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Bee Culture

August Features . . .

TECHNOLOGY TIPS FOR BEEKEEPERS 19
Abstracts from WAS 2020.
submitted by Malcolm Sanford

GOING FOR A RIDE 37
How bees carrying fungi are protecting agroecosystems.
Charlotte Coates, et al

FLORIDA STATE SCIENCE FAIR 40
"Best In fair Prize" – Biological Science Division.
Atreya Manaswi

OPTIMIZING BEE GUT IMMUNITY 43
Using probiotics.
Varun Madan

APIARY INSPECTION 46
Ohio State Apiarist Barbara Bloetscher.
Brooke Decker

OFF-LABEL *VARROA* TREATMENTS 47
Pose long-term risks for beekeeping industry.
Matthew Mulica

CELL PUNCH QUEEN REARING . . . 52
. . . but different. (Reprinted with permission from Deutsches Bienen Journal*)*
Roland Gerner

BEE DRIVEN MID-LIFE CRISIS PART 4 55
A shout out to my friends.
James Masucci

WORKING TO PROTECT HONEY BEES FROM *VARROA* MITES 56
Greenlight Biosciences.
Katie Harrigan

4 EASY STEPS 60
Minimize pollinator impact when spraying.
reprinted from ILSoyAdvisor.com

UNREAL DRONES IN THE APIARY 63
Have you ever flown a drone?
Dewey Caron

MINDING YOUR BEES AND CUES 68
Genetic diversification and tracking results.
Becky Masterman and Bridget Mendel

WHOLESOME REMEDIES 75
Social and self medication.
Alexandra Nastasa

CAN SOLAR ENERGY FUEL POLLINATOR CONSERVATION? 78
From Environmental Entomology.
Adam Dolezal, et al

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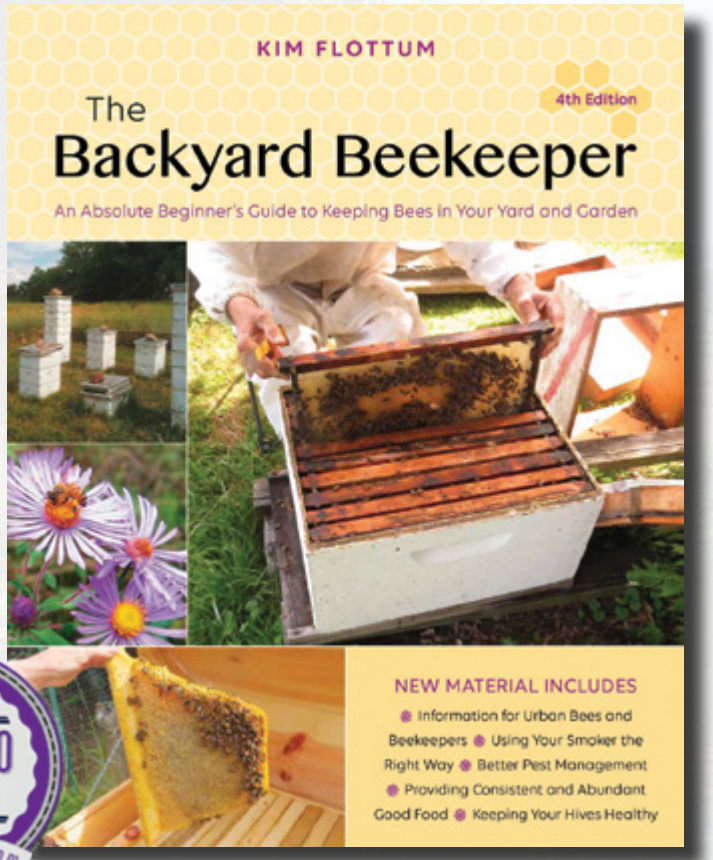

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NEW FOR YOU 11
HiveAlive Fondant Patty.

NEW READING FOR BEEKEEPERS 20
Honey Bee Alchemy; Swarming. Biology and Control; Honey Bee Medicine For The Veterinary Practitioner.

BEE CULTURE READER SURVEY 14
Please help us do a better job for you.
Bee Culture Staff

BEE VET 24
Good help can be found.
Tracy Farone

HISTORY IS HINTS AND SCRAPS 27
America beekeeping.
John Miller

FOUND IN TRANSLATION 28
Social thoughts.
Jay Evans

A CLOSER LOOK – TASTE PERCEPTION 32
Honey bee chemosensory organs.
Clarence Collison

BEE KIDS' CORNER 44
All the buzz . . . for the kids?
Kim Lehman

BEEING DIVERSE: INSPIRING LEADERS IN BEEKEEPING 48
Bee Culture's Annual Event returns with an incredible lineup of speakers.
Bee Culture Team

BIGGER PICTURE 84
The devil's in the details.
Jessica Louque

A TANGING TEMPEST IN THE BEEYARD 88
If it doesn't work, why do so many beekeepers still perform this swarm-catching ritual?
James E. Tew

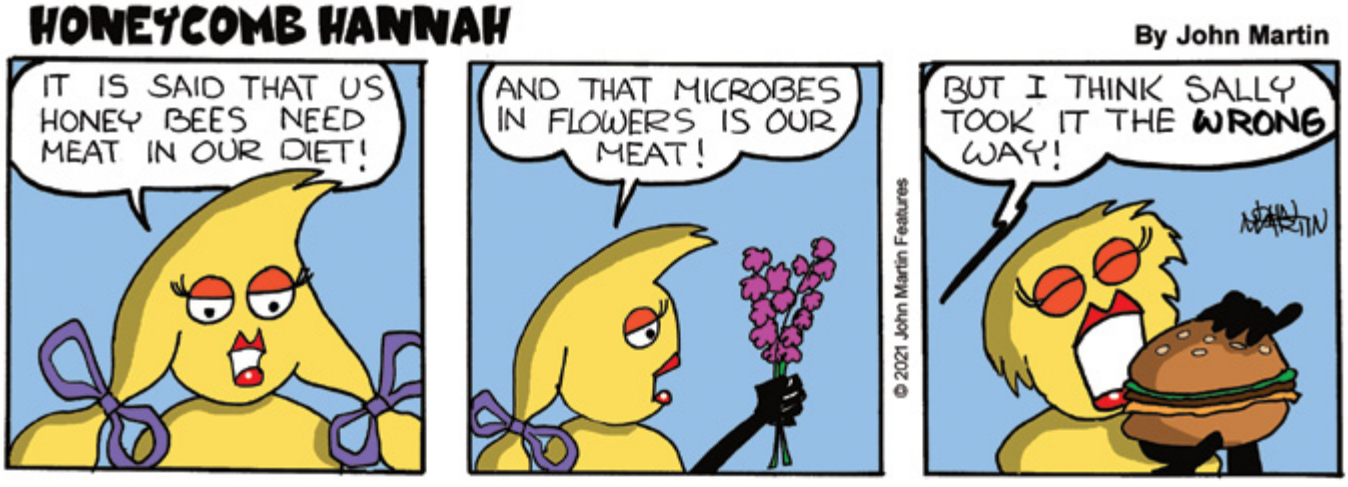
A ROYAL DRAMA 92
A conversation with the queen.
Stephen Bishop

SUMMER RECIPES 93
Honey Garlic Pork Chops.
Shana Archibald

BOTTOM BOARD 96
Aristotle and bees.
Ed Colby

In Every Month –

Honeycomb Hannah 9
What's going on in the hive.
Mailbox 10
From The Editor – 12
It's Summers Time! 15
Lots going on in Medina.
Next Month 16
What should you be doing?
Honey Market Report 17
Comparing regional prices.
Calendar 94



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From The New-Bee

Having spent the swarm of my career in the manufacturing sector, I took flight, and as luck would hive it, landed smack dab in the middle of the bee-colony world. As one mite expect, this transition has been a bit of an apicultural shock.

Truth bee told, I was clueless as to the super powers of apiarists across the globe, and I had zero knowledge (well some) of the critical importance honey bees are to the survival of this planet.

Bee Culture Magazine has proven to be invaluable to me in navigating "all things bees." I appreciate the diverse industry knowledge packed into each issue. I looking forward to devouring *ABC and XYZ of Bee Culture.*

Barb Smith

Illinois State Beekeepers Association President Corky Schnadt flanked by ISBA's 2020 Beekeeper of the Year award recipients Jim and Karen Belli.

Beekeeper Of The Year

Although the Belli's were selected for the award in Fall of 2020, the COVID-related cancellation of ISBA's 2020 Fall Meeting precluded a formal presentation of the plaque until recently. Jim is a past president of ISBA and a current director of the American Beekeeping Federation representing honey producers/packers. At a virtual meeting of the Lake County Beekeepers Association, a group for which Karen serves as the program director, Schnadt praised them for their work at the local, state, and national levels. For more information on the their achievements and contributions, see the Fall 2020 issue of the ISBA Bulletin and a recent segment on WTTW's Chicago Tonight.

Hilary Ward Schnadt
Interim Editor, *ISBA Bulletin*

New For The Beekeeper –

HiveAlive Fondant Patty Now available in the U.S. and Canada

Due to significant demand among beekeepers, Dara Scott and the HiveAlive team created a ready to feed fondant patty that already has the correct dose of HiveAlive added as well as vitamins and amino acids key for honey bee health.

"We have been shipping HiveAlive all over the world for the last eight years and one of the things we got asked for a lot was a fondant that already had HiveAlive added, mostly from areas with harsher Winters", says Scott. Scott is the founder and Managing Director of Advance Science, the company that developed and produces HiveAlive, a liquid feed supplement for honeybees made in Ireland. Dara Scott's passion for all things honey bee related began with a trip to New Zealand over 20 years ago. The physics graduate who had been working in medical diagnostics took a year out to explore New Zealand and became fascinated by the amount of beekeeping that was going on there. He was hooked from then on and when he returned home, he set about getting his first hive.

He wanted to focus on developing a solution to improve the health of his bees and began work on developing HiveAlive. "I was lucky, Ireland has some of the world's top seaweed experts, so I got help from them in developing HiveAlive. These scientists knew exactly what seaweed extracts to choose and had special extraction techniques to be able to pull out all the anti-bacterial, anti-fungal, anti-viral and immune stimulatory properties that seaweeds naturally have along with a range of vitamins, minerals and amino acids. "I knew about the health benefits of seaweeds for humans and at the time they were just starting to be developed for animals. Now, they are an extremely popular feed ingredient used commercially to reduce the need for antibiotics, boost the immune system and improve gut health." He was intrigued to find out would the same benefits apply to bees. Through government supports Dara collaborated with scientists from several universities across Europe in developing and testing what would soon become HiveAlive.

