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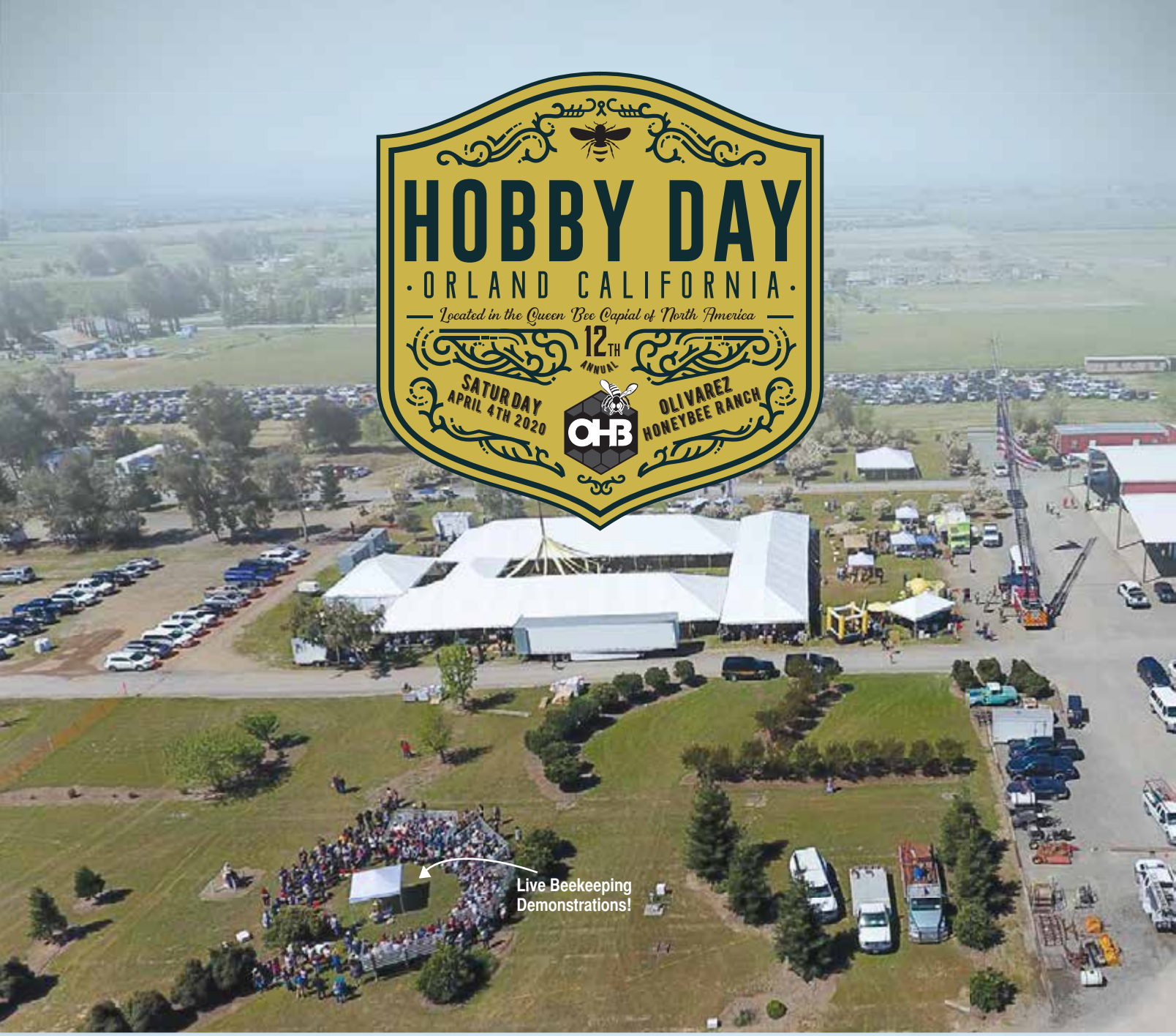

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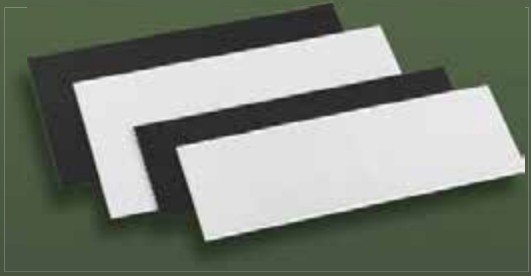

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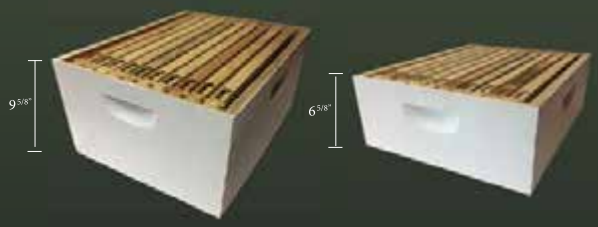

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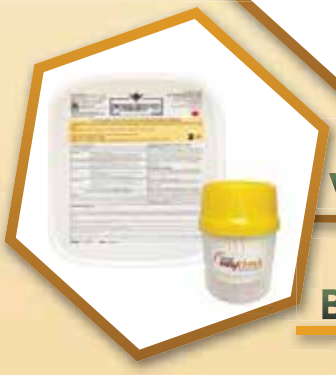

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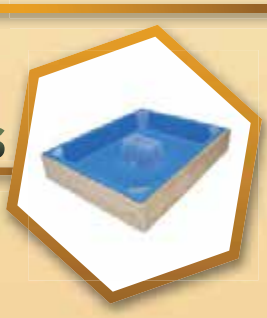

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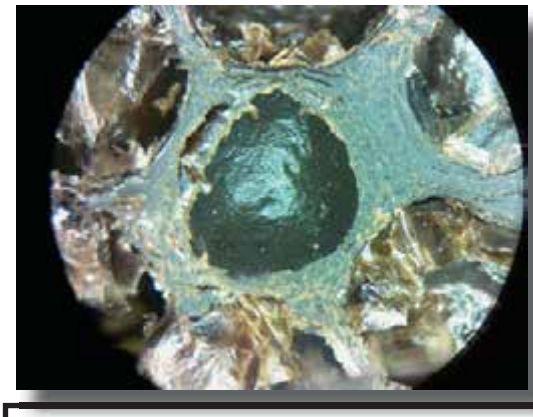

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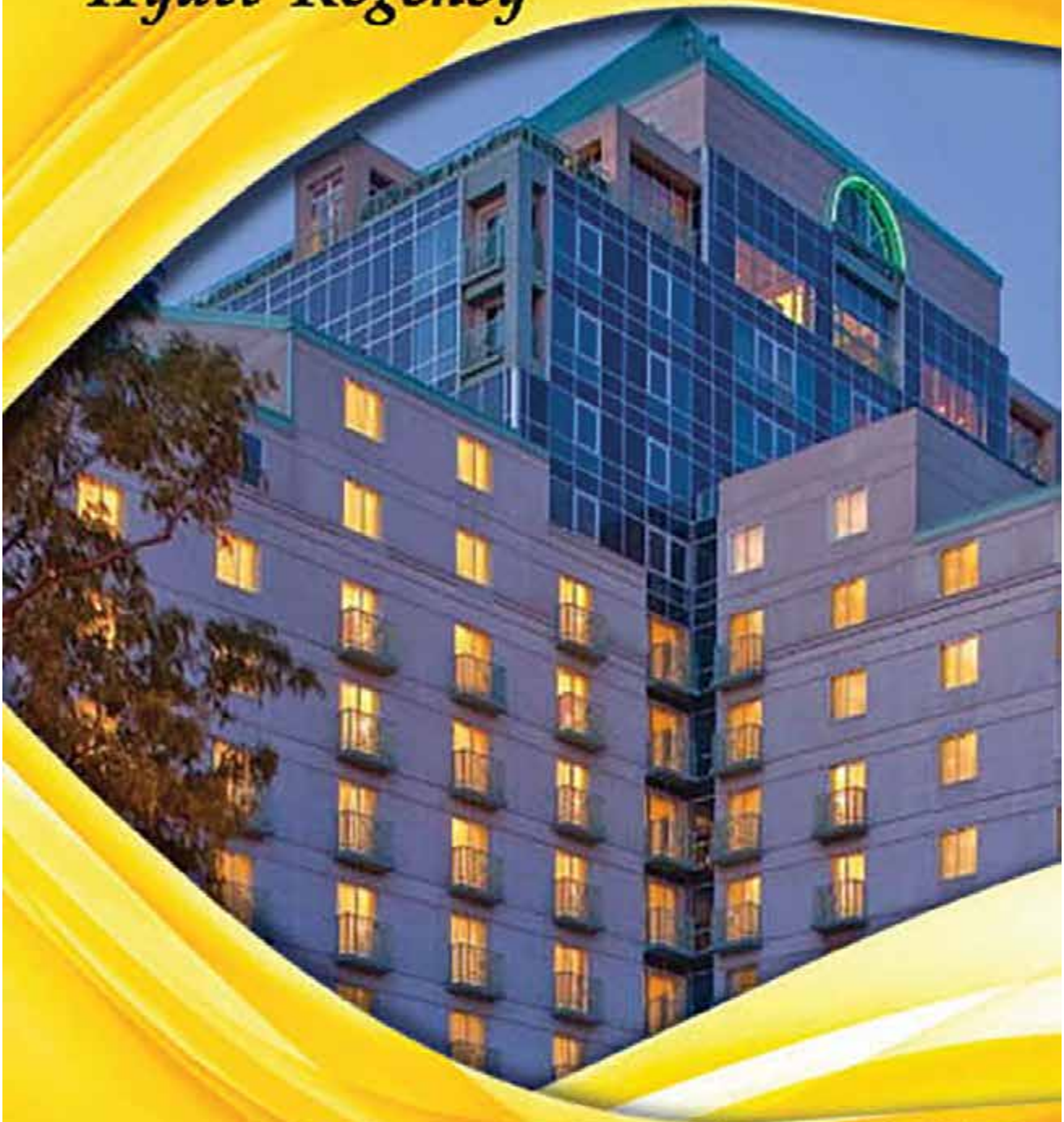

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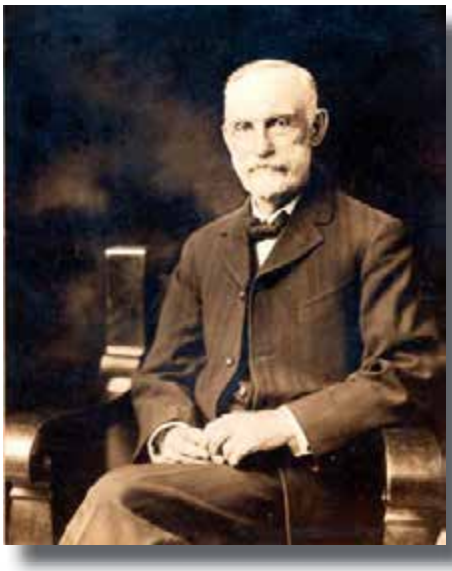

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Three Acres A Minute

Your September "Inner Cover" targetting land use – should be the poster child for why consumers should search and buy produce and products shining the BFF (Bee Friendly Farming) logo!

Everyone's wallets determine what we will have or not have in our future.

Kathy (email)

Facts Matter In "A Closer Look"

Every month when my copy of *Bee Culture* comes in the mail, I open it first to find out what Dr. Clarence Collison is writing about in his monthly article "A Closer Look." I really appreciate how Dr. Collison takes a complex or emerging issue, synthesizes the multiple sources of research and summarizes the findings.

Like many beekeepers, when I'm trying to learn about my bees and decide on the best course of action, I get confused by the "Ask 10 beekeepers a question and you'll get 11 different answers" situation. However, I find that when I research the question using **reputable** sources, I find fewer and better answers. Yet, it's not easy for us regular folks to read through all the resources on a topic. That's where Dr. Collison and his article is so helpful.

Here are just a few of the recent things I've learned from "A Closer Look" that has enabled me to keep healthier, more productive bees.

***Varroa* Mite Dispersal** January 2019 – ". . . mite numbers are always lower in 100 meter apiaries than in 10 meter apiaries." – I have spaced my hives 400 feet or more apart.

Defensive Behavior May 2019 – "Guard (bees) are very sensitive to vibrations, odors, color and movement." – I work my hives by myself, gloveless, from behind the hive and with as "zen" movements as I can. I very rarely get stung and when I do, it's always because I made a mistake.

***Varroa* Mite IPM Control Techniques** July 2019 – "These data show that drone brood removal can serve as a valuable component in an integrated pest management program for *Varroa* mites and may reduce the need for other treatments . . ."– I employ many of the *Varroa* IPM strategies and having read this article, understand which work better than the others. I have tried drone trapping in the past but will employ it with more rigor in Spring 2020.

Propolis Collection and Use August 2019 – "Among their natural defenses against pathogens and parasites, honey bees coat nest cavities surfaces with propolis. Consequently, they are able to economize on immune system activation, lowering energetic costs and improving longevity." – I roughened up the interior walls of all my hive bodies using the wire brush method to encourage the bees to create a propolis envelope. It was easy and quick to do.

These are just a few of the practical applications of Dr. Collison's article "A Closer Look." His articles are relevant, fact-based and useful to any beekeeper attempting to keep current as research expands and deepens our understanding of these fascinating creatures. Dr. Collison helps take the mystery out of why bees behave as they do and how beekeepers can best help our bees stay healthy and productive. Keep up the great work and keep those articles coming!

Theresa Martin
Williamsburg, KY

Smoker Additives

I just read the letter to the editor from the South Carolina man (page 9 of Sept issue) asking about Frank Eischen's work with additives to the smoker. I strongly caution about putting leaves of various plants or even other additives in a smoker. His work was done in carefully controlled experiments. It is possible that the smoke produced from additives could contain something highly toxic to bees, and even to humans.

Ann Harman
Flint Hill, VA

Bee Culture

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Getting Water

In an extremely dry Texas Summer this year, some of our honey bees were forced to get a little creative to fulfill their water needs. (See photo). The bark of this particular tree, thanks to a poorly-directed sprinkler, stays moist all year round, as you can see from the sheer amount of lichens covering it. Each morning, the bees arrive en-masse to gather water that accumulates in the furrows of the bark, just showing how resourceful our favorite pollinator can be, when it needs to be!

Peter Keilty
Texas

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Mead has been around for ages, even long before humans discovered how to convert barley into beer and grapes into wine. There has been a definite interest to its popularity in the last decade with meaderies popping up all over the U.S. Mead is made from fermented honey, mix that with some water, called the must, and then throw in some yeast and a little yeast nutrient and a few months later it's a golden intoxicating elixir. Beekeepers have the best advantage to making their own mead when the honey is flowing in. All you need to make a 1 gallon batch of mead with Must Bee Mead is 2.5lbs of honey. Mead's range from 5-20% alcohol by volume (ABV), which depends on the amount of honey that is added to the water. They also range from dry to sweet based on the yeast fermenting out all the sugar in the honey. This Mead kit will yield between 9-12% ABV.

Mead is also tagged to the term honeymoon. History says that the honeymoon reference came from the moon cycle just after the bride and groom's wedding. It was believed that if they drank mead for a full moon cycle then the couple will certainly be fruitful in conceiving a child.

This mead kit is gluten free, no sulfates added. Best known for its ability to produce complex honey aroma and flavors with aging, so if you have the patience, the longer it sits, the better it may get.

Available for purchase for $45 from **www.mustbeecompany.com.**

Kit includes: One gallon glass carboy, rubber stopper and airlock, siphon tube, thermometer tape, funnel, yeast, yeast nutrient and step by step guide.

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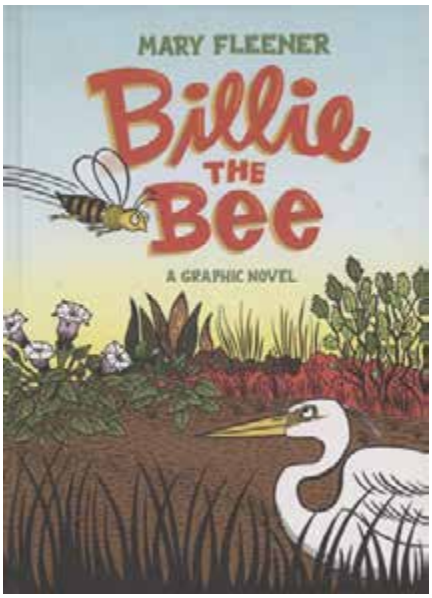

Billie the Bee, A Graphic Novel, by Mary Fleener, ISBN 978-1-68696-173-4, hardcover, 128 pages, 6¾" x 9¼". $14.99 Fantagraphics.

Meet Billie, an oversized honey bee with an even bigger personality! She's bold, boisterous, and always singin' up a storm. Billie lives a sweet life exploring the marshes of San Diego and making friends with Kay the kind Fox, Rayleen the rattlesnake, and Flo and Mo, the dirty joke-telling turtle sisters. When humans arrive and illegally release some rabid creatures into the marsh lands, upsetting the delicate ecological balance of the habitat, Billie and her woodland friends must band together to repel these wild outsiders.

Fleener's intricate crosshatching and signature mind-bending forays into cubist storytelling masterfully conjure up the world of her plucky protagonist, Billie the Bee.

INNER COVER

An interesting and educational week in Montreal. Over 5000 people attended we're told, but I suspect there were actually more. Hundreds of talks, workshops, round tables and posters – you'd have to be there a month take it all in. There is a 340 plus page book with just the abstracts of the talks that I am quite sure I will still be reading come spring. A honey show amazing in scope but clouded with controversary that we'll get to in a moment, and a vendor area larger than some airports I've been in.

The honey show had 48 classes, including honey of course, both liquid and what they call set honey, or crystalized honey, meads, beeswax and products, cut comb, honey beer, all manner of displays, photographs, books, videos, and inventions. I don't know how many entries were made by people from the U.S. but the U.S. took home three gold, three silver and four bronze awards.

I talked with some of those who were in the show and was told entries had to be sent to Germany in July for testing. And the testing was serious. One report, not yet verified, was that over 40% of the entries were rejected because of issues with adulteration, contamination, moisture, and ultra-filtering. I can understand not knowing your honey is contaminated with parts per million agricultural or beekeeper applied pesticides, but one has to wonder about entering honey with sugar syrup in it, or, what is being removed with filtering to the degree some were. Another issue was, I'm told, if your entry was disqualified, you weren't told why. And I would think another issue would be crystallization of just-harvested honey during the trip to Germany, the examination time, then the trip to Canada.

This process seems to me somewhat extreme, and I may not have all the facts, but at the least, shipping to Germany then back to Canada could have easily been avoided by simply using one of the many companies that do exactly that here in North America. In fact, we did a facebook live interview with people from one of those companies, QSI, that you can watch on our Facebook page.

I have always had the feeling that when attending a conference like this there's two kinds of things going on – the talks, research reports and discussions are bringing people up to speed – this is what is today. Researchers aren't in it for the profit. They get to eat, no matter what. If you want to know what is, sit in on the talks. If you want to know what will be, talk to the vendors.

That's because the vendors pretty much lay out the future – here's what's new, different, exciting and you better know about it, and even better you should own it. In my opinion, this is where the vision of an industry lies and the directions we will all be going even before we leave the building. The talks are necessary but I have a 340 page book I can read anytime. You only get to talk one-on-one to the guy who is bioengineering honey bees probably only once, when you and he are in the same place at the same time. And it has to work because he has to eat. So, I almost always spend most of my time chasing the future.

There were just under 20 businesses from the U.S., some familiar, some unknown and some brand new, just introducing themselves. China had the most booths with 45, Canada, the host had 29. All together there were 205 vendors representing 54 countries. The thrust of some was obvious – clothing for beekeepers was common, as were basic tool manufacturers, and cosmetic makers, and sellers were common. But the big picture, the unspoken message I got from visiting nearly every booth was that in this time and place, there were three critically important factors in beekeeping success. These three topics aren't earth shatteringly new, but the emphasis on each was strong enough to touch.

The first was glaringly obvious. I think of the 205 businesses, maybe a third were in the business of packing and selling honey, and they wanted to sell honey to the U.S. Varietal honeys were popular, especially if a particular variety was specific to that country. But just plain honey was everywhere. That we import most of the honey we consume, and our per capita consumption is pushing two pounds per person, our 320+ million people make a huge, huge global market for the stuff. And everybody wants a piece of that market. At the very same time, in those meeting rooms were people talking about the humongous amount of adulterated honey on the world market. Added ingredients lead the list – cheaper sugars, water, you name it and those who look are finding it. With that discussion were people talking about more and better ways to find the stuff before it gets sold. So rotten honey is a problem, but lots of people are trying to fix that problem. The sad part of this is that, when talking to one of the businesses that actually do the testing, as soon as a way to find bad honey is found, the crooks find something else to add. When you can produce a honey-like product for 20 cents a pound and sell it for a buck, the incentive is obvious. It becomes more obvious when those doing the selling aren't looking for problems. Adulterated honey isn't going to go away soon. And it's in your grocery store right now.

An additional issue with honey is contamination with both agricultural and beekeeper applied pesticides. Probably the most common chemical is glyphosate. But it's not the only one. And from what the testers tell me, ag chemicals dominate

Notes From Apimondia 2019.

in number, while beekeeper chemicals dominate in volume. Parts per billion vs. parts per million. There is no safe place to go to avoid ag chemicals it seems. Rigorous testing can, and will find beekeeper added poison, but the stuff from farmers is tough. And this leads to the second factor in the vendor area – enough good food, all of the time, for every bee in the bunch.

Honey bee nutrition is on everybody's plate now and pretty much everybody is developing some sort of food or food supplement for bees because they aren't getting it out there in the amounts they need, any more. Feeding bees isn't new, but it's getting better. And the sources of protein are getting interesting – seaweed is being seen more frequently, and soymeal and dairy products are almost completely gone. But it's the rise of probiotics that is really amazing.

It seems there are several active biota in the honey bee gut that help with digestion and absorption of a honey bee's diet. And, it seems, some of the chemicals we apply to colonies, or, some of the viruses they encounter because of their constant encounters with *Varroa*, or, some of the ag pesticides they run into on a daily basis looking for food, are detrimental to these tiny gut creatures, and as a result their numbers are lowered or even eliminated. Thus no digestion, thus starvation. Not enough food.

But researchers have identified these tiny digesters, and can grow them outside of bees, then feed them to bees to replace those that have been lost or killed. Being able to eat, or eat more is certainly a step in the right direction of keeping colonies alive, and healthy, and there are companies producing this stuff by the ton for bees.

So, more food, better food, and better digestion – enough good food all of the time for every bee in the bunch. That was a strong focus of what's going to solve the nutrition issues with bees.

The third factor was the obvious and amazing increase in the magic of intelligent remote sensing. Right off the top there seemed to be about a dozen companies designing and selling remote sensing equipment, improving data interpretation, reducing labor costs, improving colony, beeyard and operation efficiency and all of them are using the cloud.

Most of them are measuring weight changes, humidity changes, sounds, temperature changes and colony movement. These measures are then compared to thousands, maybe millions of similar measurements and analyzed to predict some activity that is going on and what, if anything the beekeepers need to do to solve a problem, avoid a problem or send somebody to resolve the problem.

Coupled with this is one of the systems of citizen science, where many operations are sharing their data to form a huge database for analyzing individual colony inputs. Some of these work on cell phone transmission so if your beeyard can get a signal you can make that work. Others actually have a transmitter in a beeyard that gathers data from each colony, then sends it to the cloud for collection and use later.

Part of all of this of course is the goal of a genius hive, which is being explored each month here, with the goal of having a hive and a beeyard able to make certain decisions without input from the beekeeper. Watch this space for what's down the road on that.

More business than science, but lots of that also, was the BApp program for commercial beekeepers. This is an amazing tool. It operates in both English and Spanish, can translate if needed, uses inputs from 10 different commercial operations so it has a very broad set of input requirements and specialties, does voice messages, has inputs for photos, comments, treatment, numbers for treating, feeding, harvesting, what to do next time, and reports from last time a yard was visited. All on your cell phone.

One more topic that, though not quite as focused, was nearly everywhere I looked was housing. Not for beekeepers, for bees. Beekeepers in temperate climates are looking at heat loss through thin walls, reduced humidity in well ventilated hives which encourages *Varroa* populations, the fact that no propolis shell can be made and most hives have a huge entrance. The boxes we use are convenient for beekeepers, but not so much for bees. Dr. Seeley should be pleased to see others are making the same decisions he is relative to this bee health issue.

From the talk side of the meeting, there were a host of symposia, where a single topic was studied from the perspective of many researchers. Leading the way was honey fraud, which, as noted was a very hot button item. But biology, pesticides and residues, apitherapy, beekeeping in developing countries, genetics, Canadian beekeeping, pollination as a business, citizen science projects, honey bee nutrition, non Apis bees, of course pests and diseases, other pollinators, breeding bees, hive products and marketing were all covered extensively.

There were round table discussions covering honey adulteration, the social impact of beekeeping and the economic value of bees and their products. There were also sessions on Technology, income sources, amitraz resistance and treatment free beekeeping.

There was, quite literally something here for everybody. You can still download the book of abstracts which will give an introduction to the talks, posters, workshops or roundtables so you at least have a feel for where the industry is today, and to some degree where it is headed tomorrow.

A final note. Phillip McCabe, the past president of this organization passed away suddenly and much too young this past year, and the organization has been working with an interim president until this meeting. At this meeting, Dr. Jeff Pettis was elected President for a four year term. He had been serving as President of the Apimondia Scientific Commission for Bee Health from September 2015 to September 2019. As you may know, Dr. Pettis for a time was the Research Leader at the USDA Beltsville Bee Lab, so comes to the position with a strong government and science background. He is currently a consultant for several beekeeping research projects, and is well placed to take this group into the future. Congratulations to Apimondia on this wise choice, and to Jeff for raising his hand.

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It's Summers Time –

Ducks, Chickens and Apimondia

Well, it has been more than the usual busy for us this past month. It's hard to believe this is already the November issue. And you know what that means – Winter and Christmas will be here soon.

I think this Summer seemed to fly by so quickly because, here in Northeast Ohio, we missed just about all of June as far as being outside because of all the rain. So our growing season was cut really short and the corn was late and on and on – it's just been an odd Summer. Then we had about 20 days of 90+ temperatures, which I know for some of you is nothing. But here in Ohio that way exceeded our norm. Last week it was 90° on Monday and then by Friday it was in the 40s.

So here we sit looking at all of the things we didn't get done, again this Summer. But there's always next year – at least we hope so.

It's time to start getting the birds ready for Winter and still one of the most difficult things for us is the water situation. And this year, of course there are more chickens and those ducks. Those ducks are so darn cute, but what a mess they make. And when they're outside in the pen it doesn't much matter. But now we're trying to figure out how to contain the water they need to have available and not have a complete frozen, muddy mess in the coop all Winter long.

We lost another older chicken this week. Like some of the others she seemed to just tip over. Nothing seemed wrong and then gone. The young crippled girl is doing just fine. And yesterday we finally found one very small blue egg, so it's finally looking like the younger ones are starting to lay.

I don't think the ducks have laid any eggs, at least not that we have found. We put a nesting box on the ground for them and even put in some of those fake eggs, but so far nothing – unless they're carefully hiding them somewhere.

They still travel in their little pack of seven. At night when I go out to close the door the ducks are always still outside. All the chickens are in and ready for bed, but the ducks I have to call. But they now come when they hear me whistle and call for them. There is one male and one female that seem to be a pair and seem to be the dominant ones in the group. Often they come in first at night and stand by the door calling to the others, as if to say, "She's here, it's time to come in!" They head right in, I close the door behind them and all is good. I think I should have been a farmer.

Our trip to Apimondia was wonderful. The best part was seeing many friends that we hadn't seen for quite some time. We counted about 70 people that we knew and got to talk with. Travel was easy and uneventful, always a good thing.

The venue was wonderful. It was a huge conference center (you can see how big the escalator was in the photo). It was multi-purpose – shopping, food, and the metro station along with the conference center. Each morning and evening we were mixed in with local folks travelling to and from work.

Apimondia did an excellent job of making it easy to

get around. They had these hexagons all along the path that you were to take to get where you were going. It made life so much easier.

Kim and I spent most of our time in the absolutely enormous exhibitor hall. I hope you got to see some of our Facebook live things we did with vendors. There was so much to see, it was hard to take it all in. The one thing that stood out after about the second day is the number of gadgets there are to put in your hive and measure things – temperature, weight, are the bees alive. There must have been at least 20 companies from all different countries selling some version of these things.

We hurried home on that Thursday and the next day drove to Seven Springs, PA for the Mother Earth News Fair. It made for a very busy week, but we always enjoy these fairs. The weather was good and lots to see and do. Kim gave a couple of talks there and then finally home for a bit.

This week we've been busy getting ready for our October event, finishing off our year of celebration for the A.I. Root Company's 150th year. I think we're ready. If you didn't get to join us, watch the December issue. I'll let you know how it went.

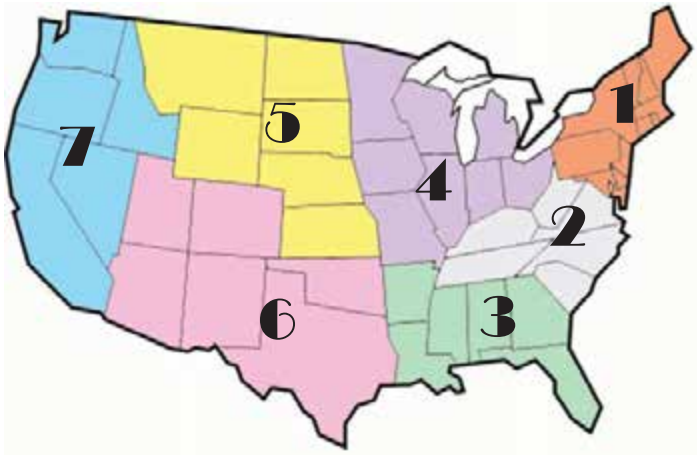
I hope you have enjoyed the year with *Bee Culture* as we've tried to give you just a bit of our history. The magazine and the company started by A.I. Root are a part of the local history here in Medina and have had a pretty good impact on the beekeeping industry as a whole. It has been a treat go go back and visit the stories.

