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Bee Culture's Best . . .

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In Every Month –

More About Diversity

I wish to respond to the Mark Winston article of January 2019, "Listening To The Bees About Diversity." I hope that *Bee Culture* is open to diversity of opinion, because my take on "diversity" *diverges* from Professor Winston's and, apparently, yours. Whether you choose to publish this letter *in toto* will be an interesting experiment on your tolerance for diversity of opinion within your pages. I'm actually quite curious to see the result.

Is "diversity" good or bad? Is salinity good or bad? Is humidity good or bad? It all depends on what one is considering and what one's point of view is. Nature seems to like "diversity" of species; but if Earth is the sole living ecosystem in our Solar System, she cannot create life in the absence of liquid water, so Earth must orbit in the "Goldilocks Zone" which permits liquid water. Diversity of distances from the Sun is of no benefit to life, so, from the point of view of exobiologists, is not a positive.

Honey bees don't seem to like "diversity" very much, actually. A hive having two queens is too much diversity for them, and, if necessary, her own daughters will kill an aging queen who has fallen behind in her pheromone production. Since the entire hive are the progeny of the queen, they are genetically extremely un-diverse; this uniformity allows them to exclude bees from other hives (*! inmigrantes undocumentados no pasaran !* could well be their battle cry) and to act in concert as a single "superorganism". African honey bees used to live in Africa; now we have Africanized honey bees in our American Southwest. Hurrah for diversity! (Or, on second thought, perhaps not in this case).

Moving to the human realm, it appears that the Han Chinese don't relish the "diversity" offered by their Uighur minority; are the Han "wrong" or "right"? Should the United Nations force Nigeria, for example, to take the Uighurs in as refugees? Would this benefit Nigerians now resident in Nigeria? Should Nigeria have the right to exclude some or even all? If Nigeria may exclude some Uighurs, may the United States exclude some Mexicans?

Singapore "works" as a *polis* and as a society because the Han who run the show import as many Han as they can while keeping a sharp eye on the Malay and Indian populations. The Singapore Chinese feel that they have as much "diversity" as they care to handle at the moment. Maybe Professor Winston can "light a candle for universal good" by seeking to persuade Singapore to take in a few thousand Uighurs. I'll go get some popcorn.

Peter Kilbridge
Rochester, NY

50th AHPA

The 50th annual convention of AHPA was held in Phoenix in January with a great time had by all. One of the highlights was the past president's roundtable and lunch. Richard Adee, AHPA's 3rd and 8th president, shared some of the history of anti-dumping. Our current president, Kelvin Adee reminisced about Jack Meyer playing "bad cop" while Richard played "good cop" at important meetings in DC (there may have been a tossed chair to make a point). Steve Park also told a funny story of him and Lyle Johnston having to stay at an "interesting hotel" while in DC for meetings (you'll have ask Steve what that means; we need to be politically correct). Mark Brady thanked all who went before him as presidents and, not having come from a beekeeping family, how much they helped him build his business. Kenny Haff mentioned the work to keep the visa program going for us while he was president (and no crude jokes this time). Mark Jensen highlighted how much secretaries Jerry Brown and Cassie Cox have done behind the scenes. Also mentioned was how valuable Jensen's explanations have been to new board members of Mike Coursey's anti-dumping work. Randy Verhoek told a funny story of meeting Mark Brady for the first time as he (Brady) pulled up in his huge, lifted pickup truck. Randy has done incredible networking for AHPA over the years with Farm Bureau, Honeybee Health Coalition and others. Randy's "Death Marches" across the DC mall between meetings will be remembered by all that had to endure them. Darren Cox highlighted putting the Honey Integrity Task Force together to get the price of honey up by trying to create a level playing field with imports. Darren was thanked for being the "instant reference machine," able to quote pesticide and other bee trial studies to EPA and USDA officials on the fly in important meetings. Cox also spent thousands of dollars to get Byrd Amendment money to our members, even though he never received any Byrd reimbursement himself. Thanks was given to the Adee family and others for helping pay the AHPA lawyer bills during the lean years. We thank all our past presidents for their selfless service on behalf of all American beekeepers!

2019 AHPA Beekeeper of the year, Joe Sanroma pictured with kelvin Adee.

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With the government shutdown we were missing some speakers, but the open discussions about ELAP and indoor wintering ended up being some of the favorite talks during the convention. The Thursday night dinner at Rustler's Roost outside Phoenix with the food, music and games was as fun as it was back in 2007 (the last year of the forklift rodeo). We would like to thank Mann Lake and everyone else who generously donated for our auction at the banquet Friday night.

Chris Hiatt
Vice President, AHPA

War Against Pollinators

As a beekeeper, I have always tried to help native pollinators, and the environment as a whole, by planting pollinator-friendly native plants. However, it is only recently that I have come to view the colony itself, and the hive in which it lives, as a boon to nature, too.

Over the years I have observed myriad creatures either preying on the honey bees themselves (think crab spiders, orbweavers, assassin bugs, and a host of native Texas birds), using the shelter or elevation of the hive (snakes basking on the hot flagstones the hive sits on, or giant cicadas using the hive as a jump-off point in their molting cycle), or a combination of both (green anole lizards and praying mantises hanging out above the hive entrance, snagging unwary foragers; orbweavers spinning their webs between the long legs of my top bar hives).

Now don't get me wrong: I cringe a little every time I see one of my hard-working honey bees get snapped up by a hungry predator. And of course I have my limits: would I be writing a wistful letter to *Bee Culture* if the cute anoles were in fact lumbering *Ursus americanus* instead? Not likely. But if a sustainable number of casualties in a colony of tens of thousands can help maintain some of our beloved wildlife, I am all for it. Placing a beehive in an other wise "dead" spot, ecologically speaking, provides an injection of biomass and draws other species in. Those species' natural predators are, in turn, drawn to the feast and on it goes.

It is my view that we beekeepers are uniquely positioned to make a difference in the world, as we operate on the front lines of the war against pollinators every day. Not only are our efforts contributing to the plight of the honey bee, but our actions, both intended and unintended, serve to improve the environment for a plethora of other creatures too.

Peter Keilty
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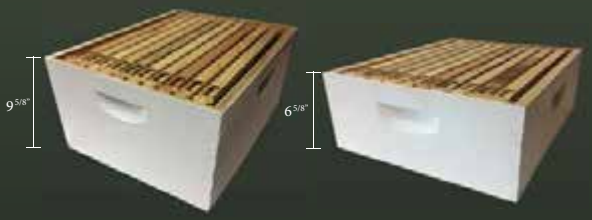

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Number 1 Tip of the Month – Easy Rider

Time to take honey off? Those supers can get heavy if you have to carry them very far. A two wheeled dolly can help a lot, but usually the platform is too small to work well. However, a telescoping hive cover can make it much easier. Turn it upside down and with a couple of holes in the rim, you can bungee it to the dolly frame. The super fits right in and you can stack several on it. The hive cover can be taken off and used as normal. Michael Brotzge, Monticello, KY.

Better Way To Feed

The boards are built out of ½ plywood. The jar hole is cut with a three-inch circle saw and the 2x3 inch patty opening is cut with a saber saw. Cut the patty opening in the center of the board so that the patty lays as close to where the brood area in the hive usually is. I drill the three-inch hole for the jar halfway between the patty opening and the edge of the board. I personally like to add a 1/8-inch strip of wood around the bottom edge of the board to make the bee space under the jar and patty screen higher to give the bees a bit more room to feed. The bees do pack under the syrup and patty when feeding on it.

I found that these boards are also indispensable for feeding my colonies during periods of drought or lack of forage. In my region drought is common during the period my colonies are producing the Winter bees. Without natural sources of nectar and pollen, supplementing both is important for colony Winter preparation. There is also an increase in robbing and hornet harassment during this same period. With this board, the syrup and patty supplement is hidden deep in the hive far from the entrance. Also, checking and adding syrup and patty is fast and done without opening the body of the hive exposing the colony. Ernie Schmidt Olympia, WA

The picture shows a feeder board I made. I saw this somewhere and thought it was a good idea. You can place feeder jars in the smaller holes and press pollen patty into the screen on the larger hole. The pollen patty was what caught my attention as it makes it tougher for the SHB to hide and lay eggs under a patty laying on the frames or inner cover. This would also need an empty box to allow feeder jars to be placed for the bees. Mine are actually only 16" wide as I was able to get 11 from one sheet of OSB board. Then placed a ¼" strip along the edge for some bee space, without it, you do crush bees. Gave the edges heavy coats of paint to protect. They are only used for a short time during build up in spring or a new hive, so the OSB board seemed to hold up well last year. 2 ¾" holes for jars 4" hole for pollen patty with #8 screen stapled over holes. I don't have an exact cost, as some of the items I had around, ¼" wood strips, #8 screen and staples. Not counting your time they cost about $2.00 to $2.50 each. Harold Keiner, Wapwallopen, PA

The wrist elastic on my bee jacket tore and needed replaced. The thumb elastic to hold the sleeve down also was stretched out and ineffective. Putting on my running shirt one day, I realized I never use the thumb feature on the shirt, but could be put to use on the bee jacket sleeves. Simply cut about five inches off the sleeves of the shirt. Cut the elastic off the bee jacket. Match the sleeve end to the bee jacket sleeves and sew together. A perfect match to keep the sleeves down. Jill Wiest, Lykens, PA

Number one of my bee equipment is the blower.

Number two is my Honey Jar Adjuster. I can change from gallon jars to two-ounce jars in 10 seconds. It adjusts up and down depending on the jar size. I bottled over 300 two-ounce jars for my granddaughter's wedding. Holding 300 jars with waiting for that last drop would be hard work. The adjuster is made from scrap material. I thought $25 was a good price, but I've been giving them away. Charles Leitner, Troy, IL

Keep It Simple

Test honey for moisture BEFORE extracting it. If too wet, stack the supers 'staggered' and use a fan heater to blow warm air at them (but not too close or you may melt combs); a dehumidifier can also help. (most of our honey is fine, but that from ling heather – *Calluna vulgaris* – is often wet even when the weather has been dry). Peter

---

A headband or sweatband.

Stops sweat dripping into your eyes or on to your glasses and stops bees stinging your forehead when wearing a Sherriff style veil - especially if, like me, you are a bit short of hair! Peter

---

For those of us with old eyes, glasses with yellow lenses really help seeing eggs. Cheapest are the TV infomercial night driving glasses. Most readily available are yellow tinted safety glasses from any hardware store. Best quality are in the gun section of sporting goods stores. Jerry Bromenshenk

I have talked to several beekeepers at our bee club and found that several use stands to work bees. I have not really noticed that in *Bee Culture* there is any one specific thing said about a hive stand that can be used to work bees. I have enclosed a picture of mine that is very simply constructed out of leftover wood and two strong nylon straps purchased at the army surplus store by the yard for a couple of dollars. It is small, lightweight, and closes to be carried with one hand. I use it particularly when I am extracting honey or checking bees from the top supers on down as shown in the picture. Sandra Center, Omaha, AR

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 (more to come).

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Website: **https://nosweatco.com/**

Peel

Stick

The Bras and the Bees: The Extraordinary Life of BJ Sherriff, by FA Notley. Publication date: Mid May 2019. ISBN: 9781999759834. Price: $25.00. Hard cover with jacket. 260 pgs. Available from Northern Bee Books, and Bee Culture Book Store.

I first met Brian and his wife Pat at an EAS meeting in the 1980's. I was familiar with the design of his new suit because they were advertising in our magazine, but I had never seen or worn one. That day changed me and the way I kept bees until today. I still have my first Sheriff suit, and the several I've accumulated since. They are perfect for friends visiting a beeyard, for everyday hive inspections, and for those days when it's going to get rough out there because of the weather and time of day. Below is a short synopsis of the book by the author. She pretty much covers it all....especially the history of how this all came to be. You will enjoy this story. It is unlike any other in the world of bees.

From the author: This is a biography of particular interest to anyone in the beekeeping world. It tells the story of Brian Sherriff, a man born in the late 1920s in the UK who inherited his father's corset factory and went on to run a bra factory in Cornwall, but lost everything in the recession of the 1970s.

Using boning, net and fabric intended for bras, Brian and especially his wife Pat created an entirely new kind of beekeeping hood and veil - literally from the bones of the old enterprise - and founded an internationally successful beekeeping clothing company: BJ Sherriff. All BJ Sherriff garments are still produced in Cornwall.

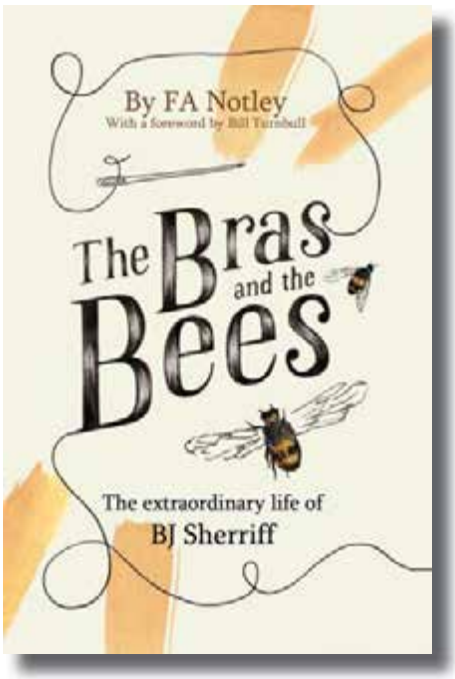
The story takes in some unusual history: the early days of Langridge Ltd corset factory in Bristol, dating back to 1816, and details of the family's experiences during two world wars. Brian's father was in a reserved occupation and made panty-girdles for the WRNS and the WAAFs during World War II. Brian lived through the first nights of the Bristol Blitz as a boy and heard the lions in Bristol Zoo roaring. Brian entered the family profession of corsetry and became a much-loved director of a bra factory. Then one day he started to keep bees. His life was about to change beyond recognition.

What makes this a fascinating story is the extraordinary personality of Brian Sherriff. In his twenties he taught himself square dancing from a book and established the group Bryan Sheriff and his Square Dancing Posse, for which he acted as caller. As bra factory director, he had a calling card for dull business meetings. In his top pocket he kept what looked like a handkerchief. When taken out with a flourish, however, it revealed itself to be a miniature bra. He called it The Bra-kerchief.

This account of Brian's life takes us through the bad times and the good and shows how one man's tenacity, good humour and sense of adventure can make a real difference in the world.

The Sheriff Beesuit truly changed the world of beekeeping. A safe, easy to use, clean and wearable suit made keeping bees an enjoyable hobby for anyone. Copied by nearly everybody now, when it first came out it was both recognized as that great leap forward by newer beekeepers, and as a step back from being a tough old beekeeper by those used to less than ideal beesuits, veils and hoods. It has, however, stood the test of time and today is arguably the best on the market.

Kim Flottum, and Felicity Notley



INNER COVER

I've been talking with someone who is interested in starting a business dealing with the beekeeping industry. He has extensive, successful experience in wholesale, retail, mail order and store front sales in a somewhat related industry, and already has national and international connections.

He has a good mail order set up, catalog experience and production, promotional and cross promotional projects and even TV, radio and an extensive internet reach for advertising, information and connections with customers.

He has, or had anyway, essentially zero bee experience when he first started, but you can hire good bee people he says, but it's a lot harder to hire good business people, and he has plans for both.

He wants to sell overwintered nucs and Spring splits because that's what he, or his bee people, seem to think that they have fairly good control of when it comes to the quality of what they will sell. He has good ideas on both the genetics and the diversity of the bees he wants to sell, and has the resources to supply all the forage those bees will need to build, sustain, produce honey and overwinter.

All in all, the bee part of this looks to be mostly self-contained, with the only outside resources needed to come from the producers of new or better genetics. And he has some visions for that, too.

For the rest, at least initially, he wants to produce, maybe even invent, rather than buy and resell bee housing, and probably enlist local manufacturers to produce better equipment than he thinks is available now. The rest is being decided even as I write this relative to the equipment and supplies beekeepers need to keep bees.

But wait, there's more.

"I have looked, and my experience elsewhere fails to include a single example of a farming or manufacturing industry where the basic equipment is unchanged for 100 plus years", he recently remarked.

I think he's coming in right on the cusp of, perhaps, beekeeping's "Great Leap Forward" in terms of all of the things he's looking at. Materials, technology, services, genetics, sustainability, diversity, safety and profitability. Right place, right time, with no preconceived notions, no ties to the past, no 'That's the way we've always done it' cement shoes. Stay tuned to this station for a year or two while this all comes together. It'll be fun to watch, even better to be a part of. I'm thinking you don't need our good luck wishes, but they're there anyway.

•

The Bee Internet Of Things. BIT.

Have you been paying attention to the way our world, that is the beekeeping world is moving lately. The internet, cell phones, data, artificial intelligence, smart hives, genius hives, gps locators, and more and more and more. The article above brings this to the fore in spades. ". . . unchanged for 100 plus years," was the comment by someone just beginning to look at what we do on a regular basis.

Just this calendar year *Bee Culture* has covered Data Sharing for Commercial Beekeepers, Electronic hive scales, Trust and Data Sharing, The Sentinel Apiary Program run by BIP, Technology In Action – Commercial Apiary Management Systems, The ApisProtect Colony Monitoring System, Technology In Action – Hobbyist Platforms, Thermal Efficiency, and this month The Songs Of Bees, and Optimizing Pollination With BeeHero.

Whether you are a two colony backyarder or a 20,000 colony commercial pollination, queen production honey maker, the world of zeros and ones is both here to stay and won't get out of your way. So rather than fight it, embrace it.

We've covered several over the past year or so, but there are so many more. Of course, in our opinion, HiveTracks, **https://hivetracks.com/index.php**, is a front runner in both promotion and technology simply because they pretty much got a head start, and have drawn in people from both the world of beekeeping and the world of IT (information technology) that are pretty sophisticated in their respective areas.

The BIP people have a vested interest in the equipment they use for remote sensing all over the place. I know they use SolutionBee hive scales because they work for them, and that says a lot.

But the list is long. Arnia equipment is pretty well known and seems to do what it says it will do. You can find more at **https://www.arnia.co.uk/**. Solution Bee, **https://solutionbee.com/**, like the others is in the cloud and designed for both hobby and commercial operations. Broodminder, **https://broodminder.com/**, seems more aimed at the hobby and sideline market, checking weight and temperature, but they continue to change so don't ignore their equipment either. OSBeehives, the Buzz Box system, **https://www.osbeehives.com/**, uses sound and your cell phone to tell what's going on inside. More along the songs line it seems, but the network is up and running so maybe check it out.

There are others of course, but all of this brings me to where I wanted to start.

And that is, this BIT thing is probably only number 4 in really new things to enter the beekeeping world in the last 100 years, as noted above.

OK, back up a few pages. Jim

What's New?

Thompson, one of the writers of beekeeping history we like to use here has put together a list of all of the patents employed in bees and beekeeping relative to hive types and designs since Adam and Eve caught that first swarm. It's gotta be more than 100 pages, in tiny, tiny type on both sides of the page. Hundreds and hundreds of better ideas, all in one book.

This got me to thinking, which can be hazardous to you health. What is new lately, say, the last 100 years in our world? So, I went looking.

To look, you find the catalogs of the major players in the industry. They sell what sells. They sell what beekeepers buy. Not, necessarily what beekeepers want or need, but what they will buy. For the most part anyway.

Of course BIT is new. But apparently nobody wants to use it because there's nothing in any catalog remotely resembling any of the devices, technology or equipment noted that you can buy from any of them. At least yet.

So take a look. One thing, if you can make it out of wood, you can make it out of plastic. New stuff, not new ideas. But there's lots of plastic out there, and more every year. Basic wooden boxes are the same as ever, but the Styrofoam and polystyrene plastics have eased some things for the bees relative to environmental stresses. But a 10 frame box is still a 10 frame box (and even eight-frames boxes are still eight-frame boxes).

Some plastic things make some things easier. Honey house equipment that's plastic now, instead of stainless or galvanized is a good step in the right direction, but an extractor is still an extractor is still and extractor. Put the frame in, spin out the honey, drain the tank. Century's old technology.

And though there are more designs, a hive tool is a hive tool, a smoker is a smoker, and plastic foundation is still foundation.

Some things have come to us from outside our world that we have adopted with enthusiasm. Consider the pallet and the forklift. Much better than one at a time muscle power. But that pretty much already existed in some form before we took it as our own. Not new, but better.

Interestingly, we are going back to overwintering in caves again. Special caves now, controlled this and that, but caves, for protection from the elements. And the food we give them is, well, some of it is better than 100 years ago. Some not so much perhaps, but some, but then so is the food we feed chickens and our kids.

Anything else? Bottles are bottles are bottles and that hasn't moved off square one much. Plastic, again, has replaced glass to some degree. But the purists still want glass, for reasons known only to sticky bottle tops. And the plastics are now upside down making them even easier to use, so they get used a bit more – that was a good move, but a bottle is still a bottle.

So, anything? I'll point to two things that didn't exist 100, or even 50 years ago that have really changed our world, again in my humble opinion. The first is the Sheriff Beesuit design. Copied to death since it first came out for a very good reason. It doesn't leak bees. It took chance out of the equation and any, and everybody could and can work bees without fear, without hesitation and have fun doing it. That suit design changed the world of beekeeping, in my humble opinion.

But what about honey sticks? Probably the cleverest marketing tool to come along since sliced bread. You can sell them as is, you can give them to kids and then parents buy the rest, you can use them as tasters, you can use them a million ways for almost free.

But any more, I'll bet Langstroth could drive by a beeyard, and go, "Look, bees!" don't you think? And A.I. Root could walk into nearly any honey house and ask about settling tanks and filters. I don't think we could fool either of them.

But I'll bet a farmer from 150 years ago wouldn't have a clue what he was looking at watching a no-till planter putting in seed treated GMO corn, or why was that just planted field being sprayed with what ever that stuff is.

I'm not blaming the suppliers for this. They sell what sells. They sell what beekeepers want to buy. Sometimes they take a chance and cast their nets upon the water and see if this new idea might work, or not. After a couple of years, it does, or it doesn't and everybody has a plastic something instead of a wood something, but it's still the same thing as before.

So, I'll go back to where we started with this new business operator noting nothing's changed in the last 100 years. And, with the exception of what I consider only four things, I think he's more right than not. So what are those four things: Plastic everything, the Sheriff beesuit, Honey Sticks – and The Bee Internet of Things.

I may be wrong however. Get back to me in 100 years and let me know what I missed.

•

You know where the sounds inside a beehive is going to go, don't you? I'll bet, maybe $20, that inside a decade, there will be a sensor inside every beehive on the planet (that wants one) that will be doing something similar. The size of a dime, costing a buck each. In a bee yard they talk to each other, summarize data and send a message home on a daily (or more or less often) basis telling home whatever it wants to know. At home the data is summarized again so labor can be perfectly assigned, equipment used efficiently, problems solved before they are problems, and warnings heeded and headed off. Somewhere, back home, every beeyard is categorized, labeled, examined, evaluated and fixed, abandoned, or improved or encouraged or added to or taken away. The need, and role of the experienced beekeeper will move to marketing, weather analysis and finding help. Recognizing AFB will be a thing of the past. Just wait and see.

•

There's lots to do coming up. The California Honey Festival in early May, Virginia in late May, Pollinator day here and EAS in SC in August and Apimondia and Mother Earth in September will keep us hopping. Hope to see you at one or more of these events. May Summer be kind to you and your bees.

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It's Summers Time –

More Travel, Spring and Chicks and Ducks

I'm excited to say that we are home for a few weeks. And also, it's starting to look a little like Spring here in Medina County. We have daffodils, crocus and the tulips are popping up and will be blooming soon. We were actually able to go for a short walk last night after supper.

Last month I talked about the Cincinnati meeting and referred to it as the Southeast Ohio Bee School. Well it's actually the 'Southwest' Ohio Bee School – my apologies. If you've known me for very long you are probably keenly aware of my lack of any sense of direction. I probably appreciate the map program on my phone more than a lot of people.

So, anyway we made it to Cincinnati – no challenges of any kind and it was a good meeting as usual. It's a much smaller, but just as devoted, group than the Tri-county meeting. And it's a group of folks that we only get to see at that meeting.

We just returned this past weekend from a visit to Olivarez Honey Bees in Orland, CA. This is our third year to attend their Hobby Day and it was great as usual. The day of the event it threatened rain and was cold and cloudy all day, but that did not dampen the enthusiasm of those coming to pick up their packages or those just coming to learn more about bees and have a good time. They, like many others this year, have had a hard time getting packages and bees ready because of the weather. There's been lots of rain in California. But they're getting it done and soon we'll be picking up our packages here in Ohio at Queen Right Colonies.

Olivarez Honey Farm on Hobby Day.

The weekend before that we were in North Carolina at Campbell University for a bee school. Kim and Kirsten Traynor were the speakers, taking turns all day teaching people how to keep their bees alive. The weather was beautiful there and we were well taken care of. Thanks to Ray Hunt and his group of volunteers.

Our next trip is back to California for the California Honey Festival in Woodland – just north of Sacramento. The date is May 4, 10:00 a.m. to 5:00 p.m. Kim will be speaking throughout the day and I'll be handing out magazines and talking to people about bees. If you're in the area it looks like a great day of fun! Maybe we'll see you there.

We put in our poultry order yesterday at the local feedstore. We're getting nine more hens for us and 12 that we're keeping for our friend until they're older and stronger and eight of the little Call ducks. They will arrive next Thursday, April 18. So my project for this coming weekend is to get the coop cleaned and take inventory of water and food sources for these babies. We haven't had babies for a couple of years to I've got to get organized. Also need to clean out the coop and get new straw down. There's work to do on the outside pen – making it bigger, repairing some of the spots where they can get out and probably putting some sort of net over at least part of it.

We haven't had a big predator problem over the years with our chickens. But the Call ducks are small and we lost all six of the first ones we got a couple of years ago. So I've got to make sure they're going to be safe this time.

Kim is also thinking about getting quail – for meat. I'm not sure about that idea. I've never eaten quail and I've certainly never killed one and prepared it for cooking. I'm going to do that part. We have a cage though, that was left by our neighbor, Quentin. So we'll work on that.

This is the time of Spring where we in NE Ohio get really anxious and have to reel ourselves in so as not to be planting and doing things too early. We could still have snow and certainly we'll have more cold nights before May 31. Most of the old farmers/gardeners caution us not to plant before Memorial Day.

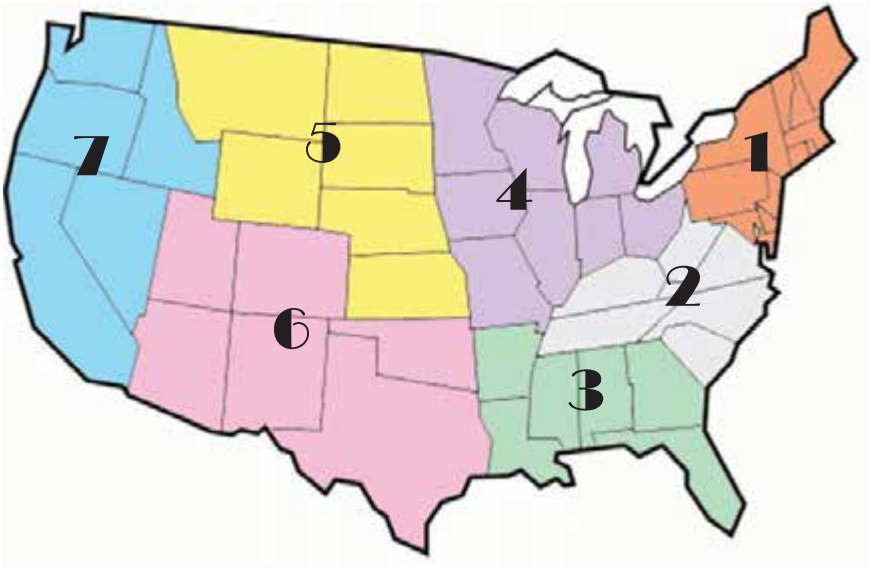
We'll keep staying as busy as we can for as long as we can with travelling to bee meetings, bigger garden, more bees and those babies coming soon. I hope your Spring has been pleasant and good luck with all that you do along with your beekeeping this Summer.

Hoody Summers

Kim talking with Ray Olivarez in CA.

Our good friend, Mark Smith in NC.

MAY – REGIONAL HONEY PRICE REPORT



Coming Up

So what's the prognosis for the honey market this coming season? We checked in with our reporters again this year to see what they think is going to happen.

Overall, 46% believe that the demand for their honey this season is going to increase. This ranged from a high of 83% in Region 6, to a low of 25% in Region 2. Will demand remain steady, we asked? 48% believe it will be about the same this season as last. That ranged from a high of 75% in Region 2, to a low of 17% in Region 6. That makes sense. Will it decrease? Only 17% in Region 7 seem to think it will.

Prices! Will increase think 35% of our reporters, remain steady think 63% and actually decrease feel 2%. Region 2 and 5 had a 50% raise in mind, while only a third of Region 7 felt prices would climb.

Prices will increase for several reasons. Increased demand accounts for 26% of those increases, while 63% of the proposed increases are due to the cost of keeping bees alive, which continue to soar. Some, not many, but some will increase prices this season because they can, which, all things considered, is kind of anti-marketing, but certainly profit minded. I think we need more of the profit minded beekeepers out there.

As a result of all this, demand, price increase and the rest, 33% of our reporters will increase production this season (providing all the rest fall in place), but fully 55% don't intend to do anything different. They will just stay the same. And, interestingly, 12% actually plan to decrease, for reasons not specified, production this season.

Briefly, take a look at the overall prices for each of the products we list. Almost, not quite, but almost everything is down from last month. But interestingly, almost everything is up from last year. Some by enough to wonder why?