His theory was correct. HiveAlive has since been tested in multiple field studies around the world. Results consistently show that feeding hives with HiveAlive makes the colonies more productive – they have more brood and more honey with less disease, in particular Nosema, and lower overwinter losses. "To be honest we could spend lots of money on marketing but the best marketing team we have are the beekeepers that give HiveAlive a proper try over a full year. Once they do, they are our best advertisers as they can really see the benefits and are keen to tell their friends. People don't believe our claims when we tell them, but they believe them when their friends have seen it for themselves. That is genuinely the most rewarding part of the job, when I go to shows and people tell us how much they love using HiveAlive."

It was from attending these shows and speaking with beekeepers that he realised the demand for fondant with HiveAlive added so he set about developing a premium formulation. "We spent a lot of time making sure all the ingredients used were of very high quality, the sugar particle size is small to ensure the bees can digest it easier and it is produced using a special process to keep the amounts of HMF very low", says Scott. Demand from the US and Canada is already high for the coming fall season.

Solid sugar feeding products aren't as widespread in the U.S. and Canada as they are in Europe. Scott claims that his new fondant patty is an extremely easy way to feed bees and is particularly great for emergency feeding. It is put on top of the colony, either under or over the brood box, so no feeders are needed. It can be used as an Autumn feed but is mainly used to top up over Winter when it is too cold to feed syrup, or in late Winter when bees are running out of stores. Because it is placed directly over the cluster, the bees do not have to leave the cluster to access food, minimizing the chance of starvation. Fondant is easy to handle and store and does not cause robbing like syrup can. In addition to this, it also gives all the benefits of HiveAlive as well as added vitamins & amino acids.

To order, enquire with your local beekeeping store or visit **www.usa.hivealivebees.com**

U.S. Beekeepers Continue to Report High Colony Loss Rates, No Clear Progression Toward Improvement. Annual Bee Informed Partnership survey results show the continuing cycle of high honey bee colony turnover, with beekeepers and researchers hoping to find solutions.

Beekeepers across the United States lost 45.5% of their managed honey bee colonies from April 2020 to April 2021, according to preliminary results of the 15th annual nationwide survey conducted by the nonprofit Bee Informed Partnership (BIP). These losses mark the second highest loss rate the survey has recorded since it began in 2006 (6.1 percentage points higher than the average annual loss rate of 39.4%). The survey results highlight the continuing high rates of honey bee colony turnover. The high loss rate was driven by both elevated Summer and Winter losses this year, with no clear progression toward improvement for beekeepers and their colonies. BIP hopes to use the survey results to better understand how colony losses are experienced by beekeepers, and what can be done to reduce losses in future seasons.

Since beekeepers began noticing higher losses in their colonies in the early 2000s, agricultural agencies, researchers, and the beekeeping industry have been working together to understand why and develop best management practices to reduce their losses. The BIP annual colony loss survey, which has been conducted since 2006, has been integral to that process.

"This year's survey results show that colony losses are still high," says Nathalie Steinhauer, BIP's science coordinator and a post-doctoral researcher in the University of Maryland Department of Entomology. "Not all beekeepers are affected at the same intensity, but the turnover rate of colonies is still overall higher than beekeepers deem acceptable [normal or acceptable turnover is defined at about 20%]. We should remember, however, that loss rates are not the same as population decline. The recent numbers of honey bee colonies in the U.S. are relatively stable despite those high losses, but that's because beekeepers invest a lot of time and effort to increase their operation size to mitigate their losses."

Commercial honey bee operations are essential to agricultural production in the U.S., pollinating $15 billion worth of food crops each year. Honey bee colonies are moved around the country to pollinate important agricultural crops such as almonds, blueberries, and apples. Minimizing their losses and ensuring the health of both commercial and backyard colonies is critical to food production and supply.

"Beekeepers of all types consistently lose a high number of colonies each year, which puts a heavy burden on many of them to recoup those losses in time for major pollination events like California almonds," says Geoffrey Williams, assistant professor of entomology at Auburn University and co-author of the survey. "Colony losses remain elevated, and this year's annual and Summer loss rates are among the highest recorded."

This past year, Winter losses were reported at 32.2%, which is 9.6 percentage points higher than last year and 3.9 points higher than the survey average. Summer losses were some of the highest ever reported again this year at 31.1%, which is 0.9 percentage points lower than last year, but 8.6 points higher than the survey average.

The survey asks beekeeping operations of all sizes to track the survival or turnover rates of their honey bee colonies. This year, 3,347 beekeepers managing 192,384 colonies across the country responded to the survey, representing about 7% of the nation's estimated 2.71 million managed colonies. This effort helps to keep a finger on the pulse of what is going on with beekeepers to identify why high losses are persisting.

"Though we see fluctuations from year to year, the worrisome part is we see no progression towards a reduction of losses," says Steinhauer.

"The long-term efforts of the BIP's annual survey are so important to monitoring honey bee colony losses and beekeeper management over time, and hopefully to identifying key practices that are protective for colonies," stresses Williams. "Because of the close connection of honey bees to the environment, the survey's long-term data may lend itself to insights into how changes in land-use and weather impact the beekeeping industry too. These are really understudied areas at the moment."

This year, to get a better understanding of different management practices that may lead to loss fluctuations, the BIP team delivered two versions of the survey to cater to different beekeepers. The two surveys found that backyard (managing 50 or fewer colonies) and sideliner (managing 51-500 colonies) beekeeping operations face both similar and distinct challenges to commercial beekeepers managing more than 500 colonies. While parasitic *Varroa* mites continue to be a major issue for beekeepers regardless of operation size, queen management might be a factor that can lead to variation in seasonal colony losses.

"A colony needs a healthy, fully functioning queen before major pollination events to be productive," explains Williams. "A preliminary look into survey data reveals that commercial beekeepers almost always replace old queens with new ones during the Summer, whereas only about half of backyard beekeepers do. Could this explain why commercial beekeepers lose fewer colonies in the subsequent Winter than backyard

45% Losses From April 2020 To April 2021

From The Editor –

beekeepers? Perhaps, but we need to dig deeper and possibly perform experiments to shed more light on this."

While the survey suggests that beekeepers are remaining responsive to the current best management practices and health concerns of their colonies, the loss data shows little progress.

"We see in the survey signs that beekeepers are adjusting their practices over time," says Steinhauer. "We also see that their perception of risk is changing. The level of acceptable loss, which was originally around 15% in earlier years of the survey, has crept up to 23% this year. So that tells us beekeepers are thinking about those factors that affect honey bee health more actively. We also see some beneficial changes in agricultural practices that could affect honey bee health, like changes in spray recommendations. But there are still a lot of issues that are left unaddressed. It seems we're running to stand still because beekeepers are changing their practices, and yet we still don't see a clear improvement in their loss rates."

BIP stresses that the lack of improvement in losses is a clear call for more attention and efforts to be paid on finding solutions, especially concerning *Varroa* mites. The BIP annual loss survey continues to be an important part of documenting the data necessary to drive future research, best management practice recommendations, and support for honey bee health.

"We hope to continue BIP's survey effort to record colony losses experienced by U.S. beekeepers and explore beekeepers' management practices," ensures Steinhauer. "We have a general idea of what practices are associated with higher success, but the devil is in the details, and we need to understand why the implementation of some practices are more successful in some cases than others. Of course beekeepers also need the support of the public and political sectors. We need to recreate environments that are conducive to healthy bees, and that will benefit both honey bees and native bees or other wild pollinators."

The survey is conducted by the Bee Informed Partnership with data collected and analyzed by the University of Maryland and Auburn University. Survey results are available here [Note: Link will be updated when embargo lifts to feature this year's report] on the Bee Informed Partnership website, with a summary provided below.

Winter Loss Estimates:
1 October 2020 – 1 April 2021: 32.2% losses
9.6 percentage points higher than Winter 2019-2020: 22.6%
3.9 percentage points higher than average Winter loss (2006-2021): 28.3%

Summer Loss Estimates:
1 April 2020 – 1 October 2020: 31.1% losses
0.9 percentage points lower than Summer 2019: 32.1%
8.6 percentage points higher than average Summer loss (2010-2020): 22.8%

Total Annual Loss Estimates:
1 April 2020 – 1 April 2021: 45.5% losses
1.8 percentage points higher than 2019-2020: 43.7%
6.1 percentage points higher than average annual loss (2010-2021): 39.4%

Loss Comparison by Beekeeper Category:
Backyard beekeepers (manage 50 or fewer colonies): 27.0% Summer vs. 42.0% Winter losses
Sideliner (manage 51-500 colonies): 19.5% Summer vs. 31.9% Winter losses
Commercial (manage more than 500 colonies): 30.9% Summer vs. 32.9% Winter losses

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Bee Culture Reader Survey

My name is Miguel de Gracia. I am the CEO of The A.I. Root Company in Medina, Ohio. We recently celebrated our 150-year anniversary linked with the highly valued Honey Bee industry and its Beekeepers. All those beekeepers who came before you, and each of you who are reading this now in *Bee Culture* Magazine (started by our founder A.I. Root) are part of that history. Because of your love of Honey Bees, what they do and how they do it, *Bee Culture* Magazine has been there with you from the beginning.

Among our corporate values we proclaim that "saving the honey bee is our heritage and our duty." You are fundamental to our vision of the future of the A.I. Root Company. The A.I. Root Company continues to connect to the honey bee industry not only with *Bee Culture* but also through the valuable product of the hive: pure natural Beeswax, from which our Religious Candle and Decorative Candle products depend.

We are constantly thinking about how *Bee Culture* can adapt, modify, and add value for you, our readers. Our desire at Bee Culture is sharing accurate information on honey bee management to inspire you. Your success is our Goal and has always been our Goal. But to be sure we are meeting your needs I would like to ask you to participate in a short survey to tell us a little bit about you, how we can make *Bee Culture* better, and how can we help bring the future of beekeeping to you. Please tell us how we can "bee" better – for you.

Thank you!

