid acts and to evaluate the amount of oxalic acid penetrating the midgut, the nervous and the respiratory system of larvae.

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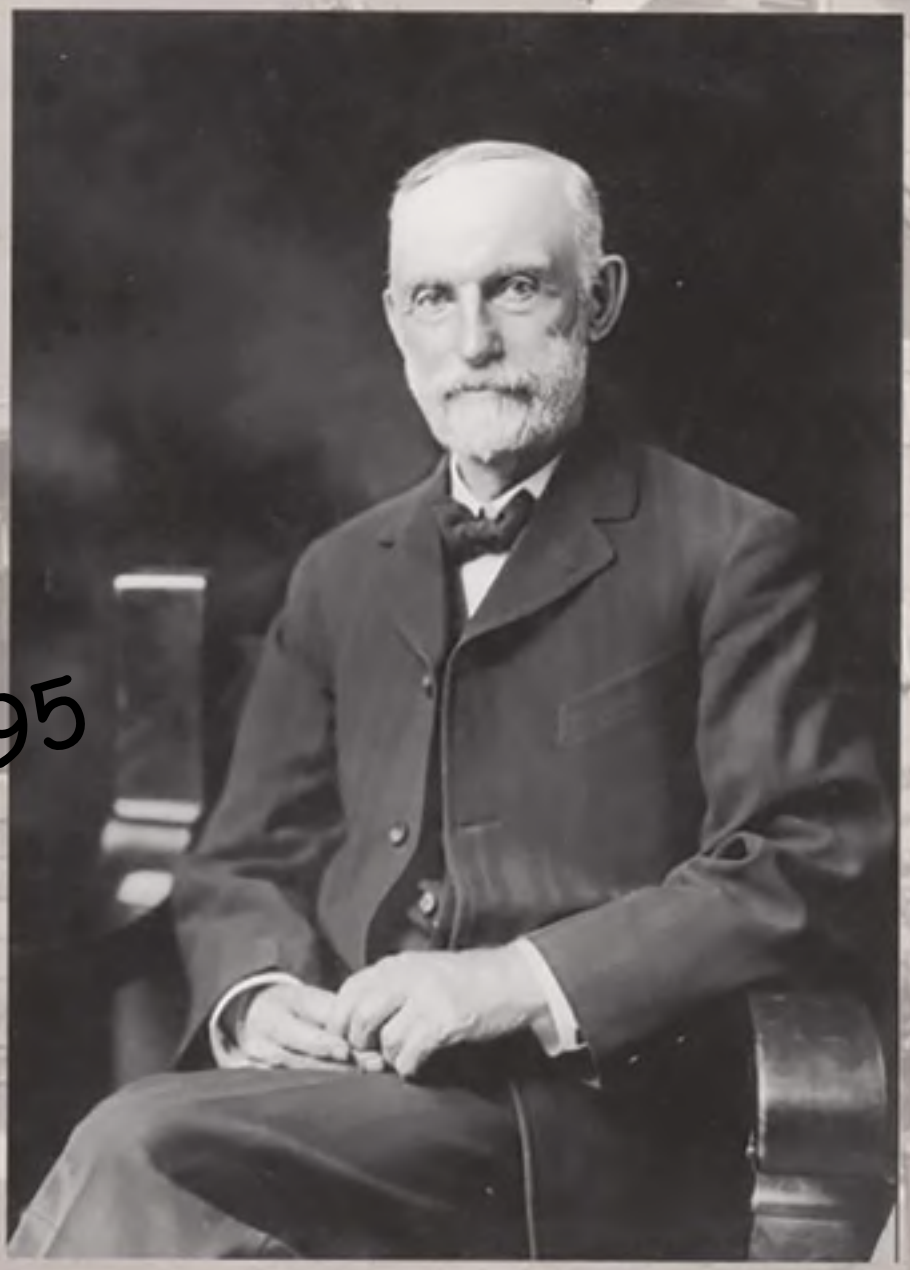
AN EYEWITNESS ACCOUNT OF EARLY AMERICAN BEEKEEPING



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OBITUARY

Claribel 'Claire' Roberta Rothenbuhler, nee Hall, passed away May 3, 2020, in Saint Louis, MO, where she lived near her son and daughter-in-law Eric Rothenbuhler and Jane Martin. Claire was born August 6, 1924 in Ashtabula County, Ohio, to Howard and Anna Belle Hall, nee McCormick.