Don't miss the December issue. We'll finish up the year with a little more history and it's our Interview issue so we'll have some interesting stories about interesting people.

Stay tuned! Happy Thanksgiving.

Hardy Summers

NOVEMBER – REGIONAL HONEY PRICE REPORT



We went to our reporters this time looking for a couple of inputs. We wanted to know how the honey crop was, at least so far anyway, since most had finished harvesting, and, we wanted to know how the Spring, summer and fall weather was where they were, so perhaps there would be a correlation between the two – good weather, good crop, or, bad weather, bad crop. It seems simple, but – let's take a look. To measure this we asked production per harvested colony, and temperature and rainfall (average, too much or too little) for spring, summer and fall (they got this about mid-October).

Region 1 averaged 87 pounds/colony, ranging from 30 – 250 lbs/colony. Overall, the season was better to much better than last year. Spring was generally cold and wet pretty much everywhere. Summer about average temp, but still too wet, and Fall warmer than normal with about average rainfall.

Region 2 had an average of 51 pounds/colony, ranging from 20 – 95 lbs. The season was better than last year for nearly everybody. Spring was average to warm, and pretty much too wet, Summer hot and dry and Fall average to too warm and really dry also.

Region 3 averaged 63 pounds/colony, with a range of 30 – 85 pounds/colony. The season was better to much better than last year for most, but a few didn't fare so well. Spring was average to too warm and way wet. Summer was essentially too hot and average to too wet, while Fall was still hot, and all over the map for moisture.

Region 4 averaged 71 pounds/colony, with a range of 50 – 122 pounds/colony. Overall the season was better to much better than last year. Spring was, quite simply, cold and wet. Summer had pretty much average temps to a tad too cool and average/wet/dry in places, depending, where ever. Fall seemed to have about normal temperatures, and, interestingly, about average rainfall – except in Medina, where the chickens are growing web feet.

Region 5 had a less than stellar year, with only a 40 pound average, ranging from 25 -53 pounds. Everybody had a bad year compared to last year, with a cold and wet Spring, a warm and dry Summer and a hot and dry Fall.

Region 6 averaged 45 pounds/colony, ranging from 10 – 60 pounds, pushing nearly everybody to say it was worse than last year. A cold, wet Spring led into a warm and dry Summer, and a very hot, and dry Fall topped of the year.

Our Region 7 reporters averaged almost enough to feed a colony for a week or so – 25 pounds. It was a terrible year for them, ranging from 10 – 45 pounds/colony, and everybody thought it was worse than last year. Cold and wet Spring, but an overall average Summer, which tends toward too dry, and still warm all Fall with more rain than normal. We hope next year is better for them.

	REPORTING REGIONS							SUMMARY			History	
	1	2	3	4	5	6	7				Last Month	Last Year
EXTRACTED HONEY PRICES SOLD BULK TO PACKERS OR PROCESSORS								Range	Avg.	$/lb		
55 Gal. Drum, Light	2.00	2.23	2.20	2.19	2.28	1.97	2.83	1.65-3.25	2.21	2.21	2.22	2.16
55 Gal. Drum, Ambr	1.97	2.06	2.05	2.22	2.20	1.80	3.25	1.35-3.25	2.11	2.11	2.09	2.06
60# Light (retail)	225.00	187.00	201.67	160.68	160.00	178.25	220.00	120.00-325.00	195.93	3.27	207.85	193.41
60# Amber (retail)	214.68	189.60	200.00	152.96	208.62	173.25	220.00	119.74-325.00	194.88	3.25	205.98	191.57
WHOLESALE PRICES SOLD TO STORES OR DISTRIBUTORS IN CASE LOTS												
1/2# 24/case	100.98	75.67	94.80	69.40	61.20	107.77	107.77	57.60-194.40	89.54	7.46	93.90	86.86
1# 24/case	151.49	109.67	138.02	111.69	125.33	119.76	128.40	80.72-300.00	135.50	5.65	129.57	128.45
2# 12/case	134.19	97.63	121.17	129.66	103.92	144.33	114.00	78.00-246.00	126.65	5.28	117.60	114.31
12.oz. Plas. 24/cs	104.50	104.26	102.67	91.87	83.76	107.76	100.80	66.00-172.80	100.12	5.56	101.55	98.77
5# 6/case	153.36	111.85	190.50	121.20	113.16	148.26	148.26	71.50-240.00	140.76	4.69	133.62	128.19
Quarts 12/case	175.31	152.17	133.50	149.09	141.02	119.88	192.00	108.00-300.00	155.43	4.32	150.70	146.33
Pints 12/case	90.46	98.60	77.00	81.18	96.80	80.00	90.00	60.00-140.00	88.92	4.94	91.14	96.14
RETAIL SHELF PRICES												
1/2#	5.90	5.31	4.46	4.48	4.40	2.98	6.00	2.50-9.00	5.19	10.38	5.24	5.07
12 oz. Plastic	6.77	6.40	5.79	5.08	5.10	6.32	5.33	3.70-12.00	5.99	7.98	6.10	6.12
1# Glass/Plastic	8.70	8.07	8.72	6.89	7.19	5.88	9.25	4.79-17.00	8.06	8.06	7.98	7.59
2# Glass/Plastic	13.98	15.32	14.85	12.26	13.20	10.00	15.25	7.99-28.50	14.09	7.05	13.22	12.88
Pint	10.91	10.61	8.16	8.94	10.30	10.32	10.47	4.00-16.00	9.99	6.66	10.57	10.20
Quart	20.63	18.13	15.76	16.00	15.76	17.40	21.58	8.00-36.00	17.91	5.97	18.66	16.38
5# Glass/Plastic	30.01	27.10	40.75	26.37	24.25	20.94	30.74	15.00-50.00	28.99	5.80	26.68	26.17
1# Cream	10.33	8.58	7.00	8.83	12.13	10.45	9.00	6.00-16.00	9.90	9.90	9.83	9.53
1# Cut Comb	13.18	14.16	9.33	12.94	14.33	14.24	14.00	7.00-24.00	12.98	12.98	12.58	11.99
Ross Round	11.79	7.15	10.33	11.00	10.00	7.50	12.49	4.00-17.00	10.16	13.54	9.83	8.88
Wholesale Wax (Lt)	7.91	5.20	5.60	6.84	6.75	4.25	9.33	3.00-15.00	6.96	-	6.76	6.54
Wholesale Wax (Dk)	6.37	4.93	4.52	5.14	7.50	7.42	8.33	2.55-15.00	6.06	-	5.04	5.48
Pollination Fee/Col.	100.45	74.00	70.00	81.25	88.33	88.33	88.33	30.00-150.00	86.67	-	84.56	90.45

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

- Check ventilation, and hive weight, and close screened bottom boards
- Check mites if weather permits
- Wrap with Bee cozy, or tar paper, keep entrances clear
- Check stores and feed if necessary, sugar and pollen patties, candy boards or fondant
- Finish what I didn't do in November
- Remove dead bees from bottom board, check mouse guards
- Move to winter yards
- Check bear fence

Region Two

- Check food and queens and wind breaks
- Combine small colonies, feed syrup and protein patties if needed
- Insulate hives, close screened bottom boards, check ventilation
- Move to warmer location
- Treat for mites if necessary and possible
- Check mouse guards
- Replace old equipment, clean up beeyard
- Monitor hive weight
- Treat with oxalic end of month if needed

Region Three

- Provide wind breaks, check food stores, reduce entrances
- Check mite numbers, treat if too high
- Order spring supplies, prepare new equipment
- Cull old equipment

Region Four

- Put dry sugar on inner cover, add pollen patties, sugar patties as needed
- Remove any mice, reduce entrance, Close screened bottoms
- Combine small colonies
- OA treatment if needed
- Moving to different, better, pollination beeyard
- Provide wind breaks and wrap with insulation

Region Five

- Get winter wraps on, entrance reducers, close screened bottoms
- Provide Winter food, candy boards and protein patties
- Check ventilation, wind breaks

Region Six

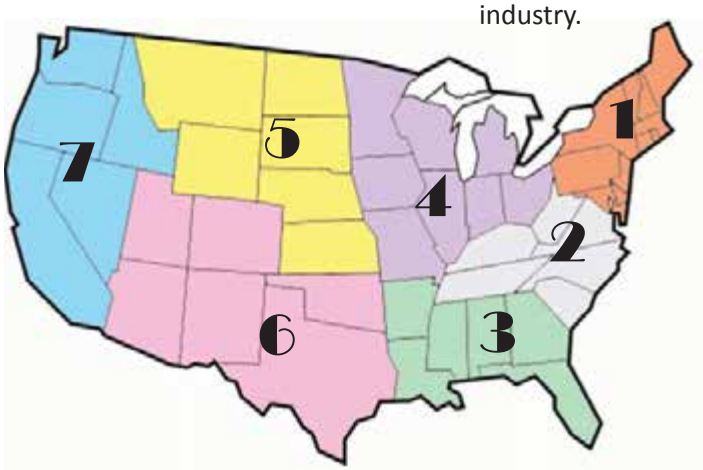
- Treat for *Varroa*, remove dead hives, collect samples for bee lab inspection
- Feed, feed, sugar and protein
- Check bottom entrances, provide wind breaks
- Combine small colonies
- Prepare equipment for next season

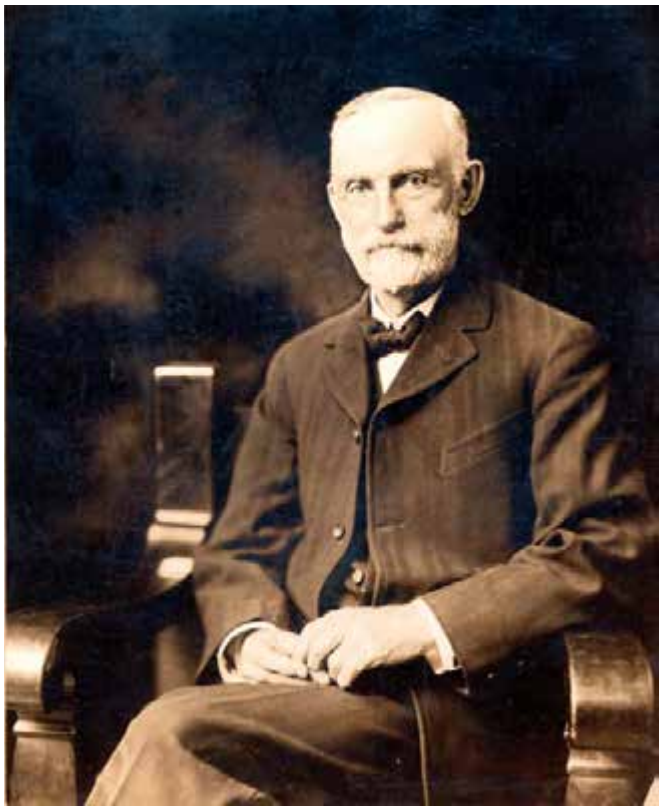
Region Seven

- Treat for mites
- Feed if needed
- Check for vandalism and theft

Honey Reporters Wanted

We are expanding our Honey Reporter population and need new reporters in EVERY region. We ask that you fill in most of the wholesale or retail or both sections, most months, and our short survey on the back. We give you a FREE subscription for your service. So if you are interested send an email to **Amanda@BeeCulture.com** and put REPORTER in the subject line. Include name, email, phone number and mailing address and we'll get you the next Honey Report form. Sign up today and be a part of the BEST Monthly Honey Price and Beekeeping Management Report in the industry.





"For, lo, the Winter is past, the rain is over and gone; the flowers appear on the earth; the time of the singing of birds is come, and the voice of the turtle is heard in the land."
– Song of Solomon 2:12

THE STORY OF A.I. ROOT

Famous Friends

A.I. **Root**

About the year 1870 a stranger called who wanted to talk about bees. I was just then getting ready to go out bee-hunting in order to be able to write intelligently on that subject. So many had come to see me about bees that I felt a little impatient at being hindered just then; but as this visitor seemed to be quite an intelligent man I told him I should like to have him go with us if he cared to. While we were in the woods looking up among the trees for a bee-tree I began whistling a simple little air from a music book, for I was then taking music lessons. The stranger made the remark that what I was whistling was rather pretty. I told him I thought it was very pretty indeed, even though it was just a simple little exercise for beginner's music.

"Well, I am glad you like it Mr. Root, for it is something that I composed myself." I turned about and stared at him and concluded he was not only a brag but that he was untruthful and I replied a little dryly that he must be mistaken, for it was an exercise I had just learned for the Curriculum.

"Can't help it Mr. Root, I composed it all the same. "

As he saw I did not believe it, he said nothing more about it, but when we got home he asked if he might look at my Curriculum and as he did so he placed his fingers on a foot-note on one of the pages to the effect that Dr. C.C. Miller had assisted in the compilation of the work. I nodded.

G.M. Doolittle

"Well," said he, "that refers to me. I am Dr. C.C. Miller."

Or course, we asked him to play for us and we were glad to have him consent to stay over night – in fact, to make our home his home so long as he remained.

Just before he was ready to take his leave, he surprised me by a little talk something like this:

"Mr. Root, I think I may confess now that I had a plan and purpose in making you this visit besides learning what I could about bee culture. I wanted to say something to you, but felt that, before I could say it, I must have you get acquainted with me and I wanted to win your confidence that my words might have influence with you. I have now got acquainted and I think I have won the friendship of both yourself and wife. You will excuse me for being somewhat presuming. Mr. Root, I want you to be a Christian. I want you to exert the influence you possess and to use the hold God has given you on the hearts of the people for the cause of the Savior."

I cannot remember what else he said just then, but I hastened to tell him that I was already in favor of Christianity and good morals. I then expected him to "let up," in the same way I had induced our pastor and other good friends to pass me by. He had no intention, however, of giving up thus easily. He told me that he who was not for the Savior was against him, kindly and pleasantly insisted that my influence was on the wrong side. I had tried to make him compromise a little, but he held fast to the Bible and the Bible text with such earnestness and faithfulness that I never got over it. He talked with all the energy I had heard traveling men use to sell goods but he had nothing to sell. He pointed me to the open door of salvation, open to all who would accept it "without money and without price." This talk I never forgot and it influenced me greatly in the years that followed.

In November, 1876, I had the rare pleasure of a visit from G.M. Doolittle. The chief characteristic of this man as an apiculturist seemed to be an intense determination to make his bees self-sustaining and even during the very worst season to make them bring in more money than was paid out on them. Not only did he aim to get all the nice white honey that his bees gathered, but he aimed to get it in the most marketable shape. There were many in those days who reported large yields from

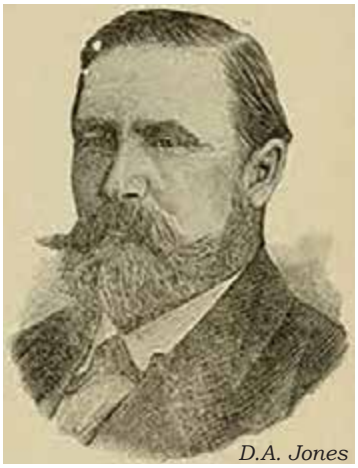
single colonies, but the number who could report a steady cash income from their apiaries, good seasons and bad, as did Doolittle – such men were few.

L.L. Langstroth

In April, 1875, Mr. Langstroth was our guest for a week or so and many were our talks on the unsettled questions pertaining to bee culture. He had performed in the past a great multitude of experiments, many of them to decide points which I had supposed had never been considered before. He had a wonderful memory in referring to the exact place in which the subject had been considered in earlier volumes of the *American Bee Journal* or in earlier editions of his book.

Prof. A.J. Cook

In the Fall of 1875 I took a trip through Michigan, calling on those beekeepers whose addresses I could remember. It was not a planned trip but a random route so far as the beekeepers were concerned.


D.A. Jones

I was more pleased then I could tell with my visit to the College Farm at Lansing and I shall always feel under obligations to my friend A.J. Cook, Professor of Entomology, for the many courtesies he showed me. Although the bees in the college apiary had died out entirely the Winter before, on account of being in a bee-house that was not proof against a temperature of 31° below zero, a new start was made in the Spring by the purchase of two colonies. These had been increased to eight good colonies, besides furnishing honey that was sold to the amount of $80, with still more to be taken.

In the afternoon in company with Prof. Cook I had a most interesting visit with my old friend, John L. Davis, of Delhi Michigan. That season Mr. Davis had increased his 39 colonies to 130 and had about 2500 pounds of comb honey and 1000 pounds of extracted. He said he could have secured nearly twice as much if he had given the bees' proper attention. Mr. Davis had kept bees successfully for 40 years and his winter losses were always quite negligible.

Met Many Old Friends at Conventions

On the 14th of September, 1883, I returned from a trip to the Tri-State Fair and the Toledo convention. Although I stayed but a few hours I had the pleasure of meeting a good many old friends – Thomas G. Newman, Charles F. Muth, E.E. Hasty, J.B. Mason and a host of others. The display of honey was most excellent, as was also the collection of implements for the apiary.

I attended the North American convention held in Toronto in 1883. D.A. Jones was there and he was D.A. Jones still, just as he always was, a natural born leader, a man kind and liberal to a fault. It was he who secured the beautiful building on the fair grounds and who taught the Canadian people that they could raise honey. It was through his influence, moreover, that the convention was brought to Canada. If he ever asked for anything he did not get without any trouble, it was something that I never heard of.

Prof. Cook and his "twin brother," Dr. C.C. Miller was there.

L.L. Langstroth came a little while after I arrived. C.F. Muth told us about buying and selling honey. Rev. W.F. Clarke had wandered from away up north down among his bee friends again. Vandervort and Pelham were there with their samples of comb foundation and also their mills. O.O. Poppleton, then of Iowa, Judge Andrews of Texas, Mr. House of New York State, Mr. Hart of Florida and many more whom I can not remember were there.

Mr. Langstroth and I roomed together at the convention in Toronto and we not only talked until after 12 at night but he wakened me before six in the morning to tell me of some more grand ideas he had just thought of. You may know that I did not object to being wakened so early, for if there was a pleasant bee enthusiast on the face of the earth, it was good friend Langstroth.

I attended the national convention at Detroit in the Fall of 1885 and found there D.A. Jones, Thomas G. Newman, W.F. Clarke, W.Z. Hutchinson, James Heddon, good old father Langstroth again and L.C. Root of New York State, whom I had never seen before. Mr. Root occupied the president's chair. Round about were the friends of whom I had heard through the journals, for years.

During one of the sessions Mr. Clarke stood up with a paper box in his hand and said something as follows:

"Will A.I. Root please stand up here before me and look me in the face?"


Dr. C.C. Miller


C.F. Muth


W.E. Clarke


O.O. Poppleton.

Langstroth

People think of a great many things while they are falling from a building or while they are in some great danger. Well, while I was rising to my feet I thought of a great many things. I inventoried, as it were all that I had been guilty of to see whether there was anything that I might fear to have brought to light. Although I thought I was bad enough, I could not think of anything that should warrant my being called up in that way for public reprimand, so I concluded that friend Clarke's medicine certainly would not be anything bad to take. In substance, he said something like this:

"Brother A.I. Root, we the beekeepers of North America in recognition of your services during the years that have gone by, not only in laboring for our temporal good but in view of the energy and zeal with which you have toiled for our spiritual good as well do hereby tender you this book. We do not all of us endorse all your peculiar doctrines, neither do we think exactly as you do on many points but for all that we know you have worked honestly, faithfully and unselfishly and in view of this we take pleasure in handing you this small testimonial of our esteem and friendship."

They said I would have to make a speech. A few weeks before this, I had been called upon at large Sunday school convention at Akron, Ohio, to tell my story about the Mammoth Cave. The next day the papers in reporting a part of my talk said that Mr. Root told the truth when he explained at the outset that he was not much of a speaker. Well, I am afraid the friends at the national convention thought I was not much of a speaker; but I think they gave me credit for being honest as the newspaper reporter did.

I wish I could tell what was said and done during the convention that day. No pen could picture the pleasant, hearty good healing that pervaded the meeting. We went there with out hobbies, a great many of us and got laughed at, but we were laughed at so good naturedly that the grace was given us to laugh back again. W.F. Clarke had his hibernating box; James Heddon his pollen theory; C.A. Jones his wonderful stock of dry jokes ready to crop out when an opening gave him half a chance; J.B. Hall of Woodstock, Ontario, kept us roaring with his grotesque oddities and Prof. Cook rose up once in a while with wise counsels and suggestions. Prof. Cook had a kind neighborly way of making these suggestions or even calling us back to the right track and no one could for a moment think of feeling hurt at anything he said. Friend Charles F. Muth was there too, towering above the rest of us and making us all feel pleasant just to look on his genial face while he read an article on the sale of extracted honey.

In shaking hands with different ones at noon I asked one big stalwart man his name and he just laughed at me. It was G.M. Doolittle. There was such a sea of pleasant faces that I got sort of mixed up and scarcely knew anyone. Besides, that big book they had given me had scared me and astonished me so that it all seemed somewhat unreal. I forgot to say that the book was a large edition of "Paradise Lost," illustrated by Gustave Dore.

As previously stated, I had never before met L.C. Root, the president; but before the convention was over I had abundant reasons to be sorry that I had never known him in the past. By the way, I began to have a much higher opinion of a great many whom I had never met and by a strange coincidence I began to have a smaller opinion of myself.

A Visitor from England

Thomas William Cowan visited Medina in the Fall of 1887. I do not know how many colonies of bees he had. Furthermore, I do not know that he ever made any money by following the pursuit of bee culture and yet Mr. Cowan gave me a new glimpse of life. He gave me a glimpse of the life of a human being who is not working as we Americans do, too many of us, simply to pile up dollars. In his two days' visit I did not hear anything said about great chances for making money, nor any discussion whether this or that would pay. It is sometimes said that riches tend to discourage energy and industry. It was not so in his case, for my friend must have been all his life a most energetic and determined worker, both with his hands and his brain.

Mr. Cowan was a member of the Church of England, but it was not until I hunted up some of his old letters that I discovered what a very earnest, pure-minded Christian he was. After I saw the man and talked with him face to face the letters he had written to me in years gone by had a new meaning. I presume such might be the case with many more if it were possible for me to meet the writers face to face.

Helen Keller

In 1891 Geo. Goodhue, of Danville, a Providence of Quebec, Canada, the man who helped me so substantially at the time. I was putting up the brick building (see *Gleanings*, January, 1925, page 48), a man who was never so happy as when helping the helpless, wrote to me in regard to Helen Keller. In the June number of *Gleanings* of 1891 we published two pictures of Helen Keller and a facsimile copy of a part of her letter. In the November 1st issue for the same year, the little blind girl wrote a long letter for *Gleanings*, in response to a fund which we had raised for the benefit of a blind boy whom she was trying to help.

The Wright Brothers

In 1904 I learned of two minister's sons who loved machinery and who were interested in modern development of science and art. Their names were Orville and Wilbur Wright, of Dayton Ohio. They had begun by studying the flights of birds and insects and they soon turned their attention to what had been done in the way of enabling men to fly. They not only studied nature but they purchased the best books the world contained on the subject. When I first became acquainted with them and expressed the wish to read up all there was on the subject, they showed me a library that astonished me. They had conducted a vast number of experiments with their "gliding machine," with which they learned to soar from the top of a hill to the bottom. By making not only hundreds but

thousands of experiments they became so proficient in guiding these machines that they could sail like a bird and control their movements up and down as well as sidewise.

When they became expert they used a gasoline engine to furnish power and had some little success with their apparatus in the fall of 1903. As soon as the weather would permit, their experiments were resumed early in 1904. The conditions were so different with power applied that it seemed at first that they would have to learn the art of guiding all over again. At first they went only a few hundred feet and of course their progress was necessarily very slow.

When I first visited the Wright Brothers and saw their apparatus, it was persisting in going up and down. Sometimes it would dig it nose in the dirt, almost in spite of all they could do. After repeated experiments it was finally cured of its foolish tricks and made to go like a steady old horse. This work mind you, was all new. Nobody living could give them any advice. It was like exploring a new and unknown domain. They cured it of bounding up and down simply by loading the nose or front with cast iron. In my ignorance I had thought the engine was not large enough, but when 50 pounds of iron was fastened to the front, it flew in a comparatively straight line and carried the burden with ease. Other experiments had to be made in learning to steer from right to left.

Witnessed First Successful Airplane Flight

On the 20th day of September, 1904, it was my privilege to see the first successful trip ever made by an airplane without a balloon to sustain it – that is, the first complete flight, turning the corners and coming back to the starting point. In making this trip, the machine was kept near the ground, except in making the turns. Later on they twice succeeded in making four complete circles, each circle passing the starting point. These were nearly a mile in circumference and the last flight, December 1, 1904, could have been prolonged indefinitely, had it not been that the rudder was in such a position that it cramped

the hand of the operator so he was obliged to alight. The longest flight at that time took only five minutes and four seconds. Over 100 flights were made in all during the Summer of 1904.

I was surprised at the speed and astonished at the wonderful lifting power of the comparatively small apparatus. When I saw it pick up the 50 pounds of iron so readily, I asked if it would carry me in place of the iron. I received by way of assurance the answer that the machine would no doubt carry me easily. You see I would then have had the front seat. It used to be customary in olden times to accord the "front seat" to the ladies, but I think the greater part of my readers would say, "Oh, sit still, Mr. Root, do not think of getting up to give us your seat."

At first there was considerable trouble about getting the machine up into the air. This was accomplished on a long single-rail track, perhaps 200 feet long. The engine would be started and gotten up to speed, while the machine was held by a sort of trap to be sprung when all was ready; then with a tremendous snapping of the four-cylinder engine, the huge machine would spring aloft. When it first turned that circle and came near the starting point, I was right in front of it and I said then and I believe still, it was one of the grandest sights. BC

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BEE TALK

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

Question 1

This is a simple question, and we aren't looking for the text book answer. What do you do about small hive beetles in your colonies you use for research, especially if you aren't researching small hive beetles?

We have trapped some with dryer sheets, and otherwise just keep boxes crowded. *Jay Evans, DC*

In Michigan we don't really have to worry about small hive beetle as a pest yet. In my area, hive beetles are only found in weak colonies. If I see them in colonies I usually ignore them, or squish them, depending on my mood. *Megan Milbrath, MI*

SHB are not as big an issue in New England yet! I have used beetle blasters with vegetable oil early in the season before they reproduce. If you can keep the first generation from reaching pupae stage and reproduction, then you have a low number in late Summer. Traps do work when a few beetles are present. Winter seems to keep SHB in check. *Dan Conlon, MA*

Although I do not have research colonies I keep small hive beetles under control two ways – the hives and free-range chickens (for eggs) are in a large bear-fenced enclosed grass yard with dense clay soil in and also surrounding the area. In addition cheap paper coasters with three drops of wintergreen oil are in each hive on the tops of frames in upper brood boxes. *Ann Harman, VA*

I tend to rely on strong hives to keep beetles in check but will resort to using traps should their population numbers appear to be getting uncomfortably high. *Ross Conrad, VT*

We seldom see SHB. The question I have is What is CA doing about hive beetle? 29 counties forbid SHB. 29 counties allow SHB. No neutral counties. *John Miller, CA*

Question 2

Although all of you are good at what you do, I gotta bet that sometimes you encounter a situation with the bees or beekeeping equipment or bee management that you haven't run up against before. Where do you go for basic beekeeping information – not the scientific, book based stuff, just plain bee stuff?

I usually ask someone in the building for help or advice, or the IBRA 'Beebook' for more technical things – or a good magazine. *Jay Evans, DC*

I usually talk to other beekeepers. The best part of my job is that I get to talk to beekeepers from all over, and with a wide range of experience. *Meghan Milbrath, MI*

I have commercial beekeeper friends. Lucky me, because they've seen it all. But sometimes I simply throw the dice and charge blindly into the fog. Success can be rewarding, but failure's the better teacher. *Ed Colby, CO*

I have lots of beekeeper friends who are waaay smarter than I am. *Gerald Hayes, MO*

Most of my answers come from other beekeepers when it is about new equipment or easier ways to get the work done. Second is to talk to the manufacturer. As our apiary grew books became too general, and efficiency became the time saver. Many questions most often involve local conditions and every region has some different concerns. I read articles and research papers, attend meetings and share ideas with other local beekeepers. *Dan Conlon, MA*

I ask several long-time beekeeper/research people. Although answers may result in some differences, basically those answers give me something to think about. *Ann Harman, VA*

I primarily rely on myself by taking the time to think about what is going on, what might be the potential cause(s) and what can be done to address the issue. When stuck, I will turn to other experienced beekeepers, or the state bee inspector. *Ross Conrad, VT*

Forage: I go to Clint Otto at NRCS Jamestown, ND Research Center.

Almonds: Mel Machado, Blue Diamond Growers – Modesto.

Bees: I don't know. Every one has seven different opinions.

I use Tech Teams. They see more bees in more outfits in more places than any other boots on the ground. *John Miller, CA*

Comment –

Question 3 in the September issue dealt with a severe *Varroa* mite infection in all of their 12 hives. All the responses dealt with treating aggressively ASAP. Losing hives is distressing, however even with treatment the probability of losing some or all the 12 hives is likely. Treatment is not cheap, except possibly oxalic acid vaporization. Would any of the experts recommend not treating and use the saving to purchase new bees in the Spring. *Miles Seeley, OR*

Number 1 Tip of the Month – End Bar Eyelet Jig

If you assemble your frames and use wired wax foundation, then you know how much time is taken, installing the metal eyelets into the end bars. One hundred frames require 800 eyelets.

This is how I deal with this task. Using this jig for installing four eyelets per hammer strike greatly reduces the time for doing this.