Miguel A. de Gracia
CEO – The A.I. Root Company

1) State/Country _____

2) I live in an Urban/Suburban/Rural (please circle one)

3) Beekeeping Focus (please circle one)
   a. Hobby, 1-25 hives
   b. Sideline, 26-300 hives
   c. Commercial, over 300 hives

4) My favorite BC writers are?

   _____
   _____
   _____

5) I'd like to see more or less of (Put M for more or L for less)
   a. Science/research ____
   b. How To ____
   c. Basic Beekeeping ____
   d. Pest/Parasite/Disease Control ____
   e. History ____
   f. Interviews ____
   g. International ____
   h. 'Other' pollinators ____
   i. Honey Markets ____

6) In your opinion, what is the single most important action necessary to promote the well-being of honey bees?

   _____
   _____
   _____

7) What can we do to inspire the next generation of beekeepers?

8) What can we do to enhance your experience with Bee Culture magazine?
   a. Educational webinars
   b. Podcasts
   c. ??? _____

You can fill out the survey online at our webpage by using this link : **https://www.beeculture.com/survey-page/**
Or fill out this sheet and send us a hard copy to Bee Culture Magazine, 623 West Liberty Street, Medina, OH 44256

It's Summers Time –

Lots Happening In Medina

It's been busy here in Medina so far this Summer – at home, at work and just in general. First of all we have had extreme heat – by our standards – several days 90 or above and lots and lots of rain. And hearing from folks around the country it's been so hot. Places that need rain aren't getting it and some of us are dealing with flooding. My son lives in central CA and they have had temps in the 100s for several weeks now (it's mid July as I write this) and as always they are hurting for water and the fires have started.

Closer to home because of all the rain and sunshine the gardens seem to be doing well. Our farmer's markets are going strong and those who got an early or on-time start are already getting some nice produce. It's so good to be able to gather with friends and family again and be outside and just enjoy Summer. Life is almost back to normal here in our area - churches, rec center, theaters, restaurants are all opening up and going strong.

We had an exciting Sunday afternoon on our road a few weeks ago. A huge tree just decided this was the day to tip over. Fortunately it wasn't our tree. The sun was shining – there was no storm, no loud noise, but suddenly we lost power. On our nasty curve the first thought is always a car accident, but not noise. Within minutes the sherriff's car was in front of our house blocking the road. We soon saw that the neighbor's tree had fallen, completely blocking the road and taking out four or five power lines. Luckily it was Sunday afternoon and not much traffic so no one was hurt.

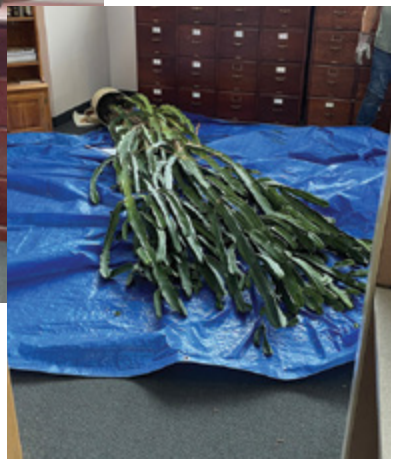
Because it is a state route ODOT (Ohio Department of Transportation) had to be called to remove the tree. Amazingly it only took until early evening to get power back on and the tree completely removed.

Back at the office it's been a little crazy. The observation hive came back to the candle store for the Summer. That's always an event that you just hope goes smoothly. It seemed to at first. Johnny (our wonderful IT guy here at Root) helped Jerry get it all installed. We watched for several minutes and everything seemed fine. About a half hour later I got a call from the store saying there are honey bees loose over here. The ladies in the store are pretty amazing. They don't really get upset when this happens. I guess they've just gotten used to it over the years.

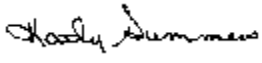
So Jerry and I went over to try and figure out how the bees were getting in the store. After catching all the loose ones and observing for several minutes Jerry saw the problem. We got it sealed back up and haven't had any problems since. Next time you're passing through Medina stop and visit our store and the bees.

And then there's Oscar. Oscar is some sort of giant cactus that has lived in the Publications Department for 10 years or more. He came to us from John Root when he and his wife, Elisabeth relocated to Florida. Oscar has grown a good two or three feet taller since we've had him. We just sort of propped him in the corner and tried to remember to water him once in awhile and he seemed quite happy there.

Well due to renovations – painting, new carpet, etc. – Oscar had to be relocated. That was a challenge trying to figure out how to get him out without getting hurt. There is no place to touch Oscar without getting poked. So finally the maintenance guys got a tarp and tipped him over and drug him out of the building.



Fun times! I hope you all are finding ways to enjoy the Summer. I can't believe this is the August issue already. Time sure flies by fast!



NEXT MONTH

Region 1
- Test/Treat for *Varroa*
- Check Food Supplies
- How is the Queen doing?
- Add Supers
- Alcohol Wash for Mites
- ReQueen/Winter prep
- Take off full supers and Extract
- Prepare for Fall Feeding
- Apply Mouse Guards

Region 2
- Alcohol Wash for Mite Count
- Inspect Colonies
- Stored Food Check
- Check Queen Laying pattern
- Mite Wash and SHB check
- Prep Extracted Supers for Storage
- Feed if Necessary
- Prepare for Goldenrod flow

Region 3
- Sample for Mites / Alcohol Wash
- Treat for mites if sample indicates
- Feed after dearth if needed
- Check on quantity of stored honey for Winter
- Make Fall Splits
- Control SHB
- Check Hive Strength
- Extract Honey

Region 4
- Sample for Mites, treat if over three per 100 bees
- Pull Honey Supers
- Combine small colonies and re-queen
- Remove Late Summer Honey
- Treat for mites if sampling indicates
- Pull Honey
- ReQueen weak colonies
- Leave enough Honey on for Winter
- Rotate Boxes
- Put Mouse Guards On

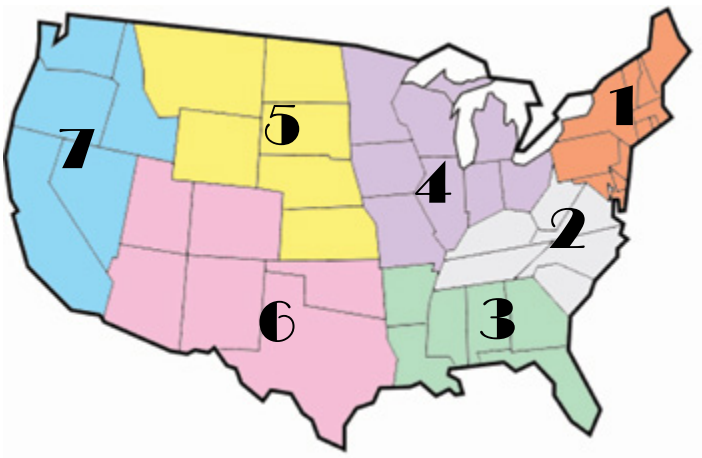
Region 5
- Sample and Treat for Mites
- Check Colony Weight
- Add late Flow Supers
- Feed Syrup if Needed
- ReQueen where needed
- Take late honey off

Region 6
- Sample and treat for *Varroa*
- Feed Syrup
- Treat for Mites/ don't use Oxalic
- Take all supers off
- Requeen weak colonies

Region 7
- Sample, Sample, Sample
- Treat, Treat, Treat
- ReQueen weak colonies
- Feed Pollen Sub
- Check Colony Size and Brood pattern
- Feed if Necessary
- Check Colony Weight

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.



AUGUST – REGIONAL HONEY PRICE REPORT

	REPORTING REGIONS							SUMMARY			History	
	1	2	3	4	5	6	7				Last	Last
EXTRACTED HONEY PRICES SOLD BULK TO PACKERS OR PROCESSORS								**Range**	**Avg.**	**$/lb**	**Month**	**Year**
55 Gal. Drum, Light	2.05	2.22	2.30	2.27	2.49	2.12	2.50	1.92-3.00	2.29	2.29	2.25	2.15
55 Gal. Drum, Ambr	2.00	2.15	1.80	2.18	2.43	1.95	1.85	1.10-2.50	2.07	2.07	2.15	2.07
60# Light (retail)	182.78	181.90	192.50	173.75	182.50	178.51	215.00	111.60 -245.00	185.23	3.09	198.09	203.50
60# Amber (retail)	197.78	175.50	205.00	167.35	200.00	177.13	198.75	108.00-240.00	187.14	3.12	201.18	204.11
WHOLESALE PRICES SOLD TO STORES OR DISTRIBUTORS IN CASE LOTS												
1/2# 24/case	88.67	74.20	113.00	82.00	133.21	111.05	111.05	66.00-192.00	93.11	7.76	86.09	88.56
1# 24/case	139.27	87.80	121.68	113.17	177.67	94.33	120.00	45.00-288.00	126.93	5.29	128.36	135.46
2# 12/case	138.66	104.30	109.33	106.30	76.22	102.00	132.00	40.60-312.00	120.02	5.00	118.06	119.66
12.oz. Plas. 24/cs	106.84	104.03	106.67	109.08	94.32	101.40	114.00	66.00-216.00	106.40	5.91	108.15	99.77
5# 6/case	142.46	114.50	130.62	117.40	113.16	105.00	130.62	71.50-192.06	129.45	4.32	127.15	141.30
Quarts 12/case	159.36	158.31	137.20	108.51	162.22	155.94	183.00	57.24-231.00	149.70	4.16	152.00	158.42
Pints 12/case	101.99	83.67	80.33	81.71	98.53	109.00	96.00	60.00-139.00	92.14	5.12	99.84	96.56
RETAIL SHELF PRICES												
1/2#	5.70	5.30	5.75	5.55	3.96	5.94	7.50	2.75-10.00	5.50	11.00	5.16	5.05
12 oz. Plastic	6.54	7.76	6.82	5.92	4.75	6.05	5.70	3.50-15.00	6.43	8.58	6.19	6.05
1# Glass/Plastic	8.59	8.74	8.71	8.17	7.84	6.76	9.50	4.00-15.00	8.42	8.42	8.21	8.21
2# Glass/Plastic	14.20	15.33	15.99	12.91	10.98	11.14	13.00	6.29-28.00	14.09	7.05	13.70	13.86
Pint	11.89	10.40	10.42	9.71	11.40	11.60	13.03	5.99-22.00	10.95	7.30	10.84	10.64
Quart	22.59	17.80	18.76	16.09	19.71	16.74	20.55	9.25-42.00	19.10	6.37	19.42	17.73
5# Glass/Plastic	31.63	27.93	57.50	27.40	25.29	27.65	36.12	16.95-65.00	31.26	6.25	30.46	29.16
1# Cream	10.06	9.69	11.32	10.10	9.37	11.32	16.00	7.00-18.00	10.13	9.75	9.50	9.59
1# Cut Comb	14.28	11.33	27.49	13.53	10.50	27.49	16.00	7.00-72.00	15.47	15.25	12.19	11.89
Ross Round	10.80	9.35	15.00	13.50	11.70	11.70	13.75	7.00-16.80	11.49	15.32	10.27	11.18
Wholesale Wax (Lt)	6.88	7.78	5.75	7.06	6.25	4.17	7.33	3.00-16.00	6.60	-	6.71	6.70
Wholesale Wax (Dk)	5.91	5.75	4.68	4.69	6.50	3.50	5.30	2.55-8.00	5.33	-	5.71	5.41
Pollination Fee/Col.	89.44	63.75	77.50	100.00	140.00	101.30	70.00	30.00-200.00	87.60	-	81.07	83.89