	REPORTING REGIONS							SUMMARY			History	
	1	2	3	4	5	6	7	Range	Avg.	$/lb	Last Month	Last Year
EXTRACTED HONEY PRICES SOLD BULK TO PACKERS OR PROCESSORS												
55 Gal. Drum, Light	2.27	2.22	2.40	2.50	2.26	1.95	3.00	1.60-3.00	2.23	2.23	2.22	2.36
55 Gal. Drum, Ambr	2.16	2.18	2.21	2.50	2.25	1.80	3.00	1.35-3.00	2.15	2.15	2.09	2.22
60# Light (retail)	211.08	187.10	190.00	208.00	157.50	190.44	200.00	131.74-300.00	206.30	3.44	207.88	201.79
60# Amber (retail)	204.63	189.65	187.50	203.00	204.63	185.95	223.33	119.74-285.00	206.88	3.45	208.31	204.60
WHOLESALE PRICES SOLD TO STORES OR DISTRIBUTORS IN CASE LOTS												
1/2# 24/case	107.92	76.07	106.80	69.67	74.40	84.00	107.92	57.60-194.40	89.84	7.49	85.54	80.90
1# 24/case	140.27	109.67	137.52	114.80	134.00	127.44	142.20	91.20-211.20	129.34	5.39	132.11	127.06
2# 12/case	140.99	97.63	124.17	108.86	111.84	104.40	114.00	78.00-245.00	120.48	5.02	121.26	107.75
12.oz. Plas. 24/cs	112.40	104.00	100.00	91.09	83.76	92.60	103.20	72.00-172.80	102.40	5.69	98.61	96.27
5# 6/case	150.77	111.80	190.80	144.00	113.16	115.50	150.77	90.00-240.00	136.55	4.55	131.27	125.82
Quarts 12/case	181.97	147.50	133.26	180.00	144.03	152.33	144.00	108.00-300.00	159.95	4.44	154.14	143.93
Pints 12/case	96.78	91.95	78.67	84.42	111.00	82.05	84.00	60.00-144.00	91.57	5.09	89.35	89.19
RETAIL SHELF PRICES												
1/2#	5.38	4.74	4.40	5.25	4.28	5.00	5.38	2.50-9.00	5.01	10.02	4.97	4.60
12 oz. Plastic	6.11	6.08	5.46	5.50	4.58	6.84	6.00	3.50-9.00	5.98	7.97	5.91	5.61
1# Glass/Plastic	9.25	7.16	7.79	7.40	7.11	7.00	9.25	4.50-17.00	7.76	7.76	7.90	7.10
2# Glass/Plastic	15.10	11.94	13.80	12.25	13.39	12.33	15.50	7.93-25.00	13.74	6.87	13.58	12.05
Pint	11.67	10.40	8.16	9.50	9.50	9.98	9.20	4.00-22.00	10.33	6.89	10.94	9.95
Quart	20.13	17.57	15.14	17.67	16.24	18.23	20.38	8.00-36.00	18.27	6.09	18.41	16.58
5# Glass/Plastic	30.05	26.25	40.25	27.00	23.91	26.67	30.05	14.48-48.00	28.87	5.77	29.02	26.61
1# Cream	10.44	8.65	7.00	9.27	10.31	8.50	9.67	6.00-16.00	9.89	9.89	10.06	8.71
1# Cut Comb	12.94	9.95	10.49	13.50	15.50	10.50	14.00	6.00-22.00	11.87	11.87	11.29	10.64
Ross Round	9.70	6.87	9.70	10.00	9.70	11.25	12.49	6.00-13.00	9.90	13.19	9.83	8.75
Wholesale Wax (Lt)	6.99	5.23	4.46	7.17	5.50	4.50	7.40	3.00-12.00	6.48	-	6.52	6.58
Wholesale Wax (Dk)	5.64	4.80	3.68	5.25	5.64	2.75	7.00	2.00-10.00	5.28	-	5.39	5.62
Pollination Fee/Col.	91.42	73.60	70.00	70.00	91.42	92.00	86.67	30.00-160.00	87.85	-	94.48	87.50

NEXT MONTH

Welcome to NEXT MONTH, where our Honey Reporters share a line or two about what they will be doing NEXT month with their bees. Advice is given for each region so you can see what others are doing where you are, and, of course in all the rest of the regions. Check these out. These reporters are successful in business.

Region One
- Super early
- Keep yards mowed
- CR for swarm cells-"redistribute" if necessary
- Keep tabs on new Nucs
- Keep up on food supplies
- Medicate
- Electric fencing
- Keep the hive strong but pull frame now and then
- Pest inspections
- Continue to monitor for varroa mites
- Add honey supers to ensure bees have room to store excess honey coming in
- Make splits off the larger hives
- Vaporize with oxalic acid
- Check mite load
- Remove cozies for spring build up
- Raise queen
- Split hives
- Alcohol wash

Region Two
- Monitor and treat for varroa mites
- Continue swarm prevention
- Check queens
- Super
- Make my hives have a laying queen
- Check at least once a week to see if honey supers need to be added
- Monitor queen laying pattern
- Check to see the honey flow was
- Monitor hive space and honey storage and keep adding honey supers
- Ensure queen right
- Make splits
- Checking for insects

Region Three
- Control mites
- Trap SHB/ treat for *Varroa*
- Treat with mineral oil/ fogging process
- Make splits to reduce swarms
- Maintain large healthy hives to keep wax moths
- Re-queen
- Check mite count
- Inspect
- Watch for mites and hive beetles
- Keep plenty honey supers on
- Continue to reduce swarming
- Treat for mites
- Check beetle traps
- Give more space
- Monitor pests and disease levels

Region Four
- Manage swarming
- Supper with drawn foundation
- Find suitable apiary locations
- Check colonies for swarming
- Split
- Re-queen as needed
- Inspect and treat for mites as necessary
- Equalize colonies if need be
- Move out of blueberries, feed pollen
- Add supers for honey flow
- Make sure they have plenty of room for surplus honey
- Merge two weak hives to make one strong hive

Region Five
- Replace queens with new ones
- Treat for mites
- Mite check
- Feed if necessary
- Add honey supers if needed
- Check brood population
- Cut drone comb
- Small hive beetle traps

Region Six
- Check for mites
- Treat after honey harvest
- Keeps mites down
- Keep bees fed
- Watch for swarms
- Don't let too many supers get stacked too high. I had a laying worker on the 4th super. Keeping an eye on full supers and removing them when full.
- Splits- be sure they have queen
- Get supers on early
- Feed if dry
- Check for *Varroa*

Region Seven
- Splits
- Mite check
- Super for honey flow
- Spot check mite loads
- Feed
- Medicate
- Put them in a location with ample food available

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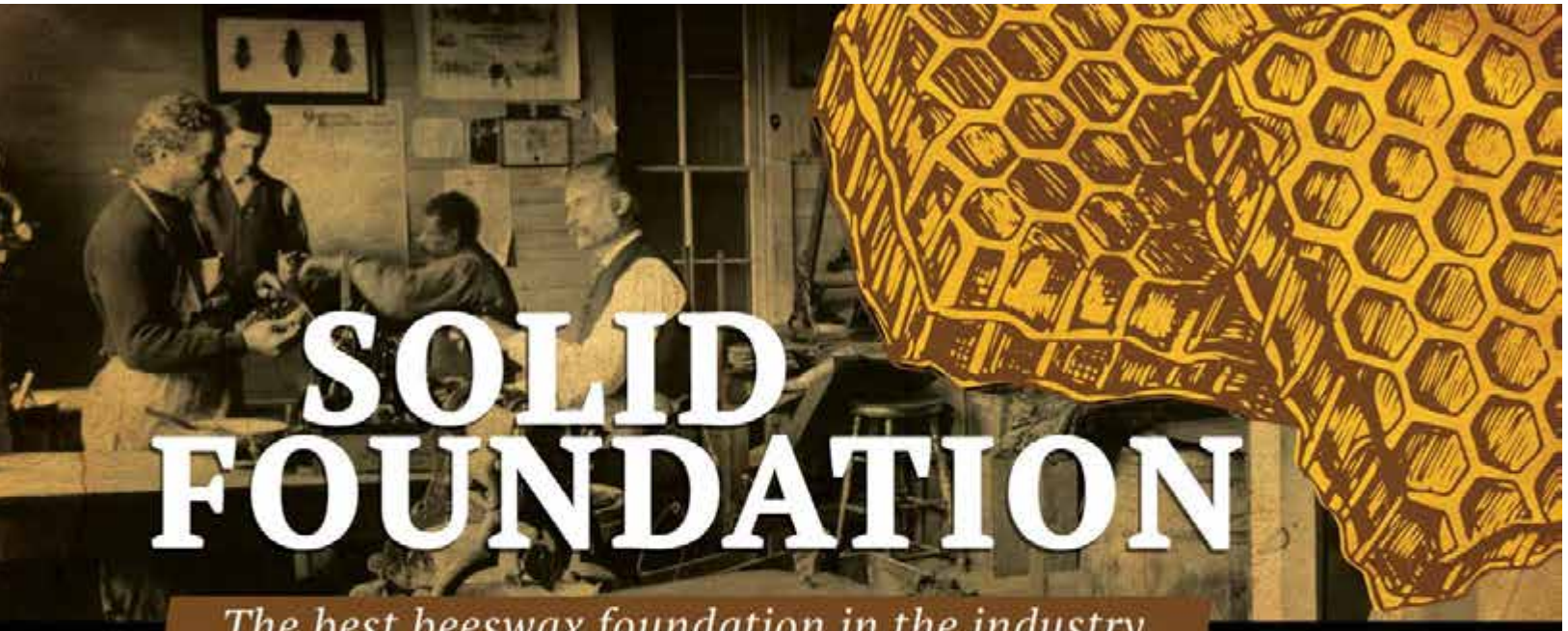

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BEE TALK

Got a question for Bee Culture's Authors? Send it to Kim@Beeculture.com with BEETALK in the Subject line. Who better to answer your questions?!

Question 1

What is the significance of queens being mated after the Summer Solstice? I have always heard that queens that are mated at this time of year lay/raise/produce more and better Winter bees. I do my last round of Summer splits on or around June 1st for this reason.

That seems like peak numbers time for drones in northerly sites. In the Summer, queens will meet with drones from the best/strongest colonies to that point and diversity should be high. Just make sure the splits come with enough food as the flow also could have peaked, at least on parts of the East Coast. *Jay Evans, DC*

I would like to see some good scientific research about this. Currently we know that drone quality and the greater number of drones mating with the queen give the beat results. *Ann Harman, VA*

After the Solstice, the egg production starts to decrease and adult bees will start to physiologically change as "Winter bees" with more fat to survive the Winter. Queens mated after the solstice would possibly be born as a "Winter bee" and would get a start on Winter bee production without having to convert from "Summer bees." I don't have any proof of this but it seems reasonable to me. *Jessica Louque, NC*

This appears to be opinion or speculation as I am not aware of any research that supports the theory that late queens are better. We all have opinions and mine is that late mated queens provide a late season break in the brood cycle and will head colonies with smaller populations leading into Winter, both of which help to reduce *Varroa* mite loads and increase overwintering performance. *Ross Conrad, VT*

Question 2

As my state bee inspector suggested doing a midsummer *Varroa* mite treatment, I was wondering what treatments are available that will not adulterate the honey if there is still a flow on.

It is most important that beekeepers read the label for a particular treatment and follow those instructions. Beekeeping equipment supply catalogs, including those online, may give specific details. A phone call to your supplier would also provide information. However, reading the label will also give important details about temperature range during application, length of treatment and beekeeper protection. Read the label! *Ann Harman, VA*

Go with either HopGuard or Formic Pro as per label instructions. *Ross Conrad, VT*

Question 3

How many are using 10 frame medium supers for both brood boxes and supers. I.E., one size box for all. I'm late 60s and boy the deeps are getting heavy to move. I guess the same question could be asked of eight-frame mediums for all also.

We use one-size-fits-all deeps, due to inertia, but the mediums do seem like a good route to go! Maybe the new hires will make that switch. *Jay Evans, DC*

I have kept bees in 10-frame mediums for 41 years with everything interchangeable. I can easily switch to eight-frame mediums and might do so. Also I have known handicapped beekeepers using the shallow size for both brood and honey. The bees don't mind – it's a dry cavity. *Ann Harman, VA*

Many people are going with either 10- or eight-frame mediums for both brood and honey supers (including the illustrious Editor of *Bee Culture* if I am not mistaken). Much easier to lift when full of honey. Just be sure to use an extra box or two on the hive over what you would normally use to help ensure the bees have enough room and make up for the reduced capacity of each super/hive body. *Ross Conrad, VT*

Question 4

What can we as beekeepers do to have a tariff on all honey imported from other countries (including Canada which receives and bottles imported honey). Since tariffs are being raised on other products these days, it would help beekeepers immensely if imported honey or so-called honey was taxed.

I recommend contacting the American Honey Producers Association and the American Beekeeping Federation to see what actions they are taking. Both of these associations work closely with the U.S. Congress on such matters. It is necessary for the United States to import honey since domestic production does not fulfill U.S. needs. *Ann Harman, VA*

I don't really have a dog in this fight since I only deal with local honey at most (I'm not selling honey out of research hives), but it seems like a lot of taxes have been levied against imports in the past few years in an effort to increase American production. There's a decent chance that a lobbyist group could take up this cause given enough incentive or support, or a large beekeeping entity like ABF or AHA might be able to push something like this. My advice would be to talk to some of the well-known commercial guys to get a feeling of how much community support it would have, and how likely it was to get traction and not be dead in the water. *Jessica Louque, NC*

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Gleanings In Bee Culture – The Early Days, The 1870s

A.I. **Root**

Gleanings in Bee Culture was started on January 1, 1873, as a quarterly for the purpose of answering the multitude of questions that kept pouring in. In getting out the first number I had to confess to feeling not quite as much at home as in the old *American Bee Journal*. Improved bee culture was my end and aim. I knew that perhaps I might not do as well as the least of those whom I had criticized. At any rate, I was in the crucible, and if the fiery ordeal left nothing of any value I made up my mind I would bow my head in submission, and stop when I had fulfilled my promise of giving four of the best numbers of which I was capable.

The first number, however, was received so enthusiastically that *Gleanings* was immediately changed to a monthly instead of a quarterly; those who wished 12 numbers sending 50 cents additional, making 75 cents a year. Those who paid but 25 cents were to receive only five numbers.

By the end of the year I had about 500 subscribers, at the end of the second about 806 and at the end of the third, more than 1500. To accomplish this increase I spent about $300 in advertising.

Trouble, Trouble, Toil and Trouble

In the second year I received quite a number of complaints because *Gleanings* was not received on time. There were some suggestions of putting *Gleanings* on the list of the tardy periodicals. I protested against this, for so far I had mailed every number promptly on or before the 30th of each month. I asked my readers to conclude that the post office had failed, that the cars were off the track or that Uncle Sam had suspended business – at any rate not to intimate that I had been so shiftless as to fail in mailing *Gleanings* as heretofore. About this time, if anyone wanted to stir me up, all he had to do was to send in a postcard asking if I had printed the October or April or some other number, as the case might be. I made sure of promptly printing them but it was occasionally more difficult to avoid making a mistake in mailing.

In 1875, C.F. Muth gave directions for cleaning honey jars with sal soda and shot. My compositor got the last word "salt," and it was printed in *Gleanings* that way – "sal soda and salt." About that time I purchased a typewriter, so that henceforth all that I attempted to say on postals would be printed. It cost $125.00. It is a shame to make blunders in advertisements, yet that is just what I was doing early in 1876. I quoted Mr. Lane's buckwheat at 75¢ a packet instead of peck; and still worse, Dr. Larch said "Italian bees at $4.00," instead of $14.00, just because I did not see that very little figure "1" had some means dropped out.

Quite a good many of the May number of *Gleanings* for 1877 were reported as folded wrong, the first page being on the leaf next to the last. No one could tell how it came that way. As the June number was being mailed I picked up one copy at random and found it in the same predicament. I opened three more and found them just like it. Of course, the whole lot had be overhauled and made right.

One afternoon the boss printer said he wanted so many inches of matter to fill up a given space. I got it into my head that the space was to be after an article by Mr. Boardman, entitled "A Model Beeyard," therefore I gave the printers the required amount of copy for the matter in view. When the journal was printed later on, my reply to Boardman appeared as a part of my reply to Manum. In the same issue appeared a short item headed "Rat-tailed Maggots." I had dictated a reply to this, but to my consternation it did not show up on that page but appeared at the end of an excellent article by Prof. Cook on "Cuckoo Bees," while the intended footnote to the article on "Cuckoo Bees" did not get in until the next issue.

Of course, it was not such a terrible matter, but it gave one an impression that the editor had his head filled with reservoirs, windmills or something else besides the business in question.

In the May number for 1876 I printed a letter from D.P. Lane in reference to the difference of opinion among beekeepers regarding smokers. If it had been only smokers on which beekeepers disagreed, I might have felt thankful, but it was hives, honey, bees, feeders and patents to say nothing of the diverse opinions in regard to how a bee journal should be conducted. As an illustration one reader wished his journal stopped because I did not answer questions more at length, so that a novice could understand, and at the same time several of the veterans were actually getting mad because I filled the "Heads of Grain" department with so many repetitions of things

that everybody knew already. Again, my regular readers did not wish me to repeat the whole of what I wrote the last year or the year before, and yet I was getting abused because I often referred inquirers to the back numbers. One subscriber insisted that I make every number complete in itself without any reference to previous numbers, while others wanted me to collect all the facts I could on the subject, give an exhaustive article and then refer future inquirers to that number.

And it was the same in regard to small or large type. In the April number of that year I called for a vote on the use of small or large type and the votes were just equally divided and about equally vehement, so that I was finally obliged to decide according to my own best judgment.

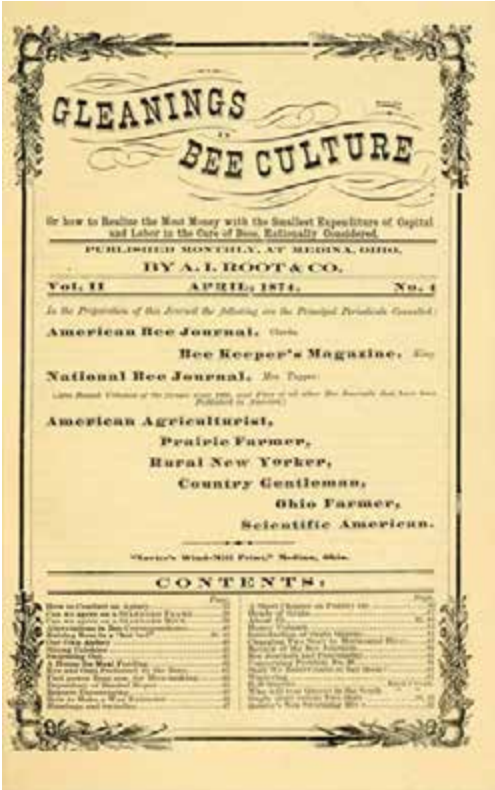
In the January 1 number for 1899, I promised to make a present to the old subscribers who had taken *Gleanings* 20 years or more. I promised those who had been subscribers 20 years, 20 issues in advance free, and those who had taken it the whole 25 years, 25 issues free.

When *Gleanings* Was Printed by Power from Windmill

Several in writing me in regard to it, mentioned the time when *Gleanings* was printed by windmill power. Vol. 1, No. I was dated January 1, 1873, but was taken from the press on December 6, 1872, the printing for the first year being done at the office of the Medina Gazette. A year later, however, I had a press of my own, and the first issue for the second year was printed on this press, I myself running it by foot power. I had a large windmill and when the wind was blowing I had a mechanical arrangement that would relieve me from working the treadle. A good deal of the time the printing was done partly by wind power and partly by foot power. I remember one night, when we were late, I made preparations to run the press all night. As there was not a breath of wind, there was no way but to tread it out. About 10 o'clock, however, a breeze sprang up, and the press kept going faster and faster, but as the wind came up gradually I learned to feed it as the speed increased. Under the inspiration of seeing my two hobbies work at the same time, the printing press and the windmill, I put in the sheets so rapidly that I was through and at home not much after midnight.

Of course, there was some grumbling among the subscribers because some of the sheets were printed crooked, but when I explained the matter everyone was kind and forbearing. After that it began to be a kind of standing joke that any crookedness was to be attributed to the irregularity of the windmill. Before Volume 3 was off, however, the wind proved to be too uncertain and a 4½ H.P. steam engine was put in to supplement the foot power. For quite a while both the windmill and the engine pulled together quite amicably.

Careless Correspondents


GLEANINGS IN BEE CULTURE

Or how to Realize the Most Money with the Smallest Expenditure of Capital and Labor in the Care of Bees, Rationally Considered.

PUBLISHED MONTHLY, AT MEDINA, OHIO,

BY A. I. ROOT & CO.

Vol. II APRIL, 1874. No. 4

In the Preparation of this Journal the following are the Principal Periodicals Consulted:

American Bee Journal. Chicago.

Bee Keeper's Magazine. Kingston.

National Bee Journal. New Haven.

American Agriculturist,
Prairie Farmer,
Rural New Yorker,
Country Gentleman,
Ohio Farmer,
Scientific American.

"Harris's Wind-Mill Press," Medina, Ohio.

CONTENTS:

I wonder if it is wrong to wish to shake people who do not sign their names to their correspondence. A beekeeper in Texas wrote twice complaining the he did not get his "*ABC of Bee Culture*" and there was no sign of an address on either of his postals. On the last one, however, after a great amount of trouble we deciphered "Texas."

A few asked to have *Gleanings* kept going, saying they would remit soon and then when they remitted they made no mention of the fact. The result was I sent them two copies and after a while a "dun." When one is paying a debt he should by all means say so when he sends the money. I could not remember individuals any more than I could remember drops of rain during a summer shower. To be sure I was glad to see the individuals and the raindrops, too, for that matter.

In 1877 I received a letter from a friend who said he could not afford to take *Gleanings*, but who asked so many questions that I felt I would almost prefer sending him a year's subscription free rather than to undertake to answer them.

Gleanings goes to all sorts of people in all sorts of places. It frequently made visits in lunatic asylums. From a pathetic letter from an unfortunate brother in one of these asylums I quote the following:

"Mr. Root, I have no honey bees here. You never sent me any of your journals to the hospital since I was at this house. I had one when I was down at the other house, but some scamp stole it. They do not like me here. I use no tobacco at all. I do not even smoke. I have not since my name was used for President." BC

FOUND IN TRANSLATION

Scraping Out A Living

Jay **Evans**, USDA Beltsville Bee Lab

A great mentor of mine once described true scientific discoveries as ones where half of the people say "that's impossible" while the other half say "that's a fact the whole world knows". This contradiction reflects an innate trait of scientists. We are stubbornly skeptical and, when a seriously novel insight comes into view, can be slow to embrace the messenger. This year's messenger of an important paradigm shift in bee health is Dr. Sammy Ramsey (even with his newly minted PhD., Sammy is steadfast in not being addressed as Sam or Samuel). Dr. Ramsey and colleagues at the University of Maryland, including his adviser Dennis vanEngelsdorp, teamed up with USDA and University of Florida scientists to study what, exactly, *Varroa* mites take from their honey bee hosts. With a set of clever and tedious experiments they, to use a scientific term, "knocked it out of the park" for this topic. If you haven't heard the punchline for this study you can find the full paper online at **https://www.pnas.org/content/116/5/1792**. It turns out *Varroa* mites are scrapers and not slurpers, carvers and not bloodsuckers, more Dahmer than Dracula. This great insight brings past observations into more clear focus and sets the stage for breakthroughs in both fundamental and applied bee biology.

So, what did they learn and how? The study began by observations of where mites feed. It has been known for some time that older female mites initiate feeding on bee brood by carving a sort of artesian well from the cuticle of their hosts, returning to the same spot and eventually bringing their hungry offspring. This is distinct from, say, mosquitoes and aphids, which poke and prod their hosts repeatedly and in a way that mainly reflects their fear of being whacked or eaten by a predator. Why so much effort? Similarly, mites feeding on adult bees take time finding a protected niche between hardened plates and truly nurture their feeding spot, scraping away the hard shell and then settling in for what was long thought to be a drinking binge on bee hemolymph (watery blood). Ramsey and colleagues noticed that mites were selecting crevices that not only protected them but gave an entry to the most accessible sources of bee fat. Strikingly, mites were most likely to be found directly over an ample reserve of the 'fat body', a honey bee organ that is more complex and important than its name. This diffuse organ not only stores fat to be used for future efforts, but contains cells that are key for detoxification, immunity, and general bee development. If you've tried to drink a thick milkshake through a thin straw you will know that tapping into the body's fat reserve is not the fastest route for draining blood. In contrast, it is an excellent spot for carving out a complete and filling meal. *Varroa* mouthparts are entirely consistent with this feeding strategy, looking like little rasps and rakes, with no evidence of straws of any sort. Ramsey and colleagues present amazing microscopic images of *Varroa* mites and their bee hosts. Along with closeups of mite mouthparts, they were able to show precisely where mites had scraped their entry into bee bodies. They even show pieces of fatty food left behind by feeding mites whose meals (and lives) ended under a million-dollar microscope.

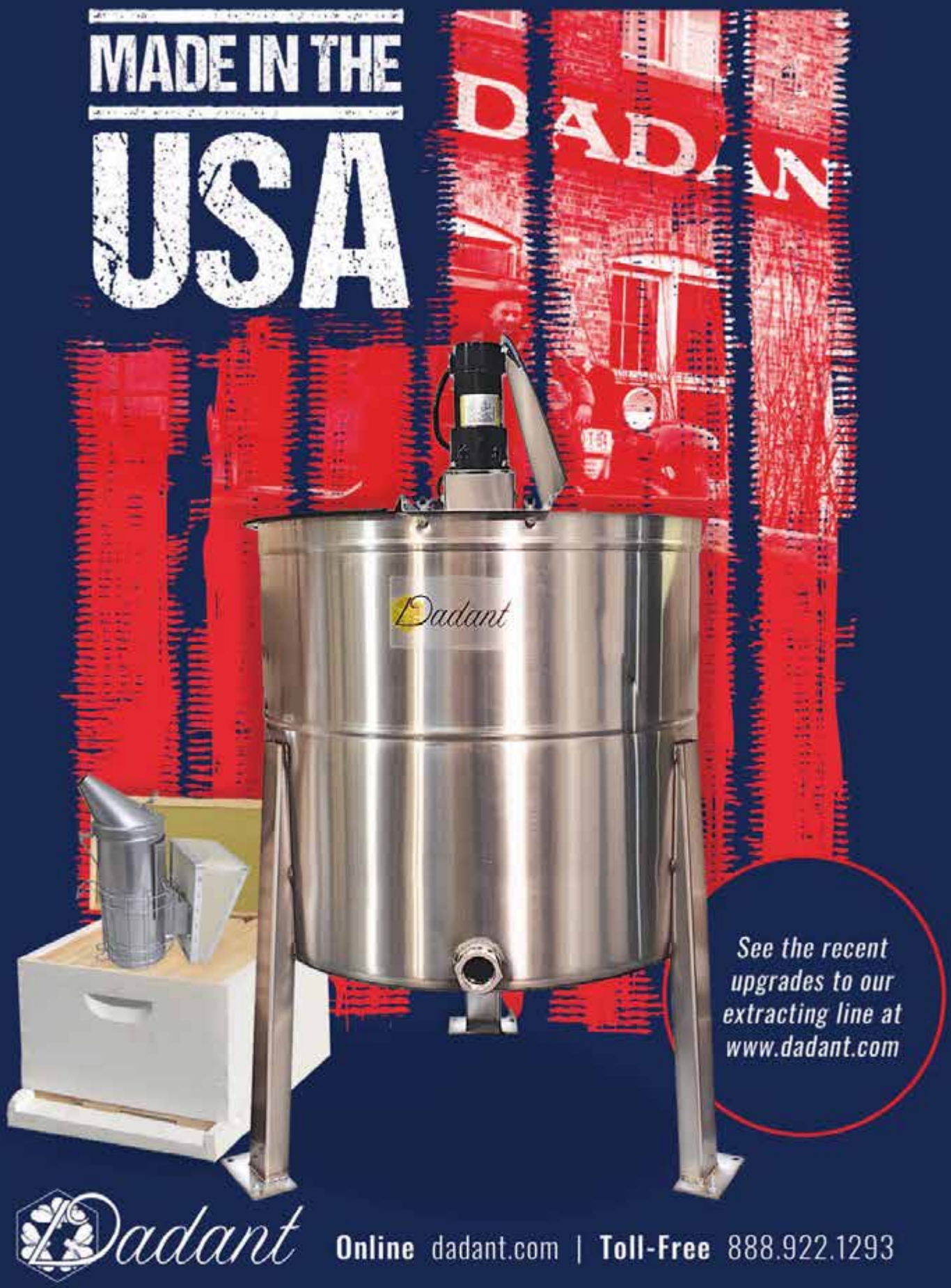
The researchers had me convinced right there, but they stacked their paper with additional clever and convincing arguments. As a shout-out to teenage boys everywhere, they also discuss mite excreta. Everyone poops, but the solid nature of *Varroa* feces, as opposed to the honeydew of aphids, is further evidence of a diet rich in fat. They nailed this observation by feeding adult bees with both a water-soluble dye and a dye that attaches to bee fat. As expected, mites collected after a feeding bout were full of the fat-linked dye and showed very little signs that they had even touched the liquid parts of their hosts. If mite poop is your thing, Francisco Posada-Flores and USDA colleagues recently provided an in-depth analysis of this byproduct (**https://doi.org/10.1017/S0031182018001762**). Even at the closest look available for poop science, all evidence supports the feeding model proposed in Ramsey's paper.

If mites are feeding on bee fats, is this really good for them, or are they just dealing with an easily accessible and chewable part of the bee? Using diets ranging from pure bee 'blood' to pure bee fat, Ramsey and colleagues found a distinctly better outcome with the latter. In fact, mites fed on anything less than 50% fat body (the consistency of chowder) never survived a seven-day trial, while those fed 100% fat body (too many fast-food analogies to name) did the best of all. These mites survived better AND laid more eggs, indicating that, in nature, the most successful mites are those that tap directly into this organ. This result is immediately relevant for scientists who maintain *Varroa* mites in the laboratory, as they search for weak spots and new treatments along with

new insights into the biology of these odd creatures.

The next few years will tell if a better understanding of *Varroa* feeding habits will speed the search for new control methods. This line of thought should also provide new insights into how *Varroa* mites and associated viruses cause so much harm to bees. My guess is that fat removal and fat body damage is key to understanding why parasitized bees live shorter and less productive lives. Next month, I will explore how insights into mite feeding help explain the devastating effects of unsolicited fat removal on honey bees. What is certain is that hard-won discoveries like this one remind many of us of how we found our thrill for science in the first place. BC

If you'd like to listen to Dr. Ramsey tell more, tune into our podcast with him at ***www.beekeepingtodaypodcast.com****, Episode 15.*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A Closer Look

DEFENSIVE BEHAVIOR

Clarence **Collison**

Guard bees are usually at the entrance of hives and though their numbers are few, they represent the first line of defense.

Honey bees are social insects that coordinate a suite of defensive behaviors to ensure colony survival. Their nests contain valuable resources such as pollen and nectar that are attractive to a range of insect and mammalian intruders. These resources need to be protected, a task that is performed by specialized workers, called guard bees. Guards tune their response to both the nature of the threat and the environmental conditions, in order to achieve an efficient trade-off between defense and loss of foraging workforce. By releasing alarm pheromones, they are able to recruit other bees to help them handle large predators. These chemicals trigger both rapid and longer-term changes in the behavior of nearby bees, thus priming them for defense (Nouvian et al. 2016).