Jigs are the key to saving time on repetitive tasks.

Greg Carey, Maryland

The end bar eyelet jig. Bottom made with nails spaced to fit end bar and base to hold nails in jig and hold jig in place on workbench. Top anvil with holes to marry bottom anvil nails.

Eyelet Jig with deep frame end bar in place.

Upper anvil given one swift strike with a rubber mallet.

The Eyelet Jig can be made with a saw, drill, and hammer. Use the end bar for your measurements.

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.

Need to move a hive to a new location without losing part of the colony?

You don't have to use the old rule of two feet or two miles.

You can move it any distance, 10 feet, 20 feet, etc. Just wait until sundown, block the entrance, make the move.

Then block the entrance with twigs with leaves so the bees have to crawl through to exit, remove the entrance block and they will notice the new landmarks and reorient themselves to the new location.

Works every time for me!

Bob Sitko, Minnesota

The The closet hangers supports to make shelving ,now to hold frames for year-round visual inspection.

Richard Warner

I have found that as the years and bee seasons go by, I have a hard time remembering what exactly I have done in which hive. It is not that I have so many – at present 36 and the most I have had is 72 – but it is an age thing. So I have started writing in erasable pencil what I did and on what date on the hive box or super, whichever is the highest box. Very easy to do with a beesuit on and leave no doubt as to what I need to do the next time I am in the hives. I also write down how much honey I extract from each hive on the box or super left behind which helps when I have to do the accounting for the USDA forms. I can carry an eraser or simply mark through the last entry and erase later when I add a new entry. *Sandra Center, Arkansas*

For your readers who use top-bar hives and know how much of a hassle it can be to strain honeycomb by hand, here's a little tip: instead of using cheesecloth, which gets gummed-up with wax and has to be discarded after one or two uses, try these re-usable produce bags instead. The width of the mesh is perfect for straining honey and unlike the cheesecloth, the leftover wax can be removed easily and with no damage to the material. When you're completely finished just wash with warm water, dry and it can be used again and again.

Peter Keilty, Texas

Please keep sending in your tips for making life around the beeyard easier.

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FOUND IN TRANSLATION

Beetles On The Move

Jay **Evans**, USDA Beltsville Bee Lab

I distinctly remember meeting small hive beetles (SHBs) through the glass walls of vials and mason jars as they arrived for inspection and study at the Bee Research Laboratory in 1999. Already under quarantine and affecting package sales into Pennsylvania that Spring, they had gone from formal detection in two southeastern states to a pest that had overwintered in a Minnesota hive cluster in less than two years. Like mite parasites, these pests took advantage of the high-mileage movement of bees that defines modern beekeeping. While still having their biggest impacts in the southeast, SHB are now a reality across the entire United States, including Alaska and Hawaii.

To learn from our mistakes, and hopefully reduce future risks, scientists often use genetics to trace the origins of newly arrived bad actors. This was the case for SHB and we were able to fairly quickly trace these pests directly to their roots in southern Africa (Evans, J.D. Pettis, J.S. Hood, W.M. Shimanuki, H. Tracking an invasive honey bee pest: Mitochondrial DNA variation in North American small hive beetles. *Apidologie* 2003, *34*, 103-109., **https://doi.org/10.1051/apido:2003004**). The U.S. population seems to have come from a very small set of founders. These founders, arriving once or perhaps twice in Georgia and Florida, enjoyed the climate and naïve bees of this country and soon slimed their way up the east Coast and beyond.

Nearly two decades later, SHB are still finding ways to jump from country to country, and their genes give a fascinating and insightful look at how these jumps have happened. Today, SHB occur in North, Central, and South America, South Korea, China, Australia, Europe, the Philippines, and islands including Cuba, Hawaii, Jamaica, and Mauritius. Within Africa, they have expanded from their native range below the Saharan desert to Egypt. All of these invasions have apparently occurred within the past 22 years, starting with the arrival of beetles into the U.S.

Franck Idrissou and colleagues from the Institute of Bee Health in Switzerland have just provided the most complete look yet of SHB cases, their genetics, and the risks of these beetles to continue leaping into the world's apiaries. They have arrived at the provocative conclusion that SHB have achieved international travel not with the help of bees and beekeepers, nor with shipments of fruit or other plant products (both long suggested), but through the international beeswax trade (Idrissou, F.O., Huang, Q., Yañez, O., Neumann, P. International beeswax trade facilitates small hive beetle invasions. *Scientific Reports* 2019, *9*, **doi:10.1038/s41598-019-47107-6**). The data remain circumstantial, i.e., SHB have not been directly intercepted in shipments of beeswax. Still, the results in terms of both the genetics of the invasive populations and the directions of commerce suggest that the sale and movement of beeswax presents some risk.

Knowing how parasites and pathogens catch up with honey bees can improve beekeeping beyond regulatory and quarantine practices. There has also been steady progress on controls for these pests (see this month's Beetalk and various adds and testimonials for traps ranging from Swiffer wipes to oil- or pesticide-infused traps. All of these can do some damage to beetle numbers, more than an avid beekeeper with a hive tool. One intriguing SHB partner is the fungus *Kodomaea ohmeri*. This fungus was first noticed in cultures of beetles, and in hive products from infested colonies (Detection and characterization of *Kodamaea ohmeri* associated with small hive beetle *Aethina tumida* infesting honey beehives, Nicole D. Benda, Drion G. Boucias, Baldwyn Torto, Peter E. A. Teal, 2008, J. Apicultural Research

47(3), 194-201, **DOI:10.1080/00218839.2008.11101459**). Work this month from Australia (enabled by the aforementioned leap of beetles to that continent from Africa) shows that the smell of *Kodamaea ohmeri*-infused pollen and a blend of individual chemicals released by this fungus were highly attractive to beetles, hopefully another step in developing a better beetle trap (Hayes, R. A., Amos, B. A., Rice, S. J., Baker, D. K., Leemon, D. M. (2019) Behavioural responses of the small hive beetle to volatile components of fermenting honeybee hive products. Entomologia Experimentalis et Applicata. 167, 784-793, **https://onlinelibrary.wiley.com/doi/abs/10.1111/eea.12819**). BC

A Closer Look

HONEY STORAGE AND RIPENING

Clarence **Collison**

Getting from nectar to honey can be complicated.

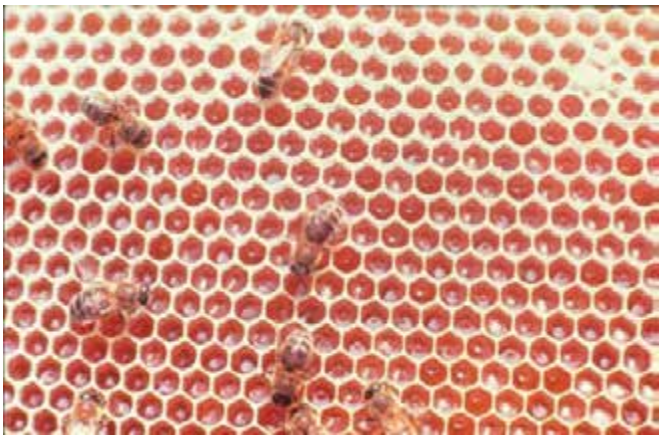
"Nectar, the raw product of honey, is converted into honey through a maturation process. The most prominent feature of this process is a considerable water loss (40 to 70% of nectar initial weight) that takes place in two stages: an initial evaporation carried out by the bee, which brings down water content to 40 to 50%, and the final evaporation that takes place in the honeycomb, which yields a product with 15 to 18% water. Besides dehydration, a number of chemical transformations have been detected (Bailey 1963). A considerable microbial population exists in the initial stages of maturation and may be involved in some of these transformations (Ruiz-Argueso and Rodriguez-Navarro 1973)."

"Shortly after a forager honey bee returns home loaded with nectar, she begins to transfer her nectar to a younger bee working inside the hive, a so-called receiver bee (Park 1925). As forager and receiver approach each other, the forager opens her mandibles widely and a nectar droplet appears on the upper surface of the base of her tongue (the distal portion remains folded under her head). The receiver extends her tongue and sips the proffered nectar from the forager (Huang and Seeley 2003)." Sometimes a forager's entire load is given to one receiver, but other times it is distributed among several receivers in multiple bouts of unloading (Park 1925; Seeley 1989; Kirchner and Lindauer 1994).

"Hart and Ratnieks (2001) examined four hypotheses for why foragers make multiple unloadings. Their first was that receivers have smaller honey stomachs than foragers, which would make it difficult for one receiver to accept a forager's entire load of nectar. They rejected this hypothesis because they found that the crops of the foragers and receivers are the same size. Their second hypothesis was that multiple unloadings arise from unloadings to non-receiver bees, that is, dance followers and other bees not prepared to fill up on nectar. They rejected this hypothesis because they found that only 8% of unloading occurs to non-receiver bees. Their third hypothesis was that multiple unloadings occur because receivers purposely do not fill their crops, to facilitate the removal of excess water from the nectar. They rejected this hypothesis because they found that most receivers sought nectar multiple times and filled their crops to a level comparable to that of bees fed to satiation. It was clear, therefore, that receivers do try to fill their crops. The fourth, and most intriguing, hypothesis of Hart and Ratnieks (2001) was that foragers make multiple unloading to improve their information about the allocation of labor in their colony between the tasks of nectar collecting and nectar processing." The state of this variable is indicated to a forager by the difficulty she experiences in finding a receiver bee (Seeley 1995).

After the house bee receives her nectar droplet from the nectar carrier, she then begins to manipulate the droplet; a process which apparently reduces its water content and probably permits the addition of enzymes such as invertase. The partly ripened nectar is then deposited in the cells where further ripening takes place (Park 1925).

Ruiz-Argueso and Rodriguez-Navarro (1975) "reported on microorganisms found in ripening honey and their possible relationship with other microbial groups in the beehive. Two main groups of bacteria, classified as *Gluconobacter* and *Lactobacillus*, are present in ripening honey. A third bacterial group, classified as *Zymomonas*, and several types of yeast are occasionally isolated. Both



The costs involved in locating particular cells probably outweighs the benefits of clustering.

in natural honey and in synthetic syrup the bacterial population decreases in the course of the ripening process. *Lactobacillus* and *Gluconobacter* disappear after minimum moisture (about 18%) is reached, but the former does so sooner than the latter."

"Honey bees forage for nectar which is subsequently stored in cells of their nests. Despite the importance of honey storage for colony survival, very little is known about decision making by honey bee workers that could optimize the transformation of nectar into honey. Eyer et al. (2016b) tested, using diagnostic radioentomology, whether workers use rules based on sugar concentration to optimize the spatial distribution of storage cells during nectar ripening. The data show that after the first three days of storing activity, various sugar concentrations were mixed in individual cells. A spatial clustering of cells with content of similar concentration was only occasionally observed. The results, therefore, suggest that at early stages of storage, spatial proximity of cells with similar sugar concentrations does not result in improved efficiency and, therefore, does not seem adaptive. The costs involved in locating particular cells probably outweighs the benefits of clustering. Alternatively, but not mutually exclusive, physiological constraints (e.g. variation in the perception of sugar concentration) might limit such optimization behavior."

"Under controlled conditions in a flight room, honey bee colonies with no food stores were given separately: (a) concentrated solutions of sucrose, (b) a mixture of pure D-glucose and D-fructose (pure invert sugar), (c) enzymatically hydrolysed sucrose, (d) enzymatically commercially produced invert sugar (Trimolin). All stores produced from these materials were extracted. Using the same feeding concentrations, the losses in dry matter during processing by the bees were lower with solutions containing reducing sugars; with the same solution the losses decreased when higher concentrations were used. Partial inversion of sucrose before feeding was sufficient to ensure that little sucrose remained after ripening in the cells. Residual sucrose in the stores showed a marked decrease after six days of storage in the laboratory. The bees added invertase during processing whatever the composition of the material fed. Invertase activity in stores produced from sugar solutions fed, was lower than in honey produced from nectar, and it decreased considerably during 42 days storage in the laboratory (Bacilek et al. 1980)."

"Honey bees obtain carbohydrates from nectar and honeydew. These resources are ripened into honey in wax cells that are capped for long-term storage. These stores are used to overcome dearth periods when foraging is not possible. Despite the economic and ecological importance of honey, little is known about the processes of its production by workers. Eyer et al. (2016a) monitored the usage of storage cells and the ripening process of honey in free-flying colonies. They provided the colonies with solutions of different sugar concentrations to reflect the natural influx of nectar with varying quality. Since the amount of carbohydrates in a solution affects its density, they used computer tomography to measure the sugar concentration of cell content over time. The data show the occurrence of two cohorts of cells with different provisioning and ripening dynamics. The relocation of the content of many cells before final storage was part of the ripening process, because sugar concentration of the content removed was lower than that of content deposited. The results confirm the mixing of solutions of different concentrations in cells and show that honey is an inhomogeneous matrix. The last stage of ripening occurred when cell capping had already started, indicating a race against water absorption. The storage and ripening process as well as resource use were context dependent because their dynamics changed with sugar concentration of the food."

"Honey contains small amounts of different enzymes, the most important of which are diastase (α-amylase), invertase (α- glucosydase), glucose oxidase, catalase and acid phosphatase. In particular, invertase is the enzyme responsible for converting sucrose to fructose and glucose which are the main sugars in honey (Oddo et al. 1999). The origin of invertase in honey is commonly attributed to the bee (Rinaudo et al. 1973; White 1978). The nectar collected is mixed with secretions from the salivary and hypopharyngeal glands of foraging bees. In the hive, when nectar is passed from bee to bee before being stored in the cells, more secretions are added enabling nectar to ripen into honey (Maurizio 1975). This process – and consequently the amount of added enzymes – depends on various factors such as age, diet, and physiological stage of the bees, strength of the colony, temperature, abundance of nectar flow etc. (Brouwers 1982, 1983; Fluri et al. 1982; Huang and Otis 1989; Huang et al. 1989; Simpson et al. 1968)."

"Nectar concentration is assumed to remain constant during transport by honey bees between flowers and the hive. Nicolson and Human (2008) sampled crop (honey stomach) contents of nectar foragers on *Aloe greatheadii* var. *davyana*, a major winter bee plant in South Africa. The nectar is dilute (approx. 20% w/w), but the crop contents of bees captured on flowers are significantly more concentrated. In returning foragers, the concentration increases further to 38-40%, accompanied by a volume decrease. The doubling of sugar concentration suggests that nectar is regurgitated onto the tongue and evaporated during foraging and on the return flight. Processing of the dilute nectar into honey thus begins early, aided by low

The relocation of the content of many cells before final storage was part of the ripening process.

ambient humidity's. This has implications for honey bee thermoregulation, water balance and energetics during foraging and for the communication of nectar quality to recruits."

"Analysis of honey enzymes diastase and invertase is one important parameter in honey quality control. Enzyme activity is one of the measures of adequate conversion of nectar to honey during the ripening process. In addition, certain activity levels of invertase or diastase activity can also act as indicators for heat damage of honey samples. Depending on the botanical origin, enormous differences in enzyme activity can be observed, even though the enzymes are mostly added by the bees. Lichtenberg-Kraag (2014) therefore collected nectar and honey samples during the ripening process of honey and investigated enzyme activity depending on the floral source. Based on the analysis of nectar samples, they could demonstrate that floral source and environmental conditions affect the total sugars and sucrose concentration. They, therefore hypothesized that the composition of the nectar, especially the amount of sucrose, may interact with the activity of invertase. They found that the correlation between sucrose concentration and invertase activity is highly significant during the ripening process of honey confirming an interaction between these two parameters. This effect was further substantiated by a sugar feeding experiment with defined sucrose concentrations."

"The invertase activity was determined for 499 honeys (27 multifloral and 472 unifloral from *Arbutus*, *Carduus*, *Castanea*, *Citrus*, *Erica*, *Eucalyptus*, *Hedysarum*, *Helianthus*, *Rhododendron*, *Robinia*, *Rosmarinus*, *Taraxacum, Thymus, Tilia,* fir honeydew and honeydew produced by *Metcalfa pruinosa*), in order to determine its variability and establish the range characteristic for each honey type. The results show that invertase activity varies considerably in the different honey types (from less than 0.5 to more than 30 IN). IN= Invertase Number. The IN indicates the amount of sucrose per gram hydrolysed in one hour by the enzymes contained in 100 g of honey under test conditions. *Robinia*, *Arbutus*, *Citrus*, *Erica* and *Rosmarinus* have the lowest values (usually less than 10) and the two honeydew honeys the highest (more than 18). The diastase content of the samples was also measured, to compare the content of the two enzymes, and a certain correlation was observed. The IN/DN ratio ranges from less than 0.1 to more than 2. DN = Diastase Number, one unit corresponds to the enzyme activity of 1 g of honey that can hydrolyse 0.01 g starch in one hour at 40°C. (Oddo et al. 1999)" BC

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Bees In A Changing Climate

M.E.A. **McNeil**

Reports From The 2019 International Pollinator Conference At UC Davis

Bee by bee, flower by flower, scientists are asking how climate change effects pollinators, and half a day was dedicated to their answers at the U.C. Davis International Pollinator Conference. In the keynote address, Christina Grozinger, director of the Center for Pollinator Research at Pennsylvania State University, said "Multiple interacting factors are driving the declines, including parasites and pathogens as well as biotic and abiotic [living and non-living] features of the landscape such as availability of forage, pesticide use, and climate." That last factor, climate, is of critical importance.

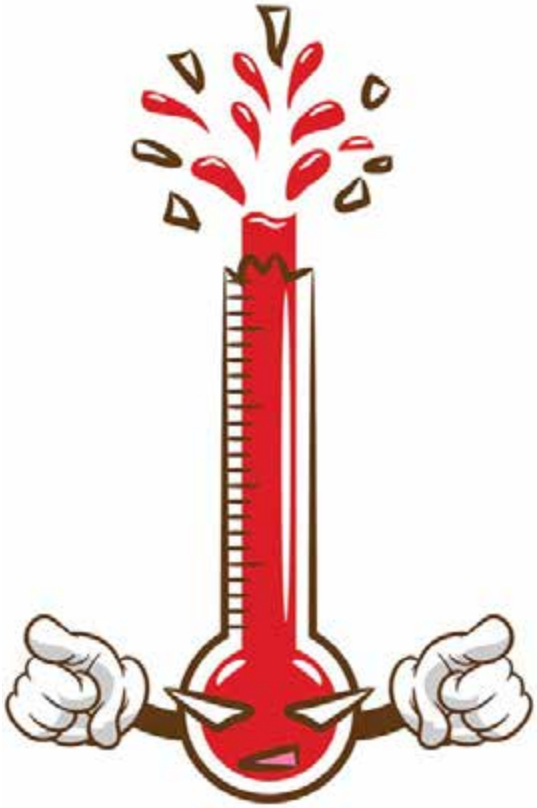
What was beyond question was whether there is any change. The scientists had the numbers by temperature, by elevation, by species, by bloom. Earth climate has always been changing, with CO_2 levels rising and falling naturally over thousands of years. What is new is what is driving the change and the pace of it. Among the presenters was Jessica Forrest, of the University of Ottawa, who referred to the geologic age we are now in as the Anthropocene. The root "anthropo," "human," is combined with "-cene," the standard suffix for "epoch" in geologic time. That is to say that fundamental earth system processes are now human-influenced, or anthropogenic. The signal is that a new epoch has begun, and, said Forrest, "What is unprecedented now is the rate in which climate change is coming."

Although research on honey bees was presented over the three-day event, the scientists reporting on this subject work largely with wild bee species. Their reasons vary: Many native bees are valuable pollinators both commercially and in the wild; studying them eliminates some complex variables of eusocial honey bees; some can be studied in artificial, accessible nests; they are understudied, and some native species are endangered or feared extinct. It comes down to this: All of the pollinators are in the same environmental boat and it benefits all to have a look at that boat.

Warming is but one aspect of climate change and the one most researchers on this subject at the conference chose to focus on. "Global warming is the most powerful driver to the changing ecosystem," said Gaku Kudo of Hokkaido University in Japan in his talk.

"Direct physiological impacts of warmer temperatures, reduction of floral rewards, and a brown bag of possible effects – that's how I perceive the literature," said Forrest. "There are massive different effects of climate change, but number one is heat stress."

Temperature-related changes in flora have been mapped for some time. For example, in his work as a biological oceanographer at the Goddard Space Flight Center in Maryland, Wayne Esaias related satellite-tracked growth of phytoplankton in the world's oceans to climate systems. As an EAS Master Beekeeper, his curiosity was triggered by seasonal changes he was observing with his backyard Maryland bees. He gathered and graphed hive weight records to indicate nectar flow from a battalion of beekeepers and found the data in sync with satellite photos and climate models over 22 years. He discovered a Smithsonian botanist's log of bloom going back to 1970, and he identified



a trend for "greening up" half a day earlier each year. At the time of his retirement in 2012, he concluded that bloom in his Maryland area has moved forward by about a month.

Esaias said that if those dates keep creeping forward, crucial plant-pollinator relationships could be in danger of getting out of sync. "Flowering plants and pollinators co-evolved. Pollination is the key event for a plant and for the pollinators in the year. That's where pollinators get their food, and that's what determines whether the plant will set fruit." Some plant-pollinator pairs respond to the same environmental cues, but others do not – the pollinator emerging in response to temperature, for example, while the plant flowers in response to snow melt. In addition, a rogue freeze can play havoc with a bee cluster expanding in response to early warming. Those are questions that scientists reporting at Davis are researching, and let us count the ways.

Supply and Demand

Flowers respond to environmental cues. Grozinger's talk contained a telling story about floral response from research on the Tibetan plateau. There, hives are more conveniently placed at roadsides, and flowers there produce less nectar than their relatives further afield, since they receive numerous bee visits and can pay less for the service.

When buckwheat, increasingly used for farm conservation, is stressed by drought, it reduces nectar production, pollinator visits and seed set. These findings by Rachel Mallinger, University of Florida, Jose Franco USDA ARS Booneville, and Caitlin Rering UC Davis were reported in a poster. The stressed flowers produced 42% less nectar and the nectar contained significantly lower ratios of sucrose to hexose sugars. Both seed set and mass declined. Pollinator visits by bees and flies dropped by nearly half, although something can be said for bumblebees: They showed no preference.

Temperature stress on the California native flower *Penstemon herophyllus* was studied by Kaleigh Russell and Quinn McFrederick of U.C. Riverside. They found that extreme temperatures affected nectar sugar concentrations and volume dramatically. Their continued work examines the effects of temperature change on microorganisms such as bacteria, fungus, and viruses associated with plants and pollinators.

Caught in a Vise

Mismatches can manifest in various ways. The bumblebee *Bombus vosnesenkii,* that once ranged from Southern California to Northern Oregon, is now rare or nonexistent in its southern range, according to a study by Michael Dillon of the University of Wyoming. Dillon is a physiologist connecting what he calls the macro ecological with physiology, and he finds that this bumblebee is caught in a climate vise.

"Insects are ectothermic," he said, meaning that their body temperature is dependent on external sources. "You can measure their CT max [critical thermal maximum]. One test is to flip the creature over and see if it can flip itself back, that's it, a temperature test." His lab tested bees from across the range and found that those from southern latitude sites tolerate a minimum of 0°C (32°F). At the northern sites they could tolerate much more cold, -10° to -15°C (14° to 5°F); Dillon found that those bees have been stable along their northern range over a 75 to 100 year period. But a southern-bred bumblebee fleeing north encounters cold below its tolerance, stops grooming, walking and moving its antenna and eventually goes into chill coma. So *Bombus v.* in different ranges has different cold tolerance; the disappearing bees from the southern range may not be migrating but perishing. This bumblebee occupies a niche as early and late season pollinators for farmers and natural habitat that could suffer from its disappearance.

A retrospective of California bumblebee data over the last 150 years by Leif Richardson of the University of Vermont shows that the distribution of species has changed, in some cases quite a bit. More than half of all bumblebee species found in North America are in California – about 25 species, some of which are found continent-wide and many are important to agriculture.

"Temperature is the driving element," he said. He found that although some plants and bee pollinators responding to climate change in parallel, there is evidence of climate-driven mismatch for other pairs of mutualists. "We found some common bumblebees tracking warming by advancing mean emergence date of foundress queens by up to three weeks, but some declining species are failing to track advancement of Spring in this way. That suggests that we have a potential for phenological mismatch," he said.

The future can be studied in real time by observing pollinators in cities, according to Elsa Youngsteadt of North Carolina State University. Urban temperatures often average 1° to 3°C (34° to 37°F) warmer than the surrounding landscape. That puts cities ahead of the global-warming curve, and makes them extant labs for studying predictions about effects of climate change on pollinator health and abundance.

The NCSU research team set out pan traps, vane traps, and netting at 18 sites in Raleigh. Their sample included 3,593 individual bees of 113 species of wild bees. They found that total bee abundance declined by 41% per single degree Celsius (33.8° F) of warming. In the lab, they measured CT max for 15 common species using a heat-ramping assay. The bees with

the lowest thermal tolerance were those whose populations declined the most with warming.

Housing Crunch

Another mismatch: Changing temperatures and precipitation levels in northern Arizona have negatively affected native tree populations and, subsequently, the nesting of *Megachilidae* bee species – the subject of the research of Lindsie McCabe of Northern Arizona University. The species in that diverse family range from floral specialists to floral generalists. Some are valuable for pollination, and their growing absence is being filled by flies.

Over three years, McCabe moved trapped colonies up and down by elevation. She found significantly poorer emergence at lower, warmer elevations, but she found a lack of nesting materials at high elevations – another vise. She concluded that artificial nesting blocks may help stabilize the population in northern Arizona. Her experiments with native and non-native wood nesting blocks showed that the bees were not picky.

Honey bees, too, have a stressed response to warming temperatures, as shown by the research of Alison McAfee, North Carolina State University. She exposed queens to temperatures from 5° to 42°C (41° to 107.6°F). The higher temperature reduced sperm viability in queens by 56% in four hours. Viability of ejaculated sperm was observed to diminish with heat. While 100% of queens survived after six hours at the highest tested temperature, only 42% of drones remained alive. McAfee conjectures that this sex-biased heat tolerance may be a way to ensure that queens are inseminated with high quality sperm. The grail for this research is identifying protein biomarkers that indicate temperature stress that can serve as useful diagnostics in the field.

Forrest reported that her lab studied the effect of warming on the gestational time of Osmia bees. They found that higher temperatures affect generational timing. With warming, most of the semivoltine (taking over a year to reproduce) bees shortened their normal two-year brood cycle to one year. "Last Summer was hot and dry, and [her lab] predicted that they would find more one-year bees in the wild, and they did. It was one of those rare occasions when I could say I understand how nature works," she said.

The Osmia bees were studied in nests with removable paper straws with windows in them, so the brood could be examined. They found a brood parasitic wasp, *Sapyga pumila*, which lays its egg after the bee has just laid its egg. The wasp emerges first, eats the bee egg and its pollen provisions. The heat-driven increase in metabolic rate that expedited the bees' brood cycle also accelerated the wasp's development. So bees and predators are revved up, and the standoff favors neither. Forrest calls it a saturating relationship: "It's pretty much a wash for the bees." Except, as other presenters brought out, their heightened metabolism has a price.

"Time is the longest distance between two places." - Tennessee Williams

Since 1990, Gaku Kudo, of Hokkaido University, has been studying the effects of climate change on ecosystems. He found, in an alpine environment in northern Japan, a phenological (timing of biological events) mismatch that occurs between bumblebees and bloom. Flowering onset was associated with surface thermal degree days after snowmelt, while bee emergence was determined by soil temperature. A mismatch occurs when the snow is warmed and melts early but subsequent soil warming progress slowly. Seed set was strongly related to the extent of mismatch in that ecosystem.

Flowering time varied from year to year with snow melt time, but the seasonal dynamics of bees were observed to be more conservative. Kudo found that such mismatches tend to occur early and late in the foraging season.

Charlotte de Keyzer, of the University of Toronto, has studied how climate change can alter environmental cues, whether organisms are tuned to the same cues, and the effects on pollination. The research, conducted in environmental chambers, involved pollinator *Osmia lignaria* and the flower *Cercis Canadensis,* which the bee prefers. The plant was more responsive to warmer forcing temperatures than the bee, as Kudo also observed among wildflowers in Japan, so female bees were more likely to emerge after the average date of first flowering. Over the

last decade, she found, *Osmia l.* has been emerging about 1.2 days early while the flower has emerged 1.15 days earlier. De Keyzer says, "Mismatches are predicted to become more common in the future for most plant-pollinator interactions."

Another such mismatch is possible, according to work done by Rachel Mallinger and Sarah Anderson of the University of Florida and presented on a poster. The southeastern blueberry bee, *Habropoda laboriosa*, is a large native bee that emerges early in spring. It is believed to be oligolectic (having a specialized pollen preference) on blueberries, *Vaccinium spp.* Because the blueberries have a short, early blooming period, phenological changes could make this bee susceptible. The research examined the changing phenology of *H. laboriosa* over 100 years. Over that time, the collection date for the bee advanced 44 days. Flowering for this blueberry species has advanced as well, but the specialized pollination relationship is a risk for both the bee and the plant.

Food Security

A study of the impacts of climate change on pollinators in Brazil was presented by Tereza Giannini, of the Federal University of Para. Some losses, she found "shocking."

Many wild pollinators are important to agriculture in Brazil – 250 species pollinate 141 agricultural crops. Wild bees in the family *Apidae* were reportedly the most effective pollinators, mainly those from the genera *Melipona*, *Xylocopa*, *Centris*, and *Bombus*.

She used species distributional modeling to estimate future effects and found that the occurrence of these pollinators varied but could fall precipitously by 2050. In the national forest, the potential reduction of pollinating species ranges from 70% to 100%.

Giannini found probable decline in a large number of places where crop production is high – 20% to 90% of the GDP. Some southern areas are most vulnerable to warming, and that is where many people live who have the greatest socioeconomic vulnerability. In contrast, some parts of northern Brazil, particularly in the northwestern Amazon, could potentially benefit from climate change because pollinators of some crops may increase.