Mandatory Procedures for Domestic Honey Exported to the European Union

The European Union has listed the U.S. as a country eligible to export honey to the European Union provided honey producers meet their program requirements. Under the program, domestic U.S. companies must adhere to specific requirements for each shipment destined to a European Union member country. In general, these requirements include:

A. USDA Plant Survey at an acceptable level.

B. Honey producers must have a Hazard Analysis and Critical Control Point (HACCP) Plan in place and pass a USDA HACCP Plan Verification Survey.

C. Honey producers must follow record keeping requirements and, at a minimum, maintain the following records for review:

Completed Producer Certification (updated at a minimum each crop year or for each contract).

Dated weigh ticket for each lot/load delivered.

Crop year and floral variety description for each lot/drum/pail noted on each weigh ticket.

D. Honey producers must clearly identify each drum/pail of raw honey with the producers' name, crop year, and floral variety receipt date.

E. Honey producers must retain files for three years beyond the crop year or contract year.

F. Honey producers and handlers must control and separate honey destined for the European Union from Honey being delivered elsewhere. As the Honey travels to the port of departure it must be kept separate from other Honey and tracked.

G. Honey producers must follow the sampling and testing protocol with respect to the frequency of testing and the compounds that must be monitored as follows:

Under the proposal accepted by the European Union, handlers must follow a certain testing and sampling protocol with respect to the frequency of testing and the compounds that must be monitored. Each sample drawn must be tested for the compounds listed below at one of the two certified labs.

Sampling Frequency

Raw Product/Bulk: One sample* drawn from each 10 drums including at least one sample from each producer represented in the load.

Finished Goods: One sample* per container load of finished goods including, at minimum, at least one sample from each producer or variety represented in the container load.
*Sample size: 250 grams or as specified by test laboratory used

Compound Testing Requirements**

Antibiotics

Compound	Tolerance
Sulfonamides	None
Tetracycline's	None
Streptomycine	None
Chloramphenicol	None
Nitrofurans	None
Tylosin	None

Acaricides

Compound	Tolerance
Coumaphos	100ppb
Amitraz	1000ppb
Fluvalinate	50ppb

Trade analysis

Compound	Tolerance
HMF	All Per Codex
Moisture	Stan 12-1981
Diastase	Rev.1 (1987)
Ph	Rev.2 (2001)
Acidity	

**Individual customers may require further testing

Each sample must be tested at one of two certified labs:
Intertek Food Services GmbH
Quality Services International GmbH, Bremen, Germany

H. Honey must be certified by the USDA on a Health Certificate modeled after the EU Health Certificate.

For More Information

Certification of Honey Exports and related inspection services are available on a fee basis from USDA's Specialty Crops inspection Division. For more information about Honey, please visit the National Honey Board's web site.

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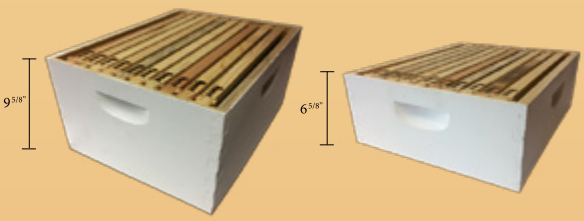


Commercial Grade Boxes

- Honey Supers & Hive Bodies
- Added Strength 1 – 5/8" Top Joint
- Pacific Northwest Ponderosa Pine
- Assembled, Primed, & Painted

Technology Tips For Beekeepers

Malcolm T. Sanford

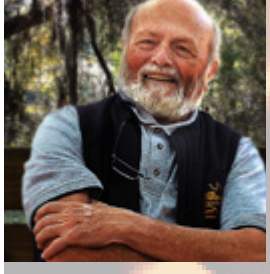
MYAPIARY-DATA-DRIVEN APIARY BUSINESS:Darren Bainbridge; MyApiary Limited; Australia; Darren.bainbridge@dmyapiary.com

MyApiary is a productivity software for commercial beekeepers. We provide business support, helping beekeepers run successful businesses, not just keep bees. Beekeepers now need to pollinate more crops and manage the health of more beehives than ever before. Information management is a critical component for successful business operators in today's demanding farming environment. We have found there is a direct connection between good business management and bee colony health. Through partnering with the industry, MyApiary has custom-built and refined a software management platform specifically for commercial beekeepers. MyApiary's platform now facilitates behavioural change in many beekeeping operations, improving organizational communication and increasing productivity by helping beekeepers make informed data-driven decisions, enabling beekeepers to run effective, sustainable business, ensuring the future of our global food production ecosystem. Our tools bring record-keeping, forward planning, asset management, and cost monitoring into one easy-to-use app. Our goal is to see commercial beekeeping companies reach their pinnacle of success by reducing business risk and maximizing finical returns. So, put our expertise to work in your business. We look forward to working with you and many industry participants as they become a part of the MyApiary ecosystem. 15 minutes, https://tinyurl.com/bdjjznhy

RFIDS FOR ASSET (HIVE) IDENTIFICATION, LOCATION, TRACKING, AND INVENTORY:Jerry Bromenshenk, Robert Seccomb; Bee Alert Technology, Inc.; USA; beeresearch@aol.com

Working with Ron Gilbert's team at the USA Pacific Northwest National Laboratory, in 1999, we put the first true RFID tags on bees. Small passive tags using nanoblock microchip technology are now employed for inventory control in the medical industry, warehouses, and stores such as Wal-Mart. These tags, produced by Alien Technology, a world leader in volume production of Radio-Frequency Identification (RFID) products, were developed by Gilbert's team. This same team placed the first RFID tag on a bee for us. Combinations of passive and active RFID tags connected to wireless, cellular, and satellite communications can economically provide theft-protection and hive recovery and also enable nearly effortless inventory, location, tracking, and management options to the commercial bee industry. In our presentation, we cover currently available options, not only for theft protection but also for data-driven bee management. We conclude with this advice to beekeepers: "The infra-structure for intercepting loads of stolen hives is already in place and being used by other industries. It is time to put in place a well-designed, state, and nation-wide service. If you buy only for theft protection, the odds are that it will not be working when a theft does occur. Instead, build a system to meet your daily needs, make it useful for many purposes, and use it to improve your management by providing data-based information. Theft protection is a bonus. Please contact us for help designing an integrated RFID and communications system that meets your unique business needs: 19 minutes, https://tinyurl.com/7m5ejh

HIVE MONITORING SYSTEMS AND HOW THEY HELP BEEKEEPERS SAVE HIVES AND MONEY: Rafael Cabrera; Solutionbee LLC: USA; rafael.cabrera@solutionbee.com



https://beekeep.info/vita_details/

Hive monitoring systems have advanced greatly in the last few years. Their features have matured, and the equipment has become even more reliable and durable. Saving money on equipment starts by selecting equipment that will last a long time in the bee yard. Apiaries are exposed to months and years of rain, dust, and temperature swings that can overwhelm poorly designed equipment. Features such as buttonless controls, wireless configurations, and water-tight enclosures ensure that your investments last trouble-free for years. Replacing batteries can also be a time-consuming effort. Furthermore, batteries that deplete in the middle of a nectar flow, or in the winter are annoying to replace. Look for designs that only sip power sparingly and whose batteries last for at least three years, if not longer. Some excellent designs will last well over five years or more on a single battery. If designed well, hive monitoring equipment will last more than a decade out in the field in the harshest conditions: 8 minutes, https://tinyurl.com/2rwe72ce

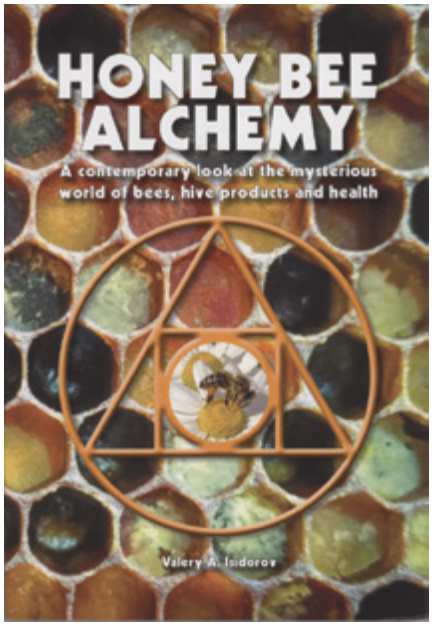
New Reading For Beekeepers –

Honey Bee Alchemy. A contemporary look at the mysterious world of bees, hive products and health. By Valery A. Isidorov. Jointly published by The International Bee Research Association (**www.IBRA.org.uk**), and Northern Bee Books (**www.northernbeebooks.co.uk)**. ISBN 978-1-913811-02-0. 6.5" x 9.5". Soft cover, 273 pages. Limited color throughout. $55.00.

This book was originally published in 2013 in Poland. It has been translated to English and extensively updated for this new release by Professor Isidorov, who studies the chemistry of natural products, and runs a laboratory at the Institute of Forest Sciences of the Bialystok Technical University.

This is a chemist's study of the chemistry of honey bees, the products they produce, the diseases they encounter in life and the chemistry of those diseases, and predators they are subject to and the chemistry of their resistances to those predators. This work is amazingly detailed in the study of all of these, and there is much information that has yet to be distributed to even specialized scientists, let alone the people who are responsible for keeping their bees healthy.