Honey bee nest defense involves guard bees that specialize in olfaction-based nestmate recognition and alarm-pheromone-mediated recruitment of nestmates to sting. Stinging is influenced by visual, tactile and olfactory stimuli. Both quantitative trait locus (QTL) mapping and behavioral studies point to guarding behavior as a key factor in colony stinging response. Results of reciprocal F_1 crosses show that paternally (drone's side) inherited genes have a greater influence on colony stinging response than maternally (queen's side) inherited genes. The most active alarm pheromone component, isopentyl acetate causes increased respiration and may induce stress analgesia (inability to feel pain) in bees. Isopentyl acetate primes worker bees for 'fight or flight', possibly through actions of neuropeptides and/or biogenic amines. Genome sequence and QTL mapping identified 128 candidate genes for three regions known to influence defensive behavior (Hunt 2007).

Some worker honey bees respond to major disturbances of the colony by flying around the assailant and possibly stinging; they are a subset of the bees involved in colony defense. These defenders have an open-ended age distribution similar to that of foragers, but defensive behavior is initiated at a younger age than foraging is. Behavioral and genetic evidence shows that defenders and foragers are distinct groups of older workers. Behaviorally, defenders have less worn wings than foragers, suggesting less flight activity. Genetically, defenders differ in allozyme frequencies, demonstrating different subfamily composition from foragers in the same colony. They also differ in allozyme frequencies from guards in the same colony, providing further evidence for division of labor associated with colony defense (Breed et al. 1990).

Guard bees are usually present at the entrance of hives and though their numbers are few (only 10-15% of adult worker bees become guards (Moore et al. 1987), they represent the first line of defense. Guard bees patrol the entrance of the hive, and search for any creature or object approaching the colony (Arechavaleta-Velasco and Hunt 2003). Guards are very sensitive to vibrations, odors, color, and movement and can discriminate between nestmates and intruders (Breed et al. 1992). When a guard bee is disturbed, she will raise her abdomen and release alarm pheromone by opening her sting chamber and protruding her sting. She also fans her wings, presumably to aid in the dispersal of her pheromone to alert the colony (Free 1987). As pheromone is released, the number of bees at the entrance of the hive increases (Maschwitz 1964). Defender bees may rush out of the hive entrance running in circles or zigzags, or assume an aggressive posture (Free 1987). This posture might include a slightly raised body with wings extended, antennae waving, and open mandilbes (Ghent and Gary 1962; Free 1987). At this stage, bees are ready to mobilize at further provocation. Additional disturbance is likely

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When a guard bee is disturbed, she will raise her abdomen and release alarm pheromone by opening her sting chamber and protruding her sting.

to lead to the stinging of the intruder. Once stung, the chances of receiving additional stings become significantly increased (Free 1961, Ghent and Gary 1962).

Nine compounds identified from honey bee sting extracts and one compound identified from the honey bee mandibular glands were evaluated in a standardized laboratory test for their effectiveness in eliciting an alarm response from caged honey bees. Two compounds, n-decyl acetate and benzyl alcohol, were judged ineffective as alarm pheromones. The remaining eight – 2-nonanol, isopentyl acetate, n-butyl acetate, n-hexyl acetate, benzyl acetate, isopentyl alcohol and n-octyl acetate from the sting and 2-heptanone from the mandibular gland-produced responses of similar frequency and strength (Collins and Blum 1982).

Wager and Breed (2000) tested compounds found in honey bee sting alarm pheromone for their roles in releasing behavioral responses, with a focus on the relative importance of chemotaxis and motion of the target in the localization response. Some compounds in the blend have specialized functions. Benzyl acetate released only flight behavior, whereas three compounds (1-butanol, 1-octanol, and hexyl actetate) caused only the recruitment response. Other compounds (1-hexanol, butyl acetate, iso-pentyl acetate, and 2-nonanol) acted in more than one behavioral context. Octyl acetate was the most effective compound in allowing bees to locate targets, but did not recruit or release flight behavior. Stationary octyl acetate sources were located by flying bees, indicating that this pheromone component elicits a chemotatctic reponse. However, localization of a target is due primarily to the motion of the target; the alarm pheromone components release searching behavior for a moving object and are relatively unimportant in target localization.

Moore et al. (1987) characterized quantitatively the ontogeny and individual variability of guarding behavior, the allocation of workers to the guard population in a colony and the intercolonial variability of guarding behavior. Guarding is a discrete task performed by a distinct group of workers that are younger than foragers and older than house bees. Workers that guarded initiated the behavior between the ages of seven and 22 days. The mean age of the onset of guarding varied; the minimum mean age of guards for a colony was 13.6 days and the maximum was 16.0 days. Workers varied in the length of time they spent as a guard. Most bees guarded for less than one day; however, some guarded up to six consecutive days. The more time a bee spent guarding during a day the more likely that bee was to guard for more than one day. Bees that guarded for more than one day also had longer and more frequent individual guarding bouts. All colonies that were studied had guard populations, but not all workers guarded. A relatively small proportion of any age cohort was observed to guard. The percentage of an age cohort that guarded varied among colonies, as did the size of the guard population. Guarding is a specialized task in that few bees guard, but guarding does not appear to require experience because so few bees remained as guards for very long. There was inter-colonial variation in all aspects of the ontogeny of guarding and in allocation of workers to guarding.

The factors inducing honey bees to sting were investigated by comparing the number of times cotton wool balls treated in different ways were stung (Free 1961). Dark colored balls were stung more than light colored, particularly against dark backgrounds. The odor of sting venom encouraged further stinging, but the effect was overcome by smoke. General bee odor did not encourage stinging and bees were more likely to sting balls with the odor of their own than of another colony. Animal scent and the smell of human sweat encouraged stinging and various repellents discouraged it. Bees probably sting materials of rough texture more readily than smooth. Rapidly moving objects were stung more often than slowly moving ones.

The defense of a honey bee society often requires that some specialized members coordinate to repel a threat at personal risk. This is especially true for honey bee guards, which defend the hive and may sacrifice their lives upon stinging. Central to this cooperative defensive response is the sting alarm pheromone, which has isopentyl acetate as its main component. Although this defensive behavior has been well described, the neural mechanisms triggered by isopentyl acetate to coordinate stinging have long remained unknown. Nouvian et al. (2018) showed that isopentyl acetate upregulates brain levels of serotonin and dopamine, thereby increasing the likelihood of an individual bee to attack and sting. Pharmacological enhancement of the levels of both

amines induces higher defensive responsiveness, while decreasing them via antagonists' decreases stinging. Their results thus uncover the neural mechanism by which an alarm pheromone recruits individuals to attack and repel a threat, and suggest that the alarm pheromone of honey bees acts on their response threshold rather than as a direct trigger.

Honey bee envenomation is initiated by the insertion of the stinging apparatus into the victim's skin. The shaft of the sting is comprised of two barbed stylets that slide back and forth on the underside of another barbed stylet, forming a channel through which venom passes from the venom sac in the base of the sting. Reciprocal axial movements of the stylets serve to progressively bury the sting in the skin and initiate flow of venom. These movements are effected by rhythmic action of the motor apparatus in the base of the sting. This occurs as soon as the apparatus is denervated by separation of the sting from the abdomen when the bee pulls away from the embedded sting, a process known as autotomization (Schumacher et al. 1994).

To determine the rate and completeness of delivery of venom from honey bee stings, bees were collected at the entrance of a hive and studied with the use of two laboratory models. In one model bees were induced to sting the shaved skin of anesthetized rabbits. The stings were removed from the skin at various time intervals after autotomization, and residual venom was assayed with a hemolytic method. In the other model the bees were induced to sting preweighed filter paper disks, which were weighed again after removal of the sting at various intervals. Results of both experiments were in agreement, showing that at least 90% of the venom sac contents were delivered within 20 seconds and that venom delivery was complete within one minute (Schumacher et al. 1994).

To inspect and manage colonies, beekeepers use bee-smokers to direct smoke at the entrance and inside of their hives. Smoke reduces defensive behavior and allows the beekeeper to manipulate frames of bees without being stung. This practice is very effective, and used extensively by beekeepers. Despite being an integral beekeeping practice, reasons behind smoke effectiveness in reducing stings are not well understood (Gage et al. 2018). One of the most compelling arguments is that smoke disrupts chemical communication among bees. The alarm pheromone, for instance, may be masked by smoke such that its many compounds become indistinguishable in the odor plume. Or perhaps smoke weakens worker bee sensitivity to alarm pheromone by affecting olfactory transduction in the antennae sensilla. There is evidence in support of the latter. It was found that smoke reduced the electroantennograph response of honey bee antennae to both alarm pheromones and a floral odor, suggesting that smoke interferes temporarily with olfaction in general (Visscher et al. 1995).

Guarding is a discrete task performed by a distinct group of workers that are younger than foragers and older than house bees.

Apart from disrupting chemical communication, another argument is that smoke may function as a distraction. Smoke induces honey bees to ingest honey from storage cells, and because of this activity, they are less likely to sting (Free 1968; Newton 1968). Smoke applied at the entrance was also found to reduce the number of guards at the entrance for a period of 10 minutes or more (Newton 1969). Smoke may mask the intruder's odor, or divert attention away toward the more immediate threat of a perceived fire in the area. Altogether, the defensive response is an example of collective action based on recruitment and amplification processes within the hive (Millor et al. 1999). If smoke affects one, or a combination of these processes, or other processes entirely, defensive behaviors are likely to be diminished. Gage et al. (2018) conducted a study to evaluate the effects of smoke on honey bee defensive response by assessing individual honey bee sting extension responses under smoke conditions. In this way, they could carefully monitor how perturbation with increasing voltage steps affects the sting extension reflex and whether this reflex is modified by smoke.

Gage et al. (2018) applied a brief voltage to the bee, ranging from a mild to a strong perturbation, and assessed four components of the sting extension reflex using two types of smoke. They found that smoke did not influence the probability of sting extension, but it did affect whether a venom droplet was released with the stinger. The venom droplet was more likely to be released at higher voltage levels, but this effect was significantly reduced under smoke conditions. Based on these results, they propose that the venom droplet coincides with greater agitation in individual bees; and smoke reduces the probability of its release. They speculate that the venom droplet serves to amplify the sting alarm pheromone, and smoke, in its ability to reduce droplet formation, may indicate that less alarm pheromone is released. BC

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Pricing:	1-4	5-99	100+
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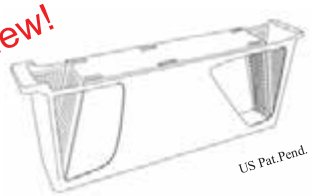

NEW Cap n Ladders
- Easier Assembly!
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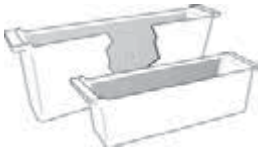
	9 5/8" or 6 5/8"	9 5/8"-2 Frame
1—9	$1.55	$ 1.65
10-450	$1.40	$ 1.50
500+	$Call!	$Call!



In-Hive Feeders
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Cap n Ladders
9 5/8" or 6 5/8"

1—9	$1.55/ea
10-450	$1.40/ea
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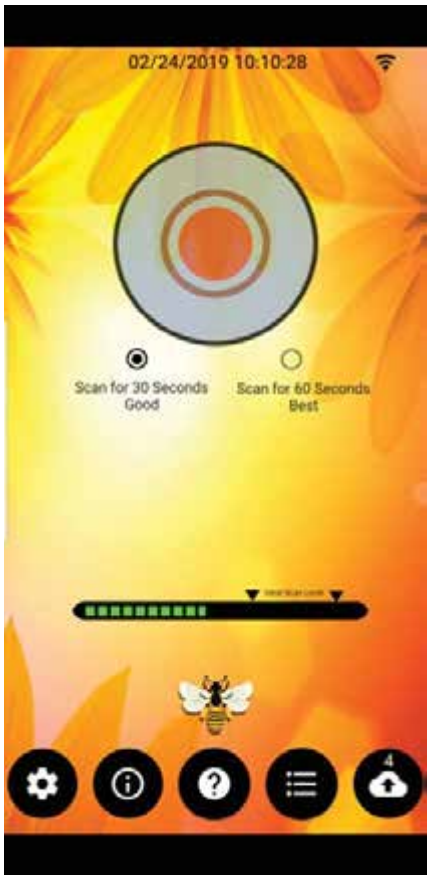


Start Screen

Bee Health Guru will launch via Kickstarter May 1. Available at ***www.kickstarter.com/profile/BeeHealthGuru****, a way to support what we are doing to help beekeepers keep healthy bees, get early access to the Bee Health Guru app, and become part of the citizen science that will make the app better and help us keep bees healthy.*

Decoding the Songs Of Bees

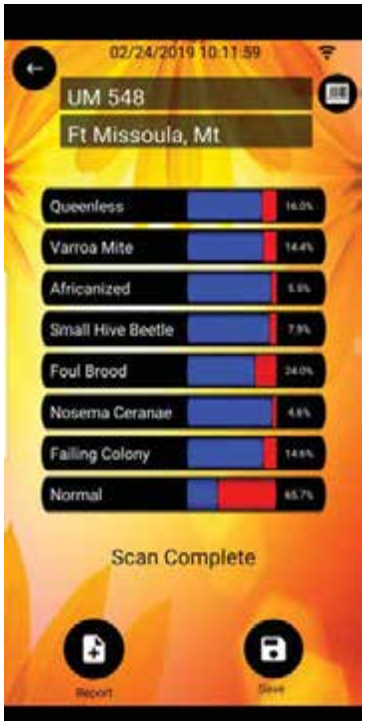
Jerry **Bromenshenk,** Robert **Seccomb,**
Colin **Henderson,** David **Firth**
Bee Alert Technology, Inc.; **Missoula, MT**

For Improved Colony Health

NPR 02/18/2019, Headline: Massive Loss of Thousands of Hives ... This article underscores a fundamental problem. There isn't a system for early detection and rapid reporting of emerging colony health issues, when and where these occur, in the U.S., Canada, and most countries. Bees need the equivalent of the USA's CDC human influenza updates and mapping. This problem can be solved immediately by just one of the functions of Bee Health Guru; our app for smartphones, where the bees themselves are the guru, indicating colony health by the sounds that they produce.

For 12 years, we have been working towards providing a hand-held device for sensing, analyzing and reporting colony conditions. As with a Star Trek Tricorder™, our bee-sound recording and analysis system uses machine intelligence (AI) to analyze colony sounds. In 2012, we built several hand-held bee recording devices that were big, expensive, and clumsy to use. Smaller, affordable, user-friendly devices with rapid processing and large storage capabilities were unattainable until 2018 when smartphones with facial recognition for security were marketed. Facial recognition uses AI requiring fast processor speeds. It's a visual counterpart to our AI sound recognition programs. Suddenly, our AI analyses, that had taken several minutes on existing tablets, laptops, and earlier smartphones dropped to seconds!

The primary purpose of our Bee Health Guru app is to allow the bees themselves to communicate each colony's health status. Recordings of colony sounds are made using a smartphone's internal microphone or microphone port with a slender microphone. Analysis of a sound recording is immediately and automatically performed by our Bee Health Guru AI program. Our algorithms assign the probability that one of eight conditions is exhibited by the colony. A form then appears on the phone's screen that provides the user the option to visually inspect the colony to confirm its condition, and then save an inspection report. These three actions: (1) Recording colony sounds, (2) predicting the likelihood of specific diseases, and (3) reporting the outcome of colony inspection provide data needed to fine-tune our AI modules and map occurrences of different colony problems. The latter will initially be based on visual



Analysis Screen

inspection reports and eventually should be based on the AI analysis reports alone – no inspection needed as the app's accuracy improves.

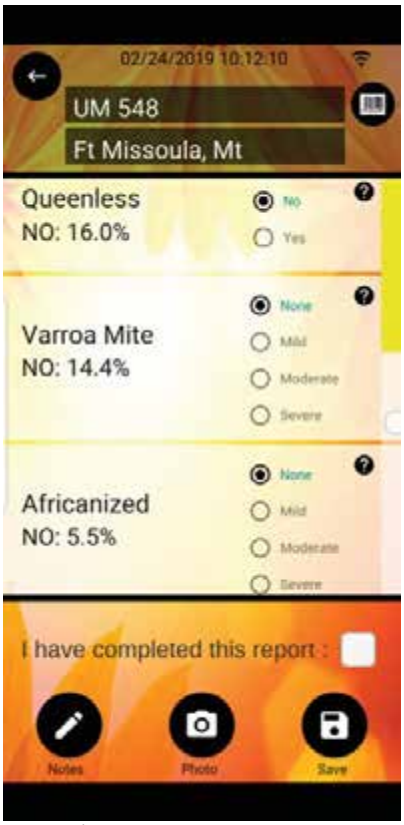
A Bee Health Guru recording takes 30 seconds. My Android 8+ phone analysis for all eight colony health factors takes 12 seconds. Filling out the inspection form takes less than a minute, but visually inspecting a colony does take more time. This last step, colony inspection is critical during the early stages of app use. It's where app users can become citizen scientists and contribute to our ability to accurately decode colony sounds.

Following recording and generation of an analysis report by the app, the user is asked to visually inspect the colony to either confirm or reject the app's sound analysis. A click of a button reveals a simple drop-down inspection form. The report is filled out at-the-hive, takes only a few keystrokes to complete, and then a click of another button uploads the report, as well as any notes and photographs, to our Cloud-based data archive. The app automatically creates a copy of the recording, the AI colony health analysis report, and adds date, time, and GPS location. Resultant electronic records have safeguards for protecting data privacy, confidentiality, and security of beekeepers (i.e., names and hive or apiary locations) and the patients, bees who may be sick (e.g., locations).

Once all of this information is posted to our Cloud-based recording, analysis, and inspection data repository, we can accomplish two tasks: (1) Refining, re-training and upgrading the AI modules for each health factor analysis, and (2) Mapping of colony health trends over time and geographical space to share with citizen scientists and anyone else interested in bee health.

Refining the App: Unlike other honey bee acoustic scanning and monitoring systems (mainly from Europe), our programs do far more than look for simple frequency markers of overall colony noise and do not rely on the user to interpret sonograms. Our custom AI's assess a broad and complex spectrum of sound

The Start Screen appears as soon as the user taps the Bee Icon to bring up the installed app. Insert phone's microphone into hive entrance up to the bull's eye or plug in external microphone. Let bees settle just a bit, then touch the red center of the bull's eye. The App will start, record for 30 seconds (can be changed to 60), run the AI analyses, and end up showing the Analysis report. The longer the red bar for a factor, the greater the probability that there's a problem. (Note, we've asked our app developer to change the word Normal (i.e. Normal Colony) to Abnormal - people don't intuit that red is the warning of a problem. Assuming that the user then moves to Inspection to reject of confirm each analysis factor, the Inspection Form drops down with a few questions. Tapping the ? for any factor brings up an explanation of the criteria. The App then reverts back to the start (Upload Screen). Note the Cloud with a number in lower right corner. The number is the number of recordings/analysis reports/inspection reports waiting to be uploaded. At the top of the screen is the GPS location for the last colony scanned. At any point, when cell or wireless is available, tapping the bee icon near bottom of a screen links the user to our www.beehealth.guru web page for further information, comparing notes with other users, etc. It's where our North American Bee Associations Directory will be made available (when the class finishes its project) and it's where we will probably post Bee Colony Health Updates and Maps. It only takes a few key strokes to record. Much of the work is done automatically by the phone, such as grabbing time, date, GPS location, hive ID (if a barcode is used – just touch a button to use camera to take a photo). There's no input of user's name, type of phone, etc. Our overall goal is to make this as simple to use as possible – people have sticky hands or gloves – need to keep button clicks typing to a minun.



Inspection Screen

Bee Health

Smart Screen

attributes, far faster and better than any person could accomplish. This standardizes the analysis. Results are comparable from colony to colony without observer inaccuracy or bias, and no training of the observer is required.

For example, if the app reports a high probability that a colony lacks a laying queen, the inspection report should either prove or disprove that analysis result. By having hundreds or thousands of examples provided from users of our app, we can take all of the recordings that the app got wrong, all of the recordings that the app got right, and re-train the AI. It's an iterative process that we know will refine and improve app accuracy.

Mapping Health Trends: As soon as visual colony inspection information is secured, automated updates and posting of incident maps can be readily produced using off-the-shelf interactive data visualization software. Posted maps will provide sufficient resolution to identify, for example, an outbreak area of *Varroa* mites, but will not pinpoint the actual location of affected colonies.

To enact the health trend mapping part of our app, we need beekeepers with smartphones, Android or iPhone, to download our app, inspect colonies, and in a timely manner, post the reports to our Cloud site. Our app stores all recordings and reports on each phone until the reports can be uploaded. Cellular service in the beeyard is not necessary. Obviously, we hope that every user also records colony sounds so that we get recordings and AI analysis results, but just the colony inspection reports alone can be used to generate bee health maps.

The inspection and reporting part of our app, by itself, should revolutionize bee health protection – early alerts, based on visual inspections, as soon as the reports are uploaded. Any beekeeper with a smartphone, anywhere around the globe, enabled to submit reports or bee colony health problems as they are discovered. Initially, we have limited the health reports to eight major factors like *Varroa* mites, foulbrood, nosema, queen status, and other aspects of overall colony condition.

All of this is based on relatively recent progress in insect and bee ethology (behavior). An excellent overview appears in Insect Sounds and Communications (Dropoulous and Claridge, 2006). We now know that in addition to the well-known symbolic dance language, bees also communicate via sound, using both vibratory and airborne-sound signals.

We can record these signals by laying either a phone's built-in microphone or a slender, external microphone on the bottom board of the hive. Our discovery, formalized in acoustic monitoring and recording system patents, published in the U.S. and Canada, (Bromenshenk et al., 2015) was that we can decode bee-produced signals to identify colony exposures to hazardous and toxic chemicals, including often the category of chemical, as well as discern a variety of colony health conditions, and even rank the level of infection or infestation of bee diseases and pests. Furthermore, bee sound or song repertoires are far more complex than can be perceived by the human ear, with frequencies beyond our audible range and additional components such as amplitude, pulses, shifts, and other related signals all contained in the airborne sound and vibratory spectrum.

Which raises the question, can bees perceive these sounds and vibrations that they produce? Bees and many other insects have long been considered to be deaf to airborne sounds. Around 1940, Hansjochem Autrum and associates demonstrated that many insects perceive minute substrate vibrations and that some insects have hair-like structures that can function as sound velocity and airborne sound receptors. But, it wasn't until the 1990s that scientists found evidence that flies and bees appear to be able to perceive airborne sounds by flagellum in the Johnston's organ of the antennae.

Modern capabilities for recording, manipulating, playing back, and analyzing the acoustic signals of honey bees and other insects have made acoustic behavior an advanced and active area of insect ethology. We are just now beginning to realize that the bee dance movements are only one part of a bee colony's communications. Communication processes of social bees that coordinate hundreds or thousands of individuals in a colony are fascinatingly complex. We have a means of tapping into colony communications.

Why do we need to fine-tune and calibrate? When using high-end recorders and desktop computers, the accuracy of detection for the eight included factors ranged from 86-98% detection, based on over a decade of our own intensive research. Our AI programs learn and improve when we've got real recordings from colonies with specific visible health factors. We now need to know which phones provide an accurate recording and which do not. We've also learned the bees have accents. New Zealand bees produce somewhat different sounds than North American bees, and bees from the U.K. are different from either America or New Zealand.

Launched in the Fall of 2017, we anticipated that it would take three months to produce and beta test our Bee Health Guru app, it took two years! It's not a finished product, but we are close to the finish line. That's where lots of beekeepers and bee colonies are needed. It's what we intend to do this Summer – calibrate the sound and vibration signal decoding!

This Spring (April) we will launch our app to the public on Kickstarter. We hope that every beekeeper in the world with a smartphone will support this launch and then download, use our app, and upload the results. That has the potential to generate a massive data set. To properly address that rich resource, we need to be able to have a team ready and willing to process the initial data, re-train the AIs, and enact regional bee health mapping – for the U.S., for Canada, for Europe, for New Zealand, for Australia – any English speaking nation. And then we need to produce versions of the app in other languages so as to truly go global. BC

Drosopoulos, S. and M.F. Claridge. 2005. *Insect Sounds and Communication: Physiology, Behaviour, Ecology, and Evolution.* 32 Chapters. CRC Press, 553 pp.

Bromenshenk et al. 2015. Bees as Biosensors: Chemosensory Ability, Honey Bee Monitoring Systems, and Emergent Sensor Technologies Derived from the Pollinator Syndrome. Biosensors 5(4), 678-711; https://doi.or/10.3390/bios5049678.

Technology In Action

Optimizing Pollination With BeeHero.io

Joseph **Cazier,** Omer **Davidi**

Introduction

In this third article in our *Technology in Action* series, we profile **Beehero.io**, a company founded by Itai Kanot, Michal Roizman and Omer Davidi focused on helping **farmers** increase crop yields through better pollination and aimed primarily at **commercial** beekeepers. This is a different approach than that taken by many hive sensor companies in that the focus is on the food and farmer first. In this case, the technology is primarily used to better manage the bees to maximize food production, but also provides many benefits to beekeepers beyond that of food production.

In this article we will continue using the framework of the *Technology Acceptance Model* (TAM) to explore new technologies that may be useful to beekeepers. Recall that TAM (shown in image 2.) posits that the main factors that influence the adoption of a new technology are:

- *Usefulness:* The degree to which the software system provides real value to beekeepers
- *Ease of Use:* How easy it is to use the system. Our research shows that this includes both in the software application and in the beeyard.
- *Enjoyment*: Enjoyment has been shown to be very important for adopting systems that are consumer-focused and optional.

In the sections that follow, we discuss the creation of this technology, including how it has evolved and what problems it is trying to address. Next, we share an overview of its features and discuss how it works in terms of is usefulness, ease of use and enjoyability. Finally we share a few thoughts from customers and conclude the article.

Know the Innovator, Understand the Technology

The BeeHero.io founders (see image 3) met three years ago as a part of an elite innovation program at IDC university in Israel called IDCBeyond. Itai, a 2nd generation commercial beekeeper operating and managing the largest bee-farm in Israel (~5,500 hives), shared his passion for the bees and the challenges bees and beekeepers like him were facing.

After digging into the problems with the knowledge from their respective backgrounds and being joined by Yuval Regev as the Chief Technology Officer, they began to explore how technology and data science could be used to help address some of the problems the bees face.

BeeHero Logo from ***https://www.beehero.io/***

After some analysis, they determined that one of the best ways to help bees was to focus on maximizing crop yields through better pollination. To provide optimized pollination services, they needed healthy hives.

They were fortunate enough to receive a grant from the Israeli Innovation Authority. This allowed them to start researching low-cost sensors and sophisticated machine learning algorithms in order to predict beehive disorders before it damages the colony. However, to do good machine learning you need a large volume of quality data. Generally, this means remote sensors generating near continuous data of many aspects in the hive thought to be predictive.

Since they could not find any existing data sets with enough volume, quality or consistency for their purposes, they began their own data collection efforts with 10 hives at Itai's backyard, running several experiments and looking for correlation in the collected data. Later scaling to 1,400 hives allowing them to collect the amount of data they needed to build and tag relevant factors needed to begin building a useful forecasting model.

As the accuracy of the model increased, BeeHero moved to the U.S. and partnered with several commercial beekeepers. They currently track ~20,000 hives, giving them one of the largest databases of sensor-derived hive data correlated with pollination results. They claim to have ~25 different data points from each hive. However the full list of items measured and analyzes is proprietary and can't be listed here.

Usefulness

On the surface, it appears that the key usefulness of this technology is to the farmers who benefit from pollination services. However there is much more to it than that. This technology is actually an important step in the direction of building a Genius Hive as outlined in the April 2018 issue of *Bee Culture*[1]. While this is cutting edge technology and much of it is still in development, here is a summary of some of the likely useful benefits

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Omer Davidi, CEO & Co-Founder at BeeHero. Holds BSc and MSc in computer science specializing in Cybersecurity and Machine-learning. You can reach him at **omer@beehero.io**

[1]*Original Genius Hive Article located here* ***https://www.beeculture.com/peering-into-the-future-a-path-to-the-genius-hive/***

that should/will emerge as they grow and deploy the system at scale.

Pollination Optimization

Their initial research shows that bees can be used to give farmers a significantly higher yield if pollination is optimized, and not just for Almonds. After developing some models for optimized pollination, the company has also run several experiments in Sunflowers and Cotton and found evidence of a significant increase in crop yields there as well.

If their initial experiments hold and scale to other crops, it is clear that pollination optimization can benefit the farmer's by increasing their yields. This will give them an advantage over farmers who do not use this type of service. However this helps not only the farmers, but also those of us who like to eat by increasing food availability without significant new external resources.

Additionally, this helps the beekeepers. By being more efficient and effective in their pollination efforts, beekeepers should be able to capture some of the increased value from the increase in yields. This should also help them be more efficient in running their operation, decreasing dramatically the operational costs, lowering mortality rates and increasing honey yields.

Inside the Hive

A nice secondary benefit of this technology is in knowing what is happening in the hive. Since they need sensors in the hive to optimize pollination services, they already have sensor data they can analyze. The data is being analyzed using several sophisticated machine-learning algorithms, where the company believes they can predict or detect early signs of:

- Queen failure
- High levels of *Varroa* mites
- Starvation situation
- Brood diseases
- Swarming

In addition, BeeHero's sensors know many bee frames and brood frames are in the colony and can predict the amount of pollen and nectar that is brought every day by the bees.

Knowing what is happening inside the hive is a critical tool for beekeepers to better manage their hives.

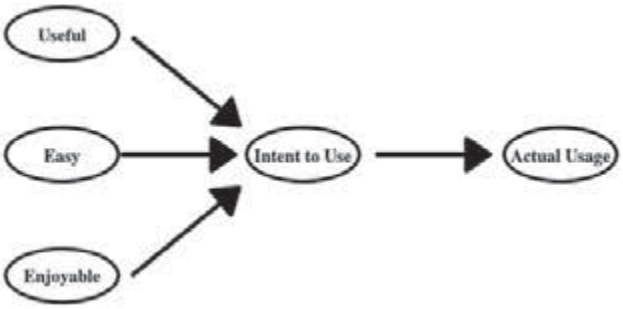

Image 2. *The Technology Acceptance Model.*

This can be done in real time with fewer costly manual inspections that take valuable time from the beekeepers and logistics optimization.

Image 4. Shows some visualization of a missing queen, healthy hive and high level of *Varroa*. These visualizations are based on enhancing specific features of the classification algorithm. Their algorithm looks at 25 different features from sensor data to know what the status of a given hive is at a given time.

Scalability

For every professional beekeeper, scaling the operation can be challenging. To manage 500 hives well is not as hard as to manage 20,000 hives well. The main reason is the expertise of the people who physically inspect the hives. Experienced beekeepers will be able to notice hive issues in an earlier stage and avoid more damage from less experienced ones.

Additionally they can watch their hives remotely, as shown in image 5, making it easier to prioritize actions and manage hives from a distance and decide how to best deploy resources. Having a real-time apiary status update from every region enables better decisions. With no need to drive long distance just to inspect hives and no need to guess which beeyard should be visited next or treated. It is easy to see how this has the potential to help bee operations scale.

Theft

Having these sensors also alerts you, in near real time, when there is a theft or vandalism with your hives and sends an alert. Another valuable feature especially during almond pollination season.