Her urgent plea is for conservation projects such as climate-refuge areas and ecological corridors to connect these areas to improve the climate-forced dispersal of species.

The Phoenix Rises from the Ashes

Some winners in the effects of climate change were found by John Mola, Michael Miller and Sean O'Rourke, in the lab of Neal Williams at U.C. Davis. The Northern California wildfires produced an increased blooming environment in the years immediately following burning. The researchers used a combination of genetic mark-recapture techniques and body size measurements of the bumblebee *Bombus vosnesenskii* both in and outside of the post-burn area. They found that the bees thrived on the rich environment, increasing forager size, colony abundance, and reproductive output.

Onward

Among many future projects for these researchers is a study in McQuinn's lab of the effects of climate change on nectar-inhabiting microbial communities. Youngsteadt will explore how temperature-related changes in bees could affect pollination services. Dillon received a $1.17 million National Science Foundation grant to study how cold tolerance is determined by genetics in bumblebees. "The point of the new grant is to learn how you go from DNA to proteins to a trait like cold tolerance," he said, with the hope that the understanding of the underlying genetics can be more broadly applied.

Scientists at the Davis conference caution that forecasting the impact of future warming requires understanding the complexities of factors that can affect population. But for now we are left with a question: Apple growers in Pennsylvania don't need to rent bees, according to Grozinger, because they have so much background wild bee population. She asks, "How do we manage bees well so that they are stable?

Each finding at the Davis conference represents many hundreds of hours in the lab or traipsing through different terrains in every condition of heat and cold – counting, measuring, comparing. Clearly the results indicate the pollinators and their forage are affected by climate change. Each individual report may not be earthshaking, but taken together seriously, they may be Earth-changing. BC

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The Promise Of Standardized Data And How To Achieve It

Key Ingredients To Building A Genius Hive

Joseph **Cazier,** Edgar **Hassler,** James T. **Wilkes,** Max A. **Rünzel,** Giovanni **Formato,** Robert **Brodschneider**

Many readers of this series in *Bee Culture* will recall that our first article, titled "Peering Into the Future: The Path to the Genius Hive," came out in April 2018. In that article we shared that a genius hive is more than a smart hive. It is a hive that takes all the information from a smart hive, integrates best management practices and years of standardized data to guide beekeepers with real-time information that can help predict what the hive needs and optimize its output and productivity.

In this article, we dive deeper into one of the very key ingredients to building a genius hive, or doing any real work with *Machine Learning* or *Artificial Intelligence*. That key component is large amounts of **standardized data.** They call it **Big Data** for a reason: these operations do in fact take large amounts of data to effectively use them.

Though many common statistical techniques can be done on relatively small data sets, big data is needed for machine learning because, even though there is some overlap, *Machine Learning* is **fundamentally different** than classical statistical approaches. Historically, with statistics or traditional programming, you have data and a **pre-existing** algorithm, that is honed with complex math and trial and error over many years on many data sets, to determine an output. This output could be some function in a program such as Excel, or could be the result of statistical output from an ANOVA, statistical index, computation of means, or other alternatives.

Machine Learning, in contrast, turns this process around (see Figure 1.). Instead of taking the data and a pre-existing algorithm to determine a standard output, it takes the data and **creates a new algorithm** to explain or predict the **already observed output.**

Recall that an algorithm can be defined as *a process or set of rules to be followed in calculations or other problem-solving operations, especially by a computer*[1]. This means that the computer is creating a new process to explain or predict the observed outcome instead of using a pre-developed one. One might imagine, correctly, that developing a new algorithm from scratch on a new data set, like the ones developed over many years of research in statistics, takes these steps: 1) large amounts of data, 2) large computational

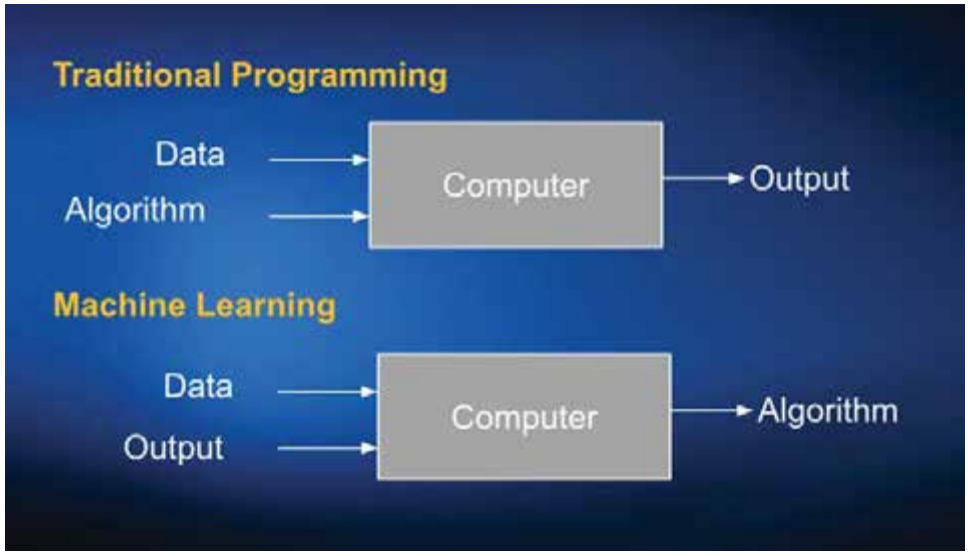

Figure 1. *Traditional programming vs Machine Learning.*[2]

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[1]**https://www.lexico.com/en/definition/algorithm**

[2]Borrowed from lecture by one of Joseph's heros Pedro Domingos, author of The Master Algorithm and Computer Science Professor at the University of Washington

resources, and 3) very complex math.

While it is true that *machine learning* takes all of these steps, in today's world, large computational resources are more available than ever before and many complex mathematical techniques have already been developed and proven effective, though more work is still being done to develop newer methods. This means that the **key thing we are missing, at least when it comes to bees, is data.**

However, in order for data to be useful, it needs to be in the same format so it can be aggregated and fed into the machine to create the proper artificial intelligent algorithms. To be aggregated reliably and effectively, it must first be standardized. In this article, we will define what standardized data is, share a few examples of how standards have transformed society in the past, show the path to building a data standard, share some current challenges to building one, and recommend a clear path forward.

Standardized Data

I recently shared a poster and gave an oral presentation that my colleagues and I have been working on at the annual COLOSS conference in Montreal, Canada just before Apimondia on the topic of data standardization. This article covers most of the key points in the oral presentation. You can see a copy of the poster n the web page version of this article at **www.beeculture.com**.

Standardized data is data that comes with a definition. We know what it means because it has a common, precise definition that anyone familiar with the topic would understand or be able to look up. Because it is defined, we know what it means and can put it together with data from other sources from other times and places. In some cases, conversion from one standard to another, such as the English to the Metric system of measurements or from one language to another is possible. However, in most cases this is much more difficult and with some it is not possible – and even when it is possible, it adds an extra layer of complexity and inefficiency.

Regardless, having and using a standard widely is the key to being able to collect large amounts of data that a machine learning algorithm can use. You will still need to piece it together, clean it, and analyze it, but having a standard makes this process much easier.

In business, you often have one large multinational company or government group that is large enough to acquire sufficient data to use on its own, but does not want to share with others due to competitive pressure, i.e. imagine Walmart sharing with Target?

However, with beekeepers, the situation is different. There is **NO** organization big enough on earth to do this effectively, at scale, and on a wide variety of topics related to bees, at least not yet. A few organizations might be able to do a piece of something here or there, but there are none that come close to having the whole picture. This situation is not likely to change in the near future for these reasons:

- *Small Scale:* Despite having a few very large commercial beekeepers, a large portion of the estimated hundred million or so hives in the world are managed by small scale beekeepers. Due to family history, small holder keepers, economics, hobbyist beekeeping for fun, and other factors, this is likely to remain this way for some time.
- *Geographic Difference:* Even if someone is a large-scale beekeeper, most do not move much beyond their home country, and certainly not continent, on a routine basis. Because our machine learning algorithms need data from many places, even the largest beekeepers will always be missing some key knowledge and insight if they keep only to their own data. Different environments will need to account for those differences in their datasets.
- *Genetic Differences:* Different hives generally have different genetics. These different lines will have key differences that will need sufficient data for those lines to round out the analytics.
- *Management Practices:* There are different management practices in different parts of the world. Some of these are necessary due to different environments, but many others are simply due to regional beekeeping customs, which makes it harder to aggregate data from different sources.
- *Language:* the many languages spoken by beekeepers around the world also make data standardization a challenge.

Unlike the case of the retail giants Walmart vs. Target mentioned above, who would likely not share data due to competitive pressure, beekeepers have much more incentive to standardize and share data. These include:

- *Natural Threats:* The threats beekeepers face are less from competitors and more from nature. We are not fighting each other so much as threats from the natural world. We need to work together to find solutions.
- *Lack of Data:* As described above, none of us have, or is likely to have, enough data to adequately address all the problems the bees face. It is only by pooling our data that we can really make the most difference for bees and beekeepers.
- *Love of Bees:* Most of us are hobbyists and scientists who love bees. We want to learn about them and help them. These groups have a long history of sharing data and information across many disciplines. However, even commercial beekeepers tend to be rather altruistic when it comes to this issue.
- *Food supply:* As much as we all love bees, we likely love food even more. We have to work together to secure our food supply for all of us and future generations.

Data Standardization Examples

In our article, "BeeXML Part II - Achieving the Goal of Standardized Data," in the November 2018 Issue of *Bee Culture,* we went into some detail about the importance of a data standard and some examples. In this article we will just list a couple quickly so we can focus more on how to create a standard.

Here are a few examples of successful standards:

- *Langstroth Hive:* Its development along with similar standard hives in the 1850s revolutionized beekeeping. Discovering the importance of "Bee Space" and having standard sizes of hives and frames allowed for the free exchange of equipment, bees, and other materials between hives and beekeepers, making it much easier to scale and manage bigger hive

yards. It also considerably lowered production and maintenance costs for hives.

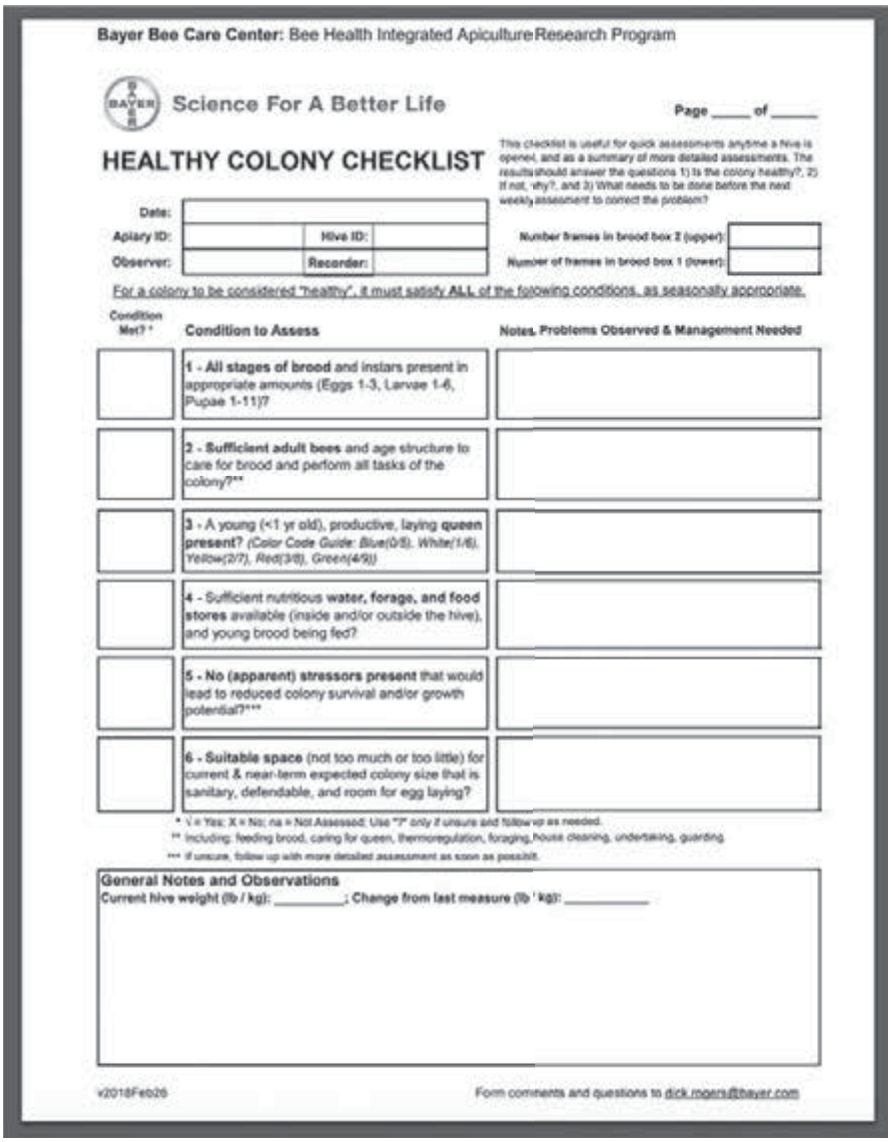
- *Healthy Colony Checklist*: A human standardized method to assess the health of a hive developed by Dick Rogers and profiled in our July and August 2018 *Bee Culture* articles, is fast becoming a standard. It has already been adopted by *HiveTracks, Broodminder*, *The World Bee Project,* our *Center for Analytics Research and Education* at Appalachian State University, and others as the default hive inspection tool for health assessments. See Figure 2.

Next we discuss the process of how to build a standard.

Path to Building a Standard

The path to build a data standard includes the following steps.

- *Survey Data Space*: Surveying and mapping a data space by collecting samples of a large variety of data to identify collectible and viable data elements for evaluation, including a diversity of data from genetics, health, honey testing, and management practices, to name a few
- *Data Prioritization*: Identifying which types of data are most important to measure and which types have the most value to researchers and beekeepers now
- *Measurement Scale:* Deciding how best to measure those factors like health assessment, weights, treatment standards, *Varroa* counts, etc.
- *Technical Architecture:* Developing the technical architecture for storing, transmitting and analyzing that data in a common format for computer-to-computer storage and harmonization
- *Inclusive Governance Infrastructure*: Following an inclusive and conscious approach both to govern the process and the output of the standardization in collaboration with practitioners, researchers, Governmental Organizations and the International Organization for Standardization (ISO), in line with ISO's approach in other fields of research[4].



Bayer Bee Care Center: Bee Health Integrated Apiculture Research Program

Science For A Better Life

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HEALTHY COLONY CHECKLIST

This checklist is useful for quick assessments anytime a hive is opened, and as a summary of more detailed assessments. The results should answer the questions 1) Is the colony healthy?, 2) If not, why?, and 3) What needs to be done before the next weekly assessment to correct the problem?

Date:
Apiary ID: Hive ID:
Observer: Recorder:
Number frames in brood box 2 (upper):
Number of frames in brood box 1 (lower):

For a colony to be considered "healthy", it must satisfy ALL of the following conditions, as seasonally appropriate.

Condition Met? *	Condition to Assess	Notes, Problems Observed & Management Needed
	1 - All stages of brood and instars present in appropriate amounts (Eggs 1-3, Larvae 1-6, Pupae 1-11)?	
	2 - Sufficient adult bees and age structure to care for brood and perform all tasks of the colony?**	
	3 - A young (<1 yr old), productive, laying queen present? *(Color Code Guide: Blue(0/5), White(1/6), Yellow(2/7), Red(3/8), Green(4/9))*	
	4 - Sufficient nutritious water, forage, and food stores available (inside and/or outside the hive), and young brood being fed?	
	5 - No (apparent) stressors present that would lead to reduced colony survival and/or growth potential?***	
	6 - Suitable space (not too much or too little) for current & near-term expected colony size that is sanitary, defendable, and room for egg laying?	

* √ = Yes; X = No; na = Not Assessed. Use "?" only if unsure and follow up as needed.
** Including: feeding brood, caring for queen, thermoregulation, foraging, house cleaning, undertaking, guarding.
*** If unsure, follow up with more detailed assessment as soon as possible.

General Notes and Observations
Current hive weight (lb / kg): _____; Change from last measure (lb / kg): _____

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Form comments and questions to dick.rogers@bayer.com

Figure 2. *Healthy Colony Checklist developed by Dick Rogers[3].*

Next, we turn to some of the challenges we face in building such a standard for bee data.

Current Challenges to Standardization

- *Lack of Organized Data:* It seems there is a near global lack of good recorded data related to bees and beekeeping, with 74% of respondents in one survey admitting that they do not keep records of their actions but instead rely primarily on memory[5].
- *Data Format*: For those who do keep records, most of it seems to be on paper, hive boxes or custom spreadsheets. If the data is not recorded digitally, in a standard format, it is difficult to collect.
- *Data Quality:* Outside of a few software systems and sensors, most data that is collected outside of rigorous scientific studies tends to have many contextual and data quality issues, making it hard to interpret and standardize.
- *Proprietary*: Of the data that is

[3] https://beehealth.bayer.us/~/media/Bayer%20CropScience/Marketing/BeeHealth/Who%20Can%20Help/Beekeepers/Health%20Colony%20Checklist/Healthy%20Colony%20Checklist%20Form.ashx

[4] https://www.iso.org/committee/4514241.html provides an overview of the technical teams working on the ISO standardization process in the field of biotechnology.

[5] Cazier, Joseph A. (2018) "Electronic Records: A Path to Better Beekeeping", Bee Culture, May 2018 Issue. Pages 37-40.

collected in a quality manner, such as by software companies, pharma, and some commercial beekeepers, much of it is considered proprietary and a competitive asset of the firm that owns it, which creates a reluctance to share.

- *Technical Help:* When we do receive or find useful data, it takes time and resources to convert that data to a conceptual standard, and even more to a technical standard, such as BeeXML.

We have a few ideas of how these challenges can be met, perhaps with assistance from organizations like Apimondia, which we present below.

Recommendations

In previous articles in this series (BeeXML Parts 1 & 2 in October and November 2018), we talked about the need for large volumes of data from citizen beekeepers on which to build algorithms. This data is critical to building a large enough data set to effectively train machine learning algorithms.

However, in order to build this data set from beekeepers, we must first identify what data elements are the most important to have to build **useful** tools for them. To do this effectively (meaning more than just guessing) we first need to collect, harmonize and test a wide variety of quality data that has good annotated records with outcomes. This will minimize the burden on the average beekeeper.

To identify this core and build a standard, we need a much broader swath of data of very high quality. The best place to get this type of data is from researchers who are trained to collect high quality data on a variety of topics with well documented records. The best way to get researchers to share their data is to allow them "academic" credit by publishing it.

We are therefore proposing that some group like Apimondia, COLOSS or an existing bee journal like *Bee World* or *The Journal of Apicultural Research* **publishes an online open access peer-reviewed journal** for bee datasets. This should include accompanying meta-data, and that the journal sees that the BeeXML technical data definitions are created and published to store and transmit this and similar data for future generations to use.

There is a similar journal, Data-In-Brief (**https://www.journals.elsevier.com/data-in-brief**), sponsored by Elsevier that operates on this model for a broad array of data. Bee data is broad and diverse enough that we should have our own dedicated journal for bee data so our data can be defined and stored in one place.

Establishing a bee data journal would help with the challenges we are facing in the following ways:

- *Lack of Organized Data:* It would create an open public venue for collecting this data, along with an incentive for those currently collecting high quality data, mostly researchers, to share their data as it would count for a peer-reviewed publication based on data collected from their experiments, giving them an academic incentive to participate. This data is ideal in the early days of standard creation due to the high quality of the data and documentation collected by researchers.
- *Data Format*: In the beginning, data would be collected more or less as defined by the researcher with a good data and process dictionary. During the publishing process, this data could be harmonized and compared with data on similar topics and a standard for similar data will begin to emerge. This format can be published as a recommended standard based on usage, usefulness, and other measures with a guided group recommending it. Finally, this data can be converted into an XML (or JSON) format (technical language for data standards) that can be used to transmit and aggregate data of this type.
- *Data Quality:* Researchers are also key here in the beginning. Again, their data seems to have the highest quality level and best documentation due to the controlled nature of research. As it is combined and made accessible to other researchers to look at and analyze, more studies can be done on this combined data.
- *Proprietary*: Even vendors of software, sensors, and testing solutions will have an incentive to share some of their data. It may be anonymized, but by sharing, these vendors might have a team of researchers look at their data and publish insights that their own analysis may have missed, generating goodwill and name recognition. Additionally, vendors' tools will inevitably be used by researchers who will want to publish at least their slice of that data, allowing for a standard to be built here too.
- *Technical Help:* Data in Brief, mentioned above, charges a small

processing fee to help guide the publication and data storage. This Bee Data Journal could be set up in a similar way, either through subscriptions fees for the data, publication fees to support the effort, or some other funding efforts associated with a publication like this. A portion of these funds could be used to pay for technical services to store the data in an accessible format and convert the data into a technical standard like XML.

In addition to helping address the challenges listed above, there would be several other benefits.

- *Wider Adoption:* As the journal adopts a standard, other vendors and beekeepers will gradually follow, paving the way for at least aggregate data collection.
- *Real Time Info:* This collection of data in the standard, perhaps from wider sources, could eventually be automated and used to build reports and create alerts in real time, such as disease monitoring.
- *Data Pooling:* This data could be pooled so that like studies could more easily be combined with other like data automatically, building an important repository over time.
- *Data Bank:* This journal would also create a data bank, similar to a gene or seed bank, or cold storage for bio specimen that could archive data for generations to come in a standard format, facilitating long time horizon research and monitoring.
- *Data Mining:* As a wider dataset grows based on the standard, data mining becomes possible. At first this will be from harmonized research data and eventually real time standardized data from the field from citizen beekeepers around the globe.
- *Complete Research Data:* Currently, many researchers carry out studies and ask or collect more data than they ultimately publish. All data from experiments could be published, minimizing the wasted effort. As the research articles typically do not publish the data, but just the analysis, and data journals only publish the data without analysis, this is a perfect symbiotic relationship.
- *Data Bias:* There is believed to be a fair amount of bias in research today as studies finding positive results tend to get published, and those with no results tend to not be published. If the data can still be published, it can be saved and analyzed which would help address some of this bias.

Conclusion

We are pleased with the news that the *Apimondia Working Group* #15 on Standardization for Bee Data has officially endorsed the recommendation in this article. Hopefully this recommendation will help make this idea become a reality.

This is a unique opportunity to help build a global data standard for data related to bees and beekeeping by supporting the establishment of a Bee Data Journal to collect high quality diverse data leading to an open data standard that can be used for machine learning and data mining to facilitate better beekeeping. Now is the time, please help support these efforts.

Finally, special thanks to *Project Apis m.* for supporting a portion of this work with a *Healthy Hives 2020* grant, *Apimondia* for supporting our working group, and COLOSS for providing a venue to share this work. Also to the leaders at the Center for Analytics Research and Education at Appalachian State University and HiveTracks.com for sharing their thoughts on this topic. Finally, we also share thanks to the editors of *Bee Culture* for publishing this work. These efforts would not have been possible without visionary groups like those above providing support and resources. BC

Queens, And Workers, And Genetics

Garett **Slater**

I have always been fascinated with queens and workers. In fact, I spent my master's degree studying the mechanisms that produce queens and workers. I want to spend the next three articles in this and upcoming issues discussing the complex processes that govern how an egg becomes either a worker or a queen. You can look forward to these three pieces:

- The Genetic Book of Life-The basics to honey bee genetics
- How genetics and the environment shape honey bee workers and queens
- The differences between queens and workers

Honey bees have a system of sex determination (male drones versus female queens or workers) known as haplodiploidy. This differs from human sex determination in several ways (***Figure 1***). With humans, both males and females carry two copies of every chromosome (they are both diploid), one inherited from the father, and one from the mother. Human males result because they have a specific sex chromosome (Y chromosome) that females lack. With honey bees, queen bees have a specialized compartment within her body to carry sperm she obtained from earlier mating events, and she determines whether or not to fertilize each egg as it is being laid. Males develop from unfertilized eggs, and therefore only carry a single set of chromosomes (haploid) and females develop from fertilized eggs and possess two copies of each chromosome (diploid), Females receive DNA from both parents, while males receive DNA from just their mother. ***A fun BIP Fact: Male Honey bees do not have fathers***

Figures 2-4 summarize the genetic differences between diploid females and haploid males. In order for females to develop, they need a different genetic recipe from both the mother and father. Diploid males are a great example of how important these different genetic recipes are in sex determination. In certain cases, diploid males can result if they receive identical chromosomes from both the father and mother. This can result from very inbred populations, and results in infertile males (***Figures 2***).

Queens are the only individuals in the colony that can produce both diploid female workers or queens and also produce haploid males. I will touch on why workers cannot produce diploid females in a later blog, but I

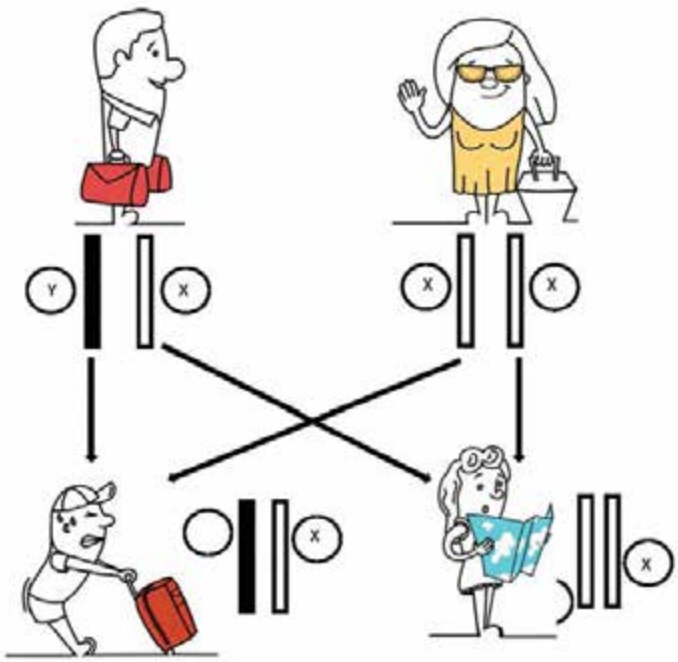


Figure 1: *The picture above depicts human sex determination. Each bar represents a sex chromosome. Also, the arrows show how these chromosomes are donated to future offspring. Humans have what is known as XX/XY sex determination system. In this system, sex is determined by a pair of sex chromosomes. While humans have a total of 23 pairs of chromosomes, 2 (the X and Y) determine human sex. Females typically have two of the same sex chromosomes (XX) and males typically have two different kinds of sex chromosomes (XY).*

describe in some detail in **Figures 3-4.** Workers can lay drones because workers are able to lay unfertilized eggs. Essentially, workers cannot mate or store sperm, so they produce just haploid males.

Haplodiploidy is both interesting and integral for honey bee colonies, but why should the average beekeeper need to know this information. There are a few reasons: 1) this information helps us understand and improve mating systems, 2) sex determination allows us to understand why honey bees cannot tolerate inbreeding, 3) this information can help us understand why and how queens fail, and 4) genetics is an important aspect of beekeeping, but going forward, genetics will be an integral component towards making beekeeping more sustainable.

Honey Bee genetics is fascinating. If you enjoyed reading this blog as much as I enjoyed writing it, keep an eye out for the next installment on how genetics and the environment shape honey bee workers and queen. BC

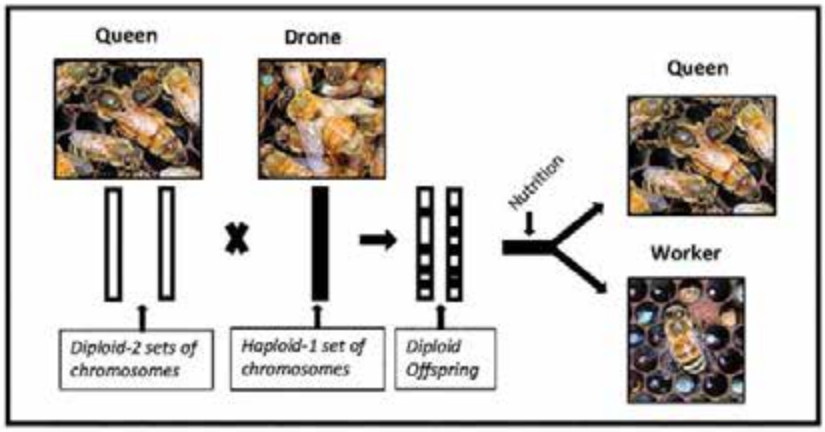


Figure 2: *Depicted above is the genetics of honey bee workers and queens. The bars represent chromosomes. Female workers and queens result from fertilization, which is the act of fusing female queen eggs with male drone sperm. This combination results in a diploid egg and contains chromosomes from both the male drone and the female queen. While I am just showing 1 chromosome for simplicity, honey bees have 16 chromosomes (versus 23 for humans). In this example, the diploid offspring would inherit a chromosome from the drone's set and the queen's set, so a "white" chromosome and a "black" chromosome. Unique to honey bees, diploid females can develop into either a queen or worker. This depends upon the nutrition they receive during development.*

Figure 3: *The picture above is the genetics of a laying worker. A laying worker has underdeveloped reproductive traits, so they cannot mate with drones. Because of this, they cannot fertilize eggs and produce female workers or queens. The laying workers can, however, produce unfertilized haploid males. This is a last-ditch effort for the colony to pass along its genetic material to future generations.*

Figure 4: The picture above shows a queen laying drone eggs. Queens can either lay fertilized or unfertilized eggs. This typically depends upon cell size as queens lay unfertilized drone eggs into larger drone cells.