She graduated from New Lyme High School and earned a Bachelor of Science in Chemistry from Ohio State University in 1946, graduating cum laude. Claire met Walter C. Rothenbuhler, of Monroe County, Ohio, at Ohio State during her freshman year.

They began their courtship and were married while he was on leave from the Army on June 22, 1944. Following WWII they moved together to Ames, Iowa, where he completed his education and began his career in the biology of honey bees at Iowa State University. Claire tutored chemistry and they began a family. They celebrated 58 anniversaries before Walter passed in 2002. Four children were born in Ames, Iowa, where the family lived until 1962 when Walter was recruited by Ohio State University and the family moved to Worthington, Ohio

In 1968 Claire returned to teaching in the Department of Chemistry at Ohio State, first as a laboratory and teaching assistant, eventually rising to a position overseeing all freshman chemistry labs. She co-authored a book of problems and study questions published to accompany a widely-used chemistry textbook. She retired in 1986. Claire was active in the First Christian Church in Ames, Iowa, until 1962, and then Northwest Christian Church in Upper Arlington, Ohio until her health required she move to Indianapolis in 2015 and Saint Louis in 2018.

She is survived by four children and their spouses, Leonard and Roberta Rothenbuhler of Indianapolis, Lorraine and Don Holycross of Logan, Ohio, Eric and Jane Martin Rothenbuhler of Saint Louis, and Hilda and Allan Talib of Columbus;

six grandchildren; three spouses of grandchildren; four great-grandchildren; a nephew and his spouse; and many in the extended Rothenbuhler family who love her as their own. Her husband, parents, and a sister preceded her.

Services will be at a later date to be arranged, at Watters Funeral Home, 37501 S.R. 78 West, Woodsfield, OH 43793. Burial will be in the Cameron, Ohio Community Cemetery. In lieu of flowers, donations may be made to the Walter Rothenbuhler Travel Scholarship Fund – 606212 to support students at The Ohio State University (**https://www.giveto.osu.edu/makeagift/?-fund=606212**).

USDA-NASS PREDICTS THIRD STRAIGHT RECORD-BREAKING ALMOND CROP

The U.S. Department of Agriculture (USDA) National Agricultural Statistics Service (NASS) is predicting a record California almond crop for the third straight year. The USDA-NASS 2020 California Almond Subjective Forecast estimates California almond orchards will produce 3.0 billion pounds of nuts this year, up 17.6 percent from last year's 2.55 billion-pound crop. Forecasted yield is expected to reach 2,380 pounds per acre, 10.2 percent greater than the 2019 yield of 2,160 per acre.[i]

This forecast comes about three weeks after USDA-NASS released the 2019 California Almond Acreage Report, which estimated total almond acreage for 2019 up 10 percent from 2018 at 1.53 million acres. Bearing acres – orchards mature enough to produce a crop – were reported at 1.18 million acres, up 8 percent from the previous year. USDA-NASS also estimated preliminary bearing acreage for 2020 at 1.26 million acres.[ii]

"Almond acreage and production continue to increase as California almond growers further invest in precision agriculture and responsible best practices," said Almond Board of California (ABC) President and CEO Richard Waycott. "Through the industry's advancements in water use efficiency to environmentally friendly pest management, zero waste efforts in the orchard and beyond, almond growers are committed to achieving our Almond Orchard 2025 Goals and the realization of the California almond orchard of the future."

The first of two production reports for the upcoming crop year, the Subjective Forecast is based on opinions obtained from randomly selected almond growers located throughout the state via a phone survey, this year conducted from April 20 to May 6. USDA-NASS asks individual growers to indicate their total almond yield per acre from last year and expected yield for the current year based on field observations. The sample of growers interviewed is grouped by size of operation, and different individuals are interviewed each year to ensure grower representation throughout the Central Valley. USDA-NASS then combines the yield estimates obtained from each grower and extrapolates the information to arrive at the numbers reported in the Subjective Forecast.