Image 3. *BeeHero's Leadership team.*

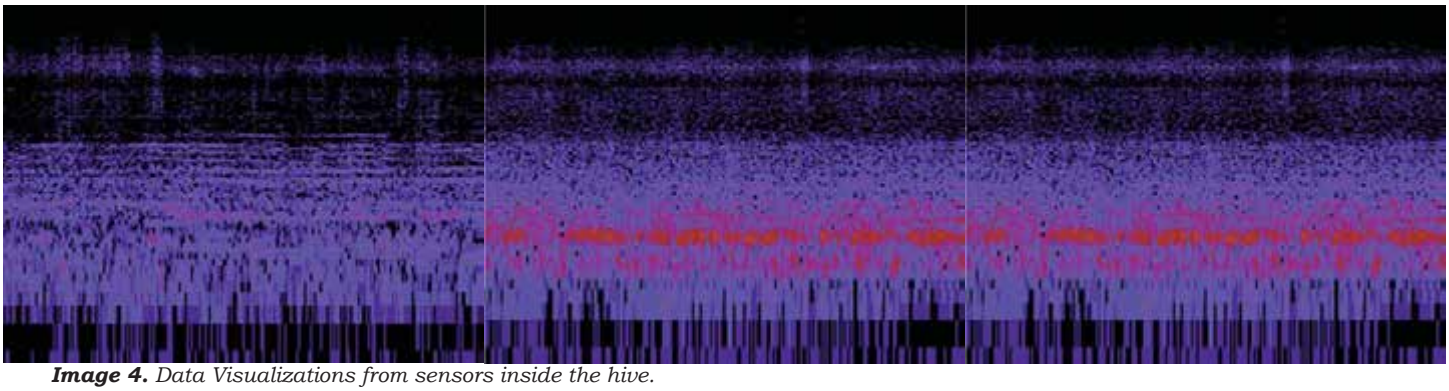

Image 4. *Data Visualizations from sensors inside the hive.*

Easy to Use

BeeHero technology is based on two units that work together to make it very easy to use as shown in Image 6. The first is a low-cost in the hive sensor that is attached to the middle frame of the colony just once. The second is a unit gateway that sits in the bee-yard and collects the data from the in-hive units and uploads the data to the cloud for processing.

The analysis is done by BeeHero and shared with the commercial beekeeper via a Dashboard. The beekeepers get units which they attach to the middle frame of a colony. They claim it requires no changes or modification to the current hives and just takes a few seconds to install. They say it is easy to work with gloves, does not need battery replacements and that no modification needs to be done to the hives.

The technology is based on the in hive sensors alone, so there are no extra parts or apps to manage and it updates automatically when the hives are uploaded to trucks, moved and re-deployed. Together this makes this one of the easiest to use technologies for beekeepers.

Enjoyment

There are multiple ways to enjoy technology. One is from the concept of hedonism, which is about self-enjoyment or pleasure. We often see this in online video games and other indulgences. This is commonly thought of as having fun.

Another way to look at enjoyment is about meaning. In this case, it is less about fun than it is about satisfaction. This often comes from doing something that one believes has a deeper meaning.

In this case, beekeepers are helping to grow more food in the world, helping to feed the hungry by optimizing their pollination. This is in direct alignment with the United Nations Sustainable Development goal #2 to Eliminate Hunger. Knowing that your bees are helping to increase food production beyond the traditional way of pollinating crops by making the effort more precise can provide this kind of satisfaction of knowing you are contributing to the world.

For others, it is also about knowing they did a good job, the best that could be done. Taking pride in your work and excellence which can be measured, quantified and seen on the screen can provide deep satisfaction for some.

For still others, if they choose to share their data and allow it to be combined with other data, even in anonymized form, the act of being a data donor and contributing to the ultimate development of the genius hive can also help the research community improve and develop treatments for the future.

Voice of the Customer

Here are a few few comments from some customers.

"Two months using the system and I saved more than 100 hives, mostly from queen failure."

"Having all this information remotely using just small unit inside the hives is a game changer."

"The installation was super fast and simple, in a day the information started showing up on the dashboard."

"It is clear that a commercial beekeeper was involved in the development process."

Image 5. *Yard Operations*

Image 6. *BeeHero Gateway and InHive Sensors.*

Image 7. *A commercial beeyard with BeeHero Sensors.*

Conclusion

BeeHero is an important step on the path to building a Genius Hive. They are taking a new and innovative approach by focusing on a critical issue for commercial beekeepers and farmers and bringing new skills and technologies to work on the problem. We wish them much luck and success! Stay tuned to BeeHero.io for the latest updates as the product continues to develop.

Finally, special thanks to *Project Apis m.* for supporting the investigation into the role of data science with a *Healthy Hives 2020* grant and to the editors of *Bee Culture* for publishing this work. BC

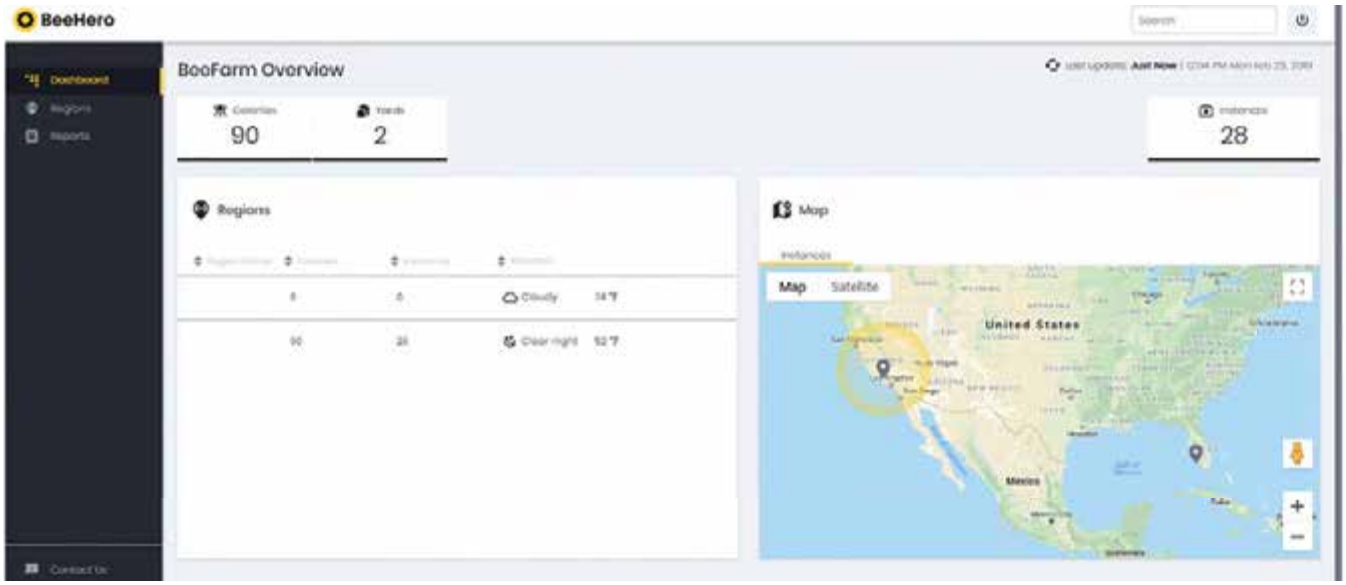

Image 8. *BeeHero Data Form.*

Image 9. *Commercial beeyard.*

Keeping It Real

Eric **Wenger**

Today's consumers care about where their food comes from. When they buy honey, they expect it to be pure and natural. Nothing added and nothing taken away.

At True Source Honey, we do too. The True Source Honey initiative was started by a group of honey packers and honey importers (or suppliers) who believed in honey and keeping it real. Real bees. Real beekeepers. Real honey.

In the six years since True Source Honey launched its certification program, True Source Certified has seen adoption by 16 North American Honey Packers, 79 International Exporters and more than 400 North American beekeepers. Estimates suggest that up to 50 percent of all honey sold at retail in the North American market is packaged by a True Source Certified® packer. So, what is True Source Honey and how does it help the U.S. honey industry?

To answer that question properly we have to crank up the "Wayback Machine" and have a quick history lesson. Most of us can probably remember where this all got started – Chinese honey companies were selling honey into the U.S. market at incredibly low prices and in substantial volumes. This honey (*and here is an important point, this was actually honey at that point in time – probably not the case these days but more on that later*) was often contaminated with antibiotics, even some that are banned for use in food-producing animals. Thanks to the American Honey Producers Association and the Sioux Honey Association, a dumping order was put in place on Chinese honey. If you don't understand how important that event was, take a look at the honey market in Europe these days; In 2015, China held a 49 percent share of the import market in the EU, up from a 7 percent share in 2006. That number dropped to 37 percent by 2017 but still represents a considerable share and exerts a profound impact on the global honey market. Imagine if Chinese imports held a similar share in the U.S. market.

As soon as the dumping order was put in place, Chinese companies started to find ways to work around it. It was in this atmosphere that True Source Honey was originally formed. At that time, U.S. Packers had to make a decision, either they were going to consider the idea of using the cheap circumvented Chinese honey or they were going to take a stand against it, avoid it like the plague and suffer the economic consequences of that decision. Some of the packers that made that decision were faced with a dilemma – how do we educate our customers about what's going on? How can we make them understand that there are companies importing really cheap honey from China but with a claim that it's coming from somewhere else? As an example, in 2010, there were 33 million pounds of "Malaysian honey" imported to the United States, up from 310,000 pounds just four years earlier. To anyone who knows the industry, this is a clear impossibility, but retailers didn't understand this, ingredient buyers didn't understand this and most of them don't have the time to sort through all the competing claims. It was at this point that a small group of packers and their suppliers got together and decided to launch an educational website

One of the exciting new developments is the launch of the "Made with True Source Honey™" logo for use by manufacturers who share in our values.

– True Source Honey. You can visit that website at **www.truesourcehoney.com.** It's got some great information and a complete history of circumvention, indictments and seizures related to Customs and Homeland Security Investigations actions during the past 10 years.

Not long after the launch, we realized that an educational website was not likely to carry much weight with our customers (the big retailers, ingredient manufacturers and largest users of honey). We decided to develop a solution that these companies were familiar with and understood – the 3rd party audit. If you aren't familiar with the food manufacturing industry this may be an unfamiliar term but it's something that retailers and manufacturers rely on to help them manage their risks. A 3rd party audit firm is an independent company that comes in to your packing plant to make sure that you are following good food handling practices and conducting your business in a manner that is satisfactory to your customer, the big retailer. Once the audit is complete, the packing plant is issued a score or a grade and all of their shortcomings are recorded in a report. This report is issued to the retailer and they review it to see if there is any cause for concern. If you fail the audit, you lose the business – so it's a big deal and retailers put a lot of emphasis on these audits.

True Source Honey realized that if we were going to have any success against circumvention as an industry, we needed to follow the same course and develop an audit that looked specifically for circumvention and shady business practices, using that audit as a tool for companies to prove that they were running an honest business. It was the same concept that everyone was already used to, just tailored to detect circumvention. The concept was a big hit with many of the largest retailers; they immediately understood the value of such a program and realized that it gave them a measure of confidence that the honey they were selling on their store shelves was the real deal and had been sourced in accordance with the True Source Certified requirements as described in the following pledge:

We pledge to adhere to the standards of True Source Certification. We pledge to protect our customers and consumers, as well as the global reputation of honey products, by ensuring to our utmost ability that honey:

- ***Is ethically sourced in a transparent and traceable manner from known beekeepers and brokers;***
- ***Moves through the supply chain in full accordance with U.S. law and without circumvention of trade duties; and***
- ***Carries truthful labeling as to its source, has been tested to ensure quality, and has been handled in a safe and secure manner from hive to table.***

So how do these audits work? Well if you want all the specific detail, you can view the complete document at **https://tshmember.com/standards.html**. But here's want a quick overview. Let's take a look.

For honey that is imported to North America, it starts at the overseas exporter. In order to participate, the exporter is prohibited from purchasing honey from outside of their country of operation and they have to prove that all the honey they purchase comes from actual beekeepers with enough hives to produce the amount of honey that the exporter claims to purchase from them. When the 3rd party auditor shows up, he or she reviews all the purchase records and randomly selects at least 10 beekeepers to go and visit. The auditor visits each beekeeper and counts hives and inspects them to make sure they contain a viable colony of bees. The auditor then uses this information to estimate potential honey production and verify that the amount sold to the exporter is a realistic amount based upon colony counts. Back at the exporter's factory, the auditor randomly selects samples and sends them out for both purity testing and pollen analysis for country of origin. If the sample does not contain pollen, the exporter fails the audit and loses their certification. In addition to an annual audit, in countries designated High Risk, an auditor must be present during the loading process for each container that is shipped as True Source Certified honey to North America. The auditor samples the load and submits the sample for country of origin analysis and then seals the load and applies a numbered True Source Certified tamper evident seal to the load. When the shipment arrives in the United States, this seal is verified to be intact. To date, there have been several exporters that have had to forfeit their

certification following a failed audit. This demonstrates that the auditors are doing their job and that the True Source Certified audit is stringent enough to identify genuine problems.

An audit of a North American packer follows a similar process but with an emphasis first on honey that they have imported and then second on their purchases directly from beekeepers. The imported honey must be sourced according to the requirements of the program and the auditors review import records and inspect storage locations, randomly selecting from records and inventory then collecting samples for laboratory analysis. Just as with audits of exporters, the auditor will select beekeeper suppliers to verify volumes of sale. This verification is conducted by both phone call and site visits to confirm the honey is coming from a real beekeeper.

The companies that participate in the True Source Certified program spend a considerable amount of time and money to subject themselves to these inspections in an effort to clearly demonstrate their commitment to honest, ethical and transparent sourcing of honey. We are seeing the benefits of this commitment as the program continues to grow, adding new members from year to year.

One of the exciting new developments is the launch of the "Made with True Source Honey™" logo for use by manufacturers who share in our values. This is an important development as we suspect that a large portion of the suspicious honey that is sold does not actually appear on store shelves but is used as an ingredient in other products. When we see these food manufacturers commit to using only True Source Honey we should celebrate that as a big win for our industry. Although we would like to see them use honey as the only sweetener, and we sometimes get frustrated when honey is at the bottom of the ingredient list, but let's at least recognize when a company makes a commitment to use real honey from real beekeepers in their product.

Last year, several major brands took a stance against honey fraud and adulteration by sourcing 100 percent of the honey used in their products from True Source certified suppliers. Honey Stinger, Droga Chocolates, Unilever's Hellmann's Real Ketchup and a universally known cough syrup were the first brands to earn the Made With True Source Honey™ certification and more products are in the works. If you have a moment, give those companies a call and express your appreciation – better yet give their products a try and tell your friends about them.

As True Source Honey evaluates global trade patterns and practices we are seeing a shift away from direct circumvention of Chinese honey to the sale of purified and manufactured syrups that imitate honey. These syrups can be sold directly into the United States without duty payments or could be commingled with honey prior to export. This is the current focus for True Source Honey – we have already made adjustments to the program requirements to get out ahead of this trend and will make more in the months ahead.

Honey fraud and adulteration undermines the entire honey industry. It undercuts ethical companies and beekeepers, and perhaps most importantly, damages honey's golden reputation. That's why True Source Honey is an initiative that should be supported by everyone in the honey supply chain – including beekeepers.

We ask that North American beekeepers participate in the True Source Certified® registration program. For more information visit **http://www.tshmember.com/northamericanbee.html.**

Join the effort to trace honey from hive to customer, an effort to maintain and protect honey quality. Join us in keeping it real. BC

Eric Wenger is Chairman of True Source Honey and Director of Honey Procurement at Barkman Honey, and Chairperson of the National Honey Board.

Bee Farming In The United Kingdom

From The Beginning To Now, Part 1

Ann **Chilcott**

This is the first article in a three-part series on bee farming in the United Kingdom by Tony Harris N.D.B. (National Diploma in Beekeeping), and Ann Chilcott B.A. (Bachelor of Arts degree). Both authors hold Scottish Expert Beemaster certificates and are freelance tutors and writers living on the Scottish Moray Coast, and in Highland Region respectively. Tony is also a bee farmer and will, in the subsequent articles, discuss from personal experiences the current challenges of bee farming in 21st century UK. I am a hobby beekeeper who has kept bees and produced honey for sale in my village for 14 years.

To understand bee farming in the United Kingdom (UK), it is essential to know how geography and climate influence and limit the success of beekeeping in this country. You may be forgiven for thinking that the UK is a small island with much the same climate and conditions all over. However, it actually comprises many islands; the country of Scotland alone boasts 6,160 miles of coastline and 790 islands of which many are inhabited. Also, the climate varies markedly from north to south and east to west.

The population of the UK is around 67 million spread over England, Scotland, Northern Ireland and Wales. Scotland, where we live, has a population of around five million and is in the northern third of the country separated from England by a 60- mile border. Scotland is about the same size as Colorado or Wisconsin. Our indented northern and western coastlines are swept by the Atlantic Ocean whilst the east coast is lashed by the North Sea, and the south coast by the Irish Sea.

Map showing main UK orchards by Linton Chilcott.

The oceanic climate of the UK is temperate and very changeable and the west coast is greatly influenced by the gulf stream carried by the Atlantic Ocean, so much so that tropical palm trees flourish on Scotland's west coast. However, the east coast is cooler and dryer and more likely to have heavy snowfalls in Winter. At higher altitude, in places like Braemar in Aberdeenshire, it is not unusual to experience very cold temperatures, sometimes down to -27˚C (-17˚F), and 59 days of snow annually compared to less than 10 days in the south and west.

The rainfall in UK is heavier in the west than in the east. For example, on Scotland's west coast the rainfall can exceed 120 inches/3,000 mm annually in some places while in the south of Scotland it can be less than 31 inches/800mm. The UK has milder Winters and cooler and wetter Summers than residents of areas on similar latitudes such as Labrador and the Moscow region, but Scotland experiences lower temperatures generally than the rest of the UK which limits forage crops available to honey bees.

In this climatic context it is easy to understand why honey yields are generally higher in the south of England than in the north and why Scottish bee farmers seeking pollination contracts must mostly head south of the border to the top fruit orchards of Kent, East Suffolk, Gloucestershire, Worcestershire, and Herefordshire. The total area of UK orchards is 17,500 hectares/43,000 acres growing apples, plums, pears, apricots, cherries and even figs as the climate warms. The area of apple orchards is 14,468 hectares/35,750 acres which is approximately the size of the cities of Liverpool in England or Scotland's Aberdeen which are 71 square miles. I believe that this would be about the same size as New York State's city of Rochester, the home of Kodak.

The fertile region of Tayside around Dundee in north east Scotland is an exception having more sunshine, and rainfall on a par with parts of England so this area is renowned for soft fruit growing and the poly tunnelled fields in the carse of Gowrie bear testimony to the success

Poly-tunnels for Soft-fruit Growing Outside Dundee in Tayside, Scotland. Photo by Fred Mollison.

of fruit farming here. Back in colonial times and the heyday of industry, Dundee was famous for jute, jam and journalism. Now the jute mills are silent but the buildings rejuvenated and filled up with restaurants and offices in a city regeneration scheme. Jam and journalism still flourish.

How did we progress to farming bees and honey production in the UK? Well, it is a relatively new agrarian activity compared with bee farming in the U.S. where you folks are ahead of us by around a hundred years. It required a brave beekeeper to make the move from hobbyist to bee farmer and Robert Orlando Beater Manley (1888-1978) was our man. Known to his friends as Bert, and, under his pen name R.O.B Manley, he wrote widely and invented things like the Manley system of frames, adding thymol to prevent mould in sugar syrup, and actually feeding bees sugar over Winter. Manley was the first man in 1948 to manage 1,000 colonies in England though a Mr Gale was another early commercial beekeeper managing many hives around that time.

Manley, a pragmatist, was highly regarded as an authority on bee farming and today his advice still remains relevant. He regarded the hive as the most important tool in the business and at that time in the UK the double-walled, 10-framed WBC hive (designed by, and named after, William Broughton Carr) was the most popular design. These hives are charming but unwieldy.

WBC hive appraisal. Author photo.

The hive types used in UK and Ireland then reflected the hobbyist element to beekeeping however, and Manley looked further afield to the U.S. for the perfect hive. He wanted one with a flat, rather than gabled, roof and no legs or projections to make stacking and transport manageable. Obviously, the hive needed to be sturdy and made of sound timber to keep out the rain, so he advocated the use of the Langstroth, Modified Dadant and British Standard hives to provide more space and meet his needs.

Manley[1] was way ahead of his time in dismissing "the fads and unnecessary trimmings that so delight the hearts of those who want to "keep Bees."" Just take a look at the latest tantalising beekeeping supplies catalogue on either side of the Atlantic today and ask yourself, "do I really need that?" when your eyes rest upon the latest "must have" fancy gizmo and gadget.

Manley's famous quote,[2] "There is a lot of difference between keeping bees and being kept by my bees" resonates soundly today with bee farmers, and Manley recognised, that hobbyists in his time looked for any excuse to disturb the bees, "it is called "Manipulating" them he says[3]. "The poor creatures are to be commenced upon in March and ceaselessly tormented until Winter brings them respite."

His dry sense of humor makes reading his books enjoyable today and I think that you may be amused to know that he didn't like the taste of honey and, according to anecdotal rumor, he coped with honey drips whilst bottling by using his wife's vacuum cleaner when she was out shopping.

Manley worked hard to change the focus on beekeeping away from being purely an amusing hobby to being a professional way of working with bees to produce a marketable commodity. The climate and weather were as challenging then as they are now but Manley ended his 20-year bee farming career wishing that he had started 20 years earlier.

UK Farming has changed markedly since Manley's day with a reduction in clover pastures, wild flower meadows and hedgerows; these have been replaced by large areas of mono-culture crops such as oil seed rape, borage, and field beans. In Scotland, a lot of barley is grown for the whiskey industry so the main mono-floral forage crops for honey bees here are oil seed rape and, if the weather permits, ling heather towards the end of Summer.

Today, our bee farmers are represented by the Bee Farmers' Association (BFA) with a membership of around 470 members managing some 60,000 hives between them amounting to 35-40% of the UK's total hives. Around 30 of these are Scottish farmers. Interestingly, the UK classification of bee farming differs from that of the US based on hive numbers. Bee farming on a large scale in the US is defined by having around 3,000 colonies, whilst in the UK running 150 or more colonies, defines large scale beekeeping.

The criteria for BFA membership are no longer figure-based. Eligibility depends upon demonstrating

that beekeeping is practiced for profit from which income is mainly or partly derived. The applicant needs to be developing or operating a bee farming business, or is employed on, or working on, behalf of a beekeeping-related business or organisation.

You can see how the direction of bee farming in the UK has been shaped by climate and geography and how it is a relatively young endeavour. We expect that bee farming will change further in the near future. The demand for honey has risen and the bee farmers produce only around 15% of the honey consumed here compared with 60% on average for other European countries, so there is much potential for expansion in bee farming. On the other hand, there has been a decline in the number of bee farmers over the last 20 years and a rise in the average age of beekeepers; half the BFA membership is over 65 years. Consequently, the industry is seriously challenged today. In the following articles, Tony Harris will address some of these issues. BC

Speyside Heather Moors. Photo by Tony Harris.

References:

[1,2,3]Manley, R.O.B. 1948. Honey Farming. Faber And Faber LTD, London.

GORMANSTON

Ettamarie **Peterson**

Spend A Week At An Outstanding Beekeeping School

Many years ago I started visiting the Irish Beekeepers' Yahoo List to learn what they were doing "across the pond" as they like to say. I became Internet friends with some of the beekeepers. They were not all from Ireland but many discussed the great Summer course given by the Federation of Irish Beekeepers' Associations at Gormanston. It attracts beekeepers from all over Ireland, North Ireland, the UK and other parts of the world. In 2005 Ireland was the host country for Apimondia. This was my first chance to meet my Internet friends. One of them arranged for a pub lunch during Apimondia so we could actually have a chance to talk to each other in person. It was like finding long lost relatives. We had a great time talking about bees. Most of them were old friends because they attended Gormanston year after year. I longed to go. Having a pumpkin patch that had to open the first of October kept me from going away late in the Summer when the course was held. In 2014 we closed the pumpkin patch. In 2015 I was free to go off to Ireland to join my friends at Gormanston. The final push was when I was asking the Irish Beekeepers' Facebook group many questions about using my newly purchased microscope for looking at pollen samples. The group's microscope expert Ruary Rudd gave me lots of advice but said to learn more I should come to the microscopy classes at Gormanston. He assured me it would be a big help. The summer course turned out to be all I dreamed of and more so I went again the next Summer.

The first time I went my 20-year-old granddaughter Jessie Peterson asked to come with me. She had been one of my 4-H beekeepers and figured it would be a fun way to get to travel to Ireland. We planned a two-week trip, one at Gormanston and the next one visiting parts of Ireland including a day at the famous Galtee Honey Farm where the Mac Giolla Coda Family raises the native Irish Black Bee and produces award winning honey. My son Lew joined us the second week to be our driver, which was great! I had great fears of driving on the left side of road and my navigation skills are horrible. The next summer I was happy to take another granddaughter Kristie Lesmeister. She was brave enough and the right age to drive. We spent one entire day with Eoghan Mac Giolla Coda, son of Micheál Mac Giolla Coda, seeing his apiaries and historical parts around there. Both of the Mac Giolla Codas and Eoghan's sister Aoife Nic Giolla Coda are frequent lecturers at Gormanston on such topics as honey bee diseases, queen breeding and rearing. Micheál is also a certified honey judge.

The campus of the Gormanston Franciscan College boarding school is the perfect place for having a weeklong school for about 400 beekeepers. The Federation of Irish Beekeepers' Associations has been using it for the past 57 years of the 72 years of having the Summer course. It is about 20 miles north of the Dublin Airport. One can use the Drogheda bus and get off at the Huntsman Pub and take a short walk up the street to Gormanston College or splurge on a 20-mile taxi ride to get there. The grounds are spacious, allowing plenty of room for the many beehives and posts for Apideas that are brought in for the week. There are a variety of classrooms and lecture halls. In the entry hall there is a screen that everyone can check to see the day's events, times and places.

Some beekeepers live close enough that they can come any number of days they can get away from their

Some of the hives brought in for the week. Building in the background is called the castle.

Students are being introduced to Apidea and how to fill it.

jobs and go home at night. Most prefer to be boarding students as the cost for room, board and tuition is quite reasonable. The food is served cafeteria style in a large dinning hall with generous servings of a good number of delicious choices at every meal. We made it a habit to sit with different people as often as possible to extend our friendships. There are morning and afternoon tea breaks with coffee, tea, juice and biscuits (their word for cookies). During the week one does not have to have cash nor a credit card for anything except the refundable deposit on the room key unless he or she is shopping in the bookstore or equipment store that are set up for the week.

All week at Gormanston we took various classes learning about Irish beekeeping, diseases and treatments, queen rearing, marketing and honey labeling and of course, microscope techniques. Other courses offered were Importance of Drones, The Small Hive Beetle, The Hive Produce and Medicine, Nosema, "Acarine and Chalk brood a beekeeper's perspective", Winning at the National Honey Show, Nuclei for Beginners, Using the Various Licensed Bee Medicines, Soaps and Lip Balms and many others. Some days it was hard to pick which lecture I wanted to hear but sometimes my choice was repeated at another time so I could fit it in.

There were some new words to learn, as Americans do not call all bee equipment by the same names as the Irish and English. We learned that "crown boards" are what we call "inner covers." Apideas are the Styrofoam mini-nucs used to keep new queens to evaluate their laying abilities. Soft set honey is called creamed honey here. They sell crystallized honey as set honey and liquid honey as runny honey.

The queen rearing class taught me how useful apideas are when you want to be sure your queens are mated and laying nicely before moving them into your colonies. The class was a combination of lecture and hands-on experience. Several beehives are set out on the spacious lawn so the instructors can use them for various courses. In the queen-rearing course our group went out to a colony that provided us with bees to put into the apideas. The instructor taught us how to pull frames of bees, allow the field bees to fly back to the hive and put the nurse bees into a large container where cups of them could be scooped up to put into an Apidea with a new queen. I learned a coffee mug holds about 400 bees, the best amount to stock the Apidea. The queen was put in before the Apidea was secured to a post for mating.

The microscopy class taught me how to look at pollen samples the first year I went. The second year I learned about dissecting bees and looking for diseases. These classes are hands-on, not just lecture. We were taught in a classroom full of Brunel microscopes that were top notch. The instructors were very helpful and so were the other members of the classes.

When you check in you get a Summer course program that has all the classes, locations and times. This booklet is full of information about the courses and workshops and the lecturers. The floor plans were very valuable as the college has many rooms in more than one building. If you get lost or confused there is always someone around happy to assist you. The courses are organized in the program by the levels Beginner/Novice, Senior and workshops. You can attend any that you want regardless of your own level of beekeeping skills. The only exams given are for the people who want to take them. We took the Preliminary exams both written and practical so at the closing ceremony we were awarded certificates. The lecturer exam, intermediate and advanced beekeeper exams are held during the week. The practical part of the exam requires going into an active beehive and demonstrating your hive examination skills.

During the week they have the National Irish Honey show. This show is a completion of honey, photography, wax displays and candles. It is an education just to see all the varieties of honey from the country. The displays are extremely beautiful reflecting the thoughtfulness and competitive spirit of the Irish beekeepers. I was able to enter a photo and won a "commended" award.

Two evenings are set aside for entertaining on campus. Sunday night is a wine and cheese reception where we can welcome each other. This is the place to renew old friendships and make new friends. It almost has the feeling of a family reunion. In the middle of the week there is another evening party called the "Monster Social Evening" with games, music, singing and dancing. Other nights there are classes such as the frame building one we attended. There is a pub down the road that is an easy walk for those who want to go out for a pint and usually

Student taking hive inspection test. This hive is polystyrene.

a spontaneous sing-a-long. We were invited to walk down with some of the Irish beekeepers and were introduced to some charming English beekeepers that go every year.

Michael Gleeson, Summer Course Convenor (**mgglee@eircom.net**) said for Sunday, August 11 to Friday, August 16, 2019 Gormanston "The guest speaker is David Tarpy, Professor of Entomology and the Extension Apiculturist at North Carolina State University. In addition to the usual program of Beginners, Intermediate, Senior and Workshops levels we are adding an additional level this year. We are introducing apitherapy to the course and we're delighted to have the President of the Apimondia standing commission in Apitherapy Dr. Bioch. Cristina Mateescu from Romania to deliver the lectures." He also said that all the rooms would be en-suite. In the past years there were just a few en-suite and most people stayed in dorms so this is very good news. In order to secure a place at Gormanston Beekeeping Summer Course 2019, request a reservation form from **mgglee@eircom.net**. Go to the website to see more as plans are firmed up **gormanston@irishbeekeeping.ie**. When you send in your completed registration you will receive an invoice through PayPal directing you to make a payment. If you decide to go, look for me, a short little old lady having a great time laughing and chatting with my Irish and British beekeeper friends when I am not in a course. BC

Just one of the honey show entries. This category was a display of 12 jars of honey for sale.