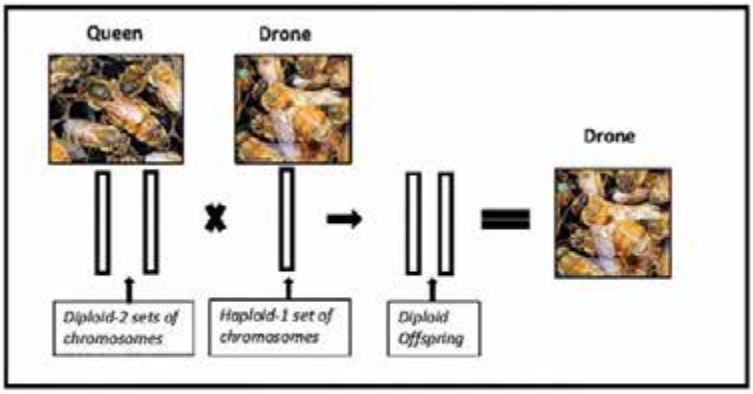
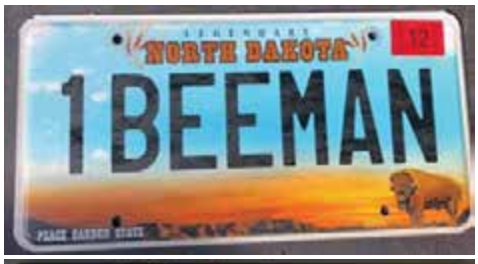


Figure 5: The picture above shows a highly inbred population. In this example, a queens mated with their sibling brother, which share identical chromosomes. The example diploid offspring above received a white chromosome from its father and a white chromosome from its mother, which results in diploid males. These males do not survive in nature because the colony removes them immediately. However, diploid male removal does result in spotty brood patterns post-mating.

PLATE TECTONICS

In the September issue we asked you all to send in your bee related license plates. We got so many we couldn't fit them all in one month. So keep sending them and we'll keep sharing them. Send a cell phone shot to info@beeculture.com, with PLATE in the subject box. We'll share it with the world.



Watch For More In Future Issues!
Thanks To Everyone Who Sent
In Photos. Send More!!!

Georgia's Honey Bee License Plate

Jennifer **Berry**

Getting A 'Bee' Plate For Georgia

I imagine that everyone remembers his or her first car, right? Remember sitting in it for the first time, rubbing your hands around the steering wheel, and adjusting the mirrors? Remember turning the key and hearing the engine roar? Remember driving around with the windows down and turning up the radio as loud as **you** wanted? Remember the feeling of freedom, the feeling of independence, the feeling of maturity? My first car was a 1980 Toyota Corolla, dealer's edition, with a vinyl roof, coach lights, sporty stripes down the sides and probably the last 8-track tape player to be sold in the U.S. I kept that car for over 13 years. It took me to almost every state in the union, coast to coast and back again, and never left me stranded. It crossed boarders into Canada and Mexico numerous times. I named my first car Roger Winton and he was a reliable buddy who kept chugging along, even though his maintenance schedule was overdue at times. I was sad to see him disappear around the corner that day at the dealership when I traded him in for a used Ford pickup. Ahhh, the adventures I had with that car. I miss ol' Roger.

Ok, we all remember our first car, but can you remember your first license tag? Mine was RGR- WTN, which is why I named my first car, Roger Winton. Makes sense, yes? I've even saved most of my license plates as well. This past year, I added a new tag addition to my repertoire: "Save the Honey Bee". There were rumors over the years about a honey bee tag someday, but once it became a reality, I had to have one. Yet, I had no idea the amount of work it took to get this pushed through the legal and legislative process. I would like to share with you some of the nuts and bolts of what it took to get a specialty tag here in Georgia. I hope this may spark some interest in other states, which may be considering creating their own honey bee tag.

The idea of the honey bee tag had been tossed around for over a decade among members of the Georgia Beekeepers Association (GBA). But due to the cost and amount of work it would require, the idea was tabled numerous times. Several years ago, a group of enthusiastic members of the GBA thought it was time that Georgia had a license tag dedicated to our beloved honey bee. This wasn't going to be easy, as these folks would soon find out. It took years but the process had to start somewhere and here is where.

At the 2016 Fall GBA meeting, Linda Tillman and Brutz English presented information they had gathered from the state about how to acquire a specialty tag. They then asked for someone to head the committee. Gail Dean raised her hand and was given charge of the new license tag committee. Gail quickly familiarized herself with the ins and outs of getting a license tag issued. She studied sections of the Georgia code along with the legal processes that must be followed in order for a tag to be issued. Gail combed through files and more files in order to gain a new understanding about the procedures on how things move through the legislature. Once she had everything in order, it was time to present the license tag proposal to the GBA Board, yet, there was still the issue of the tag fee.

In Georgia, there are two ways a non-profit can get a revenue sharing tag after a bill is signed. Frist, they can try to raise the $25,000 by promising individuals will get a tag once the 1,000 tags have been purchased for $25. The second way is to pay $25,000 as a deposit with the state and then start selling tags immediately. The first option is rarely successful, as it can take years to get the 1,000 commitments. But the second option posed a problem to some of the GBA members. They were hesitant to support the specialty tag since the association would have to pay $25,000. Why $25,000? In years past, the Georgia Department of Motor Vehicles would cover the cost of manufacturing a specialty tag. But, due to dozens of these tags not selling very well, the Department never recuperated the manufacturing cost that they paid for. Therefore, they now require

Julia Mahood, designer of the Georgia tag.

Tag committee with house of Representatives.

a one-time fee of $25,000, which covers all the expenses incurred for the manufacturing of a tag. The GBA would have to agree to put up this fee, which was a gamble. Here's why.

In order for the GBA to break even, they must sell 1,000 tags within a two-year period. Then and only then will the GBA be reimbursed the $25,000 ($25/tag). Once the 1,000 tags are sold then every tag after that the GBA receives $22. On top of the usual $20 renewal fee, the Georgia Department of Revenue charges an additional $35/year for specialty tags, in which the GBA will get $22. That is why it's a gamble since there is no guarantee that 1,000 tags will be sold in two years, which made some folks nervous. However, the proposal, which included how the GBA was going to pay the $25,000, was presented to the GBA board and unanimously passed. To date, over 700 tags have been sold. This is due to the diligence and hard work of so many folks, social media and the marketing campaign that is still going on today.

But wait, what was the tag going to look like? The GBA announced there would be a contest for the design of the plate. Out of the 12 entries, a panel of judges chose Julia Mahood's design, and it is lovely! Once the design was in place, Gail got the go ahead from the GBA. It was time that she and the committee members get to work gathering and preparing the necessary information needed to make the application. In November of 2017, Gail met with the State Department of Revenue, Division of Motor Vehicles. Since this was going to be a "revenue sharing" tag, an actual bill had to be introduced and passed in both the House and Senate and then signed by the Governor before it could become legal. What? Yep! It's not a simple "fill out all these forms a – z, pay your fee and wait" kind-of bureaucratic process. Ok, one minor detour, but it didn't stop the process.

The committee pulled together and figured out what they needed to do. Fortunately, a member of the House of Representatives, Emory Dunahoo, was a beekeeper and a member of the Agriculture and Consumer Affairs Committee. He was the perfect person to approach to help move the bill forward. Gail contacted him and Senator John Wilkinson, who was the Chair of the Senate Agriculture Committee and Consumer Affairs Committee to explain about the importance of the tag. After much discussion they both agreed to bring the bill to the floor. But, before a bill can be brought to the floor it must pass through committees (no wonder it takes forever to get anything done in government!). After several meetings, the bill was brought to the House of Representatives floor, in January of 2018. It passed unanimously. The day before the vote, honey donated from beekeepers across the state along with information about the tag, was placed in adorable gift bags and delivered to each of the 180 House of Representatives and to the 56 Senate members. What a way to sweeten the deal.

Once it passed the House, it was time to move the bill to the Senate committee. As the bill was about to go into the Senate hearing, Emory delivered some sobering news. The Department of Revenue, Motor Vehicle Department was about to install new software, which meant, even if the bill was approved that day, the GBA wouldn't be able to start selling tags for at least a year. It was another minor setback since from its inception, Gail and the other members worked so hard to get this tag issued. But it didn't stop them. In March of 2018, the Senate voted unanimously in favor of the bill and the Governor signed the bill on May 3rd, 2018. And as Emory predicted it took just over a year for the GBA to start selling tags. In June 2019 they began to sell the new tag and to date (September 8th) over 700 tags have been sold. GBA directors and members along with local clubs have really worked hard to get the word out. But what is really cool, 71% of the tags sold to date, were

Gail Dean's tag.

Stuffing gift bags.

Gift bags for the House.

Honey for the House.

not purchased from GBA members. That goes to show you there's a lot of support for our honey bees out there!

Another cool tidbit which was revealed to Gail, and why all those involved should be most proud, the state legislative, legal representative said that no one had ever gotten a license tag bill passed as fast as they had. First meeting with the Department of Revenue administrative personnel was on November 17th, 2017, House approved on February 1st, 2018, Senate approved on March 21st, 2018 and the Governor signed into law on May 3rd, 2018. Baam!

Here is the actual bill as it was read on the floor.

SECTION 2.

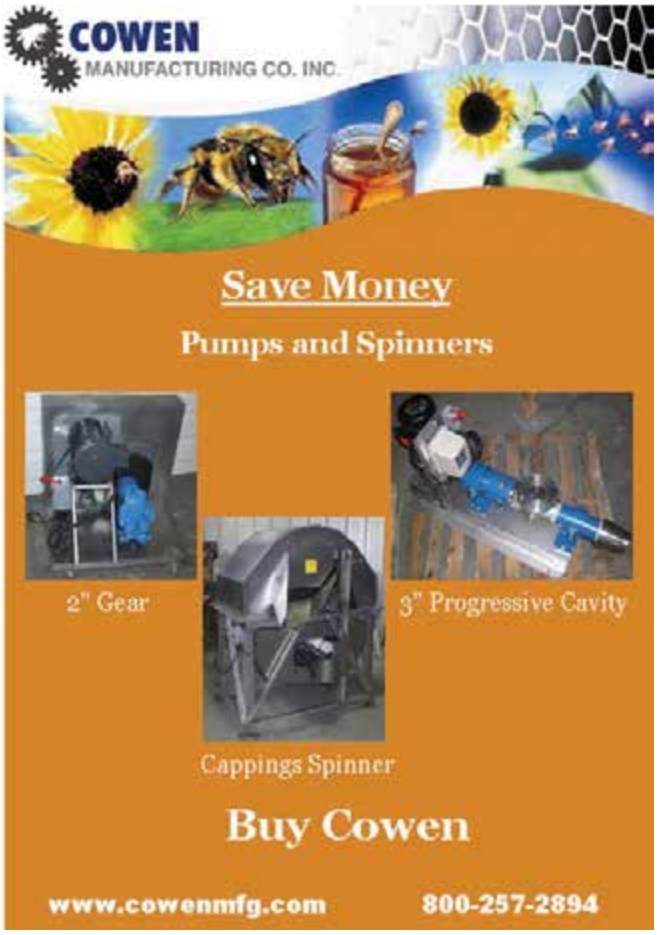
Said chapter is further amended in Code Section 40-2-86, relating to special license plates promoting and supporting certain beneficial projects, causes, agencies, funds, or nonprofit corporations, by adding a new paragraph to subsection (m) to read as follows:

"(14) A special license plate promoting the conservation and protection of the official insect of this state, the honey bee. The funds raised by the sale of this special license plate shall be disbursed to the Georgia Beekeepers Association and shall be used to increase public awareness of the importance of the conservation of the honey bee and for funding and supporting numerous association programs, including but not limited to the training and education of both new and experienced beekeepers, prison beekeeper programs, grants to beekeeping related nonprofit corporations, beekeeping research facilities in this state, and projects that encourage public support for the license plate and the activities it funds. Such special license plate shall include the phrase 'Save the Honey Bee' in lieu of the county of issuance."

If you are interested in purchasing a "Save the Honey Bee" tag, please go to the GBA website (**www.gabeekeeping.com**) and follow the instructions. Once you pay the $25 fee online, you will receive two receipts, one of which you will take to your local tag office. You will pay them your renewal fee and the tag will be mailed to you shortly thereafter. This is a great way to support research and education for our state along with promoting the importance of the honey bee. Let me give a shout out to the committee and those that spent hours of their time sifting through layers of bureaucratic legal jargon, schmoozing Georgia politicians and their aids, walking the halls of the state capitol, writing proposals, stuffing goody bags and making sure anyone wanting a tag could have access. Those members are Gail Dean, Gina Gallucci, Brutz English, Katie Goodman, Linda Tillman, Bobby Chaisson, Derrick Fowler, Tim Doherty and Bob Grant. Good Job! Ok to all the other states out there with boring plates, it's time to make a statement, and to not just remember our cars, but our bees.

Take care of your bees! BC

Jennifer Berry is the Research Leader at the University of Georgia Honey Bee Lab.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Why Comb Rotation Is Important

Bob **Binnie**

The Blacker It Is, The Worse It Is. Here's Why.

Whenever beekeepers report problems such as premature queen failure, sick brood, or excessive and repeated colony losses, one of the first questions they should ask themselves is: "***How old is my comb and what has it been exposed to?***"

Research has shown that old comb, especially old brood comb, contains significant levels of contaminants including pesticides, heavy metals, fungi, bacteria, and viruses. Any of these can be detrimental to a colony's wellbeing and large amounts will produce all of the symptoms listed above and more.

Additionally, the cell diameter in old, heavy, black, brood comb can shrink from an accumulation of these materials along with fecal matter and cocoon silk left behind by each emerging bee. In a three-year field study at the University of Georgia, Jennifer Berry compared new comb to old, dark, heavy comb for brood rearing.[1] It was shown that, "On average, colonies with new comb produced a greater area of brood, a greater area of sealed brood, and higher weight of individual young bees." Also, "Bees reared in old comb may weigh up to 19% less than bees reared in new comb" (Berry, 2001). The message here is clear:

"Colonies full of old, dark, heavy comb will have smaller bees and fewer of them."

"Comb rotation" is simply the removing of old comb and replacing it with either newer comb or new foundation to be drawn out, or allowing the colony to build their own new comb from scratch.

Until recently, comb rotation wasn't considered very important, and in years past some beekeepers were actually proud of their old comb. They understood old, black combs to be strong and durable, and beekeepers especially valued them in extracting supers because they wouldn't break apart during rapid uncapping and extracting.

Of course, our understanding has evolved since then. We now know that a colony of bees will eventually probe almost every square inch of a sizable piece of ground, and some of what they touch, collect and bring home can be very toxic. Nectar, pollen, and propolis frequently contain compounds that didn't exist in the not-so-distant past, and because comb can absorb much of this, old comb should be considered a liability rather than an asset.

On a brighter note, honey consumers can take comfort in the fact that many of the toxins collected in nectar migrate to the comb because they are attracted to beeswax rather than honey. This is due to the lipophilic properties of wax, which means they tend to combine with or dissolve in lipids or fats rather than water. This is also why the comb in a beehive is often called "the liver of the colony."

A few years ago, a second generation commercial beekeeper I know, who inherited much of his outfit from his father, was struggling to keep his bees alive and healthy. He had tried everything, or so he thought, to keep his bees in good condition, but nothing seemed to work. He suspected that the high percentage of very old comb in his hives might be part of the problem and sent samples off to a lab for a complete analysis.

A few days later, he got a call from one of the technicians at the lab who explained to him that they would be glad to take his money for an extensive analysis and report, but all he really needed to know was that nothing could survive in this comb.

He was dismayed at first and thought about quitting. However, rather than throw in the towel, he decided to undertake the laborious and expensive job of shaking all the bees from every colony onto new frames and foundation. Six months later, he reported having the best looking bees he had ever seen.

Another problem with old comb is the synergistic interactions that can occur between compounds previously absorbed and substances currently coming in. Because of the myriad of substances bees are exposed to today, the number of synergistic effects that can be generated is astronomical, and can be practically impossible to know.

When I began pollinating almonds in the early 1980s (before mites), I would often notice a setback in the overall condition of the bees immediately after a fungicide application. Although the change would sometimes be subtle, other beekeepers I knew noticed it, too, but we

Very old comb. Age unknown.

Cell cross section. Note layers.

never considered it a major problem because it wasn't extreme and the bees always seemed to bounce back.

Today's world is very different. Because there are so many more chemicals our bees are exposed to and a colony's comb is the ultimate sink for many of them, an exposure like that could result in interactions that are insidious and unforeseen.

An example of this occurred with a friend of mine some years ago when he came out of almond pollination in California with very sick colonies. The sickness was consistent throughout his entire outfit and was especially evident in the brood. It was a month or two after the bees returned home before they began to turn around, and it was midsummer before he felt like the problem had completely gone away.

This problem was especially puzzling because it developed while he was covering a contract with friends, and their bees were fine, even though they were in the same orchard and exposed to the same environment as his. They all moved their bees in and out of the orchard together and managed them in much the same way while they were there. Because he was a newer beekeeper and his equipment wasn't very old, he ruled out the possibility that old, contaminated comb was the problem. No one could figure it out.

A year later, I recognized a possibility while attending a lecture aimed at beekeepers by Marion Ellis from the University of Nebraska where he spoke on the synergistic effects that occur between chemicals and substances bees are commonly exposed to. He shared a chart that included mite treatments (acaricides) routinely used by beekeepers, chemicals that bees are commonly exposed to in the field, and the levels of toxicity that occur when these substances interconnect.[2]

It was very interesting and enlightening to see all the possible combinations and the results of their interactions.

One of the things that caught my eye was that fluvalinate, the active ingredient in Apistan, which at one time was the varroa mite treatment of choice, was shown to have greatly increased toxicity when combined with many fungicides. Of course fungicides are widely used by almond growers and are routinely applied during the bloom period.

I knew my friend had been using this mite treatment for several years before the almond pollination in question, while the other beekeepers with him had been using an amitraz-based product which showed less toxic interactions with other compounds. Because fluvalinate is stable in beeswax (it persists in comb for years) and will build in concentration with repeated use, it seems plausible that exposure to fungicides in the almond orchard, combined with the residual chemical in his comb, produced a synergistic effect that caused his problem.

It's helpful to understand that fungicides are simply a specific type of pesticide and many can be absorbed by comb and cause countless difficulties. Among these are issues with the production of bee bread, which leads to nutritional problems, and the hindrance of a honey bee's ability to detoxify, which leaves a colony overly susceptible to an ensuing chemical exposure.[2]

Another fun fact is that the fungicide Prochloraz produces an almost 2000-fold increase in the toxicity of fluvalinate[2] (I wonder if it glows in the dark?). Although it is widely used in Europe, Australia, South America and Asia, American beekeepers can consider themselves lucky that Prochloraz is not currently being used here.

As a side note, I've noticed that fluvalinate-based products have been making a slight comeback as an alternative mite treatment to reduce the chance of resistance with other compounds. In my opinion, fluvalinate should not be used because of its persistence in beeswax and propensity for toxic interactions.

I personally experienced an instance of toxic comb about ten years ago when I made a deal with a northern beekeeper to install nucs in his equipment and let them sit in my southern yards in Georgia for a month before he picked them up.

I placed three frame nucs, produced from my bees, in his brood boxes along with enough of his drawn comb to complete the box. Within two weeks, I noticed brood issues developing in his boxes, even though the rest of our nucs looked great. I called him with a report and asked if he had any ideas. He asked me to give them a terramycin treatment, which I did twice, and also asked if he could leave them there for a few extra weeks. The brood problems did not go away, and when he finally picked them up, many were still struggling to expand into his comb, even though they had been on a nectar flow for several weeks. After some discussion, he admitted that he had been having trouble keeping his bees alive and was fairly sure it was because his comb had been exposed to years of multiple types and excessive amounts of chemical mite treatments. By the looks of his very black comb, I was inclined to accept his theory and winced at the idea of having handled his frames. He also admitted he was hoping to repopulate his equipment, make a crop, and sell out in late summer. This leads me to this straightforward and obvious advice:

"Beware of purchasing nucs or colonies with old black comb."

All of this begs the question, "How old is too old?" I don't believe anyone can give an exact answer and suggest that it all depends on what the bees have been exposed to. Beekeepers that pollinate multiple crops each year and have a high degree of chemical exposure should consider rotating combs out more often than someone who is isolated from agriculture.

There are those that suggest all combs should be rotated out within three years for optimum results, while others advocate the replacement of twenty percent of your comb each year in order to achieve a complete turnover in five years. Still others believe that by not replacing all combs at the same time, the migration of substances from older combs to new ones permits a continuous low level contamination. Some, such as myself, approach it from a business perspective and try to understand where the point of diminishing returns begins when comparing costs to results. As for me, when all things are considered, I believe I am well served by replacing brood combs before they are ten or twelve years old. Please note: I no longer pollinate and this is only my opinion, and my conclusions are based on observations and experiences rather than a scientific study.

Beekeepers occasionally ask if using old black combs in extracting supers can influence the color and flavor of honey. Unless honey is filtered so completely that it removes all the particles and substances introduced by exposure to the comb and processing (i.e. uncapping, extracting, etc.), including those that are absorbed or microscopic, then both color and flavor will be influenced. The blacker the comb, the less subtle the results. We should also remember that, for better or for worse, these substances will be ingested when the honey is consumed.

Please also consider that changes will occur with color, flavor and aroma when cappings from old dark combs are separated from honey with a cappings melter. Although honey quality will always pay a price when wax is separated from honey by melting, the end result will inevitably be worse when old, black comb is involved.

All beekeepers should rotate out old comb as a part of their overall management strategy and this includes nontreatment and organic treatment beekeepers alike. Any beekeepers who think they are immune to the problems associated with old comb are kidding themselves. We can't tell the bees where to go or what to bring home, and organic compounds can easily have nasty interactions, too. Even in what seems to be a non-exposure situation, combs will eventually become contaminated and overloaded with undesirable substances, and will need to be replaced. BC

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Nucleus Colonies

A Bee Store In Your Backyard

Zachary **Lamas**

Why beekeeping is unfair to beginners

Ever wonder what it would be like to have all the resources you needed for your beekeeping when you wanted them? Like if I needed a queen and magically one appeared. No calling around to queen breeders, no waiting for the shipping box to arrive in the mail, just magically in my procession. Or what if I wanted brood to boost another colony along, just a little? Wouldn't that be nice. Or maybe if I could just replace my Winter losses without buying in bees in the Spring. That would be fantastic.

If you've kept nucleus colonies then you know exactly where I am going with this. Some beekeepers have created hugely successful operations by incorporating nucleus colonies into their management. My first experiences with nucleus colonies came from shadowing Kirk Webster and then working for Michael Palmer. Both are revered beekeepers and queen producers in northern Vermont. They make nucleus colonies which act like a reservoir of resources within their apiaries to buffer against honey bee issues and their losses. Both have written or presented on the subject at length. Famously, they created a solution of replacing their own Winter losses in a northern climate. As a result, neither are reliant on the annual purchase of southern bees.

There is a lot more to having nucleus colonies than just replacing Winter losses in the Spring. Over the next few articles I will be talking about nucleus colonies, one aspect at a time. We will look at how nucleus colonies are different than traditional splits, how to manage them, expand your apiaries or even just to requeen with them.

For this first instalment, I thought it would be appropriate to begin the conversation how nucleus colonies can help beginner beekeepers learn a lot faster and better. This became obvious to me the first Summer I began making nucleus colonies. I was a new beekeeper and I really didn't know much about beekeeping. I was also suffering from what all new beekeepers suffer from. *We are so excited to do more, but learning in beekeeping is inherently slow.* These nucleus colonies were the solution to that.

If you're not a beginner, try to think back to what it was like the very first season you had bees. Simple things like pulling a frame out straight or lowering a box without squishing tons of bees is all new. By the time a new beekeeper develops some skills, the season is over and they wait all winter before they get a chance to practice again.

This is a horrible way to learn a new skill, let alone something like beekeeping which requires a mixture of dexterity and mental judgement. In fact, this is the exact opposite of how we as humans learn tasks. Everyone learns slightly differently, but there are some core principles that are universal. One of which is repetition of the same task. We get better at tasks as we engage with the same activity over and over again until mastery. Usually this is aided by a period of rest in between repetitions. We also learn through pain or pleasure. Pain is an excellent way to learn to *not* do something, while pleasure is a great enticer to do the task again. Pain or pleasure allows us to learn through feedback loops. Essentially, if I am working and seeing a poor result, then my brain will understand that my actions are unsuccessful. We stop what we are doing and change practices. Finally, we learn best when we find meaning and purpose in our work.

I want to argue on every new beekeeper's behalf that you're not at fault for finding beekeeping so difficult to learn. Inherently beekeeping is fundamentally flawed for learning. Can you really think of any complex task that you learn practice once, and then don't repeat until the next year? And, by the way, next year when you practice that task again the conditions will be different. That is exactly what beekeeping is all about. We install packages once a year, reverse once a year, super once or twice, etc etc. Then there is a long period without any practice whatsoever. Next, the pain and pleasure experience is far delayed in beekeeping.

Usually when we do something wrong we get a response close to when we made an action. Not in beekeeping! This alone makes it difficult to develop feedback loops and successful learning. In fact, beekeeping would be a lot easier if it was like milking a cow. The first cow I bought, I bought with my grandparents. I had never milked before, but my grandad had. He milked her the first evening we brought her home. I watched him, and when he was finished he said, "Well, the morning she's yours!".

That poor cow . . . Try as I might, I couldn't get a stream from her. I was having an awkward time balancing on the short stool, let alone trying to fill the pail. But, that evening I had to do the same task again. And, lucky for me, conditions hadn't changed. It was still Molly waiting for me. I got a little better that evening. The next morning was ok. I was getting the motion, and balancing on the stool was becoming normal. Soon enough the task became habit.

Back to that first Summer I was making nucleus colonies. It wasn't the first year I had kept bees, but it was more or less the first year I really learned anything about beekeeping at all. I attribute that to having a better method to learn.

Unlike previous years where I would buy a couple packages, it was the first time I had true repetition. I made almost 50 colonies that Summer. This meant I had 50 repetitions of making a new colony. Fifty times I would have to add a super. Fifty times I introduced a new

Here, someone snapped a photo of me looking at a brood frame. I can't remember what I didn't know back then. I am sure it was something simple, but no matter. I was no longer worried about hurting my one colony. Instead, I wanted to actively learn from the many colonies now at my fingertips.

queen. By the end of the Summer I had 50 opportunities to assess colonies against one another. Fifty chances to see which ones felt ready for Winter and which ones I didn't feel confident about. For me, this was the true leap forward in improving my beekeeping knowledge – *having repetition of each task I needed to learn.*

Having more colonies that I was actively working was what I needed to jump ahead with my beekeeping experience. I could compare one colony to another now that I had a yard filling up with new colonies. When we have just one or two colonies, it is difficult to assess if the colonies are doing well or poorly. I could only reference the quality of the colony in front of me by a single neighbor.

As a new beekeeper, how do we know if this is healthy brood or if this colony has a good population? Well, by having even just a handful of nucs it becomes apparent which colonies are growing and which ones are not. I stopped thinking that all the issues in a hive were somehow my fault, and began understanding that some colonies were more productive than others. The colonies that were really lagging behind now became apparent. I stopped questioning myself about requeening those laggards.

The nucleus colonies provided another gift to me as a new beekeeper. Prior to making nucs, my goal was always to just keep a colony alive. That is probably the goal of all new beekeepers. In fact, because of colony collapse and *Varroa*, many of our beekeeping conversations are about the woes and failures of beekeeping. The nucleus colonies gave me a different goal. I wanted to make a lot of these new colonies, and I wanted them to grow. What they provided was an attitude shift. I shifted away from *just keep the colony alive* to a different attitude that I was in charge of *how many of these nucs can I get to thrive?*

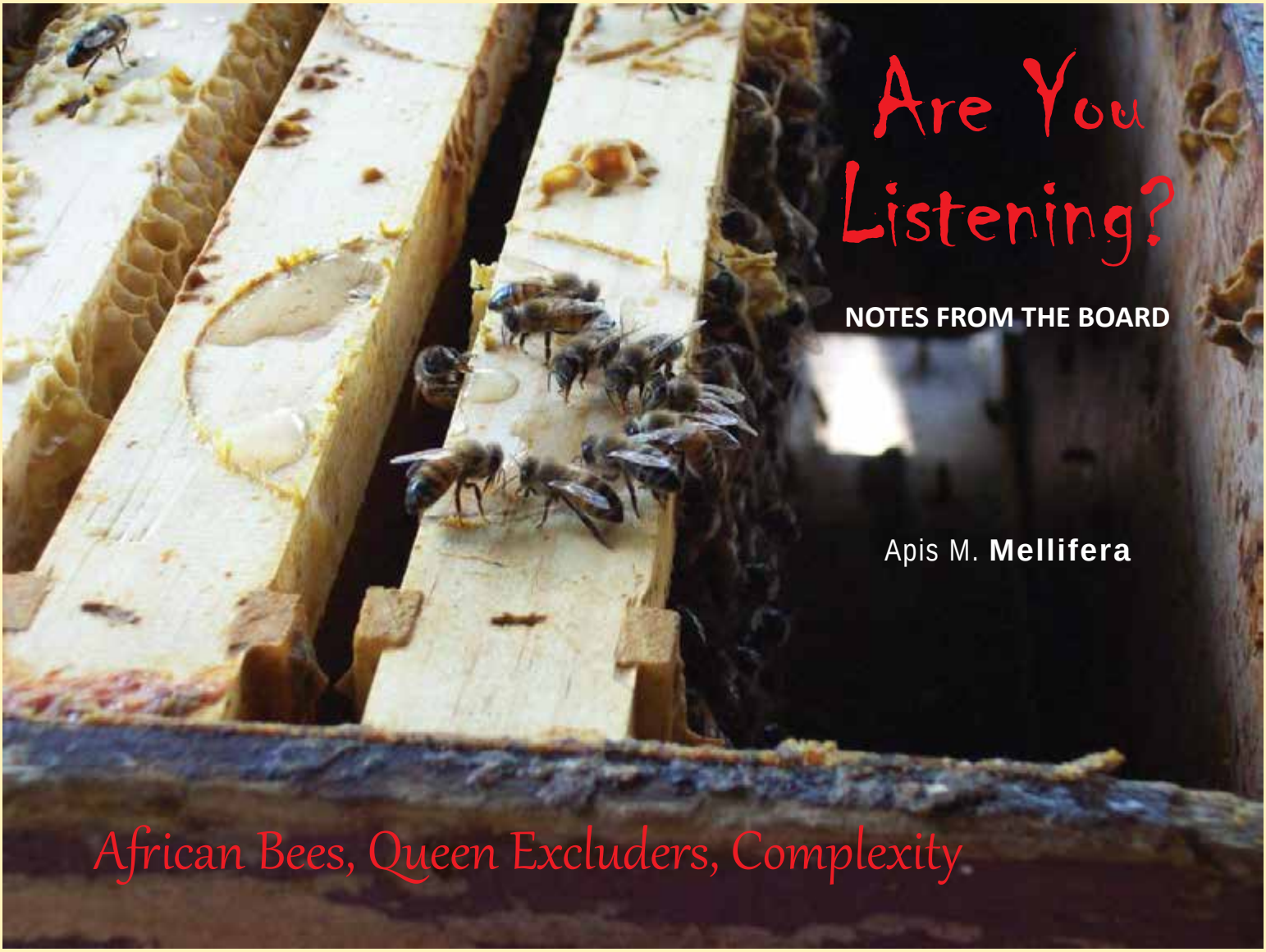
Now, I knew very little that first Summer making nucleus colonies. My mistakes in the end were representative of that. Only 19 of the colonies survived the Winter. I had increased the number of my colonies quite a bit, but I still took losses higher than the national average. I was set on achieving that 50 number. As a result I over split my colonies in late August. The strong colonies lost the brood resources they needed to build a Winter population and the new colonies I made were too weak to build up before the season ended. I was feeding my colonies, but not efficiently. I still had top feeders on by the time the very cold nights started. I could have united the smallest colonies in the Fall, but I was too stubborn to do so. I hoped they would power through.