It starts with the history of discovery, and those who made the discoveries. Names you know, or thought you knew, and now you'll know where these came from – Nasonov, Huber, and many more…all this just for grounding.



The chemistry of pheromones is next. Communication isn't by phone, or signals, or an easy chat… it's all chemistry, and it's all explained here. And the exchange of food in trophallaxis is even more chemistry….what's exchanged, and what's received is what this accomplishes between workers.

Then the science of Royal Jelly. It's antibiotic properties, it's food value, both to bees and to people who harvest it, and what happens when it is intentionally contaminated with the remains of drone larvae? Is it better, the same?

But it's propolis that takes center stage. Fully 20% of the book examines the history of the study of this substance, what it is made of, where it comes from, the chemistry of the plant extracts it is made from, the kinds of trees that it is made from, differences by region, what can be extracted from it – propolis is a chemical factory in a beehive, and scientists are still discovering its secrets.

Of course honey shares center stage, starting with the chemistry of nectars, honey from sugar syrup, and the value and chemistries of unifloral honeys. Certainly the medical history and value of honey, especially manuka honey is examined, along with what makes honey taste the way honey tastes.

Do you know of herbal honeys? Infused with the chemistry of dried herbs soaked in honey? Herbs such as thyme and nettles and many more, along with juices of a great collection of plants. Fermentation, flavors – herbal honeys are unique, and very common in some parts of the world.

Bee Bread is a biologically active additive, an anabolic. It is, simply, the food of the Gods. Many Olympic athletes readily consume bee bread because it helps them increase muscle mass and improve their endocrine systems. When pollen is collected by foragers, they add enzymes to the pollen grains that immediately render the pollen unable to fertilize plants, and the chemistry of breaking down to simple sugars is explained. When stored, more saliva is added, and the product that is produced is nutritious and, incredibly, adds not only nutritional benefits, but also offers antibiotic properties.

The final chapter looks at what it takes to have healthy bees. After researching all of the above properties that bees produce, there is still more. Scientists in the U.S. have found that it is the fat body that varroa consumes when attacking a bee, but here it is detailed how that works. There is much new information on *Varroa* resistance in bee populations, resistance of *Varroa* to chemical treatments, and more about this terrible pest.

But propolis is far more important than we have thought, and our selections for bees that produce less and less propolis certainly have not been a good thing for honey bee health.

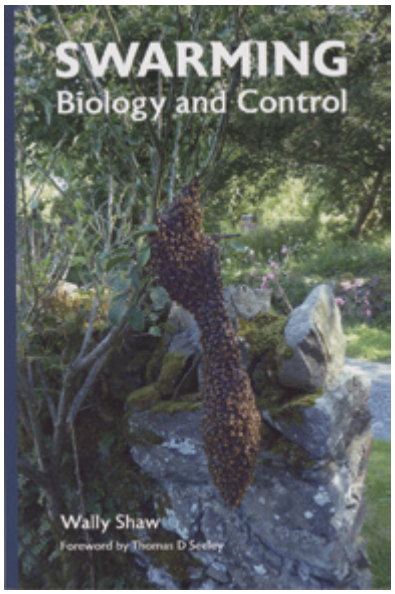
The closing information deals with herbal remedies for all that harms our bees – essential oils, bacteria, fungi, predators that attack varroa in the hive, brood breaks, heating a hive, harvesting drone brood, natural and not natural treatments for AFB, and other, more natural perhaps, remedies that will help our honey bees.

This is, absolutely, a chemistry book. It is a serious look at what is happening in a bee hive all of the time. It is not, by any stretch, a how-to book on keeping honey bees healthy, rather, it is a collection of facts that we can use, if we are smart enough to listen, to keep our bees alive, and producing the food we all, every day, need to consume.

Kim Flottum,
Growing Planet Media

Swarming. Biology and Control. By Wally Shaw. Published by BEE CRAFT LIMITED, (**www.bee-craft.com/shop**), UK. ISBN 978-0-900147-10-4. 214 pages, 6" x 9". Soft cover, color throughout.

I was immediately attracted to this book because on the front cover, right beneath the authors name was, for me, a very strong selling point – Foreword by Thomas D Seeley. That Dr. Seeley would take the



time to review this book, and let his name be associated with it spoke volumes to me about the quality of both the science and technique of swarm control this book offers.

The author has been considering swarming for most of the 30 or so years he has been keeping bees. So, when he decided to preserve what he had learned, he divided his information into essentially two ideas. First was 'why do bees swarm', looking at the biology of an insect we still do not completely control. The second part then looked at the many ways beekeepers and scientists have devised to control, at least to some degree, that behavior we still have not tamed.

Part one then looks at colony reproduction including the biology of queens and drones, genetic diversity, and the advantages of polyandry. It shows that there can be several types of queen cells at this time, and the differences they create. Swarm triggers, cavity size, and the external environment are all considered, as is which bees in a colony know they are going to leave, secondary swarms, or as he refers to them as cast swarms, and finally a return to normal.

Part two looks at how to mitigate, prevent or control swarming, drawing on what you now know of the biology of all concerned. Pre-emptive control looks at queen clipping, comb management, box management, supering, moving brood and splitting, and then re-uniting colonies.

Re-active swam control includes reading queen cells - could this be supercedure or emergency queen cells, and basic queen cell development. There are many, many excellent photos showing all of this, along with excellent diagrams of frame adjustments that support all of these techniques.

He then adds a very detailed set of photos showing almost anything you will find in your hives, describes what you are looking at, and what to do about what you are seeing, if anything. There are a dozen of these posed as questions, including queen cups, sealed queen cells, did this colony swarm, there's no sealed brood, and drone laying queens, among the dozen. This section is very informative with excellent diagrams, frame location diagrams and photos.

Then he looks to re-active swarm control, or artificial swarming. Here again his frame diagrams go a long way is showing and telling the concepts he refers to, including using split boards, using Snelgrove modified boards, what happens when you find emerged and sealed queen cells, but don't know if the colony has actually swarmed. And finally, why those late season swarms?

A series of appendices answer more questions, such as using bait hives, feeding a bait hive swarm, and more post-swarm problems and questions.

Dr. Seeley summed up his Forward by saying that "Every beekeeper who desires sizeable honey crops from his or her bees needs to understand how a colony decides to swarm, and how to prevent colonies from doing so. Therefore, this book is an important read for most beekeepers."

I couldn't have said it better.

Kim Flottum,
Growing Planet Media

Honey Bee Medicine For The Veterinary Practitioner. Edited by Terry Ryan Kane, DVM, MS, A2 Bee Vet, Ann Arbor, MI; and Cynthia M. Faux, DVM, PhD, DACVIM-LA, Univ. of AZ College of Veterinary Medicine, Oro Valley, AZ. Published by John Wiley & Sons, Inc. 386 pages, 8.5" x 11". Hard cover, digital, e-book. ISBN hardcover 9781119583370. Color throughout. $175.00.

From the Publisher:

"Honey Bee Medicine for the Veterinary Practitioner offers an authoritative guide to honey bee health and hive management. Designed for veterinarians and other professionals, the book presents information useful for answering commonly asked questions and for facilitating hive examinations."

The book covers a wide range of topics including basic husbandry, equipment and safety, anatomy, genetics, the diagnosis and management of disease. It also includes up to date information on *Varroa* and other bee pests, introduces honey bee pharmacology and toxicology, and addresses native bee ecology. This new resource:

- Offers a guide to veterinary care of honey bees
- Provides information on basic husbandry, examination techniques, nutrition, and more
- Discusses how to successfully handle questions and 'hive calls'
- Includes helpful photographs, line drawings, tables, and graphs

Written for veterinary practitioners, veterinary students, veterinary technicians, scientists, and apiarists, Honey Bee Medicine for the Veterinary Practitioner is a comprehensive and practical book on honey bee health.

Yes, this is a very pricy book, and my guess is that there weren't very many printed because there aren't millions of veterinarians who will want this book. Hundreds perhaps, along with that many scientists and researchers. And, essentially, it is a text book. But, and this

Continued on Page 86

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ADVERTORIAL

HiveAlive Fondant Patty finally available in the US & Canada

Due to significant demand among beekeepers, Dara Scott & the HiveAlive team created a ready to feed fondant patty. **Fondant patties are an extremely easy way to feed bees and are particularly great for over-winter and early spring feeding when feeding syrup isn't possible.** This article will help explain how **HiveAlive fondant patties help prevent starvation of colonies and with the correct dose of HiveAlive and additional vitamins & amino acids key for honeybee health added can help ensure your bees come out strong and healthy in spring.**

"We have been shipping HiveAlive all over the world for the last 9 years and one of the things we got asked for a lot was a fondant that already had HiveAlive added to help with over-wintering success", says Scott. Scott is the founder and Managing Director of Advance Science, the company that developed and produces **HiveAlive, a liquid feed supplement for honeybees made in Ireland now sold in over 45 countries.** Dara Scott's passion for all things honeybee related began with a trip to New Zealand over 20 years ago. The physics graduate who had been working in medical diagnostics took a year out to explore New Zealand and became fascinated by the amount of beekeeping that was going on there and has been a beekeeper since.

He wanted to focus on developing a solution to improve the health of his bees and began work on developing HiveAlive. "I was lucky, **Ireland has some of the world's top seaweed experts**, so I got help from them in developing HiveAlive. **These scientists knew exactly what seaweed extracts to choose and instead of just mushing up whole seaweeds we developed special extraction techniques to give us super concentrated extracts containing all the anti-bacterial, anti-fungal, anti-viral and immune stimulatory properties that seaweeds naturally have along with a range of vitamins, minerals and amino acids."** Dara knew about the health benefits of seaweeds for humans and at the time they were just starting to be developed for animals. Now, **seaweeds are used commercially worldwide to reduce the need for antibiotics, boost the immune system and improve gut health**. He was intrigued to find out would the same benefits apply to bees. Through government supports Dara collaborated with scientists from several universities across Europe in developing and testing what would soon become HiveAlive.