L-R My granddaughter Kristie Lesmeister with her certificate showing she passed the preliminary examination in the theory and practice of beekeeping; Colette O'Connell, Honey Queen; the author and Eamon Magee, President of Federation of Irish Beekeepers' Association wearing his chain of office.

Maryann **Frazier**

Good Queens Good Real Estate Good-Bye Mites

As beekeepers we disagree about many things (some would say, most things) regarding how best to keep bees healthy and productive. And even the things we agree on, we often have wildly differing views about. However, I believe, nearly all of us would agree that we want more of our honey bee colonies to survive longer (especially through Winter) and we want them to be able to do this with as little (preferably no) chemical intervention as possible. I'll even go out on a limb here and say that a majority of us believe a key to achieving this objective is dependent on genetics, in other words, the inherited ability of bees to resist or tolerate mites and diseases.

This is possible and has been documented in different honey bee populations around the globe: early work by Walter Rothenbuhler (1964a) and more recent work by Marla Spivak and Gary Rueter (2001) and others in the Spivak lab demonstrated that we can select for hygienic behavior and this can lead to resistance to America foulbrood; Russian bees shown to be *varroa* mite resistant and brought to the U.S. by the USDA are now being propagated here; in South Africa where *Varroa*, first identified in 1997, was identified as a major threat to beekeeping on the African continent (Allsopp, 2004) but by 2006 was considered an "incidental" pest, (Allsopp) and the wild honey bees of the Arnot forest in New York State now considered "persistent" despite *varroa* (Seeley,2005).

So we have solid evidence demonstrating that mite and disease resistance is possible in honey bees. But how to bring this about on a broad scale across a large and varied landscape (the whole of the U.S.) made up of beekeepers keeping bees with countless different reasons for doing so and, again, widely if not wildly, differing views on how this is best done, is where things break down. But given that the genetics of a honey bee colony is totally determined by the queen and the drones she mates with, the selecting and breeding of queens for mite and disease resistance should be totally within our grasp. However it is important to remember that there are actually two components to achieving the queens we desire; genetics (inherited qualities like good honey producer, mite resistance, reduced swarming, etc.) and quality (ability to lay a lot of eggs over a long period of time). And it turns out trying to produce large numbers of high quality queens that have the genetics we desire is very difficult.

The Good Queen

The acquisition of a "good" queen is what all beekeepers have desired for as long as there have been beekeepers. We know them when we see them, not necessarily by how they look but by how their colonies look; the ones with most supers, overflowing with bees when opened, frames of brood solid from top to bottom and side-to-side. But now the "good" queen, the "ideal" queen we dream of, needs to be able to withstand the pressures of mites and diseases. We want queens that are mite resistant and/or "survivors". There have been a number of approaches to acquire these qualities in our queens. One approach advocates for locally reared queens. In the north especially, where winters are long and cold and overwintering losses high, some believe wintering can be improved by using locally reared queens that are perhaps better "adapted" to northern climates

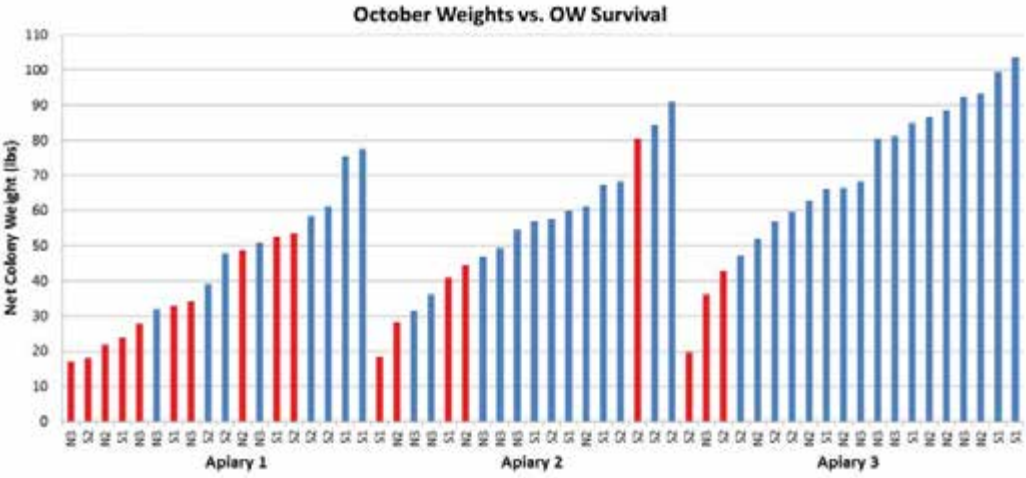

Figure 1. *Each bar represents the October net weight (bees, pollen and honey) of each of fifty-six colonies located in one of three apiaries. The origin of each queen is indicated below (N2 and N3= northern queens from two different breeders, S1 and S2 =southern queens from two different southern breeders. Blue bars designate colonies that were alive in March while red bars indicate colonies that were dead in March. There was no significant difference in overwintering survival in colonies based on queen origin. There was however a significant difference survival based on apiary location with those in Apiary 3 having the highest survival and those in apiary 1 having the lowest survival and apiary 2 was intermediate.*

Figure 2. *There was a significant difference in overwintering survival based on colony weight in the Fall.*

as opposed to queens reared in the south with its short, mild Winters.

Honey bee population structure is interesting. In places where honey bees have existed for thousands of years (think Africa and Europe) subspecies or ecotypes have evolved. These are populations adapted to specific local conditions, for example, *Apis mellifera mellifera*, the dark German bee, *A. m. ligustica*, the yellow Italian bee, *A. m. scuttelata*, the African savannah bee and. *A. m. yemenitica* the East African coastal bee. It is worth noting that as our ability to understand the genetic makeup of organisms improves through the use of molecular techniques, some of these long-designated subspecies are being amalgamated, nevertheless sub-species do exist. But honey bees are, of course, new to the Americas and several sub-species have been introduced here, not to mention, the Africans that have invaded from the south. This, in addition to the fact that we have a highly mobile beekeeping industry; queen and package bee rearing in a few locations and shipping to all corners of the country, migratory movement of colonies for pollination and honey production, etc. makes the existence and maintenance of any kind of population structure very unlikely. Still some have argued that bees reared in a place, albeit a large place "the north" are more likely to survive in the north than bees reared in other places, specifically "the south."

In 2013 we carried out a study to ask the question, "are bees (queens) reared in a northern climate more likely to have higher overwintering success than bees (queens) reared in the south." We used 60 colonies established from packages and nucs (Russian stock used for one of the Northern groups), to compare four different stocks, two northern and two southern. These were equally divided into three apiaries around State College, PA. It is important to note that all four stocks were from reputable queen breeders and selected for some type of *varroa* mite resistance. While we carried out this work over a two-year period with similar results both years, the newly published study (Döke et al. 2018) focuses only on year two of the study. What we found was that, where the stocks originated from did not affect their overwintering survival but what did significantly influence colony size, weight in Fall, and overwintering success was apiary location (Figure 1). Colonies that were heavier in the fall were more likely to survive the Winter (Figure 2). In addition, colony size, weight in Fall and overwintering success are very likely correlated with floral resources around the apiary (Figure 3).

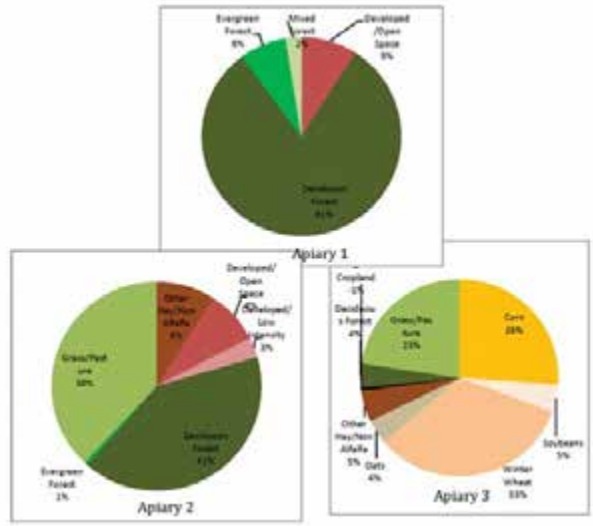

Figure 3. *Landscape designation within a 1.5 mile radius of the three research apiaries. Apiary 3 had the highest overwintering survival and the most diverse landscape (including agricultural crops) surrounding the apiary. Apiary 1 had the lowest survival and the least landscape diversity and apiary 2 was intermediate in overwintering survival and landscape diversity.*

Another similar study conducted by E. MacGragor-Forbes (2014) in Maine did find evidence that colonies headed by locally reared queens did overwintering better those headed by non-locally reared queens. Similar to our study, she used packages, half of which were re-queened with locally reared queens while the other half, used for comparison, were not requeened. But under these circumstances, the observed increase in overwintering survival of the re-queened versus non requeened colonies could have been due to the act of requeening itself, a difference in quality between the locally bred and package queens, local adaptations of northern bred queens, or some combination of these factors.

Package bees; blessing and a curse.

Thanks to the package bee and commercial queen rearing industries we have virtually unlimited access to bees and queens. Other than perhaps dairy farming, I cannot imagine work more demanding than the production of package bees. The relatively recent increase in demand for bees, created by high annual losses and thousands of new beekeepers, has placed tremendous strain on this relatively small industry. As is the case in most industries, maintaining high quality is challenging when demand for quantity skyrockets practically overnight. It is perhaps not surprising that maintaining queen quality in package bees may be a causality of both the decline of honey bees and the new found popularity of beekeeping.

From 2007-2016 our lab at Penn State conducted research on the impacts, particularly, sub-lethal affects, of pesticides on honey bee health. Queen egg-laying was one of many criteria we measured. To do this we caged queens and some young workers on an open frame for 24 hours and then counted the number of eggs laid. We did this prior to and after pesticide applications. In 2011 we installed 25 packages and assessed the egg-laying rates of their queens. Even before applying pesticides, egg-laying rates ranged from 200-800, averaging slightly

And this forage needs to be free of pesticides; no small challenge! For beekeepers in Pennsylvania, Indiana and Illinois, you can now examine the relative forage quality and insecticide toxic load in your landscapes at beescape.org.

over 400 eggs per day. Easy to say, these are not the "good" queens we desire. To address this, in 2012 and 2013 we re-queened all of our packages immediately after installing them with queens from a well-established (southern) queen breeder. Egg-laying rates by these queens, 32 (2012) and 37 (2013), ranged from 185 to 1,500 averaging 1,045 and 137 to 1,684 averaging 1,038, respectively (unpublished data). True, this work was done several years back and we only have one year of data on the packaged bee queens, but queen failure continues to be a problem and is listed among the major reasons for overwintering losses by commercial beekeepers (self-identified, Bee Informed Partnership) many of whom now re-queen on an annual basis. And while there may be several different factors contributing to queen failure, the pressure has not let up on the package bee industry to produce ever-increasing numbers of packages and queens.

So what's a beekeeper to do?

Undoubtedly many of you have your own ideas about this, but I offer my own humble opinion on how we can make progress on improving the health of our own honey bee colonies and the population at large.

Regardless of where your bees live, use the best **quality resistant/survivor queens you can get your hands on,** regardless of where they come from. Support those breeders who are working to develop resistant/survivor stock. Buy local if you can get 'em. This takes some of the pressure off of the large commercial queen rearing outfits and supports local efforts. Who knows, perhaps overtime we can even develop local population structure with bees adapted to local geographic and climatic conditions.

Bees need **good real-estate**. Apiaries need to be located in close proximity to diverse sources of nectar and pollen that is present throughout the foraging season, hopefully punctuated by intense seasonal nectar flows that allow them to make enough honey for themselves and an excess for you. And this forage needs to be **free of pesticides**; no small challenge!

Have a **mite/disease control plan**. Even if that plan is to do "nothing," allowing the mite-susceptible colonies to die and making splits and/or rear queens from the survivors; that's a plan. Albeit a plan that requires ownership of a sufficient number of colonies, ideally located in a number of apiaries in order to have enough survivors to split and/or select from for rearing queens.

On the other hand, buying a few packages or nucs, placing them in your yard that is perhaps surrounded by fields of corn and soybeans, or on your rooftop in a golfing community and taking a hands-off approach to mite and disease management with the objective of simply buying more packages/nucs next year when this year's die off, is not a plan. This approach only counters efforts to establish resistant bee populations by seeding an area with non-resistant genetics. When they die and are robbed out, these colonies are a source of mites for other colonies. In addition, this approach puts undo pressure on package bee and queen producers trying to meet the ever increasing demand for bees.

If we truly want mite resistant and/or survivor bees we must work toward that goal. We can do this by supporting the efforts of those producing high quality, resistant queens, be they local or not. And because we know that using resistant stock alone **currently** is not likely to keep mites from killing colonies, we can assist these colonies by using other cultural methods that fit our management objectives and even treating with soft chemicals.

But treating only when mite levels reach a designated threshold that keep them from killing colonies. The goal is to get to the point where we can rely on resistant stock and cultural controls most of the time. This approach, of course, is called Integrated Pest Management (IPM) and it is applicable across agricultural systems. It does not exclude the use of chemical control but makes chemical control the choice of last resort.

Taking this a step further, some in the scientific community are now suggesting an upgrade to IPM to enhance pollinator protection; **Integrated Pest and Pollinator Management** (Biddinger and Rojotte 2015). IPPM advocates for pest control in cropping systems that also takes into consideration pollinator protection and improving habitat to enhance pollinator populations, especially in crops that are pollinator-dependent. The earnest implementation of IPM in our honey bee colonies and IPPM across agricultural systems can do much to improve the health of our honey bee populations and the environment they, and we, inhabit. BC

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A Yellow Marked Queen

Jean **Hacken**

This true story begins with a healthy observation hive that had a yellow-marked queen.

The observation hive thrived with eggs, larvae, capped brood and honey.

One morning, I received a call from a staff member, "The bees are swarming!" When I arrived at the nature center, most, but not all of the bees had returned to the hive.

On the ground below the outside entrance to the hive, there was a three-foot cluster of bees. "The queen must be in there," I remarked to bystanders. While contemplating rescue options, the cluster got smaller and smaller. I leaned down to see more closely and saw the queen, or . . . what was left of her.

Though she was twitching and moving, I realized that there was only half a queen – the lower half was missing. Not a pretty sight. After 20 minutes, she quit moving and the bees slowly departed.

We scratched our heads and speculated among ourselves why she was cut in half.

The next day, Kenneth Rosenthal, the naturalist from the nature center emailed a photo taken of the queen the previous day with the subject line: "Now I know what happened to the queen."

Post script: At the start of the swarm, we had seen a skink beneath the hive entrance, a*top a two foot-high stone-wall with a bee* in its mouth, and congratulated it for being in the right place at the right time for a meal. At the time, we had no idea that *the bee*, in fact, was THE QUEEN until the following day

During the swarm, the skink had a lot of bees to pick from. Too bad (for us) it just happened to pick the queen. BC

Photos by Kenneth Rosenthal

SUSTAINABLE BEEKEEPING

Never buy bees again. Part 2

A few spring-like days means that beekeepers are peeking in their hives, hoping to find big clusters and heavy boxes. Inevitably, we'll come across a hive that is cold, quiet, and still – a corpse. It always feels bad, even after decades of beekeeping. While it never gets emotionally easier to lose a colony, we can control how financially destructive it is. Last month I introduced three steps to making my operation more sustainable: 1) Accounting for (and being accountable for) my losses, 2) Making up replacement colonies from within my own apiary, and 3) Making my excess bees available to my local community. Last month I described step one. In this article, I'll tackle the specifics of part two – how I make replacement colonies from within my own apiary.

In 2015 I was awarded a farmer rancher grant through the USDA Sustainable Agriculture Research Education (SARE) program (FNC15-1005-" Improving apiary sustainability by using an overwintered nuc system for colony replacement and expansion instead of purchased package bees"). My goal was to find a method of colony replacement that doesn't require high labor or cost, and doesn't cut into honey production. With this grant, I looked at methods of splitting my colonies in the late season and overwintering nucs. While my original goal was to have a few colonies on hand to replace dead outs in the Spring and allow me to expand my operation without buying bees, I found that making small colonies in the late Summer had other advantages as well. First, it was a good system for stock improvement. By the end of the main honey flow, I already had a sense of what colonies I liked, and which ones were not ideal. I could replace the queens in colonies that were hot, unhygienic, or had disease issues. I would be removing the genetics I didn't like every year, and increasing the number of hives with good queens. Over time, I am improving the overall quality of my bees; every year, I come out of the winter with young queens of ideal stock.

Secondly, the timing of this approach is incredibly useful for *Varroa* control. I can make a split with a queen cell, which provides a brood break in the late Summer. If I couple this with an oxalic acid dribble, these colonies would be nearly free from *Varroa* right before my precious Winter bees are made.

Late-season nuc making is now part of my yearly beekeeping plan. I have only been playing with it for about five years, so I'm still working out what system works best for me. Below I'll explain what I have learned so far. You will need to work out the timing and the equipment to fit your climate and your needs.

Timing

The goal is to find a window where you won't be sacrificing all of your honey production from your big colonies, yet the new queen can become established before you need your winter bees. For me, in southern Michigan, this target period is usually from Mid-July through August.

- I have a very strong honey flow early, and then it slows down in Mid-July. I can have a substantial secondary honey flow about the first week of September, but in the last few years this has become unreliable. Right now, I'm leaving my hives big to capture the early honey, I'll extract and split, aiming to have all the queens in the splits in order before the secondary honey flow starts.
- I don't have a strong dearth in my area, so robbing isn't a huge concern. If you have a strong dearth, then breaking down your colonies at this time could be devastating. I've talked to others who make nucs in areas with a dearth, and they try to time their splits at the end of the honey flow, when nectar is still coming in. Still others will use a screened tent or structure to make the nucs to prevent robbing.
- Another consideration on timing is how you plan to manage mites in the Fall. If you are using queen cells for your nucs, you get a break in the brood cycle and can treat with oxalic acid. If you are using mated queens, you won't get a brood break, so it might be good to use a treatment like formic acid on the larger hives before you break them down.

Equipment

Many beekeepers think of nucs as colonies in five-frame boxes, but there isn't a standard. A nuc is just a smaller colony; it can be in a 10-frame box, a three-frame box, etc. In the Winter of 2015/2016, I compared multiple equipment styles.

- Double deeps: two eight-frame colonies in the same volume of a double deep hive. The bottom deep is divided into two four-frame compartments, each with a four-frame box above.
- Full hives: prepared for winter in standard fashion.
- Four-frame towers: similar in dimension as the double deeps, but stacked according to need – two deeps, or a deep and a medium, or three mediums.
- Single deeps: standard 10-frame equipment, with the edges filled with foundation or drawn comb. A spacer with an upper entrance was added under the inner cover.
- Polystyrene nucs: insulated five-frame nuc boxes.

In year one of the SARE grant, I overwintered 86 colonies in five different styles of equipment: full size hives (n=8), single 10-frame deep boxes (n=15), double side-by-side deep boxes (n=12), four-frame towers (n=38), and Polystyrene five-frame nuc boxes (n=11). The nucs were started within two weeks from the end of July through the beginning of August, with most made the first week of August. They were made with five frames of bees, two to three brood frames and had queen cells from the same mother queen.

In year one, I had better survival in my nucs than my full hives with their old queens. The greatest survival was in the single deep hives (87%), followed closely by the Polystyrene nucs (82%). The double deeps, four-frame towers, and full sized hives had similar rates (67%, 68%, and 63%, respectively.) I felt that the equipment with lower survival was not because it was worse, but was because I wasn't using it correctly - the differences were more of a function of using the wrong methods for that equipment rather than a flaw in the equipment itself. In year two, and in the years since the SARE grant, I have worked to optimize each type of equipment to fit into my operation. Some work well for replacement colonies, some provide support for queen rearing, and some provide nucs for sale. I found that a single story nuc (five-frame Polystyrene nuc or single deep) was good for replacements, while the vertical colonies were good for small colonies that support nuc sales and queen rearing.

1. Making replacement colonies

In the beginning of July, I make my replacement 'packages' using five-frame polystyrene nuc boxes. From each large colony, I pull two frames of brood and a frame of food and put into a polystyrene nuc with a frame of foundation and a frame of drawn comb. The next day I add a queen cell. I'll check the queens, and will restart those that don't return from mating flights. I let the nucs build the rest of the season. In the spring, I just load them into the flat bed when I do my first inspections, and can put the bees right into full size equipment if I find a dead-out. If I have extra, I can sell them as five-frame overwintered nucs.

There are other ways to make up your replacement colonies. Beekeepers who purchase a package, for example, could make a small nuc with the package queen, and either let the big colony raise a queen, or introduce a local queen. That way they have a new queen in their producing hive, and a back-up for every colony, just in case! You don't have to use any specialized equipment for these options- the Polystyrene nucs are light and easy to move, which is why I use them, but the bees would be just fine in a single deep or two medium boxes.

2. Splitting my big hives

If I extract at the end of July, I can break down my big colonies into multiple single story hives. After I pull honey, I go through each hive, and set up each box to have the equivalent of a nuc, with the old queen on the bottom level. When I'm ready to split, I leave the old queen in the original location, and take one or two splits, giving them queen cells/new queens and overwintering them each as a single deep box. I don't have to do all my hives this way, (I may want to leave some if I think that I can make more honey from a later honey flow), but I found that I can usually overwinter two to three times the number of colonies. This gives me a huge buffer – if I had a bad year with over 50% loss, I won't be that far behind in spring. If I make them up earlier, and I think there will be

Testing different methods of overwintered nucs for the SARE grant.

enough nectar, I can make them smaller. If it is later, then I'll make them a little larger than a five-frame nuc. Using 10-frame equipment rather than a five-frame nuc box allows for four big advantages:

1) You don't have to buy special equipment
2) The bees have more space – good for honey in the fall and growth in the spring
3) You don't have to move the bees in and out of different equipment.
4) They are easy to feed. The cluster is right on the top, so you can always access them with a winter feed patty or sugar block.

Double deep nucs in Winter.

3. Perpetual nuc and brood makers

The two equipment styles that have vertical brood nests (four-frame towers and double deeps) don't work as well for replacement colonies, because they are hard to transport, and hard to move bees in and out of. However, they are great for beekeepers who raise queens, or want to make nucs for sale. I initially started them in early July with two frames of brood and a frame of food and a queen cell. They built up to the second box by winter (in some I added honey frames). In the Spring, after they have built a little, I will sell a nuc with the over wintered queen in it, and put another queen cell in the hive (May). Once she is mated, I'll sell another five-frame nuc from that hive, and put in a second queen cell (June). This queen will then be used to build up for the Winter. When this system works, I can sell two nucs from each tower of bees. I also use the vertical systems to support other nucs, act as mating nucs for queen sales, and to provide brood for the queen rearing operation. I will basically keep these as a separate, nuc-based operation, but can use them for replacements if needed.

Like most of beekeeping, equipment choice for nucs has a lot more to do with management preference than it does biology. The choice of equipment is largely based on my end goal (nuc for sale or replacement colony that would go in full equipment), and timing (did I want to split a hive later, or make a new colony that would grow to fill its equipment?) The same is true for the choice of queen. You can use a cell, virgin, or mated queen for your nucs. Nucs made at the early end (July) get cells; they are much cheaper, and give me a break in the brood cycle. The downside is the inevitable loss of a few nucs to unsuccessful returns from mating, but those nucs may be easily recombined. Mated queens are utilized in later late-season splits because I don't want to interfere with the production of winter bees. Remember, a nuc is just a small colony with all essentials of brood, food, and bees. You can get these components by making a very small colony, and letting it grow, or breaking down existing colonies into ready-to-Winter splits. However you make them, you have to remember that they are small, and won't produce a lot of food or a lot of bees. You may have to keep them in a more sheltered location, and really make sure they have enough food.

Step-by-step replacement colonies:
Option 1 – Improving existing queens

1. Set up an extra 'nuc' hive (single hive body or nuc box).
2. Go through your hive slowly until you find the old queen.
3. Move that old queen into the nuc hive.
4. Fill out the nuc hive with the queen with two to three frames of brood and one or two frames of food, and at least one frame to grow. Adjust accordingly to account for the season and anticipated growth – make them larger if it is later.
5. If you like the original hive, you can let them raise their own queen (remember, if it doesn't work, you can put the original queen back, and you have lost nothing). If you want new genetics, add a queen cell (if it is early enough that she has enough drones to mate with and there's time to raise young), or you add a mated queen from stock you like.
6. Manage and monitor both colonies for *Varroa*.
7. Feed them in the Fall.
8. Make sure they are in a well-sheltered or insulated location.
9. Watch them closely in the spring to make sure they don't go through food stores.
10. Plan for their rapid expansion come Spring; overwintered nucs grow fast!

Option 2 – Splitting an existing hive for expansion and *Varroa* control

1. Allow your colonies to grow into two or three deep boxes and whatever honey supers they need over the Summer.
2. In late Summer, remove the honey supers for extraction.
3. Break down the colony by distributing, rearranging or adding to each of the three boxes so each box can be a standalone colony. Put frames of food on the outside, and brood in the middle making sure all capped brood is in the top boxes. In the final arrangement, the queen will be in the bottom box with two frames of uncapped brood, some food and some space. Potential splits will be above a queen excluder.
4. Shake all the bees from all the frames into the bottom box, putting the frames back into the new arrangement.
5. Add a queen excluder to the top of the bottom box, and restack the

colony. At this point you should have three boxes with food on the outside, and brood in the middle, with no capped brood in the bottom box. The bees will spread themselves over the brood, and the queen will be in the bottom box.

6. Return early the next morning with two bottom boards and two lids per hive. Before the bees are flying take the top two boxes off, giving them each a bottom board and a lid, and move each to a new location.
7. The following day, provide each of the new colonies with a queen cell, and treat the original colony with oxalic acid.
8. Once the new colonies are queenright, treat with oxalic acid.
9. Feed as needed and manage as appropriate for your area.

Option 3 – Making up some replacement nucs

1. Get a five-frame nuc box (wood if you are in a not harsh Winter, or Polystyrene if you are.)
2. In early July, put one frame of brood and one frame of food (covered with bees) into the nuc, filling out the rest with drawn comb and foundation.
3. The following day, add a queen or queen cell.
4. Allow to grow, feeding as needed.
5. In spring, use to replace existing colonies.

All three options increase the number of colonies you have going into Winter, and increase the number of colonies that have young queens that you like. In all cases where I was making up nucs throughout the season, I overwintered a lot more colonies, and did not have to purchase bees to make up losses. BC

An Unusual Beeyard Dilemma

High winds – yet another unexpected apiary oddity.

High winds were predicted

I have spoken of this phenomenon in past articles. No doubt some of you who are reading my opening comments here have an individual weather station and are weather predicters yourselves or maybe you are even a professional meteorologist.

Even so, in my years of reading weather predictions and preparing for subsequent occurrences, it appears to me that many predictions for meaningful weather are normally over the mark. For instance, here in northeast Ohio, if twelve inches of snow is predicted, I would personally expect it to snow about three to eight inches. It appears to me that the same prediction technique is used for serious rain, extreme cold, and high heat. After the weather has passed and the effects were under the mark, television people commonly say, *"We dodged a bullet!"* Well, maybe. Or maybe the shot was never fired.

Before trained weather predictors attack me, I should say that I have no science and no data that support my notion. In many ways, if I am correct, over-predicting would be a logical thing to do. I mean who wants to be professionally responsible for people buried in snow or washed from the planet due to an under-predicted rain storm. Better to be over prepared than insufficiently prepared. That's true, but this procedure (if it exists) is a bit like crying wolf. I become more comfortable with my complacency. A few weeks ago, high, dangerous straight-line winds were predicted. In different ways, much of the country was to be affected by this large storm system. Yep. I've got it. Big storm coming! Right! I mean really, what could I do?[1]

My complacency was sorely misplaced. I was wrong. Everything predicted – and more- came raging through my area. In retrospect, to prepare, I could have put my trash cans inside. I could have secured the large lids on my outdoor storage boxes. I could have secured my pile of empty flower pots. But I could have done nothing about the two large Blue Spruces[2] that came down in my beeyard, crushing a nearby apple tree that my bees frequently use when swarming. I could not prepare for this event, and I did not see it coming. Professional predictors were spot-on.

Nothing was damaged

Other than my trees, nothing was damaged. While empty equipment blew everywhere, my bee colonies remained standing. My barricade fence was undamaged. My out-buildings were untouched. But everything else that could blow in my yard did blow. Luckily, several much larger Norway Spruces withstood the storm. If those trees had come down, my yard would have been much more damaged, and my problems would have been much greater.

I suppose I was lucky, but since my property was undamaged, my home owner insurance policy was not in effect. The upcoming expense was to be all mine. For me, the expense was not insignificant. I had no way to factor in the expense of tree removal in my bee budget. Some changes will need to be made in my bee life plans.

Unique factors and conditions

I had no experience in finding a tree removal service that could remove these trees with active beehives just a few yards away. (I now have purchased a lot of experience.) The frozen ground, when thawed would be a mud mess. The size of the removal equipment needed would destroy my yard and leave deep trenches in the access pathway running near my yard. Even more challenging, a wide, but shallow ditch separated the trees from the access lane.

The tree removal company that I hired was sympathetic to my unique needs. While the ground was frozen, I was bumped to the front of their job list. In two days, the trees were limbed and the trunks were cut to manageable sizes and hauled away. Large, loud chippers were on the job.

[1]This footnote is personal. I have a healthy fear/respect for strong wind storms. In 2010, a small, but intense tornado came across the OSU branch campus where my bee lab was. The large storage barn that was filled with sixty years of old and modern bee equipment was annihilated. The storage facility and the equipment it contained were 90% destroyed. The remaining 10% was mostly useless. That event was the beginning of me accepting the concept of retirement from Ohio State. While recently visiting my ancestral home state, Alabama, my wife and I drove through Wetumka, Alabama, after a serious tornado had passed a few days earlier. Part of the town was a wreck. Then even more recently, a vicious tornado ripped through rural communities south of Auburn University. Twenty-three people died. While I may bluster about weather predictions, I have a great respect for wind and sympathy for those whose lives were forever changed by wind storms.

[2]I didn't know this fact. Out of their home range, Blue Spruces in Ohio only live about forty years. Mine were 42 years old. They suffer from various diseases that limit their lifespan. While it takes years, these trees slowly die from the bottom up. One way or the other, my trees were going to have to be taken out. If they had to come down, I suspect my trees came down at the best time of the year.

One Tew Bee, LLC

Large amounts of chips and significant amounts of my money were flying everywhere. Finally, only the large, partially buried, insanely heavy, root systems remained.