Here are two colonies, the pictures taken on the same day early in the Spring. One colony is growing, the other has dwindled significantly over the Winter. The difference here is obvious, but as beginners we have limited experience for what is "normal." Worse, we may be sold a bad package or queenless nuc, only to find out way too late that something is wrong. By casually making nucs and having a handful of colonies, any beginner can compare how colonies are doing over time across each other.

However, those were my mistakes to own. The mystery of why a particular colony lived or died had disappeared, and I owed it to that great learning opportunity the nucs provided through the previous spring and summer. The goal going forward was to become a much better beekeeper. So what did I do?

Early in all of our beekeeping everything is a new, exciting experience. For me, these experiences were nerve wrecking. I was so afraid of hurting my bees- my only colony. It wasn't until I started making nucleus colonies did my attitude shift. Now I was focused on growing the bees, keeping the best stock, and taking the time to enjoy them. BC

Nucleus colonies are a colony in miniature. They are typically five frames of bees. Michael Palmer popularized that these small colonies can be grown vertically. Don't be fooled, with a good queen, nutrition and with varroa under control their populations can explode. This one should have been given additional space well before. For new beekeepers, nucs are pleasant to work. The boxes are lighter, the bees tend to be very gentle, and handling the equipment more forgiving to inexperienced hands.



Are You Listening?

NOTES FROM THE BOARD

Apis M. **Mellifera**

African Bees, Queen Excluders, Complexity

On African Honey Bees

Our board of directors has chuckled on occasion at the ruckus our Afro-American cousins have caused of late in the beekeeping community. Is it possible all those predictions about the African honey bee being just a flash in the pan won't pan out? Rather than "fat and happy," as they've been described in some recent press releases, they appear to be more like William Shakespeare's Cassius – having that "lean and hungry look."

With all the fuss this is causing, we may well sit back and ask the beekeepers of the nation why they didn't ask us about our prognostications. Impossible? Maybe in the conventional manner, but many creative alternatives exist to get at what the African honey bee is all about. In fact, as time goes on, it looks like those honey bees in South America are not as strange as they appeared at first glance. They are, after all, still honey bees, and much of their behavior can be compared to ours. It's just that they have some eccentricities that even we "European" bees look upon with a jaundiced eye.

For us, for example, it would be anathema to live underground. That behavior is reserved for the lowly yellow jacket. And we would be hard pressed to abscond, up and leave our babies and hard won honey at the drop of a hat, as African honey bees are prone to do. On the other hand, our African cousins have not been as pampered as we have throughout the years. In tropical Africa, there is much more biological competition to reckon with than in the temperate regions where we developed. It's true there might not be any black bears, but how about those scads of army ants, honey badgers (small bears of sorts) and even birds, like bee eaters and the honey guide, which can deliver a honey bee nest into the hands of that greatest of predators, humanity!

The African pattern of beekeeping is often extensive and predatory in the extreme. it must fall to our African sisters using their sting first and investigating later. And, then, there is the 800 pound gorilla in the room, climate. We Europeans are faced with a large climatic variable each year called Winter. Our African sisters in the main don't have to worry about the cold and snowy months of the low sun season. They do, however, have to concern themselves with water and sometimes are forced, like the mammals of the great velt, to move long distances in search of this precious commodity. They also have to contend with a series of nectar flows that many times are not heavy enough to make surplus honey and so they must at times migrate in search of richer pasture.

Forced rationing may well make African bees better survivors than we are under marginal conditions. Along with the beekeepers of the nation, we too see the inexorable advance of the African honey bee as a threat. Perhaps the most important way we can be injured would be for their actions to cause a human public outcry ⇨

against all bees. Locations for us might be infinitely more difficult to find than even at the present time. In addition, there is the real possibility of large-scale take over of European colonies by Africans due to their more "aggressive" nature in general.

On the other hand, we look forward to the bright side of the picture that the advent of our African cousins is sure to cause. This will no doubt take the form of a heavier amount of investigation by scientists, beekeepers and the general public into our value as pollinators. In addition, as information becomes available on the behavior of African honey bees, much so-called conventional wisdom about ourselves could well be replaced by information which might be used to beef up our population. Thus, invasion of the African honey bee might like so many events in nature be a two-edged sword, problematic in some respects (over defensiveness), but also contributing to survival via something called "hybrid vigor," that many now see in what are called Africanized honey bees.

On Queen Excluders:

We are concerned that many beekeepers are not aware of how to culture honey bees in the broadest sense. As such, many times they miss seeing the forest by concentrating on all the trees. This is manifested in many meetings and bee schools where so many questions pertain to specifics, rather than the principles of honey bee culture. We bees hesitate to call the specifics of beekeeping trivial or "nit picking." On the other hand we are at a loss to explain them any other way in human terms.

One topic, for example, which sets our rear ends in the air, sting extended, is the endless debate about the use of the queen excluder by beekeepers. It seems, at times, this topic is addressed at length in every school or meeting, but does it merit so much expenditure of time and energy? We think not. We all know the classic pros and cons of using the queen excluder.

Some beekeepers have no truck with the device whether it be wood and wire, all metal or plastic. At best they cuss it and deem it a nuisance; at worst, it becomes that sin of sins, a "honey excluder." The other side of the argument is also classic. Use of the queen excluder simplifies many a beekeeper's management. It is especially useful for many commercial beekeepers who don't have a lot of time to spend on each colony.

We bees prefer to remain neutral as to whether or not a queen excluder should be used. After all, what it boils down to is a personal decision on every beekeeper's part. Nevertheless, in spite of this letter, we are resigned to the fact that this question will continue to be asked time and again. The answer as to why is not clear to us. We can only suggest that some beekeepers are seeing this as a straightforward question deserving of a simple response. It only needs to be asked over and over until the answer, there all the time, a so-called "smoking gun," will eventually pop out.

We also suggest this is why so many in beekeeping seek out what can only be described as gurus, those who will answer their complex problems with simple paradigms. Unfortunately, these persons may be only conversant in one small part of the issue, the inevitable result of increasing specialization in human society. But the danger is the guru may become so caught up in reasoning and derive so much satisfaction from proclaiming it to the masses, that it becomes unreasonable to retract to a stance where logical exception is required.

In conclusion, we don't like to see humans so intent in search of simplicity. Our society is infinitely complex; it has taken tens of millions of years to perfect it. And we did not get to where we are by accident. The design did not come easy and has been mostly punctuated by failure along the way. We were, however, never so far extended that we couldn't draw back and regroup forces before putting our efforts elsewhere. We ask, therefore, that human beings look at our society as it is, a complex way of life, fully integrated into the life-support system of the earth, yet not static, but continuing, slowly to change. Only then will it become clear why even those beekeepers and scientists who know us so well continue to be amazed at their present ignorance about the honey bee. BC

Create An Environment Of Evolutionary Adaptedness

David **MacFawn**

Seeley's Darwinian Beekeeping Has A Past, And A Future

Dr. Seeley has developed an Environment of Evolutionary Adaptedness (EEA) process for keeping bees[1]. The beekeeper may already be doing much of this process with the notable exceptions being colonies being spaced as widely as possible, and euthanizing colonies if the *Varroa* level gets too high. EEA is very similar to the way bees were kept during the early part of the 20th century. EEA is a form of treatment-free beekeeping.

My Grandfather was a dairy farmer in the Detour, Maryland area. He kept honey bees to pollinate his clover, alfalfa, and other crops. Valentine Hives that were made in Hagerstown, Maryland were used. Valentine Hives were produced in the late 1800s to early 1900s and were removable frame hives. We put a Valentine Hive in Dr. Wyatt Mangum's bee museum.

Frames were narrower than the standard frame in use nowadays. A one-inch beeswax foundation starter strip was used at the frame's top to encourage the bees to draw-out the comb lengthwise on the frame. This meant the hives had the natural percentage of 14% to 17% drone cells.

The brood chamber was about the volume of today's standard eight-frame hive. The super box, after removal of comb and honey harvest, slid down outside the brood chamber in the winter, to make a single insulated, double width wooden box. This allowed a top entrance hole in the "super" in the Summer but not the Winter.

In the Valentine Hive the super was not designed to control bee space between the internal super box and outside walls, which meant the bees did build burr comb. The colonies were not typically split nor were frames removed to control swarms, instead the colonies were allowed to swarm naturally and typically landed on a nearby peach tree. The colonies were not fed nor treated for any diseases. Most of the colonies would survive the Winter on the amount of honey in the brood chamber. Colonies were kept on wooden frame hive stands on top of cinder blocks located in a beeyard. The hives were not "air tight" and had plenty of ventilation.

Refrain From Treating For *Varroa*

Dr. Tom Seeley's Environment of Evolutionary Adaptedness (EEA)

- Average in the wild is 2.5 colonies per square mile; space colonies as widely as possible
- Use small nests; one deep and one shallow; they produce less honey but colony is healthier
- Use rough cut lumber on the inside to encourage an increase in propolis coating
- Target diverse pollen sources for each location as much as possible
- Maintain 10% to 20% drone comb
- Obtain and keep bees adapted to your location
- Keep nest structure intact; keep original frame location in hive and original frame orientation; do not reverse boxes.
- No top entrances; use 2" bottom opening
- Condensation during the Winter in hives is Winter water source for the bees.
- Do not disturb colonies in Winter; no feeding syrup or pollen
- Refrain treating for *Varroa*; if level gets greater that 15 mites per 300 bees, euthanize with warm soapy water; eliminate non-resistant colonies and avoid mite bombs, or mite lures.

EEA is much like the way I was taught beekeeping in early 1960s. However, it is a treatment-free process. Let's examine each EEA item.

Environment of Evolutionary Adaptedness (EEA)

- Average in the wild is 2.5 colonies per square mile; space colonies as widely as possible. Spacing colonies will be easier for hobbyist than commercial beekeepers. Spacing should reduce disease and pest transmission, robbing, and over-pasturing.
- Use small nests; one deep and one shallow; make less honey but the colony is healthier. This is the way I was taught beekeeping. The Valentine Hive only had one super and then only in the summer. Smaller nests will increase swarming. Use of bait hives (aka "swarm traps") will help alleviate some of the bee loss

Obtain And Keep Bees Adapted To Your Location

due to swarming. However, letting bees swarm in an urban environment will cause mayhem and restrictive ordnances. Also bait hives may not be practical in an urban setting.

- Dr. Seeley recommended a 10-frame deep + 10 frame shallow:

	Size (in^3)	weight	Size (Liters)
10 frm deep	2608.68	80 lbs.	42.75
10 frm shallow	1541.49	40 lbs.	25.26
Total	4150.17	120 lbs.	68.01

If 8-frame equipment is used:

8 frm deep	2166.53	64 lbs.	35.50
8 frm med	1491.25	40 lbs.	24.44
Total	3657.78	104 lbs.	59.94

- 4150.17 - 3657.78 = 492.39 in^3 (8.07 L) less with eight-frame deep/medium configuration than Seeley's configuration.
- Bees naturally build four to eight combs in the wild. Bees also seem to do better in eight-frame equipment than 10 frame equipment but they swarm more. Swarming contains more elements than a brood break. We could go with two eight-frame deeps but that would mean lifting 64 lbs. and:
- 2166.53 x 2 = 4,333.06 in^3 4333.06- 4150.17 = 182.89 in^3 (2.99 L) more with two eight-frame deeps – may be way to go if you do not mind lifting 64 lbs. However, it should be noted that an eight-frame deep holding 64 pounds of honey may not match the nectar flow in your area. An eight-frame medium holding 40 pounds may be a better match. Also, the brood nest may expand into an eight-frame deep or medium super in the Spring.
- Use rough cut lumber on inside to increase propolis coating. The Valentine Hive used mostly rough-cut dimension lumber. This makes sense since the inside of a tree cavity is rough and the propolis is an anti-microbial/anti-septic resin from trees. Rough-cut dried lumber is difficult to obtain. Also, using dimension lumber (full one-inch not the ¾-inch planed) will achieve higher thermal insulation for the hive but will be heaver to lift. This makes sense for treatment and treatment-free beekeeping.
- Target diverse pollen sources for location as much as possible. Diverse pollen sources were much more plentiful years ago. Also, bees need a diverse diet to achieve the nutrition they require. With large fields of mono-crop plantings, it may be difficult for bees to collect a diverse pollen diet. A diverse pollen supply is required for raising brood and feeding young honey bees. This is very location dependent.
- Maintain 10% to 20% drone comb. We did this by using only a one-inch foundation starter strip in the frames. Drone brood is raised by healthy colonies. In recent years reducing the amount of drone brood has been found to not impact honey yield as much as previously thought. Solid sheets of foundation were thought beneficial to increase workers, however current foundation does not allow for drone brood unless it is drone brood foundation with larger cell sizing (typically the plastic green foundation). This will work for treatment and treatment-free beekeeping.
- Obtain and keep bees adapted to your location. This was practiced in the early 20th century at a greater degree than today. We are just now starting to raise geographically dependent honey bees with research showing increases bee heath and survivor ability.
- Keep nest structure intact; keep original frame location in hive and original frame orientation; do not reverse boxes. The practice of maintaining frame location was practiced years ago and still should be practiced today. It makes sense to keep the nest intact, the way the bees laid it out. The bees laid the bee nest in a certain fashion for a reason. The nest layout supports brood rearing and honey production. This also makes sense for treatment and treatment-free beekeeping.
- No top entrances; use 2" bottom opening (3/4" height). The Valentine Hives adhered to this practice. This also makes sense with bees preferring only a two-inch bottom opening for nest defense and it allows the bees to support brood rearing with a shorter distance when entering the hive. The brood area is the first area when entering a hive for Langstroth, Top Bar and all hives.

Surplus honey is naturally stored above the brood nest. This also makes sense for treatment and treatment-free beekeeping.

- Condensation in hives is the bees Winter water source. No special provisions were made with Valentine Hives to disperse condensation. This may be counter to the current belief, but tree cavities are limited in ability to disperse condensation, especially in the Winter. Bees remove a lot of the rotten punk wood for structural integrity prior to coating the inside with propolis.
- Do not disturb colonies in Winter for the purposes of feeding syrup or pollen. This was the way I was taught beekeeping. However, colony stores going into Winter are going to be dependent on your location. It makes no sense to allow a valuable colony, otherwise healthy and strong, to starve because your area is toxic or short on bee feed. This gets back to the art of beekeeping. In much of the south, we have a weak Autumn nectar flow. This means the beekeeper needs to leave enough honey on the colony to get through any Summer dearth, Fall, and Winter.
- Refrain treating for *Varroa*. If the colony's *Varroa* count increases to greater than 15 mites per 300 bees (5%), euthanize with warm soapy water to eliminate non-resistant colonies and avoid mite bombs. We did not have *Varroa* years ago so a comparison between this practice and the Valentine Hive is not possible. However, bees reproduce quickly and I suspect within a few years, using this model, we would have more *Varroa* tolerant bees at the right location the beekeeper will most likely experience high initial colony loss and monetary loss.

No Top Entrances, And Only A 2" Bottom Entrance

- Randy Oliver reviewed the article and made the comment we should treat the high mite colonies with Mite Away Quick Strips (MAQS) and requeen rather than euthanize.

Will EEA work? Yes, I believe it will in the right setting with expert skills. EEA is not for the new beekeeper or for inexperienced beekeepers in the urban setting. EEA requires the time and expense to replace lost bees. EEA is very similar to the way bees were kept years ago with the notable exception of *Varroa* mites. It is not a retreat to the past but rather an advance toward more natural beekeeping, as the bees do it in their tree hives. The takeaway here is today's beekeeper should become aware of the need to support the bee's natural abilities and defenses to be successful. Bees are resilient and have evolved in many ways to survive over millions of years. BC

[1]Environment of Evolutionary Adaptedness (EEA) at Eastern Apiculture Society (EAS). https://www.easternapiculture.org/images/stories/extentions/DarwinianBeekeeping-EAS17.pdf

BUILD A HORIZONTAL FRAME SUPPORT

Ed **Simon**

While researching the many methods of raising queens I found a reference to the Hopkins System. It uses the placement of young larvae suspended above the brood nest of a queen-less hive to draw out queen cells. Subsequently, I could find no commercially available frame supports for the queen cell drawing frame. Since I make as much equipment as possible, I decided to make a Horizontal Frame Support. The final cost was less than $1.23 since it was made from a 1" x 4" x 6' pine board and some scrap ¼" plywood.

The Hopkins System or **Case Method** – Developed by a Mr. I. Hopkins in the early 1900s.

This system is the placement of a frame with eggs or young larvae from a breeder colony above a queen-less colony. The frame is laid on its side (horizontal) and is positioned on top of the brood nest in a queen-less cell builder colony. The queen-less colony will feed the cells on the bottom side of the horizontal frame and create queen cells from them. The trick is to provide eggs and larvae of the correct age so quality queens will be reared.

Search the internet with "Hopkins queen rearing" for further explanations.

Parts

1. 19 ⅞" x 3 ½" x ¾" – Sides (2)
2. 16 ¼" x 3 ½" x ¾" – Ends (2)
3. 6" x 1" x ¾" – Support (2)
4. 3" x ¼" x ¼" – Support (2)

Construction

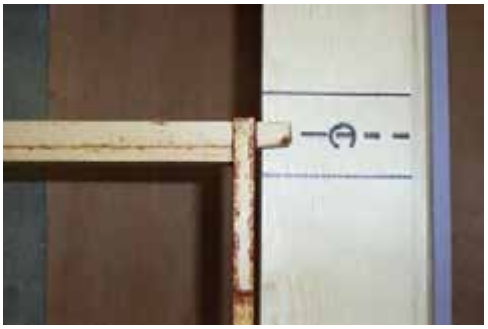
Creation of the horizontal frame support requires a minimal amount of work. The hardest part is ensuring that the support is square so it will fit on a hive with no gaps. If you use a 1" x 4" x 6' board, you will only have to make a minimal number of cuts. Two areas that need to be addressed is the frame tab and the frame side bar shape. These require a little work to make the fame fit nicely.

Step 1: Cut the sides and ends of the horizontal frame support (parts 1 and 2).

Step 2: Mark the frame tab locations by laying out the 16¼" end pieces with a brood frame that you are going to use. The brood frame should be situated so the cells will be in the center of the support. Mark the center of the ears or tabs of the frame. Then place a mark ¾" on each side of this mark. These mark the edges of a wide groove that will be cut in the end pieces, so the frame can lay down inside the support. Also mark the location of the bottom bar of the brood frame. This is the minimum length needed to ensure the bottom of the frame does not drop onto the frames below the support.

Step 3: Notch the end pieces to allow the ears or tabs of the frame to fit. Make the notch ⅜" deep and 1½" wide (cut on the marks you made in the step #2). This is notch "C" in the drawing. The 1½" width of the notch allows you to adjust the position of the brood frame for the best fit when you are placing it on top of the existing frames.

Step 4: Cut two pieces of wood ¾" x 1"x 6" (parts 3) to use as guide/supports for the bottom of the brood frame (Parts "A" in the drawing).



Step 5: Glue and nail the pieces cut in step #4 to the end pieces of the horizontal frame support.

Step 6: Cut 2 pieces of plywood ¼" x 1"x 6" (parts 4) to use as supports for the ears of the brood frame (Parts "B" in the drawing).

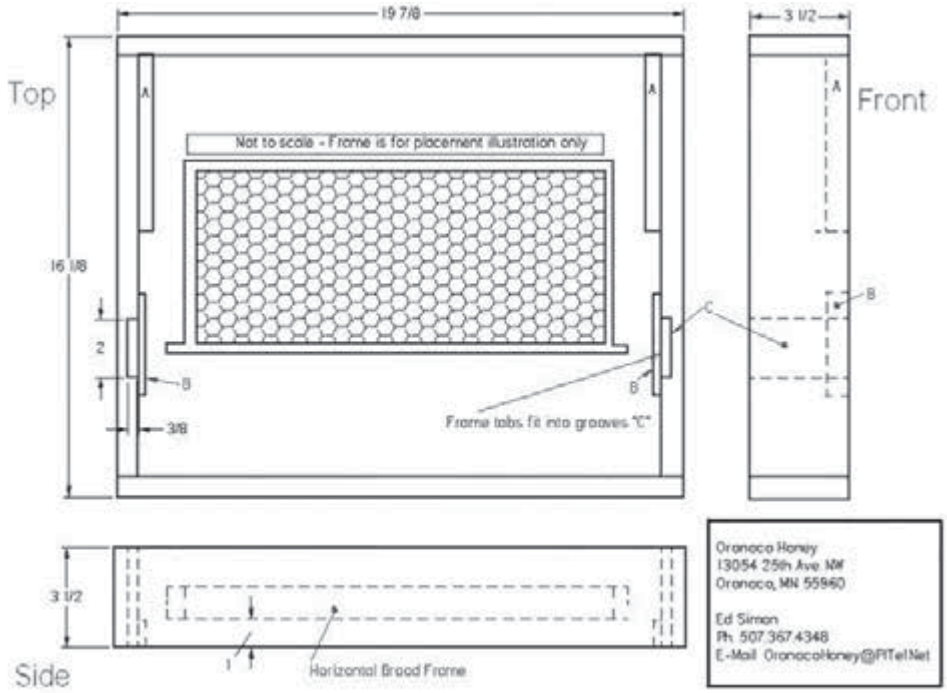
Step 7: Glue and nail the pieces cut in step #6 to the horizontal frame support. The ears of the brood frame will rest on these pieces. Span the grooves (marked "C" in the drawing) that were cut in step #3. Make sure the top of this piece supports the frame in a level of position.

Step 8: Assemble the support the same way you would assemble a standard hive box. Be careful to make sure the horizontal frame support is square. I'd recommend using screws at the corners rather than nails since the support is only 3½" tall and can easily be forced into a non-square position

Step 9: Paint the frame support and you are ready to raise your queens.

Usage

Using your creation is easy. After selecting the donor hive remove a frame of brood with many young larvae or eggs. Place the horizontal frame support above the brood nest of the queen-less hive and with the selected side down, lay the frame in the slots provided. Then comes the hardest part – WAITING. Within a couple of days, you should see the queen cells being started. Once some of the queen cells are capped you can either leave the frame where it is and allow nature to take its course or move the frame and the horizontal frame support to a cell builder hive or another queen-less hive. If needed, it could also be placed above a queen excluder in a queen-rite hive.



Note: I have had as many as fifteen queen cells built on one frame using this method.

Possible multi-queen development

This method of creating queen cells can produce a lot of cells with an emergence range of a week or more. Although I have not tried the following, they should and could be considered.

1) Once a queen has emerged and there are additional queen cells that have not been destroyed by the emerged queen, move the frame to a different queen-less hive.
2) Use thin (pure wax) foundation for the donor frame. You can then cut the capped queen cells from the foundation and place them in individual nucs. After cutting loose the queen cell put it in a queen cell protector (Mann Lake #QC-700) and install it in a nuc.

Note: I have tried cutting queen cells from the standard plastic foundation and have found very difficult

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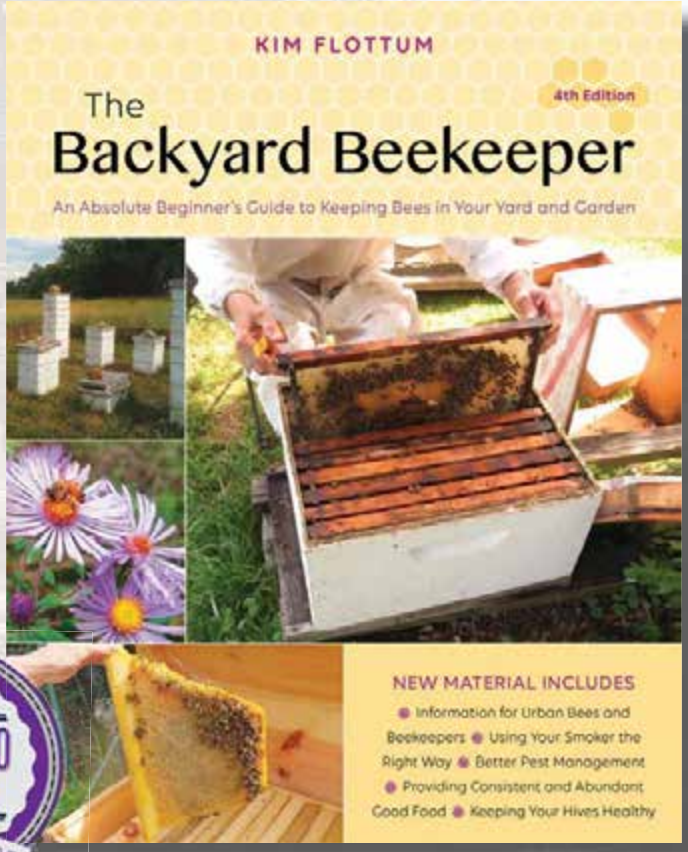

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to accomplish without destroying the cell.

Conclusion

Considering the ease of construction, the Hopkins Method and the horizontal frame support used in conjunction with a Cloake Board could be a viable alternative for small bee keepers who want to raise queens with minimal disruption of a productive colony.

Additional Thoughts

How many times have you wanted to feed a hive with an existing frame of honey? You certainly didn't want to disrupt them since they were expanding nicely. Consider using the horizontal frame support. It will allow you to lay a frame of pollen or honey on top of an existing colony without removing the ears from the frame. It can then be removed very easily when the bees have emptied the frame. BC

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

The Herb is Mightier Than the Sward
or
The Revolution Will Not Be Fertilized

Like a highschool teacher
Still dressed for the 70's
The colors of the past
Are no longer en vogue.

Green has had its day.
Last-century, passé.
Let's embrace the full palette
Taste the spectrum.

Like a medieval king
This despot holds sway
His green robe draped proudly
O'er the suburbs.

But kingdoms crumble
And so must his.
Clover stands up, tall
Screams "revolution!"

It will not be fertilized
Hell it barely needs water.
Bio-desert turned cradle
Of new life, fresh hope.

Peter Keilty

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Hobbyist Honey House From Half A Garage

Pat **Boling**

Counter with sink and open cabinet mounted above. Five-gallon pails of honey ready for bottle filling on countertops. Plenty of room to store bulky items underneath.

If you have been a beekeeper for a while, two or three years anyway, you know what a hassle it is to find a suitable place in the house to process your honey harvest. Depending on location and circumstances, you may need to pull honey as many as three times a year. That's a lot of domestic disruption.

My first few harvests, I used our playroom to uncap and extract honey. We pulled frames one by one, brushed off bees, set 10-15 frames in a lidded container and moved the container onto the screened porch. Once all frames were in containers, we moved them into the playroom for extraction.

In preparation, the floor of the work area was covered with the kind of plastic film used when pouring concrete. All containers, the extractor and various buckets along with the de capping bin sat on the film, in a failed attempt to keep the sticky stuff contained.

We used wet towels to constantly clean our hands. Despite all efforts, we spread honey on doorknobs, countertops, and tracked it and bits of wax on our shoes, on to the house floor. As a bonus, a few bees having found a ride in on the frames, buzzed through the house to the chagrin of non-beekeeper residents.

Extractor and bee suit share the wall dividing the garage, freezer to the left. The a/c unit on wheels slides under the counter when not in use.

This went on for two years, three times a year. Prepping the floor, moving the equipment from storage and setting it up, harvesting the frames, moving them into the studio. After the extraction process, we broke down the equipment and set it out for the bees to clean. It took a least another day of moving equipment in and out of the house before we could do a final cleaning and move the gear back to storage.

Bottling and labeling followed. Another sticky, bulky, disruptive process. This time commandeering the kitchen for counter space, cleanliness and running water. The non-beekeepers were losing patience.

I knew if I had a purpose-built room out of the middle of the house, I would become a hero and perhaps even be welcome again. Seriously, not tackling a sticky, bulk to bottle, food process in your living area is common sense. Unfortunately, how to move it out can be a problem.