His theory was correct. HiveAlive has since been tested in multiple field studies around the world. **Trials consistently show that feeding hives with HiveAlive makes the colonies more productive – they have more brood and more honey whilst maintaining low disease levels, in particular Nosema, and lower overwinter losses.** "To be honest, even if we could spend lots of money on marketing, the best marketing team we have are our beekeepers that give HiveAlive a proper try over a full year. **Despite the proof, people don't believe our claims when we tell them, but they believe them when their friends have seen it for themselves.** That is genuinely the most rewarding part of the job, when I go to shows and people tell us how much HiveAlive helps their beekeeping."

It was at beekeeping shows that the team first realised the demand that was out there for a fondant that contained HiveAlive so the team spent three years developing the most premium fondant possible**.** "We spent a lot of time making sure all the **ingredients used are of very high quality, the sugar particle size is small enough to ensure the bees can digest it easily** and it is produced using a special process to keep HMF negligible", says Scott. **The addition of HiveAlive ensures the health of the colony is maintained and the unique proprietary blend of vitamins and minerals further helps the bees through the winter months.** The team launched the fondant patty last fall in Europe and it was sold out by Christmas. Pre orders for this coming winter season from the US and Canada are already exceeding expectations.

The **HiveAlive Fondant Patties are packed in 2.2 lb individually sealed bags to ensure freshness, avoid fondant drying out and to make handling very quick, clean and easy.** It is put on top of the colony, either under or over the brood box, so no feeders are needed. By having the fondant directly over the cluster the bees do not have to leave the cluster to access food, minimizing the chance of starvation. Because **the bag is the flattest on the market it can easily be placed directly over the cluster**. The patties can also be used as an autumn feed but are mainly used as a top up over winter, when it is too cold to feed syrup, or in late winter when bees start running out of stores. The patties do not cause robbing like syrup can. **By using HiveAlive Fondant Patties you know you are giving your bees the best chance to survive the winter allowing them to emerge in the spring strong and healthy for a great productive year.**

For more information, visit www.usa.hivealivebees.com or enquire with your local beekeeping store.

BEE VET

Good Help Can Be Found

Dr. Tracy **Farone**

On a rare day off in mid-May, I went fishing with my family, ironically at Slippery Rock Creek. I found a beautiful tributary off the main stream and walked up the bank to a deep hole I found amongst the car-sized rocks. I had my eye on reaching a large flat rock in the middle of the stream, to plop down and go after a few trout. While traversing a few steps to get to my prized destination, my feet failed me, I slipped, wedged my knee between a rock and log and fell, tearing my anterior cruciate ligament (ACL) and smashing the tibia of my right leg. Even before the doctors' visits, X-rays, and the MRI, I knew instantly something was seriously wrong. One of my first thoughts was what am I going to do now? How am I going to work? Take care of my family? Build my house? Take care of my bees? Perhaps other beekeepers can relate to "What if I get hurt? How am I going to do life?" I certainly know several Beeks that have struggled through managing their yards with health problems and injuries.

Here is the good news . . . While surgery for an ACL repair can put you on your back for several weeks followed by months of rehab, my orthopedic doctor did not recommend surgery for me but instead said I was a good candidate for physical therapy rehabilitation. He said that in his experience and depending on the individual patient, ACL reconstructive surgery is often a mistake and may cause more harm than good. As a veterinarian, this concept made complete sense to me, but as a patient, I needed to hear it from my physician.

Benign Neglect

In veterinary and human medicine, we have a treatment called "benign neglect". It essentially means that as a medical professional, after evaluating a patient with a condition, we determine that the best course of action is to do really nothing (with perhaps just supportive care) and wait. Time and the amazing body often heals itself, if given the chance. "Above all else do no harm", "Go home, rest and drink plenty of fluids", "Take two aspirin and call me in the morning", and the placebo effect are all common illustrations of this approach. When diagnostics or treatments *are* started, we begin with the least or minimally invasive approach. For example, we may try medicines or therapy first, before surgery to address a certain condition. Less can be more in certain situations.

I know that I have preached before in other articles that it is essential for beekeepers to learn how to do a complete hive assessment or exam. That is still very true, however once you have learned how to do a complete hive inspection, you should also be learning when to stop. Risk assessment, risk vs. benefits, should be involved in everything you do in a hive. The why and the how of what you plan to do before opening a hive should be well defined. For example, if you find white wax and eggs do you really need to go through every frame to find the queen to confirm queen status? …maybe, maybe not. You can often gain information needed just by observing the exterior of the hive and entrance, just by "popping the top" and looking in, or simply pulling a few frames. The necessary extent of hive inspections may vary by season, hive/yard history, and the type of beekeeping operation. "Surgery" is not always needed. "Everything in moderation" applies to our invasive behaviors when working our hives, but it comes down to a (hopefully educated) judgement call by the beekeeper. As a beekeeper you may need to recruit some help from a seasoned beekeeper or veterinarian on what level of intervention your hive/s may need.

Normal fanning and foraging on a warm Summer day.

Helping each other and how beekeepers can help vets . . .

Every one of us needs help sometimes. From what I have seen, most beekeepers are pretty good at forming groups that lean on each other in tough times, but I believe this symbiotic relationship can be expanded. I have listened to the concerns that beekeepers have about the difficulty of finding a competent, local veterinarian to

help them. From the veterinary side I can share this: Currently, bee medicine curriculum in U.S. veterinary schools is being developed and delivered, more honey bee veterinary textbooks and references are being created, hundreds of hours of honey bee continuing education for practicing veterinarians have been developed and delivered, and a bee vet certification program is under development. In previous articles, I have shared ways veterinarians can be of service to honey bees and their keepers, but how can beekeepers get involved on our end? Here are a few action steps beekeepers can take to help veterinarians.

1. Invite your local veterinarian/s to your beeyard to shadow you.
2. Invite your local veterinarian/s to your beekeeping meetings. Most may say "no", but you only need one in your area to take care of the local bees.
3. Reach out to local Veterinary Medical Associations (VMAs). Like beekeeping clubs, most states have state and/or regional veterinary associations. Most VMAs are very interested in learning more about bees and working with beekeepers.

Swarm cells warrant further investigation.

4. Reach out to your state Department of Agriculture (DA). Most states have apiarist/s and state veterinarians working at the DA. These groups have started more conversations lately and may have resources available for you or be interested in collaborations.

These help suggestions do not have to be as difficult as "surgery" but simply provide supportive care for a healthy, symbiotic relationship.

As for me and my broken knee, luckily, I have "paid it forward" by previously allowing a neighborhood teenager to shadow me at my home beeyard and I have two trained Summer research college students to help me do much of the "heavy lifting" around the College yard this Summer. BC

Are Your Colonies Ready to Overwinter?

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

Successfully overwintering your colonies can be a complicated task. From large commercial operations to backyard hives, beekeepers need to prepare for wintering in the heat of the summer. Seasoned beekeeper, Tom Nolan shares his key steps to getting bees ready for winter—so you can be cracking into stronger, healthier colonies in the spring!

1. MONITOR MITE LEVELS

Determining your colonies' mite counts is critical to inform if you should treat before the winter brood is produced. Ideally, mite counts should be performed monthly. Use a simple alcohol wash, sampling from a frame with older larva (just before capping) to get the best example of a hive's mite count. The typical threshold to prompt treatment is 1-3% infestation—about 3 to 9 mites in a sample of 300 bees.

2. TREAT FOR VARROA MITES

Flexibility is key for fall treatment. *Mite Away Quick Strips™ (MAQS)* and *Formic Pro™* allow you to treat at end of the honey flow (2-3 brood cycles before Queen goes off-lay), while the last super is still on. The ready-to-use strips make for easy application and quick treatment periods. *MAQS* and *Formic Pro* are all-natural products made with formic acid, killing Varroa mites in the dispersal phase (phoretic) that are found on adult bees and mites under the brood cap, where they reproduce.

3. ENSURE PROPER FEED

Providing your colonies with amble feed stores is essential to keep honey bees healthy over winter. You should commence feeding after your last honey pull, in late summer or early fall. There are a variety of feeders available, 2:1 liquid sucrose in a bucket top feeder is a tried-and-true method for overwintering. Remember: do not feed during *Formic Pro* or *MAQS* treatment period and ensure hives are well-fed before winter wrapping.

4. WRAP YOUR HIVES WELL

Bee Cozy™ Winter Hive Wraps prevent unnecessary heat loss, conserving feed stores over the winter and assisting your bees to brood up faster—so you can split earlier in the spring and be ready for the honey flow. Wrap once temperatures are consistently below cluster point (50°F/10°C), and remove when temps are consistently above cluster point and the possibility of snap freezes have passed.

Watch How-To Videos at youtube.com/NODApiaryProducts

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Want to hear more?

Contact us to book Tom as a guest speaker for your Bee Association:

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Learn more about *Mite Away Quick Strips, Formic Pro* & *Bee Cozy Winter Hive Wraps* at www.nodglobal.com

History Is Hints And Scraps

John **Miller**

"History is hints and scraps of a former self." It's not my quote; but I know a good quote when I steal it. Actually, there is a bit more to this flip remark. In my business, if someone steals or plagiarizes my work I take it as a compliment!

American Beekeeping in 2021 is the product of a history. North American Keepers of bees are today here because some lost to history figure took a risk. How on earth did this anonymous historical figure prepare the first hive[s] – to cross the Atlantic – in a creaky tub not much bigger than todays muni-bus? Were other pilgrims ok with this basket of stinging insects? Was it a single hive, upon which the traveler bet everything? Or were more than a couple skeps involved? And on that Atlantic hop – the lethal cleansing flight on an open ocean – how did that go?

The re-introduction of honey bees went reasonably well, and hundreds of thousands of us mesmerized by bees enjoy the labor of this historical figure. We have only a hint and a scrap of who, or why, or when honey bees were re-introduced. And what great calamity befell the earlier amber entombed honey bees? Was it the Caribbean Meteor? Was it a pre-historic ice-age?

Americans aren't good at history. We should be.

Here is a scrap: Out here in Dakota Country we pay a lot of attention to the weather. Weather can turn on a dime. A 2004 book titled "The Children's Blizzard", by David Laskin documents a fierce blizzard that caught and killed hundreds of North Dakota children walking home from school one weirdly balmy, deadly day, January 12, 1888.

More recently, snow totals during the 60s averaged 34" in Fargo. During the 70's, snow totals averaged 44". During the 80's, snow totals fell slightly. But during the 90's [including an ice-cap creating 1996 & '97] averages were 58" for the decade.

Does this trivial scrap have value?