The weather warmed. Normally, blue skies and gentle warm winds are a relief for my neighbors, but not for me. The top three inches of the ground thawed. The bees began cleansing flights. At the work site, comments and jokes were common. The bees were in no way aggressive, but the workers were still leery. I was, too. A huge, muscle-bound all-wheel drive truck having a powerful front winch was brought to the site. From about 35 yards away, the stumps were pulled from the ground and down the ditch to a point where they could be loaded from a chip/seal paved area beside my house.

A cleanup crew put landscape Band-Aids on the remaining muddy sore spots and stump holes were filled with soil. The end was in sight. But not for me. I will have to clean/clear my yard while working in water logged Ohio clay. No doubt I will make photos and movies for you. Then the fencing work begins.

Truck pulling stumps from the apiary edge.

Now, the fencing project begins

I don't know why. I'm sure; it's just me, but I like privacy in my beeyard. I tinker. I work. I use smokers. I wear strange clothes. I take photos. I shoot video. I do not want an audience for any of this. Indeed, it is a rare occurrence when I invite you to my yard. It's just me.

Now, all my activities are exposed to the non-bee world. My barriers are gone. I will have to purchase more fencing or wait until I am 112 years old for replacement Spruces to reach full height. Is all of this over yet? No. All that fencing will require protective exterior coatings. I didn't see all of this coming. It was not in any of my beeyard future plans. Know this. In some way, I will recover and redesign my yard and its layout. It's just bee life. You know that I will keep you informed.

An update on (very) late season swarms of last season

I wrote articles about them. I composed slide decks on the subject. I have thought about them at length. Why do some swarms issue so late in the season? Last season, during late September, I had three large swarms leave. Two "pitched" in the apple tree that was badly damaged by the falling Spruce trees. Another landed near the ground on a bush. I mean these were three to four-pound swarms. As I said in my earlier article, working to hive these swarms was probably a waste of time and valuable food resources. What was I to do? Just leave them there? Obviously, no. I had to try.

One swarm suffered this fate

After considerable work to hive it, one of the swarms was immediately robbed by surrounding powerful colonies. There was a nectar dearth starting and unemployed foragers were abundant. When I tried to feed this oddly late swarm, I soon had hundreds of robbers doing their thing. Robbing behavior is maniacal. Robber bees are simply unreasonable. They will ***not*** be deterred.

In past articles, I subsequently wrote about robbing behavior and about this specific robbing event. I could not save this particular swarm. It was killed by its bee neighbors for just three quarts of sugar syrup. I would strongly suggest that a late season swarm should be moved to a distant location far away from bee neighbors.

Yet another swarm suffered this fate

One of the other swarms died during the Winter. Because it was a large swarm with little time for significant late season Winter bee production, the population waned rapidly *(I guess that that was the reason.)* This colony's death was unremarkable. I gave this colony a super of honey that I was holding, but I specifically did not take honey from established colonies in order not to jeopardize them, too. You may wonder why I did not try to feed dry sugar or some other emergency feeding technique throughout the Winter? I can only say that such an effort would require a considerable amount of work and resources to Winter a weak colony with a poor chance of survival. However, it is still disheartening to see a colony be Winter-killed for making a serious biological error.

The third swarm is still alive – barely

I also gave the last colony a full medium depth super of honey. Confusingly, this was actually the second swarm to be hived. For writing purposes and since it is still alive, I have discussed it last. For whatever reason, at the time of hiving this second swarm, robbing was not as bad as it was a week later when I hived the last swarm.

Bees feeding on late Winter dry sugar.

I put these three late season swarms in another part of my small apiary, but still near my established colonies. Ironically, I suspected this second swarm of being part of the robbing problem that caused the last swarm to be robbed to death. These late season swarm colonies were all immediate neighbors.

Feeding the surviving swarm colony

Winter survival feeding is always a last-ditch desperation procedure. It is always better to adequately prepare colonies, in the Fall, with enough stores for the great dearth season – warm or cold climates.

Survival feeding differs from stimulative feeding. Survival feeding is an effort to keep a colony alive until spring resources are available. Stimulative feeding is offered to a late winter season colony to entice it to develop more brood using the stored resources available to it. Wintering colonies like this are not in danger of starving.

Feeding dry sugar to a needy late Winter colony

I tell you all of this because I decided to try to help this last late season swarm. I must write that I have never had great luck with winter-feeding procedures, but there is one dry sugar technique that works reasonably well. I have no idea who first developed the procedure.

It is not my intention here to fully elaborate on the procedure, but the fundamentals are:

1. Quietly remove the upper equipment until the top of the wintering cluster is exposed.
2. Lay a sheet of newspaper over the wintering cluster.
3. Place an empty hive box atop the newspaper.
4. Pour about a pound of granulated sugar on top of the newspaper.
5. Wet the sugar, but don't soak it. Many beekeepers use a spray bottle atomizer.
6. Punch five or six holes (pencil-sized) through the dampened sugar to expose sugar to the wintering cluster. Bees will enlarge the punctures, eat the sugar, and eventually remove the paper.
7. Though not required, I place a layer of newspaper on top of the dampened sugar and then I place a towel or other heavy cloth on top of that. Beekeepers of yore called this heavy cloth a "quilt". They were advertised in bee catalogs.
8. Good luck. You and your bees will need it.

Normally, as the spring season nears, I will also place a small piece of pollen substitute along with the sugar. I hope this helps, but I have no proof that it does.

My personal opinion

My evolving opinion of late season swarms is to hive them – if practical – rather than just abandon them. Don't disrupt other late season established colonies by pilfering their honey stores. Move these out-of-sync colonies to another yard (which will most likely make consistent survival feeding even more inconvenient). Install mouse guards. Then wish them good luck.

Expecting them to die is not an unreasonable beekeeper assumption, but if they don't, you have yet another Spring colony. If she is still present, the queen of that colony still carries the late season swarm behavior in her make-up. Mysteriously, other behaviors could be involved that caused the late swarm to issue. Why these late swarms leave remains unclear.

Hey, beekeepers . . .

All that I have discussed here – trees falling, building fences, late swarms, colonies dying, feeding hungry colonies, tinkering with bees, worrying about bees – it's all just beekeeping. Be challenged. Be fulfilled. If possible, enjoy it.

I have spent all of my adult life working with bees in one fashion or another. I'm not always sure what I'm doing, but I still love trying. I hope you feel the same, too. Thank you for reading this piece. 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/3zzoiKMIRgU**

Jim's Question for you: My apiary was heavily shaded. That has all changed. Will this be a good or bad new feature of my home apiary? Presently, I don't know.

A video chat

https://youtu.be/3zzoiKMIRgU

Understanding Honey Bee Removals And Cut-Outs Part 2

Albert **Chubak**

Preparing for a Cut-Out
What Tools are needed for Bee Removal

Plan for the removal. Do not just wing it. Bring a contract with disclaimers ready to sign.

Thermal imaging device is handy in locating the colony but renting is initially cheaper than an outright purchase.

Required tools list:

1.Hammer.
2. Sawzall with masonry, drywall and wood blades. A hand drywall saw. Drywall 5-in-one is very handy.
3. Drill with 2" and 3" screws. At least one 2x4 plank.
4. Prybars.
5. A bee-vac
6. Hive tool.
7. Flashlight.
8. Garbage bags and a few five-gallon buckets.
9. Bee suit and gloves.
10. Silicone gun, silicone and a tube of roofing sealant which is tar.
11. A batt of steel wool.
12. Rubber spray sealant normally used for evaporation coolers.
13. Beehive with suitable frames.
14. Elastic bands.
15. A white large sheet.
16. A razor knife.
17. Duct tape. A 1-foot square piece of tin with 1-inch nails.
18. Blue painters tape and a roll of painter's plastic.
19. A camera!

How to assess and remove the feral colony

Learn first from the property owner all you can about the history of the cavity in question, especially how long bees have been there and if they saw a swarm enter or leave. An inspection of where the bees are entering is vital. On a non-rainy day with temperatures above 40° there should be activity. Watch for pollen on the legs of the bees. If no pollen is being carried in then no brood is being cared for, showing these bees may be scouts or robbers. Scouts are looking for a home, robbers are cleaning out a home. Determining how to access the cavity, is not just a free for all. A device that can help determine initially is a thermal imagining device. These can be rented from lumber stores or a rental store per ½ day or full day with minimal charge. Realize there has to be a cavity big enough for a colony of bees, use a beehive as a frame of reference.

Some feral colonies can't be saved

Sometimes the bees chose an area that can't be accessed due to safety concerns, risks, potential damage and repair costs, and so forth. Each property owner will have a different estimate of what they can afford. Home insurance does not cover insect infestation.

How to remove bees without physically removing them

An effective trick in removing a colony during the Summer months is mimicking a failing colony.

A few keys to understanding a failing/failed colony exist with common characteristics:

1) A strong healthy colony will not permit or tolerate leaking honey.

2) Bees are quite social insects and they visit nearby colonies daily looking for access to already stored and harvested resources.

3) All hives have wax moth but healthy ones keep it controlled.

4) Honey bees have a difficult time locating items by flight within 15 feet of their hive.

With these keys any colony can be forced to vacate. Acquire honey, preferably buckwheat or any honey with a good smell to it. Smear this honey all around the entrance or within five feet of the hive during the late morning or early afternoon. Can also devise a container or humming bird feeder to supply bait for a longer period. Stand back and watch the activity begin. Within an hour or so on a hot day, visitors will arrive feast-

ing on the "Costco SAMPLES/FREE honey." These bees will return home and will waggle their family this great spot and more will return. As this robbing frenzy begins the original colony will initially try to defend the attacks but each day you will return early to bait the entrance area. As the robbing increases and the bait is dried up the defending colony will eventually abscond as a defensive survival behavior. The efforts in defending caused a lapse in forage for water to supply humidity for their incubating young, as well as further nectar and pollen which are essential for life. Once the original colony has absconded an army of bees will converge on this hive. This frenzy will continue until all spoils are removed. When the activity of the robbers has ended, seal up the access to this cavity and let the wax moth have an open door to expand and consume all the wax left in the cavity. The empty comb will eventually be replaced with a cob-web type material and cocoons. Job is done and no pesticides were used.

What to do at a removal – saving the comb and bees

Finally, a green light has been given and the established colony has been located in a specific cavity. A "Plan of Removal" should be given and signed off on by the property owner. Ultimately the goal is to remove the bees and their by-products with the least amount of damage possible AND have everything back together. If you take it apart, plan on putting it back together or have a plan in place to have it done. Many property owners will neglect restoration.

Removals are effectively done just prior to dusk as this prevents bees from **playing the game of "into the vac" "into the hive" "back to the cavity" game**. During the removal of the drawn wax, the goal is to harvest all honey into clean buckets and place open and capped brood into frames (mini frames are ideal for this and are made by Eco Bee Box) with elastic bands. As the comb is being removed bees can be brushed into the new hive with the saved brood or vacuumed up and dumped in as soon as possible. Try NOT to suck up open cells of nectar as this splashes the bees in the vacuum and can kill them in a very short time. If the queen is killed in the removal the nurse bees with the open brood and hatching nurse bees will prepare young larvae and cells by generating a new queen. In three to five days there is either eggs in this new relocated hive or queen cells start appearing.

Setting up swarm traps near a feral colony that cannot be removed

Feral colonies exist among us but we rarely notice them until they swarm or we specifically look for them. A floor removal consisting of 120 lbs of honey resided directly beneath the floor of a master bedroom matrimonial bed and home-owners believed the bees just arrived. Further inspection showed an immense brood chamber and virtually years of stores.

A swarm trap is a box placed with the intention of luring a relocating colony. These bait hives can be seeded or baited with lemongrass, or swarm lure containing pheromones similar to a queen, and at least a portion of the darkest empty drawn comb that can be found. This dark empty comb emits scents mimicking this was an established hive. In Spring when blossoms are abundant robbing among bees is low as bees prefer fresh nectar over stored honey. Nectar is for build-up whereas honey is for survival during times of famine. Baiting with food induces robbing and bees rarely move into a location where they have to initially defend.

Placing a swarm trap near established feral colonies as well as apiaries with boxed colonies can yield swarms and absconding colonies.

A Challenging Situation

Signs can be confusing or even mis-read by some. A cabin was leaking a black sticky substance from between cedar tongue-and-groove boards requiring a costly clean-out. Things are not what they always first appear. Seek first to locate the colony's entrance as it should have debris and dried out bees as well as discoloration.

Discoloration may be due to disease, pollen, propolis and even wear. Next challenge is to locate a cavity that could have been suitable for a colony to live in. Remember, bees seldom compete with insulation and need to regulate their environment on many levels. A bee's cluster and comb is usually close to their entrance. If the hive is leaking, this is a sign of a failed or failing colony.

A recent inspection of a potential cut-out showed a black sweet substance dripping from an interior window header (above the window). The complaint was **"honey bees must have been in my cabin but I don't see any activity now."** Cabins may not have insulation in ceiling or walls and may have a colony for years without even being noticed. A drive to perform the clean-out was taken with a plan of removing shingles instead of removing the clean cedar tongue-and-grove ceiling boards. There was no visible entrance for the bees, no dead, and the ceiling and walls were heavily insulated and externally clean. A taste revealed a sweet watery substance that was black similar to what has been seen prior in other honey bee situations. A review of the ceiling showed this cabin had sprinklers installed which have watery antifreeze in the lines to prevent freezing. Honey would have been sweet, sticky and thick, whereas this was watery sweet and slightly greasy. This cut-out mimicked a failed feral bee infestation but was a false insect alarm that could have generated an immense amount of damage by a novice beekeeper and inexperienced removal technician. Insect and rodent infestations are rarely included in a homeowner's insurance but leaking water pipes are.

What the Feral Colony Teaches
A Beehive is Nature's Pantry for Insects, Rodents, and People Wanting a Part

In the world of a bee their home is a place of constant battles. These battles have nothing to do with fertile land, better view, access to waterways, and historical significance. It is all because they did a good job doing what they do. They took a place that is usually barren or in decay and have transformed it into a pantry with liquid honey (carbohydrates) bee bread (pollen) and wax (essentially bee fat). These essential items to a bee are sought after by ground crawlers, flying critters, rodents, animals and people. A colony has an innate need to clean and fill a cavity then split to start again. It is a never-ending cycle. In the growth of a colony a need is developed to defend resources, naturally this comes in late Summer into Fall when resources/forage is scarce.

What bees tell you when they're entering and exiting a beehive

Many signs are displayed by bees at their entrance, without opening their hive.

- If pollen is going in, it is an active colony.
- If no pollen is going in, it may not have a queen or could be in the process of being robbed, or scouts.
- Defensive behavior/aggression shows problems in the hive such as being honey-bound, not queen right, it is being robbed, lack of access to resources such as water, nectar, pollen.
- Bearding can show over-crowding, preparations for swarming, and is a sign of a colony showing its colors so-to-speak or like a sports team showing off their banners.
- Bees discard their dead in varying degrees out front of their hive, sometimes inches other times yards away. This discarded waste can detail signs of disease and problems with colony production.
- Signs on the exterior of the hive can show typical cleansing marks, or excessive brown marks could be signs of disease. Old hive entrances can be dark brown with years of varying issues.
- Honey leaking from any hive shows a successful colony has failed and is being robbed.

What bees need for a living environment

Bees need to be able to control their environment – protection from attacks, regulate temperature, and regulate humidity. Bees seek to disinfect their living quarters with propolis and may recoat it repeatedly to the point it looks black. Too many access points make it difficult to defend. A complicated space may lose bees as scouts' venture and explore and get lost in the process. Access in and out needs to be simple. This space needs to hold in heat, remain humid during Spring to Fall, and ideally is dry during the Winter months – it is an incubator, anything that wreaks havoc to that goal is not ideal.

What every Feral Colony Needs - water

Of thousands of removals one thing was 100% universal, close access to a water source. Bees can fly two to three miles for forage but when their colony is overheating water is needed fast. Access to water is the most vital daily need especially if their hive is in full sun. Once a water source is initially found in spring, they become loyal to it. Trying to change a colony's water source during the season is like trying to change a child's favorite cartoon. When the temperature is hot bees fly shorter distances. According to Arnia, at 50% humidity inside the hive no eggs will hatch. At 110°F bees will stop flying, and at 120°F the bees will die.

What happens when a removal is not properly performed

When a removal is performed, all areas next to the cavity need to be inspected. Little access points through wiring holds, spaces between drywall and studs, poorly fitted joints provide access to expansion spaces. When removing a colony, it is important to identify the en-

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tire brood chamber. The brood chamber is surrounded by honey – so if honey is all that was removed a brood chamber was missed. If the brood chamber is next to a joist or opening, additional areas need to be inspected. Regularly queens flee from the activity of the removal creating chances she is left behind. Even if all the comb is removed, if the queen moved she will continue to lay eggs.

If the area of removal is not sealed up and is littered with honey and wax, other bees will recycle the resources then another colony may reclaim the property. It may appear as though nothing was ever done to evict them.

Buckets can Retain Toxic Chemicals from Prior Use

A removal can be a messy ordeal so buckets are needed especially for honey. Just because a bucket is washed doesn't mean it is good for you to use for food-based products. Blindly buying reclaimed buckets where no idea of where they were used is a scary practice. Honey absorbs materials and chemicals from reclaimed buckets and their prior purpose. Use food grade containers and clean them prior to use.

Why Knowing This Makes a Better Beekeeper
Messages to beekeepers from feral colonies

Experiences with feral colonies and removals can enlighten a beekeeper on how to improve. Lessons taught:

- Pollen being brought in shows the colony is brooding up.
- Brown staining on the exterior entrance maybe signs of dysentery or Nosema.
- Robbing is a typical behavior of honey bees and can be prevented and induced.
- Bees start at the top of the hive and work their way down filling the space above with honey and bee bread. In Fall the bees are on the bottom or opposite end from where they began and work their way back eating what they stored.
- A nearby water source is critical to a colony.
- If open brood is moved to a new location with young bees the colony will make a new queen from those resources.
- When removing open brood consider the need of maintaining high humidity.
- Moving frames inside a hive haphazardly can isolate brood frames creating opportunity for each frame to requeen.
- A queen can only be made from resources for three to five days. Once the larvae are too old the only outcome is worker bees.
- Bees prefer tight confined small spaces so they can build up fast and swarm again.
- Swarming is natural and is a defensive behavior. Swarming breaks the brood cycle which also breaks the mite cycle. During the relocation of a swarm minimal resources are transported to the new cavity.
- Breaking the brood cycle lowers the mite population.
- Drones are vital in sustainable beekeeping and drones will visit nearby hives regularly.
- In nature a hive is rarely on the ground where bees have to fight against invasive ground crawlers.
- When a colony gets sick, wax moth is permitted to expand and the honey is robbed out by nearby colonies. Once it is cleaned out another colony smells it was a hive and moves back in to reclaim it.

- Feral colonies can survive with direct access to the elements during the Winter cold.
- Once a swarm commits to a new home, they can draw out wax comparable to the size of a human head overnight.
- When forage is abundant a colony is less aggressive. As the Summer progresses so does the aggression increase. Harvesting sooner in the season is less threatening to a colony compared to Fall.

Risks of a feral colony

Not all feral colonies are ideal for a beekeeper as some have risks of being Africanized, others may have issues with disease. Disease can be found through a visual inspection of: their entrance, young and capped

brood, coloring and lack of hair on some of the bees, aggression levels, and carcasses in front of the hive.

Temperament

The goal of a feral colony is to build fast and divide/swarm to a new location. This is a natural healthy process. Defense is at a minimum initially due to the large numbers of nurse bees required in forming a new hive. Nurse bees have a job of raising young and caring for their queen – not defense. Defense is more prevalent during late Summer and Fall and is more a seasonal disposition rather than a trait of the colony. There are highly defensive genetics with honey bees but it is also a seasonal issue.

Wax Moth

Many will say, "wax moth killed my colony." This is not a correct statement as a strong healthy colony can resist the advances of the moth. The ideal situation for the moth to expand is ample dark propolized comb and weakened bees due to a variety of reasons. Defensive behaviors of the honey bees inside the hive will limit growth of the moth where they can encapsulate and suffocate the larva inside the cocoon with propolis.

A Feral Hive is Setup as a Natural Labyrinth

Feral colonies control their environment by building comb across their openings. When invasive threats occur in a feral hive, it is easy for the unfamiliar visitor to become lost. In standard box hives this defensive labyrinth is essentially non-existent. This apparently random formation of comb is a natural process that protects and serves the colony as a defense as well as aiding in regulating temperature and humidity throughout the season.

Honey from an amusement park

The last fun story is one of a local amusement park that had issues with excessive bees seemingly terrorizing visitors throughout the park. A daytime inspecting initially located two feral colonies frequenting open trash cans. The abundance of discarded sugars at an amusement park is very high. One of these colonies resided in a hollow tree. The removal commenced at dusk so as to remove most of the bees as they all stay home at night. The initial capped honeycomb was inspected and appeared black. Tasting the black comb revealed an unfamiliar taste in honey, it was Coca-Cola honey! Further into the hive revealed another surprise as the comb was bright red. Again, a taste revealed tiger blood snow cone flavor! Once the removals were completed another inspection of property lines showed hundreds of nearby honey bees entering and exiting the park clearly without season passes. The risk to nearby feral and boxed hives is the amount of recycled sugars found in this sugar dumping ground. BC

Peter's Bee House

Roy **Hendrickson**

Peter Berk was born in Slovenia, but spent most of his youth in Austria. His father kept bees so Peter had exposure to beekeeping at a very early age. "I've been around bees all my life" was his first comment when I asked why he decided to build a bee house. "Bee houses were very common in Austria, almost every beekeeper had one, and, I've always wanted one too." Although bee houses are unheard of hereabouts, our snowy winters coupled with cold, erratic, spring climatic conditions would seem to favor their presence. As would the ever increasing black bear population, a fact not lost on Peter.

Upper tier colonies fitted with standard inner covers. Supplemental feeder jars are placed above the center hole. This picture was taken prior to reconfiguration, when the upper tier colonies still had traditional bottom entrances.

Lower tier colonies, picture taken in December 2017. The European inner covers are no longer in use; it seems they provided a safe haven for small hive beetles.

Located in Geauga County approximately 25 miles east of Cleveland Ohio, the bee house was built over a three to four month period during the Summer of 2015. It was a one man labor of love from design through final construction. Accordingly, the rough framing was the most challenging aspect. "It took a lot of bracing to compensate for that nonexistent second pair of hands," Peter confided. And, "I m still making minor adjustments." The structure measures six by 16 feet and can hold 10-20 colonies in two tiers depending on colony configuration and time of year. Facing due south, a wooded area to the east mandates shade through late-morning. For the remainder of the day through early evening the bee house is in full sun. The structure is insulated throughout. One inch Styrofoam is sandwiched between two layers of flooring. The walls and door contain two to three inches of Styrofoam, and there is six inches of fiberglass insulation in the ceiling. A 120-volt electric line supplies power for interior lighting, a fan in Summer, and a small heater throughout the Winter period. The bee house has a large window on the west end; access is through a door on the east end.

The bee house has a convenient, rain protected storage shelf on the outer back wall.

Each colony sits atop a screened bottom board, the pizza pan allows for year-round mite monitoring.

Summer heat is minimized by opening both to create natural flow-thru ventilation. During the Winter months the heavy insulation aided by the aforementioned electric heater helps maintain a constant 45-50 degrees. Peter estimates that he spent about $2,000.00 on materials to build the structure.

The lower tier colonies are normally housed in two hive bodies. The brood boxes rest on built-in screened bottoms under which Peter places a sheet pizza pan to collect hive debris. When necessary it doubles as a sticky board for mite analysis. Colony management is similar to that of outdoor colonies with the exception of supering. Due to the confines of the bee house the bottom tier colonies are limited to two supers apiece. This necessitates honey removal at regular intervals. Even though super space is limited, Peter doesn't attempt to sort and remove individual frames of capped honey, it's simply too laborious and time consuming. As is normal outdoor practice, supers are removed once a majority of the frames are about two thirds capped.

The upper tier colonies are managed in single hive bodies. Like their brethren below they're also fitted with built-in screened bottoms. However that's where the similarity ends. Due primarily to space considerations Peter has relocated the main entrance to the top of the hive body. This was accomplished by placing a three sided ¾ inch shim to the top of the brood box. The open front serves as the main entrance. In the event supering is required the supers rest on a queen excluder atop the entrance shim. Again, due to space considerations these colonies are limited to one super apiece. I'm sure that has more than one reader scratching his or her head. There is a very simple explanation. The upper tier colonies are rarely supered, their primary function is to produce bees and brood.

Come Spring the excess bees and brood are used to boost weaker colonies and make up replacement splits. Here Peter deviates from normal management practice. The overwintered queens are transferred into the corresponding splits. Hence, no time is lost on introduction, nor is there any concern over queen acceptance. As a result, the splits literally explode in population, putting them at least two weeks ahead of their counterparts started in the traditional manner. Peter moves the splits to a temporary second location a couple miles distant to prevent the older adults from drifting back to their parent colony. Upon their return they're either moved back inside to replace deadouts, or they're placed in the small beeyard Peter maintains outside the bee house. Once the upper tier colonies have been equalized they're left alone to rear a replacement queen. By the time they've reared new queens and rebuilt their populations the main honey flow is over, thus no

Winter entrace, the small entrance virtually eliminates robbing issues. Colony ventilation is assured due to the interior screened bottom and upper ventilation ports. The entrance cover seals the opening when a stand is vacant.

Screened inner covers are the Winter norm. In extremely cold weather, two inches of Styrofoam is added for additional protection. Note the barely visible ¾ inch entrance shim between the hive body and the inner cover.

supers. This management system allows Peter, not the tallest individual on the planet, to maximize the bee house's efficiency.

Now that the bee house has been in operation for three years, I asked Peter to list its positives and negatives. Accordingly, the main advantage is the time and energy that's saved due to centralization. The superior overwintering environment coupled with the ability to feed much later in the season is a close second. And as stated earlier, the structure negates any black bear issues. Last but not least, the simple enjoyment or therapy, derived from sitting out among the colonies, any time of year, is perhaps the greatest benefit of all. On the negative side, colony management is slightly more laborious due to the close hive proximity and the necessity of working the colonies from the rear.

A personal note, I visited the bee house on four separate occasions during the preparation of this article. I found the interior environment quite enchanting.

My last visit was on a pleasantly warm Sunday afternoon in mid September. With the door open and lights ablaze, the interior was adequately illuminated. The smell mimicked that of a hive interior. Plus, there was a slight sound, best described as a cross between a buzz and a hum. But, most notable were the bees themselves. The bottom tier colonies all had solid covers, while standard inner covers were in place on the upper level colonies. Several were being fed through the center hole. Bees were easily observed through the center holes, and around the recently reconfigured, yet not quite bee tight upper entrances. There wasn't any flight, signs of robbing, or other unexpected behavior. All was quiet and peaceful as it should be. To a lifelong beekeeper, this was one the more enjoyable experiences of my career. And I was immediately struck by the therapeutic value. Peter is a very lucky fellow indeed; he can visit the bee house any time he chooses as it's only a hundred feet or so from his back door. BC

Lower tier entrances in late Summer. Note the support posts set in stainless steel pots.

Summer Blooming Bee Plants In The Midwest

Connie **Krochmal**

There are so many Summer blooming bee plants in the Midwest. I've selected a few to highlight here. Unless noted otherwise, the following are sources of pollen and nectar. Keep in mind that the plants featured here are found in other regions as well.

Providing pollen, **Japanese anemones** (*Anemone hupehensis)* can bloom from mid-Summer until late Fall, depending on the variety. September Charm Japanese anemone is highly recommended. Over 2½ feet in height, this bears pink blossoms from August through October. This variety is available from Well Sweep Herb Farm.

Several **anise hyssop** species (*Agastache spp.)* are native to the Midwest. These include purple giant hyssop (*Agastache scrophulariifolia)*, hardy to zone three. It blooms from July through September. Yellow giant hyssop (*Agastache nepetoides)* is around ¾ feet in height, and flowers from July through September.

Anise hyssop (*Agastache foeniculum),* hardy to zone four, is 1½ to three feet in height. Blossoms are present from Summer until a hard freeze. The anise hyssops thrive in partial shade to full sun. They do best in a moist, well drained, reasonably fertile spot.

All anise hyssops are excellent sources of nectar, and are major honey plants in the Midwest. These can provide good honey crops. The premium quality honey is extremely light colored with a very mild, mint-like flavor. This is heavy bodied with a wonderful aroma.

Dolce Fresca basil is an All-America Selections winner. The shrubby, very dense, annual herb is up to a foot tall with a matching width. This bears small white blossoms in terminal clusters from early Summer until frost.

Dolce Fresca basil seeds are available from Park Seed. Very easy to grow from seed, the plant needs a sunny, well drained spot. All basils provide nectar and pollen. When enough plants are present, this can yield surplus honey.

Bush cinquefoil (*Potentilla fruticosa)* is a highly recommended shrub for the Midwest. The dense, rounded plant with peeling bark is hardy to zone two. From one to five feet tall with a matching width, the very adaptable, heat and drought tolerant species bears blossoms from early Summer until frost. Typically, the flower color is yellow or white, but can be red or pink.

This shrub rarely experiences pest or disease problems. Easy to grow, bush cinquefoil does best in full sun. The plant adapts to infertile, rocky, dry sites. But, it prefers rich, moist, well drained conditions. Bees eagerly seek out these flowers for nectar and pollen.

Japanese Anemones.

Summer phlox (*Phlox paniculata)* is a popular Summer blooming perennial in the Midwest. Forever Pink phlox is a newer one bred at the Chicago Botanic Garden. This early blooming, disease and deer resistant phlox is a clump forming, upright plant. Slightly over 1¼ feet in height with a somewhat larger spread, it is hardy to zone four. The pinkish-purple flowers begin emerging in June with periodical repeat blooms extending into October.

This pollen plant does best in full sun to partial shade. A well drained, rich, moist soil is preferred. Forever Pink phlox is available from Breck and Well Sweet Herb Farm.

Bee balms (*Monarda spp.)* are excellent nectar and pollen plants. These can bring good honey crops, especially in the Midwest and Great Plains. Disease resistant Marshall's Delight bee balm (*Monarda didyma)*, hardy to zone four, is a top performing, heat tolerant variety.

Anise hyssop.

Summer Phlox.

Blooming from early Summer into Autumn, it bears pure pink, ball-shaped blossoms. The plant reaches 2¼ feet in height. Bee balms thrive in full sun to partial shade in most soil types.

Sages are good Summer blooming honey plants in this region. Purple Rain sage (*Salvia verticillata)* is hardy to zone four. This exceptional, early blooming, award winning, disease resistant sage is ideal for the Midwest.

The very floriferous plants bear 12-inch-long flower spikes with purple blossoms. Following the initial flowering period, repeat blooms appear sporadically into Fall. The plant is 2¼ feet in height.

The sages prefer full sun to light shade. They adapt to average soils with a pH of 5.0 to 6.4.

All sages can yield a premium quality honey with a pleasing, mild flavor and a sage-like aroma. Rarely granulating, this is usually light colored and heavy bodied. The plants can provide 100 to 200 pounds of honey per colony.