I pondered the situation for quite a while, dreading the next pull, before I decided I could do something about it. It was winter, with no bee work on the schedule. The time was right to tackle the project.

Following is a model based on my solution, for converting part of a garage to a hobbyist's honey house. We'll address space requirements, materials and their sourcing, layout, and equipment. Modify the plan to fit your specific needs, space and budget. Consider it a guide.

Finding Space

First and foremost is, where to locate your honey house? Likely, there are only a few at-home options that make sense; available space within the square footage of your home; commandeer or construct a stand-alone structure; or, add a room to your abode.

I considered a small, free standing building or little trailer located somewhere in my back yard, but the cost of construction or purchase along with running necessary utilities, just didn't justify the outlay. If you have an existing, sturdy, suitable space (a shed, old playhouse, etc.), that you can easily get power and water to, then consider it. Use the layout, construction and sourcing information here to assist you.

Adding onto my house was a non-starter. Pick a reason; cost, permitting, difficulty of construction,

Deep freezer and folding table for uncapping equipment sit along dividing wall. Easy to mount tools, clothing, etc. on this wall.

utilities, conflicting family priorities. I could go on, but I won't.

For the sake of simplicity and all the above, I chose to convert a garage, as my under-roof solution.

I have two separate, full garages that share a common wall and fate dictated we would seldom park a car in either of them. They became massive junk collectors. Half of one of these junk rooms became my honey house. Half of one is all that is needed.

The garage side I used measures 13'x10'. The remaining side was left for storage and workshop. This 130 sq. ft allows plenty of room for up to three people to work and all necessary equipment.

Layout and Construction

A wall was built with 2"x4" studs on 16" centers, to separate the two garage half spaces. I applied ¾" insulated sheathing to the wall and I installed three flush mounted electrical outlets about 18" off the floor. The ceiling was finished with the same sheathing and equipped with two bare bulb light fixtures on pull chain switches. All walls were painted with a good grade of interior latex. Insulating the ceiling and new wall will pay big dividends in comfort in both hot and cold weather.

An L-shaped layout was used for counters along two walls, leaving one wall open, with floor space in the middle for people and equipment. The configuration proved to be very efficient.

Laminate covered counters with splashboards measuring 10 foot and nine foot respectively, were mounted to the existing walls in an "L" configuration. The counter dimensions are 40" high by 24" deep, with 10" splash boards. Four electrical outlet boxes were wall mounted on the splashboards or hung under a cabinet for convenience. At one end of the counter is a plumbed, 20"x32"x7" sink, constructed of ¾", fiber glassed plywood.

Cold water was plumbed in using ¾" PVC through a common wall. Mounted above the 9' run of counter is a rectangular, double high, door-less cabinet, measuring 66"x30"x10". Bulky boxes and heavy items are stored under the counters, on the floor.

The floor was epoxy coated. Any number of quality kits are available in hardware stores or online. An epoxy floor is a must, providing a non-porous, easy to clean surface. Wax still proves stubborn to manage but is easier on epoxy. Make sure the floor is clean, clean, clean before applying the epoxy.

Along the 13' new wall sits a 12-cu ft chest freezer, hangers for my bee suits and storage for a motorized, three frame extractor. The extractor is not bolted to the floor, as with proper operation, it stays balanced in use and is moved around as needed. A 10,000 BTU portable a/c unit lives under the short run of counter. Various other tools hang on walls.

A folding, 30"x72" adjustable height table in the middle of the floor, holds the de capping box and a full honey super. Additional frames in containers awaiting extraction, sit on the floor.

Compact but roomy, "L" configuration counters are supported by sturdy legs. Folding table for decapping gear sits on the floor between the extractor and the counter on right. Simple to decap, swivel and load the extractor.

Materials

Here's where we get serious, frugal and efficient. Good, used materials and on-sale items bring the project together without breaking the bank. I was a Purchasing Director in a former life, so here I'm in my element.

Constructed Wall – instead of plywood or drywall, I used insulated sheathing. It helps with temperature management, is very easy to work with (No power tools needed, cut with a utility knife or hand saw) it takes paint well and is reasonably priced.

If you find surplus or good, used wall making material through Craigslist or other sources, take advantage of it. Just make certain the surfaces are smooth, paintable and easy to clean.

Outlets – Recess mount where possible and wall mount where necessary on hard surfaces. Don't hammer holes and fish wire through block. Electrical raceways tidy things up nicely.

Counters – I used soon to be discarded lab counters, salvaged from a school under renovation. Many construction companies don't mind selling cheap, or even giving away old units so they don't have to dispose of them.

If you aren't comfortable asking strangers for throw away stuff, there are sites online to buy surplus government materials on an e-bid basis. Check out

https://www.govdeals.com/. Some nearly pristine materials and equipment can be had for a song. Select what you want to bid on in your locale and you are in business.

Mount counters as high on the wall as you can work comfortably, to allow space for bulky item storage underneath. I made simple, strong supports for the counters from 2x4's attached to a square, plywood base, screwed into the floor.

Sink – Running water is a must and a big sink, priceless. A sink is easy to make with a hole saw, circular saw, some ¾ inch plywood and fiberglass resin. Lay out and fabricate a topless box. Cut a hole in the bottom at one end and mount a sink drain in it. Cut a rectangular hole in the counter so the inside of the box mounts flush. Attach the box from underneath using brackets secured with screws and fiberglass the interior, applying at least two coats.

Cabinet – Construct a sturdy, two shelf, four-sided box, with open front and back, from 1x10's and mount on the wall near the sink. Perfect, necessary storage for small tools, materials and equipment.

Power and Water – I pulled power from my fuse box, a dozen feet away. For the limited power requirements of a small honey house, one fused connection may be enough. If you aren't confident of the load requirements or your wiring skills, hire an electrician to size it and do the job safely and properly.

Cold water was accessed from the washing machine supply, running ¾ inch pvc pipe to a spot above the sink, where I affixed a faucet. I use a wand style, adjustable garden sprayer on the end of a 3' hose for flexibility.

Not so little extras

A 10,000 btu, portable air conditioner was essential. If you don't have one and you live within 200 miles of me, you probably won't be pulling honey in a garage in the summer. Our heat indexes hit 110°F plus, so without a/c, it ain't happening. My December 2018 harvest required a/c just to keep us comfortable and dry at 80°F. The unit can also be used to dehumidify slightly wet honey. Portable units may be hard to find used but are reasonably priced new.

If you can swing it, a chest freezer, for freezing full or empty boxes/frames and wax you aren't ready to process, is worth its weight in gold. When honey must be pulled, and can't be extracted within 48 hours, a freezer will save your bacon, keeping small hive beetles and wax moths at bay.

Go as large as you can afford. Here again, don't break the bank to find a unit. Craig's list or Govdeals may provide what you need at an affordable price. Mine is 12 cu ft, but larger is better.

A small sink is not much good for our sticky bee stuff. Sacrifice some countertop space and build your sink large and deep.

Bonus Round

The convenience of a honey house on your property decreases handling and transportation, while improving storage and cleanliness. I use the space to store my off-season boxes, frames etc. and it doubles as a bottling/corking/labeling room to feed my other obsession, wine and mead making.

Great for wax and tool cleaning, the wooden sink box mounts flush with counter from below and was fiber glassed in. Outdoor style spigot with garden hose and sprayer provides water.

I keep five-gallon buckets of honey on the counters, making for an easy filling/labeling process at bottling time. Jars, lids and labels are stored in the room and readily available, as is water for cleanup.

Melting down wax and tackling candle making projects are a cinch. There's plenty of counter space for a comb melting crock pot, hot plate, wax melting pitcher and molds. No fooling around with dripping hot wax all over the house.

Remember that big sink? Washing out and breaking down cappings to flake wax and cleaning sticky equipment becomes much easier.

With some planning and prudent sourcing, half a garage can economically become a hobbyist beekeepers' best friend outside the hive. Take a good look, you may have the solution just storing junk when it could be helping. What to do with the junk? I donated to charity, threw some out and gave stuff away. Turns out after all, it really was . . . JUNK. BC

A BIG BEEKEEPER

Stephen **Bishop**

Beside beekeepers, the elite rank of creatures that fool with bees also includes skunks, bears, and a subset of the American Adolescent known as the hive-tipping teenager. Although some scientists once believed this species was closely related to the now endangered cow-tipping teenager (sadly, recent surveys show most modern teens can't identify a cow), new DNA analysis has revealed it was merely convergent evolution at work. Other scientists believed the hive-tipper was a subspecies of *Homo sapiens* called *cellphonius,* in which walking while texting bipeds accidentally ran into hives and toppled them.

Skunks have long been a pest of beehives. Although they lack the strength to topple hives, they arguably possess more intelligence than hive-tippers, leaving little evidence of their marauding, save for claw marks on the landing board and a lingering odor, which some say differs only slightly from the scent of the hive-tipping teenager. The smell of bear is more distinctive. A typical bear attack will result in more destruction, with toppled hives and frames scattered across the crime scene. A bear attack can resemble closely a loose cow attack, but perpetrating cows usually have a farmer chasing behind, so prints at the scene include four hoofs and a pair of boots. Recently, I heard a tale of another unusual marauder from a grading operator named Joe Dewalt.

First, let me preface this tale by vouching for the character of Joe Dewalt. Joe pushed dirt with attention to detail. Unlike Tater, a bulldozer operator for a rival grading outfit who was shaped liked a potato and talked like a pepper, Joe was string bean through and through – tall, slender, and full of wholesome talk. Joe was as serious and conscientious a dozer operator as you'll find, concerned about proper elevations, slopes, and compaction. Most other grading contractors competed to see who could accidentally destroy wooden slope stakes and benchmarks the fastest. But not Joe. He took time to read and decipher the cut-and-fill shorthand on stakes and follow their instruction. I appreciated Joe, a grading operator who had built many a fine farm pond for our conservation district, which was partly why I wanted to give Joe a jar of honey.

The other reason for the gift was more self-serving. Joe lived near South Mountain in the deep woods, by which I mean deep woods filled with sourwood trees. The jar of honey was my lead into asking to keep some hives at his place. I had the conversation all planned out:

He'd say, "Stephen, that's some mighty fine honey."

Then I'd say, "Well, it was a good year. It may even have a little sourwood in it this year."

He'd say, "Is that right? Well, we've got a lot of old sourwood trees up our way."

"Oh, really?" I'd reply, "Have you ever kept bees up there?"

"No sir," he'd say, "but you're more than welcome to put a few hives up there."

So one evening when Joe was finishing construction of a small pond, I stopped by the site with a jar of honey in hand and approached Joe on his D6 Caterpillar dozer to have that conversation. The conversation went according to plan, except Joe responded to my question by saying, "Yes sir. I had a stand of bees until the sasquatch got it."

Now remember, as a man of detail, Joe was not one to fib or exaggerate. Furthermore, he was also a woodsman and knew the creatures of the woods because he was fond of shooting them. Still, I felt obligated to press him on his knowledge.

"Surely, it was a bear?" I said.

"No," he said, "it won't no bear."

"How do you know?" I asked.

He then proceeded to tell me that he had "a stand of bees he'd caught from a swarm" at his cabin in the woods near South Mountain State Park. The area around the park is renowned for sightings of a bigfoot known locally as Knobby. Every year or so someone reports a sighting. One local even made all the major cable news' broadcasts for his description of a confrontation with the eight-foot sasquatch, proclaiming "it had a beautiful head of hair." (youtube: Cleveland County sasquatch.)

But Joe admitted that he had not met the sasquatch personally. He said he did have a photo from a wildlife trail camera that that showed what could be a sasquatch or a blurry bear standing on hind legs. I eventually saw that photo and can vouch for the latter interpretation. But he still felt certain it wasn't a bear that got his hive, and after hearing his story, I tended to agree with him.

His hive near his hunting cabin was less than a ¼-mile down in the woods from his house beside a creek. This cabin had a dog lot with a bunch of beagles beside it. Joe figured no bear would dare attack a hive placed by a dog lot full of baying beagles.

On the night of the alleged sasquatch attack, the dogs got to barking, and Joe thought certain a critter of some sort was messing around. He even thought he heard a strange yowling sound (he later figured the sasquatch had been stung). But that night, he scanned the woods with his spotlight, but noticed nothing awry. The next morning, however, Joe drove down to the cabin to check on the dogs and noticed that his beehive was now gone, nowhere in sight. "It had plum vanished," Joe said.

I told Joe that sounded more like a two-footed critter in a truck, or *Homo sapiens thieverus*, than a big-footed critter. He actually agreed and said he thought for many years some good-for-nothing had stolen his beehive. Of course, at this point, I was still drawing a blank as to evidence of a sasquatch and asked, "Why do you think it was a sasquatch then?" Here is his response:

"Well, a few years later I went hunting in the game lands in a mighty fine spot I've been hunting since I was a youngin. And on my way into that spot I noticed something queer. At first I didn't know what to make of what I was seeing, but then it all made sense. There was my old missing beehive – I knew it was my hive because the hand holds was made from old tomato stakes – sitting about eight feet up in the crook of a red maple. Bees was flying in and out of it too."

"Now, how else would a beehive get eight feet up into the crook of a maple?" he asked. Then he answered in all earnestness, "Only a sasquatch would tote a beehive all the way over there just to stick it in tree. A bear couldn't have done that."

He was right – a bear couldn't have done that. I didn't have the heart to tell Joe that whoever stole his hive must have moved the bees to another box and then used his old box for a swarm trap. A beekeeping sasquatch was too priceless an image to contradict.

Tulip Poplar

Spring Blooming Bee Plants In The South

Connie **Krochmal**

The South has a rich native bee flora along with lots of cultivated species that are well liked by bees and other pollinators. Some of the Spring blooming species are the following.

Tulip poplar (*Liriodendron tulipifera)* can bloom for three weeks or so during April and May. These blossoms are an aid to brood rearing. The tree is a very dependable nectar source.

The nectar literally drips from the blooms. Beekeepers can expect around 100 pounds of honey per colony. Initially deep amber to dark red, and aging to reddish-brown, this has a pleasant, distinctive flavor.

With a strong aroma, the thick, heavy bodied honey generally granulates. Along with the nectar and pollen, tulip poplar is also a source of honeydew. Dwarf types of tulip poplar are available.

Maples are important nectar and pollen plants in this region. Red maple (*Acer rubrum)* is native to the area and a major nectar tree. Also called swamp maple and scarlet maple, this is an adaptable, reliable, easy to grow tree. Compact kinds of red maple can be found.

The blossoms are generally red, but occasionally they're yellow. In the South, the flowers appear from late March into April.

Holly

A surplus of honey is possible from red maple, around 50 pounds or so per colony. Maple honey is usually white, amber, or light amber. However, it can sometimes have a slight greenish or pinkish tinge.

This honey granulates very slowly and develops either fine or coarse crystals. The distinctive flavor mellows with age.

Hollies are common plants in the South. Some are native, while others are popular landscape plants. These can be deciduous or evergreen, depending on the species.

The deciduous ones are the easiest to grow. American holly (*Ilex opaca)* is a native and a popular garden shrub or tree. The berried stems are a favorite for Christmas decorations.

In the South, this species blooms in April. In the North, flowering can occur as late as June, depending on the location. The scented blooms are reliable sources of nectar, especially during warm, humid weather. Good honey surpluses can result.

The almost white to very light amber honey has a delightful flavor, which is milder than that of gallberry. American holly honey generally won't granulate if it is pure.

Dahoon (*Ilex cassine)* is another evergreen native holly in the region. The densely branched tree or shrub is adaptable and easy to grow. This is a wonderful source of nectar in the South. The bees eagerly seek out the flowers, which emerge during the Spring.

Cherry laurel (*Prunus laurocerasus)* and the related species are often grown as informal hedges in the South. The very floriferous plants are covered with small, white blooms during the late Spring. These form large clusters.

The flowers are a favorite of bees and are especially valuable for brood rearing. These provide nectar and pollen.

The extra-floral nectaries, which are present on the leaves and new growth throughout the growing season, are also rich sources of nectar.

When enough plants are present, cherry laurel can result in a surplus crop of honey.

Chinese tallow tree (*Sapium or Triadica sebiferum)* is an invasive tree in the Southeast and the Southwest where it is also a major bee plant. The fast growing plant bears yellow blossoms during the Spring. Well-liked by bees, the blossoms yield pollen and nectar.

Honey locust (*Gleditsia triacanthos)* is a large leguminous tree. Space saving types are available. During May and June, the sweetly scented, yellowish-green to green blossoms emerge in clusters, several inches long.

Chinese Tallow

Male and female flowers develop on the same tree. This is a rich source of nectar and pollen, although there usually aren't enough trees to yield pure locust honey.

Spring vetch (*Vicia sativa)* is a weak stemmed annual or biennial that is grown as a Winter annual for animal feed. In addition, the free flowering plant has naturalized along roadsides and waste places. Flowering occurs from Spring through September.

Most of the flowers I've seen are purplish, but they can also be pinkish-rose. An inch long, these are quite showy. The plant can bring around 70 pounds of honey per colony. The flowers are also sources of pollen. A related species, Gerard vetch (*Vicia cracca)* is also an excellent honey plant.

Tupelos (*Nyssa spp.)* are some of the best known bee plants in the area. Three species occur in the East. The bloom time varies slightly according to the species, but is generally from April through June.

Either green or greenish-white, these small blossoms appear with the foliage. All species are great sources of nectar and pollen with 70 to over 120 pounds of honey per colony possible. The trees bring a heavy honey crop three out of five years with the yield never falling terribly low even in the worst years.

Poison Ivy

Very popular, tupelo honey is among the best honeys in the South. The premium quality honey has a pleasing, mild flavor and mild aroma. Very slow to granulate, this is heavy bodied. It varies in color from white or light amber to chartreuse.

Spring Vetch

Poison Ivy and Poison Oak (*Toxicodendron spp.)*

While the species above have appeared in previous articles, the poison oak and poison ivy haven't. Members of the cashew family, these native plants are found throughout most of the country.

These species inhabit a wide range of habitats, including fence rows, dry rocky fields, waste places, pastures, rich alluvial woodlands, bluffs, thickets, ridge tops, disturbed sites, and gravelly stream banks. Often, I find them along power lines, fences, hedges, and other sites where birds perch and spread the seeds around in their droppings.

Five species are native along with several different varieties. At least two species are known to hybridize. In addition, two introduced species are in cultivation.

A very distantly related species in the same family is called coral sumac or poison weed (*Metopium toxiferum).* Found in the Florida Panhandle, this species yields surplus honey although no honey description was given. The recommended native species of poison ivy and poison oak that are known to be good bee plants are profiled below.

General Description

Depending on the species, these vigorous, deciduous plants can be shrubs, trees, or woody vines, which usually have aerial roots. They can sometimes be difficult to identify due to certain similarities.

The leaves are pinnately compound. During the Spring, both the young foliage and the branchlets have a reddish tinge.

Despite the old saying of "leaflets three, let it be," this isn't always true. Some species can have seven to fifteen leaflets. The leaf margins can be entire, lobed, or toothed.

For those having three leaflets, the central one will

have a longer petiole. The leaflets bring vivid red or yellow color in the Fall.

Flowering typically begins in April, and can extend into June or July, according to the location. The small blooms contain five, white-greenish petals and five sepals. The blossoms form axillary clusters, racemes, or panicles.

Forming clusters, the fleshy, one-seeded fruits can be white, whitish-gray, or drab looking. They ripen from August to November, and are very visible once the leaves fall.

Bee Value of Poison Ivy and Poison Oak

For the moment, I'll ignore the fact that poison ivy gives me an itchy rash and focus on the bee value of all these plants. USDA lists poison oak and poison ivy as important bee plants in the Northeast, the North Central region, the Southeast, and Alaska.

These flowers are sure to attract lots of pollinators. The plants are sources of pollen along with lots of nectar. Surplus honey can sometimes result although this seems to rarely occur in the East.

The pollen and the well-ripened honey are safe to consume.

Atlantic poison ivy (*Toxicodendron radicans)*

Atlantic poison ivy occurs from New Jersey to Florida throughout the South (excluding Kentucky) westward to Louisiana, Oklahoma, Kansas, Missouri, Arkansas, Illinois, and Texas. It can be found on rocky or sandy sites, fence rows, open woods, thickets, hedges, wooded swamps, bottomlands, and rocky slopes.

The plant can be a small to medium sized shrub or a woody vine with aerial roots that cling to supports.

The trifoliate leaflets are elliptic to ovate with sharply tapered tips. These have either shallow lobes or pointed teeth. The undersides can be hairy. The terminal leaflet has the longest stalk.

The greenish-yellow to cream colored or whitish-green flowers appear in axillary panicles. These emerge from May through July. This species is a particularly rich nectar source. A small crop of honey is possible when enough plants are present.

In "Plants Honey Bees Use," Shannon R. Trimboli lists states in which Atlantic poison ivy is an important pollen and nectar plant. These include Virginia, Tennessee, Kentucky, Indiana, Illinois, Alabama, and Mississippi.

The smooth, sub-globose fruits are white to drab looking, or yellowish.

Eastern Poison Oak (*Toxicodendron pubescens)*

This occurs in all of the East and Midwest into South Dakota, Nebraska, Kansas, Oklahoma, Texas, and Arizona. Different varieties of this plant can be found. The twigs, leaves, and fruits are toxic.

Less branched than most shrubs, it is typically two to four feet in height, but has sometimes reached ten feet. This is always erect and features brownish-gray twigs that can be hairy.

Similar to white oak foliage, the trifoliate leaflets, seven to ten inches long, have blunt lobes. Glossy above, the alternate leaves are hairy beneath.

The small yellow blossoms emerge in early Spring in clusters. Forming clusters, the fruits are whitish-yellow to whitish-green. _

Poison Sumac (*Toxicodendron vernix)*

This is also known as poison elder, poison ash, swamp sumac, and poison dogwood. It is considered to be more toxic than the others because the toxin is found on the leaves, flowers, and fruits.

Poison sumac occurs throughout the East westward to Missouri, Arkansas, and Texas into most of the Midwest except for Iowa.

This can be a small tree or a coarse shrub reaching six to fifteen feet in height. Featuring smooth gray bark, its branchlets are covered with a whitish bloom. The spreading stout branches develop at the base.

The erect, woody stems form clumps. The alternate, compound leaves are odd pinnate with seven to thirteen leaflets. The smooth leaflets are entire, and can be elliptic to obovate-oblong. The young seedlings only have three leaflets. The petioles are usually reddish.

The flowers form long, slender, loose axillary panicles, nearly eight inches in length. These resemble the blooms of poison ivy.

The yellow to white, drab looking fruits are slightly flat. Poison sumac can yield surplus honey if enough plants are present.

Western poison ivy (*Toxicodendron rydbergii)*

Despite its common name, western poison ivy occurs in both the East and West in all of the lower 48 states except for California, Florida, South Carolina, Georgia, Alabama, Mississippi, Louisiana, Kentucky, Tennessee, Missouri, and Arkansas. Its habitats include forests, open areas, and rocky sites.

This can be a small to large shrub or a climbing vine with aerial roots. It can reach three to nine feet in height. The alternate, compound, toothed, leaflets can vary slightly by shape and size. Some people confuse this plant with poison oak. The white fruits last into the Winter months.

Western poison oak (*Toxicodendron diversilobum)*

This species is found in open woods and coastal areas. It is native to Oregon, Washington, California, and Nevada.

The erect shrub grows three to six feet in height. The leaves are quite unlike those of eastern poison ivy. In fact, these remind me of smoke tree foliage mainly because of the shape.

In some respects, the leaves resemble those of the box elder and Virginia creeper. These contain three to five, heavily veined, irregularly lobed leaflets.

Western poison oak is very floriferous. The whitish blossoms form large, dense, axillary clusters. Flowering is mostly in April and May.

The white fruits also form clusters. In California, this plant brings a premium quality, white honey that granulates rather quickly. Sometimes, it is thin bodied and at other times heavy bodied. BC

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

The 2019 Autumn Sunflower Bee Season

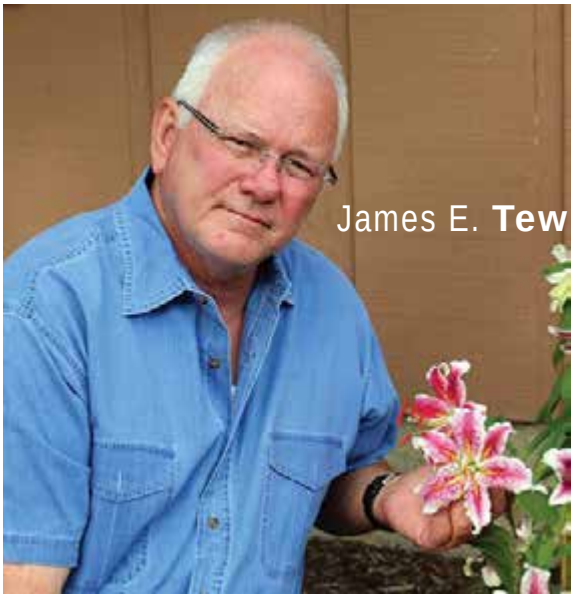
It came from nowhere . . .

Looking backwards may be bad form

If I were truly an accomplished writer, I would have written my October comments ahead of anything that was actually October-related. For October, I should have been writing in August and September. Then, my visionary comments would have been *timely*, but I've never been able to write for the future the way others can. I have to write in the present – for me – which is then the past for you as you read it. So, I can only hope that you are still experiencing enough of your autumnal season to reflect on my autumnal reflections.

For some, Just an extension of Summer

For much of my early life in the southern U.S., Fall was only a normal extension of Summer – only a bit cooler. During the Fall season, I could still go swimming and could continue to wear Summer clothes. But seasonal foods, having required the Spring and Summer to mature, would become abundantly available. That made Autumn different from the other seasons. Watermelon, cantaloupe, and all kinds of beans and peas were everywhere. That gave the southern Autumn season some character. One way or another, Autumn seasons do that in all U.S. states.



For decades now, I and my bees have experienced a true Fall season in the Midwest. In many ways, the two Autumn seasons, Southern and Midwestern, are similar, but in other ways they are regionally different. Not a cop-out, but I like them both. But, the Midwestern Fall season of 2019 is not one that I will readily forget. In their own way, neither will my bees. *(I know. I know. Most are already dead, but the fruits of their foraging labors are not.).* This was to be the *Sunflower Autumn* of my bee life.

Heavy rain last Spring produced an unusual Autumn

As was the case in much of the U.S., the past Spring was a wet, rainy time. At one point, in Ohio, forecasters predicted that only 39% of the normal crops of corn, wheat, and soybeans would be successfully planted. Including the one behind my home, many fields were left fallow.

I could just barely see another 50-acre field from my apiary, but I could see it. Like so many others, it appeared to have been abandoned for the 2019 growing season. It belongs to an organic farmer, and with no intended offense to any agricultural producer, generally, weeds are very common in this field. This season, it appeared to be an active crop of nothing.

While I busied myself with the task of remodeling part of our house, mowing grass, and tinkering with bees, the Summer passed. I had no reason to notice the abandoned field. They were common.

What *is* that crop in that field?

On a trip to gather up some of our grandchildren, my wife and I drove near the field being discussed. *What is that in that field!?* I was suddenly aware that there seemed to be a sea of immature sunflower heads – as far as my eyes could see.

I was ecstatic. Four of my home colonies were hardly six-hundred yards away. I wondered if I should buy more equipment. This development had the potential to be the mother lode of my bee life. Yep, this would be the nectar season that was for all times. I estimate that there was 50 A of sunflowers coming into flower in this organic farmer's field.

I know you folks in the Dakotas, Missouri, and maybe Iowa, see this type of thing all the time, but in Wooster, Ohio, we do not. It was an amazing sight for people in this

Photos can't do service. Though it was an artifact of agriculture, it was stunningly beautiful.

area. The local newspaper published photos.

I was lucky to literally live in shouting distance of the field. I took hundreds of photos at different stages of bloom development. More and more, the word got out, people stopped on the side road for family photos. An oil well access road that that was near the field was used as a parking area. The grass around the well became trampled down like something in the far end of the parking lot at the county fair.

On my first visit, the area was pristine, but as the crowds came, paths began to develop along the field edges and into the field of thickly planted sunflowers. Happily, the photo-taking crowd seemed respectful. There appeared to be no meaningful damage to the parts of the field that were available to photographers.

That looks just like one of my bees. It must be mine.

There were bumble bees, honey bees, various beetles, multiple butterfly species, and a number of fly species. Though not a natural setting, it was a happening place. It "looked" natural. Local people really took notice.

Reality is always on the horizon

I put on all the equipment I had. Embarrassingly, some was (still is) pretty ratty, but I felt that I would rather have some marginal equipment on the hives rather than too little. While putting the equipment on the hives, I was surprised to find that the colonies were not already packed out in burr combs filled with beautiful honey. Don't get me wrong, there was new nectar there, but not in quantities that I expected

While taking photos, "*weeds*," in the row centers between the sunflowers were being readily visited. I was trying to sort all this out while on the run. I had little time to read. I knew very little about commercial sunflower pollination, but I have commonly seen sunflower honey. So, this field of bloom must be very good – right? Yes, it is, but not like I initially thought. I began to sense some cold reality on this beautiful horizon of bloom. Foraging insects in the field were not fully committed to sunflowers alone.

Finicky insect foragers

Yes, clearly, honey bees, bumbles, and many other insects had a great interest in the millions of sunflower heads – but those same insect species could still easily be seen on other flowering plants that were within the canopy of the sunflower crop. Some of the other plants that interested insect foragers were Goldenrod, Smart Weed, and various asters with names unknown to me.

Smart Weed (maybe Polygonum coccineum*) with a bee just barely visible.*

Back in the apiary

Back in my apiary, the bees could almost have been misconstrued as swarming. They were working in clouds coming and going. Most interestingly, there was that strong, pungent odor of golden rod and Fall aster nectar coming in. At first, I find this aroma to be a pleasant seasonal event, but as it intensifies, it becomes more than a bit overwhelming[1].