This July, USDA-NASS will release its second production estimate, the 2020 California Almond Objective Report. While the Subjective Forecast provides an initial estimate of the 2020/2021 crop, the Objective Report will provide an estimate based on actual almond counts that uses a more statistically rigorous methodology to determine yield.

In Dec. 2019, ABC's Board of Directors approved a strategic approach to further improve the accuracy of USDA-NASS's reporting. From 2020 on, the Objective Report will include measurements from 1,000 target orchards throughout the state (an increase of 150 samples from 2019) and provide nut counts on not one but two branches per tree. The Objective Report will also provide the weight, size and grade of the average almond sample broken down by growing region – no longer growing district – and variety.

The 2020 California Almond Objective Report will be released on Tuesday, July 7, at 12:00 p.m. PT. USDA-NASS conducts the Objective Report, the Subjective Forecast and the Acreage Report to provide the California almond industry with the data needed to make informed business decisions, and thanks all farm operators, owners and management entities for their time in providing the information necessary to create these reports.

CALENDAR

♦COLORADO♦

The Colorado State Beekeepers Association will hold its Summer meeting June 13, via Zoom. MacArthur fellow and keynote speaker Marla Spivak talks about bee breeding at the University of Minnesota, with a second presentation titled "Landscapes for Bees." Hollie Wall-Dalenberg explores the mysteries and marvels of propolis.

Watch Bee Culture's and CSBA's own Tina Sebestyen conduct a hive examination. Ask questions! See your beekeeping friends on your computer screen! Eat, drink, and be merry in the security of your own home! Learn a lot! Close out the day with an online cookout!

The price is right. What are you waiting for? Registration at **Coloradobeekeepers.org**.

♦MAINE♦

EAS 2020 has that was to be held August 3-7 in Orono at the University of Maine has been cancelled.

For more information visit **www.easternapiculture.org/confereces/eas-2020.html**. Watch these pages for details.

♦MICHIGAN♦

The following Michiana Beekeepers monthly meetings for 2020 will be held at the Nappenee Public Library, on date shown from 9 a.m. to 12 noon.

June 13th - Speakers Mel Disselkoen and Tim Ives

July 18th - Speaker TBA

August 15th - Speaker Sam Comfort

September 19th - Speaker Dr. Jeff Pettis

October 17th - Speaker Dr. Jim Tew

For more information and to register contact Debbie, 574.277.0152.

♦VIRGINIA♦

The 2020 Virginia State Beekeepers Association (VSBA) Spring/Summer Meeting will be June 26-27 in Smithfield.

Speakers include Jennifer Berry and petra Arnhert. The Nansemond Beekeepers will host a Painted Hive Body Auction. For details visit **www.virginiabeekeepers.org**.

A workshop on Preparing, Exhibiting and Judging for the honey show will be offered June 26 8:30 a.m. to noon prior to the start of the meeting, sponsored by ApiSolutions Consortium. For more information on this workshop contact **ApiSolutionsBee@gmail.com.**

August 22

Principles & Practices of Biodynamic Beekeeping - Part IV: Fall & Winter Learn about successful overwintering, including how to consolidate hive space, wrapping, feeding and more. Classes take place at Spikenard Honeybee Sanctuary in Floyd, VA. website: **www.spikenardfarm.org** contact: **info@spikenardfarm.org** or 540-745-2153

October 10-11

Sun Hive Workshop: Learn how to build the Sun Hive! This exciting hands-on hive building experience will be accompanied by lectures related to the importance of hive scent and warmth, wax, form and hive body materials. Classes take place at Spikenard Honeybee Sanctuary in Floyd, VA.
website: **www.spikenardfarm.org** contact: **info@spikenardfarm.org** or 540-745-2153

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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 Amanda at Amanda@BeeCulture.com with the number of magazines needed, a complete mailing address and a contact person.

On an early April visit to bees leased to an apricot and sweet cherry orchard, the landowner greeted the gal Marilyn and me. I was impressed that he had on a face mask. At that time, where we live, this was still out of the ordinary.