The **linden and basswood** trees (*Tilia spp.)* are excellent choices for Midwestern bee gardens. The following cultivars have performed beautifully in the region. Sentry American basswood, hardy to zone three, reaches 25 feet in height within a decade.

Greenspire linden, hardy to zone four, is similar in size and available from Nature Hill Nursery. Redmond American basswood, hardy to zone two, is also highly recommended. These space saving, pyramidal trees feature attractive deep green foliage.

Linden.

Lindens and basswoods begin blooming in late June or so and can extend into August. The blossoms are great sources of pollen. The trees also produce lots of nectar, bringing huge honey crops in three out of five years even during rainy seasons. The premium quality, white to water white honey features a delicate aroma and a mild to strong flavor.

These trees need watered during dry periods. Light shade to full sun is preferred. They do best in a well drained, rich, moist soil.

Geisha garlic chives is a 2015 All-America Selections winner that is highly suited to the Midwest. Hardy to zone three, the plant bears flat, broad, onion-like foliage. It grows to 1½ feet in height.

The vigorous perennial has a mild garlic flavor. The white blossoms emerge from mid to late Summer, and are well liked by bees.

Tolerant of frost, garlic chives are sources of nectar and pollen. When enough plants are available, a honey crop can result. The amber colored honey can initially have an onion-like aroma, which diminishes with time.

The plant needs at least six hours of sun daily. A fertile, well drained soil high in organic matter is best. The preferred pH is slightly acid to neutral. Geisha garlic chive seeds are available from Jungs.

Sunflowers are important bee plants in parts of the Midwest. Depending on the planting time and type grown, the blooming period can extend from Summer into Autumn. The native perennial sunflowers bear blossoms over a longer period than the annual types, usually from July until frost. For small bee gardens, the multi-flowered sunflower varieties are a good choice.

These plants yield lots of nectar and pollen. They're major honey plants in the Southwest, the Great Plains, and the Southeast. A honey crop of 65 pounds is average.

The very light amber to golden or yellow honey can taste tangy with a slight hint of bitterness. Granulating rather rapidly, this honey is perfect for creamed honey due to the fine granulation.

Easy to grow, sunflowers should be planted in full sun after the last frost. Most any well drained soil, even alkaline or salty ones, is suitable. They do best in a loose, rich, moist soil.

Lanceleaf stonecrop (*Sedum lanceolatum)* is native to parts of the Midwest. Hardy to zone three, this is named for the small, gray-green leaves, ½-inch long. The bright yellow flowers emerge on six-inch-tall clusters from June to August. All of the stonecrops yield a high quality honey

Bee Balm.


Russian Sage.

that is superior to that of clover.

Mints are widely grown in the Midwest as a commercial crop. Spearmint and peppermint, the most popular types, are hardy to zone four. These are wonderful sources of nectar. All species yield a high quality honey that is somewhat thin bodied with the color varying by species. Most mint honey can initially have a mint-like flavor that mellows over time.

Mints thrive in full sun to partial shade in most any soil type, even heavy clays.

Russian sage (*Perovskia atriplicifolia)* is a stout stemmed perennial that thrives in the Midwest. A member of the mint family, it reaches three to five feet in height. The scented, gray-green leaves are silver beneath, which gives the plant a silvery appearance.

From mid-Summer until frost, this reliable plant bears masses of narrow flower spikes with deep violet to lavender-blue blooms. I never fail to see bees working these flowers.

Easy to grow, this popular perennial prefers full sun and a well drained, rather dry soil. All species are sources of pollen along with large quantities of nectar.

Additional Summer Blooming Bee Plants for the Midwest

The two species discussed below haven't been covered in previous articles while those above have done so.

Virginia Creeper (*Parthenocissus quinquefolia)*

Hardy to zone three, this native vine is sometimes called woodbine or American ivy. It is found throughout the Midwest, the East, and the Gulf region. The usual habitats are rocky banks, woods, and cultivated spaces. The vigorous, salt tolerant plant has a fast growth rate.

Less dense than English ivy, Virginia creeper bears branched tendrils with adhesive disks that enable it to climb. The stems are up to fifty feet in length. When supports are unavailable, the vine can cover banks and slopes. In warm climates, it can strangle trees if left unchecked.

Virginia creeper features soft, compound, medium green to dark green leaves that can be either shiny or dull. These contain five, toothed, pointed leaflets, two to five inches long. They range from oblong to elliptic. Some varieties have smaller, somewhat dainty looking leaflets. To develop good Fall color, the plant requires full sun.

The cream colored to greenish blossoms appear in early Summer. Bees just cover the flowers and create a distinct hum. The pollen is light green.

When the plants are plentiful, this species can provide a small honey crop of around 25 pounds per colony. The unusual tasting honey is typically amber, but can sometimes have a slightly pinkish or reddish tint.

Growing Virginia Creeper

Ornamental varieties of Virginia creeper are available with some having variegated foliage or other special features. Suitable for both sun and shade, this native plant thrives in most any well drained soil. It prefers a reasonably moist loam. The plants are propagated by seeds, cuttings, and layering.

Certain cultivars cling better to walls and trellises than the native vine. The most common insect and disease problems are Japanese beetles, soft brown scale, and caterpillars. When the plants are grown in damp shady sites, the vines can sometimes experience leaf spots and powdery mildew.

Pale Purple Coneflower (*Echinacea pallida)*

Suitable for zones five through nine, this is also known as prairie purple coneflower. Its habitats include roadsides, plains, barrens, and dry open sites. The plant is native to most of the Midwest as well as Oklahoma, Texas, Arkansas, Louisiana, Alabama, Tennessee, the Carolinas, New York, Massachusetts, Connecticut, and Maine.

This species is uncommon east of the Mississippi River. Pale purple coneflower is three to four feet tall and half as wide. The rather sparsely branched, hairy stems are largely leafless. The hairy foliage is mostly basal. The narrow, untoothed leaves are four to eight inches in length.

Pale purple coneflower differs from the common purple coneflower by blooming a little earlier – usually between April and July, depending on the location, for about two months, and by having lighter colored rays. The disks are 1¼ inch wide. The drooping rays are three inches in length. Pollen can be white to whitish-green.

Many types of pollinators visit all species of the purple coneflowers. These flowers are rich sources of pollen. They also provide nectar. When enough of the plants are available, a small crop of honey can result.

Growing Purple Coneflowers

Often self sowing, these species can withstand high humidity, hot Summers, and windy conditions. Full sun to light shade is best. A pH of 5.0 to 7.0 is preferred.

Purple coneflowers thrive in most average, well drained, moderately rich soils, particularly loamy ones. Heavy clays and wet soils can result in root rot, particularly for the white flowered types. These plants can be grown from seeds and divisions.

Plant as early as possible during the growing season to ensure they will survive the Winter. The white flowered types seem the most vulnerable to this malady. BC

Connie Krochmal is a beekeeper and plant expert living in Kentucky.

A Teaching Apiary

Local beekeeping clubs do a good job of teaching beekeepers. Many give classes that use Power Point presentations, books, magazines, wall charts and samples of equipment. Live bees are usually missing. Clubs may have a Field Day once in a while at someone's beeyard. However, that is just a one-day, or one-afternoon event. A very few clubs do have a teaching apiary. Those clubs that do have one are lucky – the members have the opportunity to see live bees in action. The colonies can be available for demonstration throughout the bee year, short in cold climates, almost year around in the warm ones. Colonies can be reconfigured so that the effects of varying conditions can be shown. Not all the bees will survive but the lessons taught will save some beekeepers' colonies. In areas that have only African bees, a teaching apiary could be impossible. These overly defensive bees do not wish to be disturbed.

There is one item to be considered when thinking of having a teaching apiary. Just read through to the end where I will mention it.

Finding a place for a teaching apiary could be difficult. More space is available in rural areas than in suburban ones or within towns and cities. Various kinds of parks can be found and some may welcome a teaching apiary. If the park is large enough an apiary "off the beaten path" could be ideal. However, a teaching apiary could consist of just one hive. Activities would be limited but with careful planning one hive would work. If the teaching apiary is a club activity, the club should be able to provide compensation for purchase of bees, queens, and necessary food as well as any treatments needed. It is possible that a beekeeper with a number of hives could set aside two hives for club activities.

The space available for a teaching apiary may be limited by its location. Room around the hives is necessary for club activities with the hives. Security for the teaching apiary would also depend on its location. A fence or a fence combined with a surrounding hedge may be necessary.

Many items are needed for beekeeping. Honey supers are not used the year around. The club may own a small extractor and other harvest equipment. Storage for ancillary equipment, large and small, would be useful. If a search for space for an apiary fails it could be possible to have a "moving around apiary." This means that volunteers from the club would select different hives or activities to demonstrate in their own apiary. True, members would need to travel to different beeyards and parking space for cars and pickups could be limited.

A teaching apiary is an excellent place to have a variety of hives: Langstroth of course, and top bar, too. Some beekeepers might like to see how the Warre' hive works or the Layens. Having a conglomeration of hives does make caring for the apiary difficult so some styles of hive could be for display only. If space is limited it is possible one of the club members would offer to care for a colony in one of these hives. It might be interesting to use both a 10-frame and an eight-frame Langstroth just to discover any differences.

Many beekeepers see pictures of keeping bees in straw skeps. Since the built-in combs are not moveable and cannot be inspected for American foulbrood they are not legal for keeping bees. However a club could ask the state apiarist or Department of Agriculture if a skep colony could be used for a season as a demonstration. The best way to get a skep populated would be to use it in a traditional way by capturing a swarm in it.

Club members can suggest some of the various activities to be done with the hives. If the state has hive inspection services one session could be a demonstration of a hive health inspection. Many diseases are just not that common. Good photographs of frames with disease may have to substitute for actually seeing a sick hive. If someone's colony has chalkbrood, save some samples of the white, and even gray or black, mummies. The club can have a collection of various items. Encourage members to save some. A container with skunk cuds. A vial, with alcohol-preserved wax moth larvae and small hive beetle larvae nicely demonstrates the difference between them. Save a few small hive beetles in alcohol, too. A preserved collection does help newbees recognize what they are looking for when they inspect their hives.

Activities can follow the bee year with its seasons. Spring is the best time for swarms. One hive could be followed as it progresses toward swarming. Why is it crowded? Search for 'pollen-bound' or 'honey-bound' then search for queen cells – where? Did this colony just swarm – search for clues. The swarm may be long gone but sometimes beekeepers are lucky and the swarm is in a nearby tree, not very high. Obviously swarms are to be discouraged in urban areas so concessions will have to be made for the apiary location.

When drones are plentiful it is a perfect time for club members to learn to mark queens. Yes, there are tools to capture queens and

Ann **Harman**

hold them for marking. However without practice those helpful items can accidentally squish a queen. Therefore practice with drones. Use the tools but also practice with just your fingers. Practice using as many drones as necessary – they don't mind. However you now have created another activity. Drones are known to drift, flying out and returning to nearby hives, not always their own hive. After the marking paint has dried, just release the drones. If the apiary has other colonies marked drones will be found in them, not only on the day of marking but also on other days. It will be interesting to follow these drones for a few weeks. Is there someone's beeyard near the teaching one? Inform that beekeeper to watch for marked drones.

When a colony has gone queenless a number of interesting things happen. A teaching apiary could certainly be used to make a colony queenless. She could be placed in a nuc to save her for later projects. One of the first things to notice is the weird sound of a queenless hive. It is a sound beekeepers should learn because it is the first signal that something is wrong. Laying workers will follow. Beekeepers have tried many ways to requeen laying worker colonies –sometimes successful, sometimes not. The colony made queenless for teaching may not survive but it has provided a challenge.

Today any colony can be used for testing for varroa. Some beekeepers prefer using powdered sugar to test because the bees are saved. However others prefer an alcohol wash. The teaching apiary is a perfect place to use both methods. Test with the powdered sugar then follow with an alcohol wash. Keep good records for this experiment. If the teaching apiary has more than one hive use different ways of testing on different colonies.

Several observations can be done during periods of great activity when workers are furiously bringing in pollen and nectar. Many beekeepers, especially if rushed for time, do not stop and simply watch what is going on at the entrance. With multiple hives in the beeyard activity at the entrance can be watched and compared. Foragers from different hives may also be going in different directions. Foragers from a single hive may also going in different directions. Look for different colors of pollen. Is there a water source close by? See if any bees are using it. Can anyone see a bee returning with propolis? It can be hard to notice. What are the guard bees doing? Does activity slow down when the sun is directly overhead?

During strong nectar flows many beekeepers have noticed bees doing their dancing on the comb. A teaching apiary makes us all slow down and take time to watch. At the times of great foraging see if a dancing bee can be found on one of the combs. Can anyone decipher her instructions? If she is in a nice calm colony go ahead and watch her for a while. Are any bees paying attention to the dancing bee? Does her information agree with the direction bees are taking from the entrance? Many beekeepers have read about what bees do inside and outside the hive. But today we are all so rushed for time that not enough time is taken to actually see what bees are doing. A visit to the teaching apiary does make us more observant.

Beekeeping today is all about nucs. Making nucs. Overwintering nucs. Selling nucs. Creating a nuc is an excellent project for a teaching apiary. Those newbees and other beekeepers who have been hesitant about making a nuc – including what to do with it – would benefit greatly with real-life teaching. Besides the nuc created could save one of the teaching apiary's colonies. Encourage the beekeepers who have come to take notes and photos. Then the participants can go home with a set of illustrated directions. Some may want to wait until next beekeeping season to make a nuc.

There seem to be endless ways to requeen a colony. Some of them work but perhaps not all the time. Now that a nuc has been made it could be used as a demonstration of requeening. This project does need a bit of organization if a queen is to be purchased and sent from a queen breeder. Perhaps the club members wish to try a particular kind of queen. Here is an excellent way to see what her colony will be like.

Bees are dependent on the weather. Unfortunately this is one thing we cannot control in the teaching apiary. However, the bees can easily show us what happens during a severe drought, or the opposite with incessant rain. What are the indications of a starving colony? Brood expansion followed by a sudden cold spell – chilled brood? Too chilly during early pollen sources? Hives too hot in the desert areas? Simply paying a little attention to weather can mean the difference between colony survival and not.

There remains one important item mentioned at the beginning. Some clubs have some type of liability insurance. It can be for activities that occur during the year, such as a picnic with a Field Day. Setting up a teaching apiary might not be covered by that sort of policy. For a teaching apiary perhaps insurance is needed. At the beginning of planning for a teaching apiary it would be essential to obtain some insurance advice. Not all the club's members will be teachers. Not all the members will participate. A neighboring club has heard about a particular teaching event and wish to attend. Be safe – advice first then make the plans for a successful teaching apiary. BC

BIGGER PICTURE

Jessica **Louque**

Around The Apiary

This year starts my 11th year as a honey bee researcher. It seems crazy now to think about just the sheer exposure to colonies since I started in contract research. I've been able to work bees in at least 11 states that I can remember and visit at least another 22 because of bee-related travel. We assess colonies by percent coverage on the frame (in increments of 5%) of adult bees, then capped and open brood, eggs, nectar, honey, pollen, and empty cells for each box. It takes about 40-50 minutes per hive for triple deeps. I hit the 10,000 colonies assessed mark a few years ago and lost track after that. Sometimes it's hard to remember what it was like to be a new beekeeper and excited and confused about everything that goes on in the hive. I saw a post on someone's Instagram page last week and it was the first time I was like, "hey that's a cool idea!" in so long that it made me think about new beekeepers and what I'd like to know about now or then.

So this Instagram post. It was actually from a gardening page that was repurposed from a beekeeping company. The idea here (with a very internet-worthy picture) was to use a mailbox in your apiary (or garden as originally intended) to store tools or items without having to take them back and forth. As someone with multiple apiary sites, this seems like a good way to have backups of commonly forgotten items. Depending on the security of the apiary site and the size of the mailbox, you could keep a blowtorch, matches, extra smoker fuel, smoker, hive tool, an extra veil, or who knows what else you might want or need. This would only work if you had a permanent site because it would need to be put on a post in the ground. I've often thought about using a plastic garden bench with storage, but people vandalize or steal so much that those just aren't permanent enough to use.

This led me into a thought process of unconventional apiary items that I would find useful, and maybe other people would too. I know some people don't like to keep records when they work their bees, and other people could write a novel off of every apiary visit. I am not a huge fan of record keeping for personal bees because we do so much in the way of intensive assessments that I don't want to do it for "fun". However, I could see how it would be really useful to have a record of all the local bee-attractive blooming plants in the area. For this, I would recommend a small stash of reference books, both because this is useful, and because I am a book hoarder. In particular, there are some guides from IBRA that are somewhat flashcard-like in appearance but they have pollen colors and most likely plant sources. WE have all stood in front of a hive trying to guess what kind of pollen is coming in, and this would just confirm our already-correct guesses. I would also say to have a wildflower guide that covers your region. Just think of the presentation you could give to your local beekeeper association with a few years' worth of data on what floral sources you have identified, when they started blooming, what the weather was like at the time, and corresponding pollen baskets. Everyone could benefit from such localized information. If it's not included, a tree guide would probably be beneficial as well. The majority of our local sources are trees, such as tulip poplar, sourwood, basswood, locust, and maple.

Since most of my bee work is research based, I have the "luxury" of having a weather station at most of the sites. I love having the data off of the weather stations, like barometric pressure, but accurate weather stations can be pretty expensive. If you look online, you can find a wide variety of weather stations for less than $200 that appear to be compatible with phone apps or otherwise remotely accessible. If you pay attention to pressure, it's amazing how much it affects the behavior of a colony. It can also be fascinating to have a weather station that's just a couple miles from another one and see how different the weather can be so close to the same place. Even if it's not perfect, it's a lot more accurate-to-you than just looking up the local weather info online. If you really want to go all out, or have a way to count it as a farm expense or business expense, I'd recommend something in the Onset HOBO line. They can come with all

A doe at the creek.

A tresspasser (it was me and I didn't recognize me because the colors were inverted).

Raccoon just inside the woods.

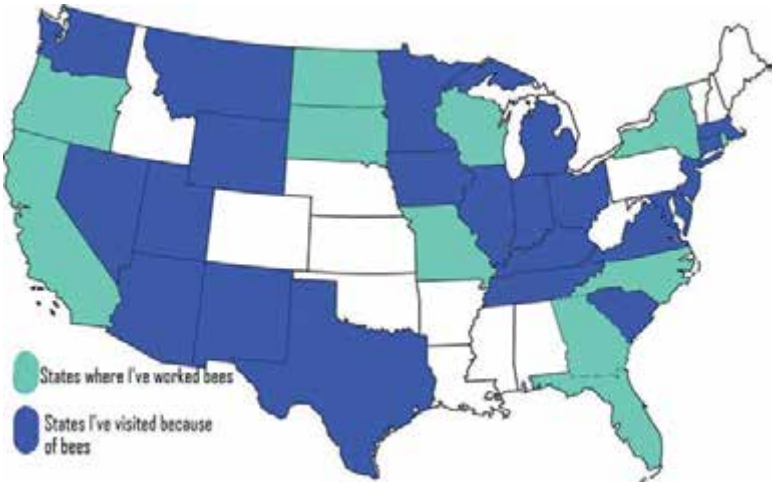
kinds of readers and attachments at a variety of price points, but still extremely expensive. I think you can get a base model setup of temp and humidity and maybe wind for $1300 that is also solar powered.

Adding to the book list, I would add a local animal ID book that includes tracks and scat. Most beekeepers like to be outside and appreciate nature, and it's always a good idea to see what's lurking in your apiary. Skunks and raccoons can pose a problem to the colonies but can be deterred with a few quick remedies if you don't want to kill them. Putting some wide square hardware cloth-like material in the front of the hive sticking out with the pointy edges will deter skunks and usually raccoons. Raising the hives off the ground a little more helps too because the bees can sting a soft squishy underbelly easier if a pest has to be up on its hind legs to reach the hive. We have also had our share of bears, as I've written about previously. Something that is a large pest or predator is not only something to worry about for your colonies, but also yourself. You don't want to be out in your apiary late in the day and have a bear lumber up to share supper with you. A deer is one that people don't normally think about, but I can't tell you the number of times a stupid deer has barreled into a hive and toppled it. If it's the wrong season, they can seriously injure a human. If it's mating season, a buck can become aggressive quickly. Coyotes are also incredibly common here. They aren't really much danger to the bees, but they can be to a human. It's a little difficult to distinguish dog tracks from coyote, which would be the reason for the book. In reality, a coyote print has a little more space between the middle two toes and the pad than a normal dog, and all of the toes and nails point to the center instead of outward. That's not to say that a dog's couldn't do that, but it's not as common. If you think you saw a coyote print instead of a dog, it's pretty easy to find out how likely it is that you have coyotes in the area.

My most common animals at apiary sites are rabbits, groundhogs, possums, skunks, and raccoons. I know this because I either see them, see their tracks, or catch them on trail cams. That is definitely on the top of my list. I love trail cams so much. They watch everything for you when you can't be there all the time. Do a little research if you decide to go this route though. As with nearly everything, the quality is not dictated by the price and there is a wide range of cameras out there. I've purchased really expensive cameras before only to find out they would not take photos at night or low light, or that they were so powerful that the battery wouldn't make it a full 24 hours. My favorite is a Browning trail cam that takes really good night photos for at least 15 feet and records date and time and temperature on

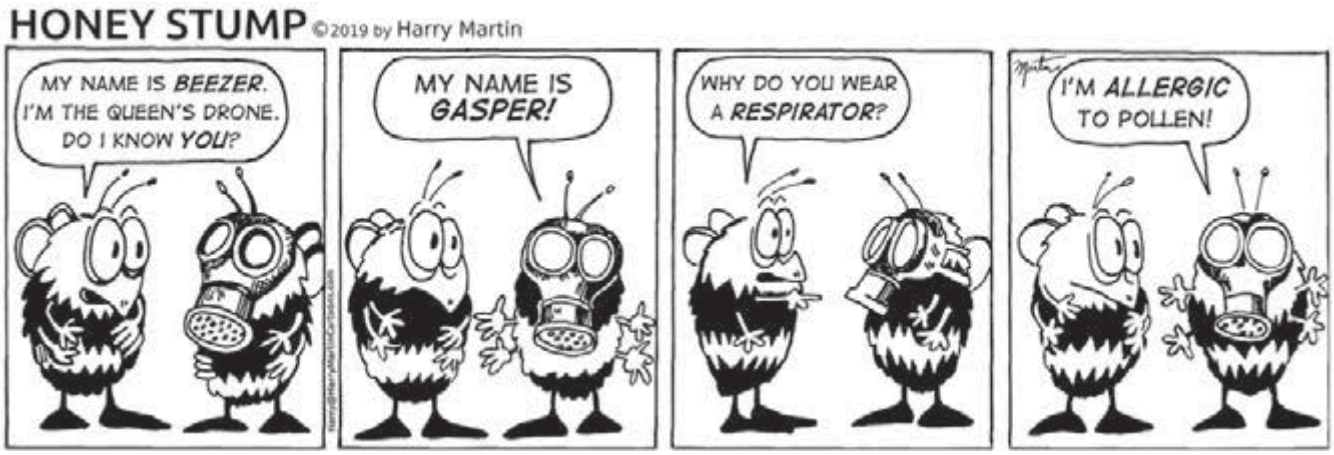
Bear in the apiary.

the photo. If you decide to invest, you may as well go ahead and buy two because no matter where you put one, you'll regret it and be sure that you could have gotten that crazy animal or amazing shot if you'd just put it in that *other* place. If you have two, you've doubled your chances of seeing cool stuff. Just be aware if your apiary requires travel that they can be pretty needy on batteries and they have to have an SD card. It's also easy to get out there, wrap it on a tree, and forget to turn it on. Or, you can screw up by taking the card out to get the pictures and forgetting to put it back in before getting back out in the field. You can also hook it on a tree wrong and it gets no pictures, or ground pictures, or sky pictures, or falls off. You can also fill your SD card up with pictures of you fumbling around with the camera and run out of space for animals. There are a lot of things to remember to keep it from being a frustrating experience, but it's worth it to get those few really good pictures. Keep in mind, it doesn't differentiate by animal, so if you make the mistake of putting it anywhere near a chicken pen, you're probably going to wind up with 2200 pictures of your chickens, who may or may not peck the camera, and run the card out and battery dead before it can get anything useful.



I hope some of these ideas could be useful to some of you. I am always a fan of learning more about the bigger picture instead of just focusing in on the colony itself to help tie things together. Beekeeping is fairly similar on a superficial scale, but everybody really does have a unique experience and expectations and way of doing things that makes everything interesting. You just have to figure out what works for you and how much time and effort you want to invest. BC

Jessica Louque and her husband Bobby run Louque Agricultural Enterprises, a contract research business specializing in apicultural studies.



AFRICANIZATION

Savior of The European Honey Bee?

In an effort to try and improve beekeeping in South America, Brazilian bee scientist Warwick Kerr travelled to Tanzania and South Africa in 1956 and brought back to Brazil 51 queens of aggressive African honey bees. His hope was that by crossing these African bees with the European honey bees (EHB) already in Brazil, the hybrids would be better honey producers. In 1957 some of the African queens were released, and mated with European bees. Unexpectedly, the African Bee genetics were not seriously diluted when mixed with the more abundant European bees but became the dominant genotype of the honey bees in the area.

Over the following decades, these Africanized honey bees (AHB) expanded their range eventually spreading through South America, Central America and into the Southern portions of North America, as well as the islands of Tobago, Puerto Rico and the U.S. Virgin Islands. Despite having earned the moniker "Killer Bee", they have proven themselves to be the second most successful invasive species ever to inhabit the North American continent.

Secrets of AHBs success

There are a number of reasons why the AHB has flourished so well and expanded across the Americas. As these Africanized traits are incorporated into the existing EHB population, there is the potential for this process to improve the situation for our honey bees through natural, biological processes rather than by relying solely on human intervention.

Drone Parasitism

African drones are known to drift into neighboring European colonies and are readily accepted, while the reverse is not true. Drones of non-AHB or mixed heritage are rarely allowed to pass the guard bees and enter into Africanized hives. While AHB colonies raise additional drones to make up for those lost to drifting, EHB colonies seem to raise fewer drones following an influx of Africanized drones. Since AHBs are also known to proportionally raise more drones and raise them earlier in their yearly population build-up cycle, this ultimately results in an increase in Africanized drones and a corresponding decrease in European drones in a given area. (Caron 2001) Thus, drone parasitism leads to greater numbers of AHB drones in local drone congregation areas resulting in virgin queens having a higher probability of mating with Africanized drones.

The Numbers Game

Colonies of Africanized bees are also known to swarm earlier in the season and about twice as often as their European counterparts. This allows AHBs to enjoy a reproductive advantage over the EHB and populate a given area at a faster rate. (Caron 2001) This creates a feedback loop where increased numbers of Africanized hives, are raising greater numbers of Africanized drones that parasitize EHB colonies in the area and can eventually create a saturation of AHB drones throughout a given region.

Africanized Behaviors

There are significant differences in the behaviors exhibited by Africanized

Their propensity to swarm several times a year, and interrupt the hive's brood cycle, is one of the traits that helps allow Africanized honey bees to exhibit greater resistance to varroa mites than the typical European honey bee colony.

bees compared to European honey bees. While the most commonly observed and easily recognized trait is increased defensive, several other traits have been documented.

Response to smoke and manipulation

When AHB hives are smoked, high numbers of the bees will exit the hive. Alternatively, when a beekeeper smokes the typical EHB hive, few bees can be seen exiting the hive and instead the bees either engorge themselves with honey and nectar or fan vigorously to remove the smoke. When the colony is opened and frames of brood removed from the brood nest, Africanized bees unlike European honey bees, will leave the brood area and hang in festoons off the bottom of the frame.

Usurpation

AHB swarms are known to move into occupied EHB hives and replace the European queen with their own Africanized queen. The swarm will typically land near the entrance on the outside of the colony to be taken over. While workers from the swarm will initially be rejected by guard bees at the entrance, eventually enough bees will slip by the guards or pick up the colonies scent from repeated contact with the guard bees, and are able to enter, ball the EHB queen, removing her from the hive and replacing her with their own queen. Historically, beekeepers have found that their formerly docile colonies become extremely aggressive following usurpation. (Caron 2001)

Absconding

While the abandonment of a hive location (known as absconding) has been reported to occur in EHB colonies, especially those experiencing high small hive beetle infestations, it is relatively rare. Absconding is relatively common among Africanized bees on the other hand, especially when there is a nectar dearth or when the colony is disturbed on a regular basis such as from too frequent beekeeper inspections.

Foraging behaviors

The AHB is known as a good honey producer. AHB workers graduate to foraging at an earlier age, make more foraging trips per hour, and switch from declining forage sites faster than their European counterparts.

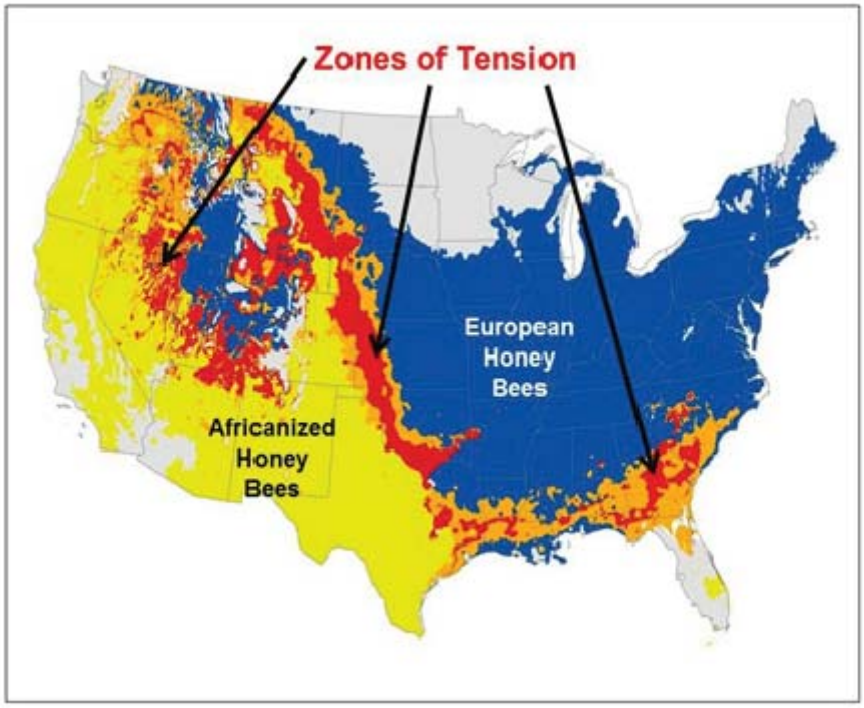
Africanized honey bees have a endency to collect a lot more propolis than the European honey bee. This may be part of the reason they exhibit such strong resistance to common bee diseases.