Clearly, with the millions and millions of sunflower blossom options, my bees continued to visit traditional fall nectar and pollen crops. Years ago, I was told by authorities of the day that given a perfect food source (both pollen and nectar), a few foragers would still be nosing around alternative food sources. The premise of the day was that these impossible-to-please foragers were pioneers for future food sources for the colony. Essentially, sunflower was a "nothing is forever" concept to the bees that are always looking for something else.

Sunflower information

Information about sunflower is everywhere, but I found a good resource at the North Dakota State University web site. This extension document contained enlightening information.

Authors reported that, "Sunflower genotypes vary in their attractiveness to the honey bee. Honey bees prefer short corolla length, unpigmented stigmas, many stomata on the nectary and high sucrose content of the nectar. Glandular trichomes on the anthers and ultraviolet reflecting and adsorbing pigments also may be important

[1]Forty-six years ago, when I was completely new to beekeeping, I had three colonies just off the edge of the Auburn University campus. I had raging bee fever. I was completely fixated over those three colonies. I micro-managed them. One glorious Autumn day, I visited my colonies and was horrified to smell a problem. Clearly, the odor of American Foulbrood filled the air. I had never smelled that odor, but what else could this be? I placed an emergency call to the regional state apiarist to tell me what to do. He came straightaway and told me that I was smelling the ongoing goldenrod nectar flow. That was another odor that I had never sensed. You must know that the odor of a colony on a goldenrod flow is dear to me. For those of you who have not smelled AFB or a goldenrod flow, I can't help you, but you should know that both odors are very distinctive.

in honey bee preference. Although some crops, such as oilseed rape, have been selected for honey bee preference, this has not been done with sunflower."[2] I wonder why such selective research has not been conducted. However, the same has happened with soybeans and pears.

Information within the publication stated that many commercial varieties of sunflowers are now hybrids, and honey bee attractiveness varies. Apparently, my bees were interested but not as bonkers as I was about this stunning source.

Was this sunflower season just a huge con?

Many years ago, this same farmer has a significant volunteer crop of alfalfa mixed with his organic soybeans. Soybeans are rarely blue. As with the sunflowers, I realize that I was about to get a good nectar flow (and some pollen) that was normally unavailable to me and my bees.

I dearly hoped that this sunflower event was the first year of many seasons to come. Finally, my bees would not be forced to be gleaners in a corn-wheat-soybean-herbicide commercial farming community. It was not to be. I suspect I was the victim of a beautiful con. Just as the sunflower blooms began to peak, the signs began to go up.

Who had that idea?

Whoever had that advertisement idea was brilliant. The property got newspaper coverage. I told every beekeeper I knew that this photographic moment was upon us. Countless photographers had taken beautiful pics. Planting the bulk of the field in beautiful sunflowers when the property was to be sold – in this area – was simply brilliant. The flowers were beacons to many people who would have never noticed that property. The brochure says that the land could be kept for organic farming or could be converted to housing development. There will be no sunflower field there next year. If anything, it will be conventional corn/wheat/soybeans.

The sunflower caper of Autumn, 2019, seemed ended

I don't know about the honey crop. I have not opened the tall, heavy colonies. I will remove Fall honey after goldenrod is finished.

I must say that I really had a good time with my bees this Autumn. I know that many of you see this all the time, but this community does not. I truly suspect that this was a one-time event, but this one-time event impressed many people. Even if my honey crop is unaffected, for a brief Fall moment, my community was aware of honey bees and flowers.

Question: *Does a good nectar flow reduce the colony's need for water?*

Weak Answer: Beats me, but I do know this: the daytime temperature got well into the mid-nineties during this sunflower bloom period, but water foragers were not at their usual place. I am comfortable saying that water forager numbers were at 20-30% of the number that

What do you think this bee is doing? She was not injured.

were present during similar temperatures during July. I suppose that water-hauling bees could have found other sources, but my two dependable sources never ran dry. I'm suspecting that the colony is getting water from water-diluted nectar. I'm guessing.

An observation: I truly enjoy watching the bees do their thing – whatever that thing may be. It would appear that due to consistent rainfall, this Autumn was a good season for Fall flowers. Above I mentioned how the colonies were flying so aggressively that one could not have been faulted thinking that swarm preparations could be underway. Yet, to my best observation, none of the colonies emptied themselves of all available workers for the nectar flow.

Propolis bees were on the job about as much as ever. House cleaning bees were removing dead friends and hive detritus, and I sensed that if I did something silly, colony defensive bees were on the job. I found that interesting. No reason to bring back prodigious amounts of raw nectar if the system back in the hive is not functional. Even during the best of time, it would appear that most of the worker bees were still on assignment back in the home colony. It's true. I suspect that I was more excited about the ongoing food flow than the bees were. Was that wrong?

An observation: What was this worker doing? She was quietly sitting on the mulch in the bed in front of my shop. She appeared to be licking mulch and then stropping her tongue. She did this until I touched her to see if she was okay. She immediately flew away. I have seen bees on mulch before. I guess these occasional mulch-foraging bees are procuring some kind of trace element or maybe minerals. I don't know-again.

As usual, thank you.

If you have read to this point, you have given me quite a bit of your time – the most valuable thing you have. I sincerely appreciate that donation. I hope we both continue to be intrigued by bees and their behavior. BC

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[2]Sunflower Production: **https://www.ag.ndsu.edu/extensionentomology/recent-publications-main/publications/A-1331-sunflower-production-field-guide**

https://youtu.be/LMIwhS2eAAQ

A video chat

Bees In Space

Boldly going where no bee has gone before.

This past year marked the 50th anniversary of the first humans landing on the moon as part of the National Aeronautics and Space Administration (NASA) Apollo 11 lunar mission. You may have noticed there was lots of media coverage and special events focused around this anniversary here in the U.S. President Trump has even directed NASA to send people back to the lunar surface by 2024 and establish a sustainable long-term presence on and around Earth's nearest neighbor by 2028. Rather than being an end in itself; the ambitious moon program, which NASA has named Artemis, will help the agency prepare for a journey to an even more challenging destination: Mars. The agency hopes to leave human footprints on the red planet within the next 20 years. While no plans have been announced to include honey bees or beekeepers in this latest space program, honey bees have had their share of space flight.

The space shuttle used to carry a colony of bees into space.

Maiden Voyage

While there have been space missions that have included carpenter bees (2003) and leafcutter bees (2018), the honey bee was the first bee in space although their maiden voyage could not be termed very successful. The honey bee's first space mission (STS-3) took place on the space shuttle Columbia March 22-30, 1982. The bee mission was part of a Shuttle Student Involvement Program (SSIP) sponsored jointly by the National Science Teacher's Association (NSTA) and NASA. The program gives students in U.S. secondary schools the opportunity to propose experiments for flight on space missions. Bees for the study were supplied by Coplin Bee Farms in Arcadia, Texas. The results were published in a report authored by Todd Nelson and James Peterson titled, *Insect Flight Observation at Zero Gravity*.

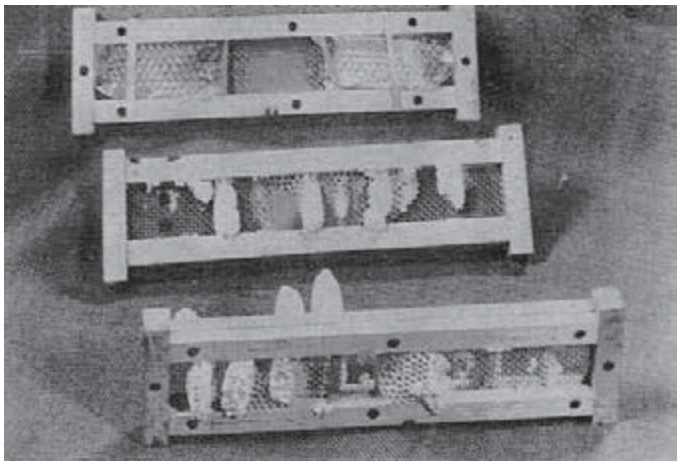
The study on insect flight motion looked at the flight patterns of honey bees, velvetbean caterpillar moths and houseflies in micro-gravity. The flies and moths that were effectively "born" in space during the mission moved around easily in microgravity, pushing off of surfaces and gliding without beating their wings. In contrast, the adult moths and bees had trouble adapting. The moths flapped their wings rapidly and tumbled chaotically in the air. The bees avoided flying and preferred to cling to the inner walls of their box. When they lost their grip, they floated helplessly.

The importance of nutrition

The feeders used during the space mission consisted of Teflon tubes with a wicking material soaking in the food syrup inside. Officials speculated that this type of feeder, which had to serve all three insect types, may not have been practical for honey bees based on the fact that all 14 bees that went up in the orbiter died in their flight box apparently from insignificant nutrition.

The final report noted: "The 14 bees aboard STS-3 were observed to walk only on the screen surfaces inside the flight box. They appeared to be unable to cling to the smooth plastic surfaces. Brief attempts at flight resulted in unstable paths, tumbling about their body axes, and floating with little or no wingbeat. Floating was observed for long durations and appeared to be a result of inability to cling to a smooth surface when they came into contact with it (with wingbeat ceasing at contact). The lack of relative-motion visual stimuli necessary to maintain flight may also have been responsible for the floating responses of the bees. In addition, it may have been that the food supply provided was inadequate for the bees and this may have led to fatigue with resulting poor flight control responses and floating."

The paper further states: "Comparisons of the zero-g flight responses of the three species of insects suggest that the flies were most able to control their flight and body orientations. The moths appeared to be somewhat poorer at controlling their flight and body orientations than the flies. The bees appeared to be unable to control their flight in zero-g conditions and they were observed to mostly float about randomly in the flight box."



Honey comb structures built while orbiting around the earth.

Following the space mission, Dr. Shim Shimanuki of the USDA Bioenvironmental Bee Lab in Beltsville, Maryland examined four bees (two from the 0-g box and two from the 1-g box) sent to him by Mr. Mel Coplin. Shimanuki found that the 0-g bees were free of any known bee diseases. He also found that the sugar solution used for feeding the insects was too dilute to sustain the bees over a nine-day period.

Mission Success

In 1984 NASA sent bees up in the space shuttle Discovery also as part of a SSIP study. The mission STS-41C (originally numbered STS-13) was to monitor honey bee behavior and survival, and compare honey comb constructed in micro-gravity (1-g and 0-g) with comb built on earth.

In keeping with NASA's love of acronyms, the bees were kept in an aluminum BEM (Bee Enclosure Module) constructed with a Lexan top to facilitate visual inspections and photography. The BEM included "a feeder trough, three wooden honeycomb frames, a small flight chamber, a ventilation hole, a fan and two temperature probes." The BEM also contained a filtration system to address concerns that dead bees and bee by-products might create hazards for the human crew.

Since the only insects to occupy the BEM during the mission were honey bees, the feeder could be designed for the bee's needs in mind. It has been found that micro-gravity can cause liquids to bead up into free-floating droplets that are fairly useless to the bees and potentially hazardous to the crew. As a result the feeder in the BEM was filled with a mixture of standard sugar syrup mixed with agar in order to create a semi-solid consistency to the feed.

Crew members observed the orbiting bees four times during the eight-day mission.

- April 6 (9 hours after launch) – Bees survived launch.
- April 9 – Video recordings and observations of bees and their behavior. Some bees attempted brief flights, colliding with the chamber walls.
- April 11 – Additional video recordings of bees and their behavior.
- April 13 – Final visual observations. Flight patterns show complete adaptation to microgravity.

The Bee Enclosure Module (BEM) that protected the bees from the human crew during their flight into space.

The scientific paper on the mission published in the journal *Apidologie* (1985) noted: "Worker bees were observed crawling on the sugar syrup mixture and feeding directly from it. The bees were observed fanning their wings in a group near the air inlet. Other clusters of bees extended from the sugar source to the area of active comb construction. Dead bees were removed from the cluster by other workers and deposited in the fan area."

The space bees survived well and of the roughly 3,400 worker bees and caged queen in the BEM, only 120 died during the course of the space flight. About 35 eggs were found in the BEM following the bee's time in space but for unknown reasons these eggs failed to hatch when transferred into a hive on terra firma.

Beeswax space station

The bees built comb both naturally and from a base of foundation. The average diameter of honey comb cells were smaller and wall thickness greater for comb built in space compared to that built on earth. For two pieces of comb the bees built during the mission, all of the cells on any one side of the comb had angles in the same plane. One comb built by the bees had cells on one side that were angled up toward the Lexan top. On the other side they were angled down toward the BEM floor. However, a piece of comb that was built up from the BEM floor "displayed a wide range of angles." This indicates that the bees were potentially having a difficult time differentiating up from down without the benefit of gravity. It was speculated that since the bees used on the space flight were all about 15 days old, prior learning from pre-flight comb building activity may have played a role in comb construction.

When it came to bee-powered space flight, the honey bees seemed to exhibit a remarkable ability to learn and adapt to conditions in space, especially when one considers the that unlike the human crew got a lot of training before-hand, the bees

got no training. "Bees were observed to engage in short flights: on 9 April some bees collided with the walls of the chamber, but on 13 April bees engaging in directed flights avoided such collisions. The crew noted in the log book that '. . . by Day seven comb well developed, bees seemed to adapt to 0-g pretty well. No longer trying to fly against top of box. Many actually fly from place to place.'"

Conditions in space are so different from those on earth that such missions are academic exercises – interesting in and of themselves, but ultimately providing little to no practical value for earth-bound beekeepers. And as for us humans, a strong argument can be made that we have no business going to other planets until we learn to take care of the one we already occupy. BC

Ross Conrad is the author of Natural Beekeeping, Revised and Expanded 2nd Edition *and Co-author of* The Land of Milk and Honey: A History of Beekeeping in Vermont.

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Poskevich D., (1989) *A comparison of honeycomb structures built by* Apis millifera (SE82_17). *In: Jackson JT, Christie NW, comps. Shuttle Student Involvement Program (SSIP) Final Reports of Experiments Flown.* Houston TX: National Aeronautics and Space Administration, Lyndon B. Johnson Space Center; JSC 24005.

https://lsda.jsc.nasa.gov/Experiment/exper/914?

Think Ahead

Just because the calendar says November you know perfectly well that December will arrive. Let's make this a Beekeeper Christmas. Since the items on Santa's suggestion list have to be ordered, right now is a good time to start ordering before deliveries get bogged down as December moves on. Nice gifts for beekeepers actually abound but it takes a bit of computer searching to find ones considered special. Caps can be found at the major beekeeping equipment suppliers. But a cap is not all that exciting. What about t-shirts? Actually the selection is huge – at least a gazillion of them exist with different mottoes. But unless one has a particularly appropriate motto, a t-shirt is in the category of caps as gifts. Many bee-themed items that are useful and beautiful have been discovered and are presented here. We'll start with some of the major suppliers.

One item may be overlooked in the catalogs – honey. If you live on the East Coast your bees are not going to make honey from the West Coast flowers. Take advantage of the honey for sale from another part of the country. Both for yourself and for gifts.

If you have a dog, large or small or in-between, then visit the website of Dadant, **www.dadant.com**, where you will find dog collars and matching leashes in all sizes and colors. Although your dog may not like your real bees at all, it will be a well-dressed beekeeper's dog. For those who like to bake cakes, Dadant has three cake pans, three different bee designs and shapes. Cakes made in these will be nice for a potluck dinner at a bee meeting. If the family likes a game of skill, the Honey Bee Tree is fun. It is a tree with branches sticking out. Try to remove the branches without letting bees out.

Ann **Harman**

If you are looking for a gift for someone in the colder parts of the country you should consider the warm cotton throws offered by Kelley Beekeeping, **www.kelleybees.com**. One is the Honey Bee Angel Throw featuring an angel carrying a skep over a field of flowers. The Sticky Situation throw is a bright magenta with flowers. You could add one or two of the cushions, with bee designs, for even more comfort.

Two unusual items can be found at Betterbee. **www.betterbee.com**. One is a packet of 12 note cards that feature the quilt designs of Vermont quilt artist, Hope Johnson, with three each of four designs, and blank interior and envelopes. The other item is called *The Bee Book*. It is not exactly a book since the sections pop up and unfold into hexagons. Twelve bee species are represented along with some flowers and lots of bee facts. For kitchens that may need a queen bee, Betterbee has a very nice one on a tea towel.

If you know someone just married or moving into an apartment or a new house, a visit to Mann Lake, **www.mannlakeltd.com** is very worthwhile. The company has a huge assortment of items for the kitchen, all bee-themed. You could buy a baking pan, large or small, to use as a gift basket and select items that are appropriate. Don't forget oven mitts and pot holders! Mann Lake offers two sets in different patterns and colors. There are bowls, both mixing and prep ones, and measuring spoons and measuring cup sets. The mixing spoons and turner will not damage non-stick pans. The spoon rest is a handy item for keeping the stovetop clean.

For specialty items you will find a hexagonal cheese board, a salad set and a teapot. For the dining table there is a beautiful tapestry runner. Of course there is a nice set of salt and pepper shakers, as well as tea towels, some are embroidered. A tea towel could be used as "wrapping paper" for a gift.

For other areas of the home, Mann Lake has an indoor-outdoor pillow for porch or deck use. The doormat is very handsome with a single bee in a wreath design. Yes, such a doormat can be a Christmas gift! For fun, try the 300-piece jigsaw puzzle, a nice gift for a family.

One supplier has some interesting and beautiful items not found elsewhere. Visit the site of Pigeon Mountain Trading Company, **www.pigeonmountaintrading.com**, located in the Georgia mountains. Open the Bee Boutique section where you can find elegant French aprons with a bee design and quite a number of tea towels, some embroidered.

There is a beautiful embroidered table runner with flowers and bees along with matching placemats. Add the napkin rings and salt and pepper shakers for an elegant bee-themed table. Don't overlook the vase for centerpiece flowers.

You can find cereal bowls, dinner plates, dessert plates, dipping bowls along with wine glasses with stems or without. The stoneware cake stand is unique and will present a dessert cake at its best. The matching stoneware cheese plate and pitcher will also make nice gifts. If you know someone who gives picnic suppers, a gift of some "paper" plates could be useful. These are actually not paper or foam but are melamine and dishwasher-safe so they can be reused. Yes, they have bees on them.

After visiting that part of Pigeon Mountain's site, move to the section called Patio and Garden. Here you will find an incredible selection of bee-themed items for home and gardens. If you know a beekeeper who would like to have some bees inside the house, look at the two different wall appliques. They are removable without damage to the walls.

If you are looking for a small gift, view the selection of mail box covers with bees and flowers. Many beekeepers today are planting gardens for bees. Pigeon Mountain has such a big selection of garden signs and flags with honey bees that you may have a hard time making choices. For someone with a deck or patio, you can select some pillows or a small indoor/outdoor rug. A visit to the Pigeon Mountain site will show you so many attractive and useful items that you will end up giving a gift to yourself.

Don't overlook these two websites. One is Root Candles, **www.rootcandles.com** where you will find a huge assortment of various candles. There are fragrant and non-fragrant ones, a large selection

Nature's Jewelry

of colors and sizes. You can make your own gift selection or choose a seasonal one or use a gift certificate. The Root Company is celebrating its 150th year during 2019. The other website is only for jewelry, **www.NaturesJewelry.com**. Along with bees you will find birds, butterflies, frogs, squirrels and even an elephant and tiger.

Now it is time to visit the website of GloryBee, of Eugene, Oregon, **www.glorybee.com** where you can find some surprising gifts. First of all GloryBee sells 20 different honeys, some from the Western states, a few flavored ones plus two very special ones. No matter where your friend lives, a jar of one of the specialty honeys would make a nice gift. The Chocolate Almond Flavored and the Raspberry honey with raspberries certainly sound interesting and delicious.

However the most unusual one is the Artisan Fermented Honey. It is made in Thailand with traditional

GloryBee

ancient methods. Now before you wonder what anyone could do with it, here is what it can be used for: as a drink it can be put into tea or added to seltzer water with ice for a cold drink. In addition it can be brushed over vegetables and meats, as a salad dressing and as a marinade. So it sounds like a very useful cooking ingredient and definitely one for a gourmet cook.

The longan tree that grows in Thailand produces a golden sweet honey that is allowed to ferment naturally. Then green tea is added before putting into oak barrels to age for six months. Then more longan honey is added for sweetness and flavor before putting into bottles for sale.

The Artisan Fermented Honey is not the only unusual honey product. GloryBee also features its Brown Butter Honey Ghee, a blend of ghee made from grass-fed cows' milk blended with honey. It's taste is described as slightly sweet and salty caramel-like. It can be used as a spread for toast, bagels, waffles and mixed with granola. If someone likes popcorn, use this instead of plain butter. Use it to brush on roasting meats and vegetables. So the Brown Butter Ghee is another useful and interesting addition to gourmet cooking.

If you plan on giving one or both of these honey products as a gift, it may be wise to also give a card with uses in case the recipient is not familiar with them.

And now, if you have not found the perfect gift yet, it is time to visit Etsy, **www.etsy.com**, where you can put "honey bee themed gifts" into the search site. These words open up truly a universe of items with honey bees. You will find jewelry, clothing for all ages, decorative items, useful items and more. Yes, caps, mugs and t-shirts with mottoes abound. You will see even a selection of bow ties with bees. But there is so much more.

A number of unusual gift items are easily found, such as a nice pill container with a bumble bee. How about a cute bee on a self-inking return address stamp? Instead of a traditional Christmas wreath, try a honey bee ribbon wreath. This is actually not designed as a Christmas wreath so it can be used throughout the year. What about bumble bee and wildflower seat belt covers to make seat belts more comfortable and more attractive.

Would a shower curtain be a suitable gift? Yes, since it has bees on it. Does a friend like house plants? You can find a bee-themed house plant pot. You will find one-of-a-kind items on this site, some are listed as vintage, meaning they are used or reconditioned. Look for a silk suncatcher with a big bee on it, a wall plaque or prints to hang on a wall.

Although only one bumble bee wrapping paper was found on this site to wrap your gift, you can buy 10-yard rolls of ribbon with several different bee designs. Since this ribbon has thin wire edges the bow can be flat for mailing and then reshaped afterwards.

Now, what are you waiting for? The calendar days are moving on. Make your list and get your orders in. If you've found something in your searching that *you* really want, Santa is ready to receive your letter. BC

CALENDAR

♦INTERNATIONAL♦

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**.

London Honey Expert-Sommelier Certification held in London November 12-15.

Anybody can attend the course at DoubleTree by Hilton Hotel London. Instructors are Raffaele Dall'Olio and Gian Luigi Marcazzan. Supported by London International Honey Awayrds (LIHA)

For the detailed program visit **www.LondonHoneyAwards.com**.

♦COLORADO♦

The Colorado State Beekeepers will have their Winter meeting November 2 at the Douglas County Fairgrounds in Castle Rock.

Keynote speaker is Elizabeth Walsh from Texas A&M. Amy Franklin and Mario Padilla will also be speakers.

For more information contact **Rebecca.Sunderlin@tsa.dhs.gov**.

♦GEORGIA♦

Lake Country Beekeepers Association 8th Annual Short Course will be held January 25 at the Greensboro United Methodist Church..

Speakers include Bob Binnie, Rick Coor, Keith and Rose Anne Fielder.

For information visit **LCBA2020.eventbrite.com** or contact **lakecountrybees@gmail.com**.

♦ILLINOIS♦

University of IL Bees and Beekeeping Short Course will be held April 18 at the Bee Research Facility and the Carl R. Woese Institute for Genomic Biology.

The cost is $100. Must bring your own protective gear. Course is limited to 50 participants.

For more information and to register email **cundiff@illinois.edu** or 217.265.7614.

♦LOUISIANA♦

The USDA Honey Bee Breeding, Genetics and Physiology laboratory and the LA State Beekeepers Association will hold their 23rd Annual Field Day November 2 at the lab, 1157 Ben Hur Road, Baton Rouge. Rain date November 9.

Gates open at 9:00 a.m. with program starting at 10:00 to 3:30 p.m. The fee is $35/adults, non-refundable. Pre-registration begins Ocboter 2.

For more information visit **labeekeepers.org** or contact Frank Rinkevich, 225.276.3998 or **frank.rinkevich@ars.usda.gov** or Joe Sanroma, 318.346.2805. For questions regarding online registration contact Jennifer Brown, 601.493.3447.

♦MISSISSIPPIT♦

The MS Beekeepers Association will hold their Annual meeting November 8-9 at Eagle Ridge Conference Center in Raymond.

Featured speaker is Kim Flottum.

For more information visit **mshoneybee.org**.

♦MISSOURI♦

Eastern Missouri Beekeepers Association 13th Annual Beekeeping Workshop will be held February 7-8 in St. Louis.

Keynote speakers include Jennifer Berry, Kim Flottum, Gary Reuter, Becky Masterman, Bridget mendel Lee and Ana Heck.

The cost is $85/person, $95 after January 19. Banquet costs is $30/person.

For more information visit **www.easternmobeekeepers.com**.

♦NEW YORK♦

Beekeeping For The Future November 16, 9:00 a.m. to 5:00 p.m. at The Pfeiffer Center, Chestnut Ridge.

Registration is $95.

Instructor is Bill Day.

For information visit **www.pfeiffercenter.org/workshops**.

♦OHIO♦

5th Annual Organic Farming Conference will be held November 7-8 in Mt. Hope.

Keynote speaker is Stephanie Frischie from the Xerces Society.

For information visit **www.organicfarmingconf.com**.

♦WYOMING♦

Wyoming Bee College will be held March 21-22 in Cheyenne, with a Pre-Conference Workshop held March 20.

The cost of the workshop is $125/person. The cost for the conference is $85/person or you can do both for $195.

Featured speakers are Phil Craft, Jamie Ellis, Scott Debnam, Reyah Carlson and more.

For information visit **www.wyomingbeecollege.org**.

"Since I've been taking the bee pollen, I've been stopping to smell the roses more often."

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

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When I made some late Summer hive splits, the bees didn't much like it. I'd already pulled the honey, but they'd made some more, so the brood supers were pretty plugged. Good! They'll need lots of honey to overwinter as single-deeps.

To make these splits, I made sure there was brood in both brood supers of double-deep colonies. I removed the top super and shook all the bees into the lower one. Next I put a queen excluder on top of the lower super and the top super over that. So now I had all the bees, including the queen, in the lower super, with free passage back to the upper, through the queen excluder. Except for the queen. She had to stay below. That's why we call it a "queen excluder."

Clever, no? Except for one thing. Those bees were furious! They came after me every which way. They sneaked up my pant legs. They stung me through the denim in the crotch of my jeans. Ouch! How can they do that? When I put on my long-cuffed heavy rubber gloves, they raced down my shirtsleeves to attack my wrists, and I had to get out the duct tape.

This, when all I was trying to do was make a few changes. What was the problem?

The next morning I came back to remove the now-bee-populated upper supers and take them to another yard to re-queen. Those little darlings were still in a tizzy! Don't tell me bees can't remember! They greeted me as soon as I got out of the truck and engaged in relentless honey bee guerrilla warfare as I completed my task.

Now all those upper supers are independent hives with new queens. I put candy plugs in the cages, so the bees can release those queens on their own. I hope they treat them better than they did me. I could have played it safe and released the queens manually after the hives had clearly accepted them. But I didn't do that, because the gal Marilyn and I were leaving the next day for the Apimondia bee conference in Montreal. I'll cross my fingers and check back on our return from Canada.

The other day when the phone rang, I pulled over. "This is Megan. I need help" the caller announced. "I'm afraid my bees are queenless, and I don't know what to do. I need somebody to come over and take a look. I think I need a new queen." She sounded desperate.

OK, but first things first. "Where do you live?" I asked.

"Carbondale," she replied.

"I just happen to be in Carbondale today," I said. What part of town?"

"Seventh Street," she said.

"Wow! I'm parked on Seventh Street," I said, "probably in front of your house. Just step outside!"

"I'm down by the Cowen Center," she said.

"I'll be right there, I'm driving an ancient yellow Toyota Tercel wagon with a red driver's side door. It's a wreck. You can't miss it. Just wave at me when I get there."

Megan had two Flow Hives, each sitting on top of two deep supers. In one, the upper super was packed tight with honey. There weren't a whole lot of bees in the hive. The first frame I pulled had what looked like a replacement queen cell on it. There were no eggs or young brood to be seen. But the next frame was full of swarm cells. This surprised me, because it was late August, and these bees had had a brand new queen. There are no hard and fast rules, but early September is a little late for swarming, and young queens tend to be reluctant to swarm. Sometimes it takes me a minute to put two and two together. Megan said, "Maybe they swarmed already."

Darn! The student was way ahead of the teacher!

"Well, you've got queen cells. With luck, you'll have a new queen soon." I said. "No point putting in a new one now."

Megan was a little vague on the concept of *Varroa* mites. I showed her how to do a sugar-shake mite test on her second, stronger, colony. The test showed no mites, which is good news in late summer! By this time, she was on Cloud Nine.

When I said, "Gotta go!" she said, "How much do I owe you?"

I said, "You have two choices: A hundred bucks, or you agree to join the Colorado State Beekeepers Association (CSBA) for 10. Plus promise me you'll attend the CSBA summer meeting next year in Rifle." This seemed like a no-brainer to me.

"Can I do both?" she wondered.

"No," I said. "Take your pick. I was green once, too, and folks helped me and never sent me a bill." Gentle reader, there's profit, and there's karma. Sometimes you have to choose.

"Well, can I at least hire you to look at my bees again before Winter?"

"Sure," I said, "but this one's free." Hiring out as a "bee expert" really isn't my thing. I know lots of people do this, and only some of them are charlatans.

You never saw someone so appreciative. She threw her arms around me and asked if she could tag along when I check on my Carbondale bees.

Free help? You betcha! She's got my number, just in case she's serious.

Ed **Colby**

Guerilla Warfare

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