In 1988 N.D. endured a drought. Amazingly, we harvested 80 pounds of honey per hive that year. I was discouraged. In 1989, the drought persisted, and it took beekeepers out. Thirty-two years later – in 2021 we are in a drought. It's ugly. This time around, though, Facebook Commercial Beekeepers page lends near real-time transparency to the situation. Beekeepers with bees to lease posted loads of bees ready to go to Dakota. I was struck with two truths. Those Dakotians keeping bees very well remember the 1988-89 bruise; or if not yet in the bee business – avoided a historic bruise. A beekeeper I know very well lost his outfit, his marriage; and ended up on the night shift in a bottling plant. History repeats.

What about our recent beekeeping history? The Bee Informed Project has over a decade of historic data on how well we husband our hives. Whether we run 8; 80; 800; or 80,000 hives – we've consistently, annually killed 30-50% of our hives – *for over a decade.* Every beekeeper has access to the data. Every beekeeper also has access to improved *Varroa destructor* controls. We no longer have to repeat recent history. We don't. But this is beekeeping. And sometimes beekeeping can feel like a donkey caught in a hail storm – we just stand there and take it.

"Those who don't study history are doomed to repeat it. Yet those who *do* study history are doomed to stand by helplessly while everyone else repeats it."

I'm encouraged by the glycerin/oxalic pad. The recipe is a gift from Randy Oliver. I've spent time in the bees with Randy O., running hard to keep up with that relentlessly curious mind.

I've also read scientific papers that slowly, incrementally opened new ideas and original thinking to improve beekeeper success.

History teaches us that challenges that vexed my great-grandfather [American Foul Brood] were solved by antibiotics. Devastating spray kill losses taught me there had to be a better way to control pests than organo-phosphates & her deadly cousin the carbamates. I am hopeful the 2021-22 BIPster data set documents improved beehive survival.

All this modern science I don't understand. Crisper is breakfast cereal, right? I think History will tell my grandchildren that this era was a golden time for discovery, and treatment, husbandry, and beekeeping success.

Is there anything more rewarding than opening a hive? Yes. Opening a healthy, robust colony and deeply sensing healthy brood, prosperity, health, well-being – and it is reaffirming. We have hints and scraps from many who came before us, who shared this passion for bees.

Lastly, an appreciation for our friend Lee Heine of Wisconsin. A brother in arms, Lee works to make the industry stronger, friendships deeper, service better. Safe travels my friend. You are a powerful example. BC

FOUND IN TRANSLATION

Social Thoughts

Jay **Evans**, USDA Beltsville Bee Lab

Honey bees, like other social insects, think both for themselves and for their colonies. All animals have a degree of awareness of their surroundings and most find a need to communicate within their species. Honey bees carry this to an extreme in that they must be highly communicative in the colony, and highly coordinated with their nestmates. How these social pressures shape the bee brain is a fascinating topic and one that has practical implications for beekeepers. To cut to the chase, honey bees are really VERY smart for an insect. You might predict that an organism with tens of thousands of others backing them up would get a little soft in the head. In fact, by conventional metrics the honey bee brain is remarkable, if a little skewed towards memory and communication.

Chelsea Cook and colleagues at Arizona State University (and now Marquette University for her) conducted a series of experiments to determine some boundaries of bee learning and the genetic variation across bees in their learning styles. In their freely available paper "Individual learning phenotypes drive collective behavior" (*Proceedings of the National Academy of Sciences, USA, 2020, vol. 117, pages 1*7949–17956*;* **https://www.pnas.org/content/117/30/17949**), they focused on how bees discriminate between what is important and what can be ignored. In studies of animal behavior, the formal term for this is Latent Inhibition or LI. In practice, it is the ability of an animal to ignore unimportant stimuli, saving energy and brain cells for the things that really matter. Hi-LI individuals, from bees to humans, have an innate sense of what they want and have blinders of sorts for the many other shiny objects they click, crawl, walk, or fly past. They do so at the expense of not benefitting from certain novel experiences.

The group has established that LI is variable across bees, and that the levels of this trait can be increased or decreased by selection. For this paper, they went further and bred bees showing each extreme via artificial insemination with single drones. Fortunately, LI can be measured in queens and drones, as well as in workers. LI was assessed by strapping bees into small seatbelts, offering stimuli and measuring the abilities of bees to favor familiar stimuli via the 'Proboscis extension response' (PER). PER is widely used in bee behavioral studies to show how well bees learn and remember cues. It is a simple test that can be used to compare the abilities of bees against each other, other insects, and even mice and teenagers. After testing individual queens and drones using PER, the researchers banked the queens that were outliers showing high or low LI, and also banked the sperm of the males that passed or failed the LI test. With human assistance, Hi-LI sperm met with Hi-LI queens while Low-LI sperm met with Low-LI queens.

Eventually, these scientists established six super colonies that were selected to be faithful to only certain cues in the environment (Hi-LI), six colonies whose progeny were in some ways more open to new adventures (low-LI), six colonies with a mix of both types of workers, and six colonies that were controls not selected in either direction. Control bees were also added to the 18 selected colonies, to give the high and low LI bees some more nestmates.

Happily, bees whose parents had shown Hi-LI and Low-LI traits faithfully represented those traits. This was not surprising after their prior studies but probably a huge relief after all the work to identify, propagate, and measure hundreds of bees. What really sets this paper apart is the ensuing effort to see how bees with these tendencies behave in a real-world setting, and nothing is more real-world for middle-aged worker bees than foraging. Bees from

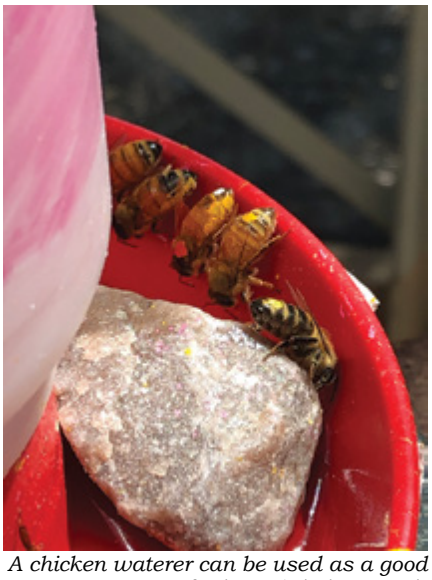
(A)

(B)

each colony were set up in their own flight tents and were trained to four sweet bait stations. Thanks to a shell game of sorts where baits were added to the bee's world over several days, one of these stations was 'familiar' to bees while the rest were 'novel' food sources. As expected, the Hi-LI bees, having found a good thing on day 1, were pretty content recruiting to and feeding from that same feeder even as the other three popped up. Their fidelity led to a ten-fold higher visitation rate to the familiar feeder versus novel ones. In contrast, 'Low-LI' bees visited the novel feeders at an equal rate to the original familiar station. What about when Hi-LI and Low-LI bees were mixed together? In these cases, bees still visited the familiar feeders at a higher rate than bees from Low-LI or even control colonies. What drove that? It turns out the Low-LI bees and even control bees in those mixed colonies acquired a preference for familiarity. This insight was gained after painting hundreds of bees of each type distinct colors, so a Hi-LI bee was identifiable, as were Low-LI and control bees. If you have spent so much time identifying traits, consummating bee pairings, and establishing field feeding trials, painting hundreds of bees is a piece of cake and it paid off.

To ice the mechanism for this social shift, and bring even more colony (and possibly beekeeper) relevance to these studies, the researchers also watched individual bees as they danced to recruit others to the food sources. Since distances were short, foragers recruited using the round dance, not the waggle dance, so some information on recruitment preference was lost. However, the bees did show different recruiting skills and energies. Hi-LI bees had significantly more followers for their dances. Not surprisingly, this spurred hi-LI nestmates to forage more often overall and when those nestmates were low-LI to still express a preference for the familiar feeder. Low-LI bees danced often, but to smaller audiences. Future work will have to resolve this relative difference in popularity, but as one hint to the mechanism Hi-LI bees were able to shake out more turns per second than Low-LI bees, and this shaking seems to have swayed their nestmate judges. Overall, these experiments show how a behavioral trait that is fairly abstract (responses to sugar and cues in a lab setting) can be used both to change things at the colony level via breeding and to give insights into how the tendencies of individual bees are converted into colony level behaviors.

This study highlights how the remarkable brain of the honey bee can be shaped by breeding and how that shaping translates into health and behavior at the colony level. If you want to expand your OWN brain with some discussions about how the colony itself can think like a superorganism you will like a long review by Takao Sasaki and Stephen Pratt "The Psychology of Superorganisms: Collective Decision Making by Insect Societies" in the *Annual Review of Entomology* (2018, vol. 63:259-75, **https://doi.org/10.1146/annurev-ento-020117-043249**). Here the authors make some pretty bold claims for how colony-level dynamics, reflecting feedback by colony members and stimuli from inside and out, are so predictable that they can be thought of in many ways like individual behaviors. Thinking of the colony as a superorganism is not new, and many will have read efforts on this topic by honey bee scientists such as Thomas Seeley and his students, but actually placing colony behaviors into the more rigorous (hopefully) context of psychology is definitely a page turner. Get out and find some novel feeders. BC



A chicken waterer can be used as a good water source for bees. (Chelsea Cook photo)

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A Brave New Solution for Beekeepers from Apiary Book

We've all read the disturbing reports pointing out that nearly a quarter of all known bee species haven't been seen for more than 30 years. It's also common knowledge why we've seen a rapid decline of bee populations and other pollinators across the globe. In the aftermath, researchers concluded that climate change, loss of pollinator habitat to human development, and the growing use of insecticides, including neonicotinoid, are the primary drivers of declining bee numbers. If you ask a beekeeper, he or she will surely add to the list a multitude of other reasons: from mites and viruses, bacteria, fungi, to failing queens, pests and invasive species, such as Vespa Velutina (Asian Hornet).

In the increasingly complex world of beekeeping, someone new to the craft can be easily dissuaded to give it up before seeing any worthwhile results. Not everyone has what it takes to succeed with honey bees. There's a long and hard learning curve, a notable investment needed to get started, not to mention the time and energy that each beekeeper willingly donates. If you are considering to become a beekeeper or maybe thinking of scaling up your beekeeping business, there's one thing you can't do without: accurate and real-time data that helps you take better-informed decisions in a timely manner.