It has also been observed that the Africanized bee will tend to fly directly into the hive entrance, rather than land outside the hive and walk into the colony's nesting cavity as the EHB will tend to do.

Highly Defensive

Africanized bees are most commonly known and recognized for their fierce defensive behavior. The short rainy season in Africa tends to limit available forage to the rainy season, and this combined with the large numbers of natural predators, has resulted in the AHB having evolved to be extra defensive of their brood nest and stored food. Africanized bees will respond to perceived threats faster and in greater numbers than European bees. AHBs will also stay on alert for a much longer period before they calm back down. When irritated, Africanized bees will attack perceived threats much farther from the hive than is normal for European bees.

Not all AHB colonies are highly aggressive however, and this has provided bee breeders the opportunity to breed a gentler stock that retain some of the AHB's other more desirable traits. According to one researcher, "Experience in South and Central America suggests that where domestic bees are abundant and remain well managed, and where constant selection pressure is applied through requeening, the Africanized strain will soon become domesticated



Research of the nuclear genome showed that the Africanization process included bidirectional gene flow between European and Africanized honey bees, giving rise to a new mixture of A. m. scutellata- and European-derived genes.

and its impact will be minimal." (Erickson 1988)

One example of this are the Africanized honey bees that arrived in Puerto Rico (most likely accidentally on a ship) in the 1990s, and have since evolved into the gentle, yet hardy, Africanized bees that dominate the island today. Biology professor Tugrul Giray, of the University of Puerto Rico, was among those who first reported on the gentle Puerto Rican bees. (Rivera-Marchand 2012) This is believed to be because the more gentle bees contain genetic material that is similar to the European honey bee although they also contain significant African honey bee genes. (Galindo-Cardona 2013, Avalos 2017) The scientists hypothesize that the bees evolved to be more docile and yet retain other AHB traits as a result of both living on the densely populated island from which they could not easily escape, and because humans likely eradicated the most aggressive bees, benefiting their more docile counterparts.

Unfortunately, following the recent devastation wrought by hurricane Maria and the sluggish natural disaster recovery response by U.S. emergency management agencies, the current health and abundance of this once promising population of gentle AHB colonies, not to mention that of the people of the island, is in question.

Evidence of Gene Drift

Researchers have confirmed that in areas of Africanized occupation, domestic EHB colonies change drastically over time from a resident population of eastern and western European maternal ancestry, to a population dominated by the African haplotype. Additional research of the nuclear genome showed that the Africanization process included bidirectional gene flow between European and Africanized honey bees, giving rise to a new mixture of *A. m. scutellata*- and European-derived genes. (Pinto 2004, 2005) Meanwhile, Rangel et. al. "found that the feral honey bee population at the WWR remains a hybrid swarm, with the majority of its mitochondrial genes being of African descent. Their genomic DNA continues to be a stable mixture of European- and African-descendent genes, representing still one of the most striking biological invasions documented to date in the United States." (Rangel 2016) Given the proven mixing of AHB and EHB genes in both directions, it would not be unusual for the resulting bees to not only express Africanized traits such as overly defensive behavior, but European traits as well. This is exactly what appears to be happening as more and more reports are surfacing of bees that appear to exhibit Africanized traits and European traits at the same time.

It is well documented that when European queens are introduced into Africanized colonies, the queen acceptance rate is low. (Caron 2001) In recent decades (since the arrival of the AHB in North America) complaints from beekeepers of problems with queen have reached all-time highs. Now not all beekeepers that experience queen introduction problems are living in areas with known AHB populations, but it is possible that the queen acceptance issues, especially among those that do live near AHBs, are being aggravated by this AHB trait.

In another instance beekeepers who keep bees in regions of the U.S. where AHBs are known to occupy, report that their bees are able to handle exposure to varroa mites despite not being treated for mites. One example is Dee Lusby owner of Lusby Apiaries and Arizona Rangeland Honey who regularly makes walk away splits from her colonies allowing the bees to raise their own queen that then mates openly with drones in the area. Such beekeeping management is highly likely to result in gene transfer from Africanized bees eventually allowing them to become incorporated into EHB populations. This may explain, at least in part, Mrs. Lusby's success with treatment-free beekeeping. I reached out to Mrs. Lusby to ask if she had ever had her bees tested for Africanized genetics, but she did not respond to my inquiry by the time this article had to be submitted for publication.

Another example lies in the fact that historically, the usurpation process had always been confined to Africanized bees and the literature had never reported usurpation in EHBs until the first decade of the 21st century when Wyatt Mangum documented this process in his colonies in Virginia. (Mangum 2010) Dr. Mangum reports that his colonies were gentle prior to being usurped and yet remained gentle following the usurpation events suggesting that the usurpation trait, formerly attributed to the Africanized honey bee is now becoming a European honey bee trait. The appearance of this trait in EHB colonies about a decade after the arrival of the AHB in the U.S. is further indication that Africanized genes are drifting into the EHB gene pool and vice-verse creating an Africanized and yet gentle bee, similar to what has been documented on the island of Puerto Rico. Dr. Mangum did not respond to my inquiries as to whether his bees have been tested for the presence of AHB genes prior to my having to submit this article for publication.

Are AFBs our future?

The African honey bee is a wonderful honey producer, resistant to mites and diseases and is highly adapted for survival. Due to their beneficial attributes, the Africanized bee is considered the bee of choice and commonly used for beekeeping in both Brazil and Venezuela. (De Jong 1984, Thimann 2001) Beekeepers in South and Central America have learned to adapt to the AHB through special management and handling, the use of special equipment, and positioning apiaries further away from populated areas. In other areas, the AHB has been selected for gentle behavior. Given its broad range of beneficial characteristics, the development and distribution of gentle Africanized bees in North

America may lead to it one day becoming the bee of choice for the most successful invasive species to ever come to the North American continent: us Europeans. BC

Ross Conrad is author of Natural Beekeeping *and co-author of* The Land of Milk and Honey: A History of Beekeeping in Vermont *due out this Summer.*

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The MiteCheck App

Jonathan **Engelsma** (Grand Valley State Univ), Meghan **Milbrath** (MI State Univ), Karen Rennich (BIP), James **Willkes** (Appalachian State Univ)

Early Spring is the time of year when beekeepers are inspecting their colonies after the long Winter months for the first time in the new beekeeping season. According to the Bee Informed Partnership's annual survey, almost 31% of these colonies were lost during the Winter of 2017-2018[1]. This high loss inevitably leads beekeepers to ask the question "why did my bees die?". The most common cause for these crashing colonies is death by *Varroa* associated viruses[2].

Properly monitoring and managing *Varroa* infestations in your colonies can reduce your colony losses year-round. However, recent data suggests that even colonies diligently managed for *Varroa* all Summer long are experiencing late season reinfestations[3]. Conventional thinking is that your healthy colonies are robbing out nearby crashing colonies and bringing home the mites from these dying hives. This suggests that monitoring and managing for *Varroa* mites in your *own* colonies, is not enough – you also need to to be concerned about your neighbor's mites! We think that last statement warrants repeating because of how serious this situation is – you now need to be concerned about your *neighbor's mites* in addition to managing your own.

We would posit that what is needed is a *coordinated response within the beekeeping community* to the mite challenge. That is, an approach that involves each individual beekeeper responsibly monitoring and managing *Varroa* mites in their colonies, and doing so in a way that further encourages and facilitates awareness within the broader beekeeping community. This is exactly what the new MiteCheck mobile app sets out to do.

The MiteCheck mobile app is the fruit of an ongoing joint collaboration involving the Bee Informed Partnership, the University of Minnesota Bee Squad, and Michigan State University. The app, freely available on both the Apple iTunes App Store for iPhone users, and the Google Play Store for Android users has a three-fold mission:

- **Educational tool**: helps beekeepers learn how to properly monitor for *Varroa* mites.
- **Data collection tool**: make it easy for beekeepers to submit their mite counts, when monitoring their colonies, for research purposes.
- **Community awareness tool:** helps beekeepers stay abreast of current mite infestations levels in their area.
- **Motivational tool**: encourage beekeepers to monitor for and manage mites consistently over the beekeeping season.

In what follows, we will describe how the MiteCheck app can be used by beekeepers everywhere to help keep mites in check. However, don't take our word for it – get a free copy of the app installed now on your smartphone and try it for yourself!

Educational Tool

There is an old adage, "experience is the best teacher, but the tuition is very expensive". Many of our readers will readily concur that this is particularly true when it comes to managing mites in your honey bee colonies. Consider the following familiar scenario:

> *You're a first-year beekeeper. It's September. Your single colony in the backyard is still busting out with bees and plenty of honey stored, in addition to the bucketful in your pantry. You carefully do a visual on every frame. As far as you can tell, there is no obvious signs of mites or the mite-related damage you've been reading about on the Web. Everything seems to be just fine. No need to treat! Time to get online and share your beekeeping prowess with the rest of the world! Fast forward to a warm winter afternoon the following February, when you take a peek in your hive and find only dead bees and a mouse nest. After a bit of research, the evidence is now clear – your colony crashed due to a mite infestation. Meanwhile, you feel like you just ran over your dog (and you aren't even aware of the effect on your neighbor's bees!). But it gets even worse. That evening, when you inform your spouse you need to shell out another $160 for replacement bees, your new hobby is nixed and instead, you'll be growing organic tomatoes in the deck planter and mowing the lawn. Time to sell your bee equipment on Craigslist.*

This is a very common scenario in beekeeping today. Not only is it discouraging new beekeepers from continuing on in their new-found hobby, it is also expensive and problematic for nearby beekeepers who are properly monitoring and managing mites within their colonies. Beginner beekeepers are constantly losing their bees to uncontrolled mite populations because they don't know how to properly monitor for mites and their neighbors are put at risk by their crashing hives. Clearly, all beekeepers need to know how to monitor mite levels in their colony and intervene when treatment thresholds are reached. The MiteCheck app is designed to serve as an educational tool, teaching beekeepers how to properly monitor for mites.

At the moment, there are two commonly used procedures for determining mite infestation levels in colonies, the sugar roll and the alcohol wash. These techniques allow beekeepers to identify the level of infestation by dislodging the mites from a known quantity of bees. The "My Guide" areas of the app provides illustrated step by step guides for conducting either of these two mite monitoring procedures. A beekeeper can step through the screens one by one on their smartphone as they complete the procedure in the apiary.

The app has features that address the most common errors beekeepers make with these monitoring techniques. Failing to perform all the steps properly can yield overly optimistic results (e.g. you think your mite levels are lower than they actually are!) which is obviously a problem. The timer and the shake trainer feature are designed to help beekeepers learn to properly do the sugar roll and hopefully avoid these potential pitfalls. After depositing the bees in the shaker jar, and rolling them in powdered sugar, it is recommended to let the jar sit in the shade for two minutes. As the bees heat up, the mites fall off and the sugar prevents them from reattaching to the bees. Many beekeepers do not remember to let them sit for long enough, and If this step is not done properly, it's possible that some of the mites in the sample will not be dislodged during the subsequent shake step, resulting in a falsely low count. The app has a built-in timer with an audible alert that can be armed when the two minutes reached, ensuring that sufficient time has passed to cause the mites to fall off.

A second potential issue when doing a sugar roll is not shaking the jar vigorously and long enough to completely dislodge all the mites. We often tell new beekeepers if their arm is not really tired after the shake step, they probably haven't shaken hard enough. In order to help new beekeepers quickly develop a sense for how hard they need to shake, and the duration of the shake step, the app implements a "Shake Trainer". Using the smart phone's accelerometer (the same technology that causes your screen to auto rotate, when you reposition your phone from a portrait orientation to a landscape orientation), the app senses the speed and rigor of your shake motion and gives you corrective audible feedback such as "Shake harder", "Shake faster", or an encouraging "Good job" or "That's it!" when you are shaking properly. As the simulated shake training session progresses towards the minute mark, the phone screen fades to an encouraging green color giving you visual feedback on your progress.

In addition to the sugar roll, the "My Guide" section of the app provides step by step instructions as well on how to do an alcohol wash. While not as popular among hobby beekeepers (it kills the sampled bees), the alcohol wash is actually ***easier to perform and more accurate***. Our hope is that by including this information in the app, more beekeepers will adopt the alcohol wash for mite monitoring.

An alcohol wash is a quick and effective way to monitor for Varroa *mites.*

In addition to the step-by-step guides, the "Tutorial" section of the app provides a variety of professionally produced instructional videos on how to conduct a sugar roll or alcohol wash, as well as quick access to the shake trainer.

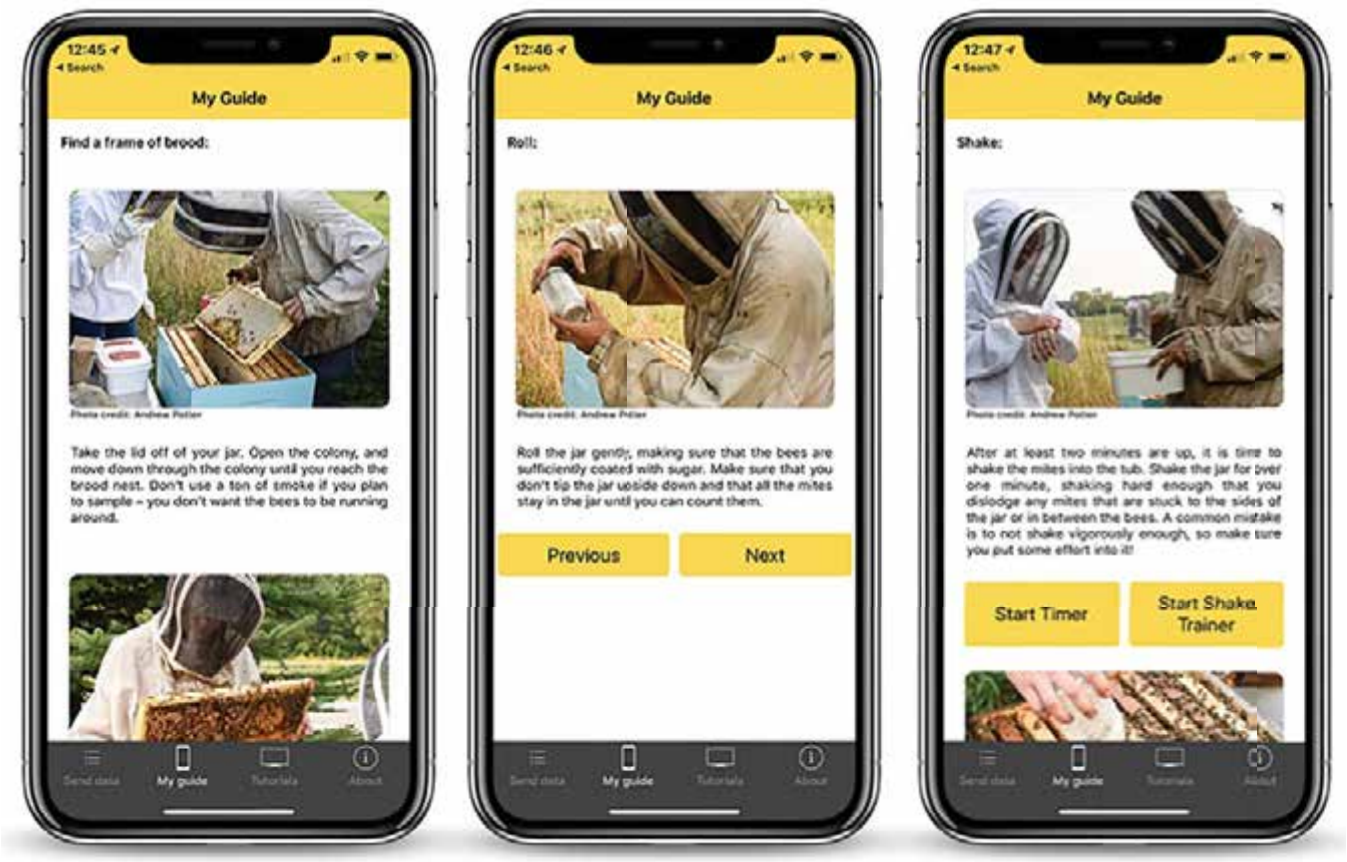
Data collection tool

The MiteCheck app is tapping into web-based technologies and the power of citizen scientist to help keep mites in check. The advent of the Internet and the World-Wide Web has significantly increased this so-called crowd sourcing of data capture in scientific inquiry. One of the strengths of the Web and the Internet in general is its ability to achieve massive scale. For example, it is reported Facebook had approximately 2.32 billion monthly active users as of December 31, 2018 [4]. Not many years ago, it was almost inconceivable that this many people could interact in a single application experience at this scale!

Imagine a research project involving a handful of grant-funded bee researchers scattered across the USA trying to go out collect and accurately process a million or more bee samples from every county with at least one managed honey bee colony during a single beekeeping season. The project is doomed from the outset, since the scope of the data collection would far exceed the researchers' capacity to collect and process data. MiteCheck app takes the citizen scientist approach to facilitate data collection at this immense scale. A recent survey indicates there are approximately 125,000 beekeepers in the U.S. If 10% of all beekeepers sampled an average of 10 colonies per month over an eight-month season, using standard procedures, and contributed their counts to a centralized database via the MiteCheck app, scientists could have data describing a million samples! We can identify regional and seasonal trends in disease risk and pest dynamics, data that are essential for getting ahead of this epidemic.

Establishing community awareness

Mite data collected at this scale and beyond can



The MiteCheck app's "My Guide" feature provides you with step-by-step instructions to complete a sugar roll or an alcohol wash.

enable us to start better understanding and responding to mite infestations *as a community*.

A key enabler underlying a citizen scientist based project like MiteCheck, is the ability to efficiently collect quality data, just in time. This is exactly what the MiteCheck app is designed to do. Beekeepers can take their smart phones to the apiary with them, and submit their mite counts immediately, via an easy to use data entry form.

Under the "Send data" tab in the app, the beekeeper enters an email address (and optionally additional contact info) and can then proceed to enter their mite counts. Multiple counts can be entered in a single submission. The location is captured automatically via the device's GPS receiver, but can be adjusted to either obfuscate apiary location, or support data entry after the beekeeper has left the vicinity of the apiary. Data is also captured on the sampling procedure used (sugar roll or alcohol wash) and date. Treatments used in the past two months can be included, as well as anticipated treatments.

We've worked hard to make the data entry procedure fun and easy. Within a minute or two most beekeepers should be able to submit the data for a half dozen or more samples. This coming bee season, we urge you to sample regularly, at least once a month. We also urge you to install MiteCheck and send in your mite counts.

The quality and actionability of the interactive heat map already provided by the MiteCheck app will be dramatically improved, and beekeepers everywhere can begin to receive real-time mite alerts and forecasts just like they receive weather information today.

Hence, if you sample a colony today, you'll know whether or not intervention is required. However, if you sample a colony today and immediately report your counts via the MiteCheck app, you'll be helping your neighbors keep mites in check as well, which ultimately is helping you in the long run.

Motivational Tool

Let's revisit the beginning beekeeper scenario we shared earlier in this article, but play it back in a slightly different way, illustrating the functionality that can be supported in the future if everybody is monitoring their colonies for mites, and submitting their data using the MiteCheck app:

It's early the third week of July. You're a first-year beekeeper, and your bees are doing great. You have three full honey supers, and can't wait to harvest it. However, your bees are far from your mind right now, as you are enjoying a cold one at the camp fire with a few friends. Suddenly you get a "code red" notification on your iPhone from that MiteCheck app thingy they told you to install at the bee school you attended back in February. You swipe open the notification, and are informed that multiple apiaries within 10 miles of your own have reported mite infestations at or exceeding three mites per 100 bees within the last 24 hours. You make a mental note of this and finish off another cold one.

The next morning is Saturday, and you're not about to let these mites get the upper hand in your apiary! However, you don't quite remember the procedure they taught for mite monitoring at the bee school, so you pull up MiteCheck and watch a couple

The MiteCheck heatmap, showing recently reported mite counts across the U.S. by county, and histograms of overall mite counts and management methods.

of tutorial videos over breakfast. After breakfast, you gather your gear and head out to your backyard apiary. You use the "My guide" in MiteCheck to guide you through an alcohol wash, and sure enough, you're at three mites per 100! You submit your count via the app and then proceed to remove the honey supers and apply a treatment. In late August you get another reminder from the app to do a post treatment count. You comply and discover you are well under threshold. Great, the treatment was effective, and you simply submit the data in MiteCheck! Late September, you receive another "code red" alert from MiteCheck warning you that nearby apiaries are once again at threshold. However, you simply dismiss it. You're dialed into the mites now, and actually proactively checked and treated again a few days earlier!

Fast forward to a warm Winter afternoon the following February, you approach the hive and see plenty of activity at the entrance as the bees take their cleansing flights. You gently pry open the cover and as the delightful smell of a healthy beehive greets you, you notice immediately the box is bursting with bees! They are starting to brood up now, and it won't be long now and you'll be out there splitting it! You realize you're soon going to have more bees than you have boxes, and make a mental note to have that conversation with your spouse about increasing the bee budget. This time you're pretty confident it's not going to be an issue.

What we've described here is realistic and achievable in the near future if we all work together on the mite challenge. We hope you'll join our project and become a citizen scientist by installing the MiteCheck app on your smartphone, monitoring for and managing mites regularly, and of course submitting your mite count data via MiteCheck. Together we can keep mites in check! BC

Acknowledgements

We'd like to thank our fellow collaborators who have helped make the MiteCheck app a reality: Nicolas Arias, Rebecca Masterman, Santiago Quiroga and Michael Wilson.

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CALENDAR

♦INTERNATIONAL♦

66th Annual Beekeepers' Field Day, sponsored by Agriculture and Agri-Food Canada, June 21, 10:00 a.m. - 4:30 p.m. at Beaverlodge Research Farm, 1000.8 Township Road 720, Beaverlodge, Alberta.

Speakers include Kirsten Traynor, Shelley Hoover, Samantha Muirhead, Paul vanWestendorp and more.

For information contact **Christine.Curran@canada.ca** or 780.354.5100.

2019 Beekeeping Tour to Cuba, November 9-17. Learn how the Cubans do it!

Arrangements by: Transeair Travel LLC 2813 McKinley Place NW, Washington, DC 20015, 202.362.6100 **blubic@aol.com Website: transeairtravel.com**.

Apimondia 2019 held in Montreal September 8-12. For more information visit **Apimondia2019.com**.

Slovenian Beekeeping presents an Apicultural Tour & World Bee Day, May 15-30.

For information visit **www.slovenianbeekeeping.com**.

The 5th Edition of the International Symposium on Bee Products in conjunction with Apimondia will be held in Malta May 7-10.

For information **ttps://msdec.gov.mt/en/beeCongress/Pages/default.aspx**.

♦CALIFORNIA♦

California Honey Festival May 4 10-5. For information visit **www.californiahoneyfestival.com**.

The 4th Annual International Conference on Pollinator Biology, Health and Policy will be held July 18-20 at University of CA, Davis. Reception July 17.

Early-bee registration is $325/person; $150/students. After May 15 $425/person; $250 students.

Keynote speakers are Christina Grozinger, Lynn Dick.

For information visit **https://honey.ucdavis.edu/pollinatorconference2019**.

♦COLORADO♦

The CO State Beekeepers Association will hold their Summer meeting June 7-9.

Speakers include Jonathan Lundgren.

For details and registration visit h**ttp://coloradobeekeepers.org/summer-bee-college-2019/**.

♦GEORGIA♦

Young Harris Beekeeping Institute will be held May 22-25.

Speakers include Francis Ratnieks, David Tarpy and Wyatt Mangum.

For information and registration visit **www.ent.uga.edu/bees**.

♦ILLINOIS♦

IL State Beekeepers Association will hold their Summer meeting June 7-8 at McHenry County College, Crystal Lake.

Friday is the members-only Short Course taught by Keith Delaplane and Jerry Hayes. This session is limited in size.

Saturday is a day of presentations. For more information and to register visit **www.ILSBA.com**.

♦KANSAS♦

Northeastern Kansas Beekeepers Funday will be held June 1 in Lawrence at the Douglas county Fairgrounds.

Speakers include Judy Wu-Smart, Matthew Smart, Randy Oliver, Katie Lee and Marion Ellis.

For more details visit **www.NEKBA.org** or call Jo Patrick, 913.645.8947.

♦KENTUCKY♦

Heartland Apicultural Society (HAS) will be held at Western Kentucky University in Bowling Green, July 8-10.

Keynote speakers will be Jay Evans, Jerry Hayes, Reed Johnson, Juliana Rangel, Jennifer Tsuruda and Geoff Williams.

For information visit **www.heartlandbees.org**.

♦NEW JERSEY

Bee-ginner's Beekeeping: The Basics of Apiculture, May 2-4; **Review of Basic Beekeeping**, February 16. Both held at Rutgers Eco Complex, Bordentown.

For more information visit **http://www.cpe.rutgers.edu/courses/current/ae0404ca.html**.

♦OHIO♦

Lorain County Beekeepers Association 25th Field Day will be held June 1 at Queen Right Colony, Spencer. This even is free

Guest speaker will be Albert Robertson from Canada speaking on Saskatraz Bees.

Lunch tickets are $10. Please contact **gargas1@frontier.com** to reserve your tickets.

For information visit **www.loraincountybeekeepers.org**.

♦PENNSYLVANIA♦

Summer Beekeeping 2019, Delaware Valley College, Main Campus, Feldman 122. **Queen Rearing**, three sessions - May 11, 12, 21, $219. **Introductory Beekeeping,** three sessions - July 26, 27, 28, $219. Vincent Aloyo is the instructor.

To register and get more details visit **www.delval.edu.**

The Capital Area Beekeepers' Association is offering its 32nd Annual Short Course May 4 and 11. Part I at the Dauphin County Ag and Natural Resources Center and Part II at Strites Orchard in Harrisburg.

For more information visit **www.cabapa.org** or d**eb.bee.caba@gmail.com**.

♦SOUTH CAROLINA♦

EAS 2019 will be held at the Greenville Convention Center July 15-19.

Speakers include Dewey Caron, Dennis vanEngelsdorp, Kirsten Traynor, Geoff Williams, Meghan Milbrath, Jennifer Berry and Jay Evans.

For information **www.easternapiculture.org**.

♦VIRGINIA♦

Virginia State Beekeepers Association will hold their Summer meeting May 31-June 1 at Fredericksburg Hospitality House.

Speakers are Kim Flottum and Jennifer Tsuruda.

For more information visit **www.virginiabeekeepers.org.**

Principles & Practices of Biodynamic Beekeeping - Part Three, May 11. Classes take place at Spikenard Honeybee Sanctuary in Floyd.

For more information visit **www.spikenardfarm.org**; **info@spikenardfarm.org** or 540.745.2153.

♦WASHINGTON♦

Washington State University Bee Lab will present a Queen Rearing and Bee Breeding Workshop, June 14-15 at Washington State University, Pullman campus.

Instructors are Susan Cobey, Brandon Hopkins, Tim Lawrence, Steve Sheppard, Nick Naeger, Jennifer Han and Melanie Kirby.

For information visit **http://bees.wsu.edu/queen-rearing-and-bee-breeding-workshop/**.

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On March 1, I got a hot tip that somebody ran a chainsaw through a bee hive in a tree at a Denver nursery. I live three hours away, so I left a message with Ray, hoping he'd come to the rescue. Then I forgot all about those bees.

I never dreamed that just four days later I'd see them in a glass observation box inside the state Capitol building, at the annual Colorado Pollinator Legislative Breakfast!

Of course Ray was there, too. He always is. He reported a certain level of consternation and confusion at the nursery, with bees on the ground, in the air, and some still up in the tree. The county extension agent had come and gone. She declared that since the temperature outside was 50 degrees, those bees would never survive. She left a bee suit and instructions to spray the poor darlings with insecticide. But thankfully the staff balked, and then Ray arrived on scene.

Ray wasn't having any gloom and doom. He rescued 99 percent of the bees and made them part of his outreach program educating the public about our declining pollinators.

The pollinator breakfast is an opportunity for beekeepers and pollinator advocates to hobnob with passing legislators. I got to meet Governor Jared Polis's partner Marlon, who likes bees. This was a good thing to learn.

At about the same time, in Durango, at the other end of the state, Meghan and Tina discovered they have a lot in common. Meghan flew into Durango from Michigan to give a talk to the Four Corners Beekeepers Association, and she stayed with Tina.

Meghan sports an academic pedigree a mile long. She owns and manages Sand Hill Apiary, a queen rearing facility; does pollinator research at Michigan State; coordinates the Michigan Pollinator Initiative; and runs the northern Bee Network, a queen directory and resource site. In her spare time, she writes for beekeeping journals.

Tina is the Colorado State Beekeepers Association (CSBA) vice-president and a *Bee Culture* and *American Bee Journal* contributor. She studied at the Beekeepers School of Hard Knocks, where she still attends classes. She raises her own queens, works with a commercial beekeeper, and oversees the CSBA Master Beekeeper program. She couples her passion for honey bees with a relentless Puritan work ethic. She knows bees. Throw her all the knuckleballs you want. You can't trip her up.

Both women live out in the sticks and raise pigs. Their husbands are carpenters not overly fond of stinging insects. But opposites attract, right?

Opposites? Let me take this a step further. Tina can be forthright. She calls 'em like she sees 'em and never holds back. And when she talks about honey bees at bee clubs and conferences, she seems to relish the hot lights.

Meghan, on the other hand, would be more the diplomat. Twice bitten and thrice shy, she's learned to relish a measure of personal privacy. Following her sparkling how-to talks, eager beekeepers with follow-up questions have gone so far as to follow her into the bathroom. "So, I have this one hive . . ."

Such is the price of fame.

Novice beekeepers ask a lot of questions, and the cagy ones figure out who best to ask. A prominent bee researcher told me she receives 1,000 e-mails a day, and if she answered them all, there wouldn't be time for anything else. So if you write to a beekeeping rock star and don't hear back, don't take it personally, OK? He might not be stuck up – just overwhelmed.

Which brings me to this: You can't learn everything about our noble craft from a book or a class or even an expert. Sometimes

you just have to get out there and do it. Do it right or do it wrong, but do it! The path to beekeeping competency is by necessity littered with mistakes. You will sometimes fail, but if you keep at it, you will learn. That I promise.

I'm not saying you should always charge blindly into the fog, but 98 percent of the things new beekeepers worry about are unimportant, anyway. So relax a little!

A guiding hand can be helpful, but good luck finding a competent mentor. Getting reliable advice can be challenging. But you could modify your strategy. How about if instead of asking for help, you offer? Let's say there's a veteran beekeeper in your community. Rather than ask for 10 minutes of his precious time, why not offer to help him for a day? You might make a new friend. Wouldn't that be handy?

Look, your offer can go one of two ways. He says yes, and you get to hang out with a pro. If he says no, he's still got to respect your sincerity, and he might be more inclined to talk to you on the phone.

Or sign up for bee conferences and save all your questions for Meghan. I'm sure she'll be happy to oblige. Just don't follow her into the bathroom.

Ed **Colby**

Pig Farmers