Well, no wonder! He reported that his neighbors on two sides were recovering from the Corona. This wasn't New Orleans or New York. We were out in the boonies.

Those bees were on a wicked honey flow, which was potentially problematic, because they came through the Winter with both brood supers mostly packed tight with last Summer's honey. I put on supers to create room for the queen to move up into empty comb, so the little darlings wouldn't swarm.

Honey-bound hives before the first spring flow are highly unusual. Here's what happened: Last year I pulled the honey at a couple of my yards on August 20. In those locations, it's generally all over by then. Well, Derrick had bees nearby, and he pulled his honey about the same time, but crafty beekeeper that he is, he supered his colonies after he got the honey off, just in case. Some of his colonies filled three honey supers in late August and September. My bees got on that same flow but without the added supers, so all that honey got stored in the brood chamber. I consoled myself that at least I wouldn't have to feed those hives prior to winter.

They wintered very nicely, thank you.

A month ago, I submitted the Colorado State Beekeepers Association June meeting announcement to the two most distinguished beekeeping journals in North America. I was writing in March about a meeting to take place nearly three months later, an announcement that would appear in the May and June issues of both magazines. This was right when the pandemic was getting legs. My blurb implied that our get-together might not happen, but since I'm no soothsayer, it was still on, officially.

One editor wrote back politely inquiring if I might be losing my marbles. But the other agreed with my reasoning. The meeting was on, until it was off.

In the meantime, I've learned about Zoom interactive meetings. Our scheduled keynote speaker, Marla Spivak from the University of Minnesota, agreed to give an interactive talk, as did her graduate student Hollie Dalenberg.

I talked to Tina about this. She's all gung-ho to do a Zoom barbecue and to carry on with our scheduled beekeepers' rodeo, also on Zoom. I'm pretty sure she's confident she can blow my doors off in the smoker lighting contest – by cheating – with her little prefab cardboard cone stuffed with juniper bark.

Tina has become a trusted friend, but in her heart of hearts, she has some doubts about my beekeeping techniques. I rush through my apiaries, throwing on supers or feeding with (gasp!) high fructose corn syrup. I keep my hives on the ground, not on hive stands. My bottom boards are ancient and warped, lids are whatever I can dig up. I'm confident the bees don't care. I rarely look at brood, unless I have a pressing reason, and until I see evidence to the contrary, I assume that all colonies are headed by a fecund queen, generally under the age of four.

Tina is much more meticulous, thoughtful and organized, which is why she gets to write serious how-to articles for bee magazines in the U.S. and England, while I struggle to entertain you with my latest misadventures.

I do listen to her. The other day on the phone, I said, "I've got to reverse some supers today."

"It's a little late for that, isn't it?" she pointedly inquired. The way she said this initially put me into a mild panic, but then I reflected that she can be a little bit of a fussbudget.

Let's talk about the Corona. Everybody else is. It reminds me of the scourge of *Varroa* mites, for which there is also no vaccine, but for which there are effective treatments.

If you catch the Corona and cough close to an uninfected person, this person stands an excellent chance of catching your disease.

Bee colonies within flight range of each other can also trade viruses, as well as mites.

Let's say you keep 40 hives in a productive rural apiary, or let's say you keep bees in a town with an average of four hives per block. In either case, if your bees have mites (and they do!) and these mites multiply – which they will – it's highly likely that your hives will ultimately collapse and disperse their mites to other hives within their flight range. Managed colonies do not practice social distancing!

No sane person thinks it's OK to ignore human social distancing guidelines and thereby spread the Corona. But for unfathomable reasons, some beekeepers think it's OK to allow their bees to transmit mites.

Like the folks who ignore human social distancing recommendations, live-and-let-die beekeepers who don't test or treat for *Varroa* make their choices with disregard for the well-being of their neighbors.

There is no *Varroa* vaccine on the horizon, but with luck, in a year we'll have a COVID-19 vaccine and be spared succeeding waves of infection. In the meantime, be a responsible citizen and a responsible beekeeper. Stay six feet away from your best friend. Manage your mites.

Then rest easy, and God bless us all.

Ed **Colby**

Social Distancing

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