Our mission: Better-Informed Beekeepers

Modern beekeeping comes with many challenges, but the community of beekeepers has already developed solutions to many of them. Take for example one common activity we all do as beekeepers: recording our work done in the apiary, whether it is treatments or hive inspections, feedings or queen rearing tasks, jotting down equipment inventory and to-do lists or reminders. All this information and more can be easily logged into an apiary management application installed on your smartphone. Forget about the pen-and-paper or traditional way of doing things, step into the future to reap the benefits of technology!

Apiary Book is one of the most popular beekeeping apps available today, being downloaded

over 200,000 times on **Google Play Store,** used by tens of thousands monthly active beekeepers, and recently **launched for iOS** devices too. Translated into 19 languages with the help beekeepers from all over the world, Apiary Book has been improved and fine-tuned over time through the feedback received from our users – the beekeepers.

Apiary Book's story began 7 years ago, when Bogdan Iordache, a passionate software developer with more than 2 decades of experience, started his beekeeping journey. His mission? To help beekeepers worldwide make better informed decisions based on historical data, current weather conditions and best practices. Today, Apiary Book has a big online community of beekeepers and a strong team that continuously works on creating the best beekeeping solution in the market.

A Solution for Beginners and Professional Beekeepers

Broadly defined, Apiary Book is a solution for managing beekeeping activities in the apiary, for monitoring beehives and analyzing data of bee colonies and environmental factors affecting their health. Specifically, how does it help beekeepers?

It is an application where you can record and log in every detail about your hives and bee colonies. For each hive created in the app, you can add a variety of details, such as: location, number and types of frames, origin, description, bee family strength, queen bee breed, origin and state. Furthermore, you can easily identify hives in your apiary and see your recorded information, by creating and printing a QR code or by using NFC tags.

Apiary Book keeps accurate and up-to-date records of your activity in the apiary, such as treatments you performed or feedings, observations from your inspections, like if you found Varroa mites, colony movements for when you're traveling, veterinary checks, queen rearing tasks and more. Nothing is overlooked. There's even a hands-free **Voice Action** feature that assists you when you're all suited up and cannot use your gloved hands to type in your observations. Simply use your voice to record information while working.

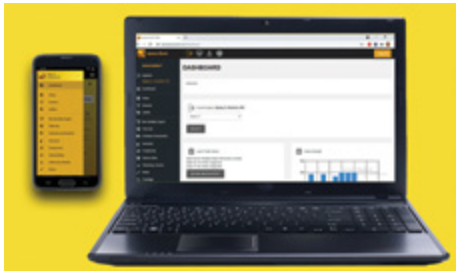
The app also helps you organize and manage your beekeeping activity in a way that improves productivity and cuts costs. Thus, you have access to localized weather information in order to plan activities when the weather is optimal and you can create reminders, so that you don't forget what to do next and when. Whether you need to keep track of your expenses and acquisitions or create a beekeeping inventory and to-do lists, you can rest assured that we have you covered.

With Apiary Book you get access to know-how from all over the world. Our knowledge base includes best beekeeping practices, insights from our community and personalized recommendations. Based on the information recorded by you in the app, the Assistant feature extracts useful data and sends you recommendations and insights that are specific to your situation.

You can connect with other beekeepers and get valuable advice. You can either **send them a personal message** through the app and ask for advice, or better yet, you can talk with a mentor from our **Mentorship** program. Our mentors are beekeepers with extensive experience, who are currently successfully managing their apiaries and making a living out of beekeeping. Whether you don't know how to apply treatments correctly, detect early signs of varroa in your hive or catch a swarm of nearby bees, it's good to know that you can always rely on their advice.

Cloud Sync allows you to **access your apiary data from different devices.** So that you can record your activities on your smartphone when you're working in your apiary, sync the data to the cloud and access your apiary data on your laptop/computer/tablet when you are at home.

There are many others features that come with the Apiary Book solution and that have been developed with beekeepers' needs in mind. To discover them all, download Apiary Book for **Android** and **iOS**, or go to our **website https://www.apiarybook.com**. While



most features are free to use, there are others that can only be accessed if a **Pro Subscription** is paid. Users can opt for 2 types of subscriptions, either for 1 year or for 6 months.

In the end, our objectives are: to increase beekeepers' general knowledge about bees, to raise awareness regarding potential threats to bees' health, to promote a set of good management practices and to facilitate communication between beekeepers.

A Closer LOOK

TASTE PERCEPTION

Clarence **Collison**

Honey Bee Chemosensory Organs

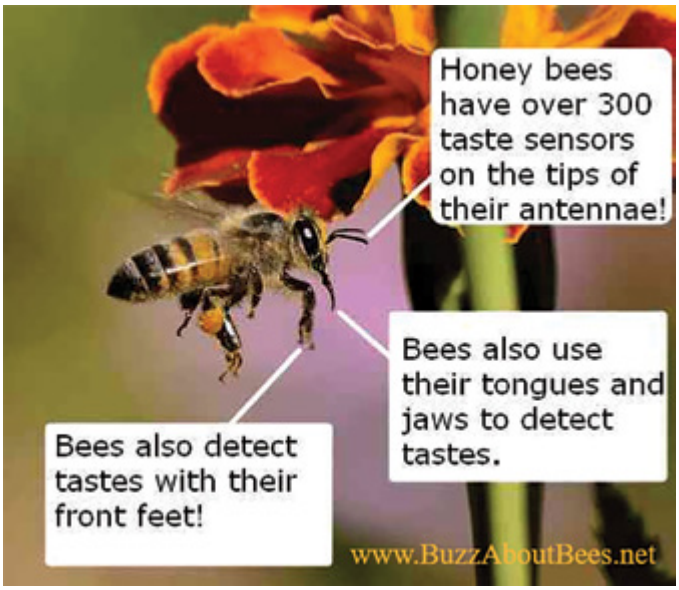
"Taste is crucial for honey bees for choosing profitable food sources, resins, water sources, and for nestmate recognition. Peripheral taste detection occurs within cuticular hairs, the chaotic and basiconic sensilla, which host gustatory receptor cells and, usually a mechanoreceptor cell. Gustatory sensilla are mostly located on the distal segment of the antennae, on the mouthparts, and on the tarsi of the forelegs. These sensilla respond with varying sensitivity to sugars, salts, and possibly amino acids, proteins and water. So far, no responses of receptor cells to bitter substances were found although inhibitory effects of these substances on sucrose receptor cells could be recorded. When bees are free to express avoidance behaviors, they reject highly concentrated bitter and saline solutions. However, such avoidance disappears when bees are immobilized in the laboratory. In this case, they ingest these solutions, even if they suffer afterward a malaise-like state or even die from such ingestion. Central processing of taste occurs mainly in the subesophageal ganglion, but the nature of this processing remains unknown (De Brito Sanchez 2011)."

"In the honey bee, the antennae, mouthparts and tarsi of the forelegs constitute the main chemosensory organs (Goodman 2003). They include gustatory but also hygro, thermo, mechanosensory and olfactory receptors. Gustatory receptor cells on these structures are located within specialized cuticular structures called sensillae, which often take the form of hairs (chaotic sensillae) or pegs (basiconic sensillae) (Esslen and Kaisslin 1976). These sensillae have a characteristic aperture at the apex through which gustatory substances can penetrate after contacting the hair or peg (contrarily to olfactory sensillae whose walls are covered by tiny pores which allow the diffusion of olfactory molecules). Gustatory receptor cells innervate each sensilla and bathe in a receptor hemolymph. Each neuron projects a dendritic branch up the shaft of the hair or peg to the apex. Such a branch – and there may be three to five per sensilla, corresponding to three to five gustatory receptor neurons – bears the molecular receptors to which a gustatory substance will bind if it is the appropriate molecule for these receptors. Such receptors are G-protein coupled proteins. In some cases, a mechanoreceptor cell terminating at the base of the shaft can also be found. This neuron is stimulated not by gustatory stimuli but by movement of the sensilla. As gustatory organs have to explore and manipulate food, evaluating the position and density of the food is facilitated by the presence of mechanoreceptor cells associated with gustatory receptor cells within the same sensilla. Gustatory molecules arrive to the molecular receptors on the membrane of the gustatory neuron through passive diffusion in the hemolymph of the sensilla, or through active transport by carrier proteins. When a gustatory molecule binds to a molecular receptor, the receptor cell depolarizes and, if the magnitude of the receptor potential is enough, an action potential is generated. The gustatory message is then relayed to the central nervous system where it is processed in the subesophageal ganglion (De Brito Sanchez et al. 2007)."

"Taste sensillae can be found essentially on the antennae, mouthparts and legs of a honey bee (Whitehead and Larsen 1976a). On the antennae, gustatory sensillae can be localized on the segment that constitute the flagellum and on the tip. On the mouthparts, they can be localized on the proboscis (formed by the maxillae and the labium), the glossa, the labial palps and the galeae of the maxilla. On the legs, they have been reported on the tarsus and pretarsus of the forelegs. The tarsi of the mid- and hindlegs also bear taste sensillae but these have been poorly characterized (Frings and Frings 1949). So far, research on gustatory function in bees has focused on these body appendages. However, gustatory receptors could be situated in unsuspected parts of the body. For instance, such receptors could be found in the oral cavity and in the crop. Such internal receptors could act as molecule counters allowing the estimation of the intake rate of gustatory stimuli such as sucrose. In this case, they would allow a concrete estimation of food source profitability. Gustatory sensillae play an important role in appetitive food sensing as shown by the fact that stimulation of antennae, tarsi and mouth parts with sucrose solution elicits the so-called proboscis extension reflex (PER) (Takeda 1961; Bitterman et al. 1983). Gustatory sweet receptors on the antennae are more sensitive than those of the legs as shown by the

fact that bees extend the proboscis to sucrose solution at a threshold concentration of 2.85% if applied to the antennae, and of 34.23% if applied to the tarsi (Marshall 1935). At the central level, a unique neuron, VUMmx1 (initials of Ventral Unpaired Median maxillar1 neuron) whose cell body can be found in the maxillary neuromere of the subesophageal ganglion (De Brito Sanchez et al. 2007)."

"Taste plays a crucial role in the life of honey bees as their survival depends on the collection and intake of nectar and pollen, and other natural products. De Brito Sanchez et al. (2014) studied the tarsal taste of honey bees through a series of behavioral and electrophysiological analyses. They characterized responsiveness to various sweet, salty and bitter tastants delivered to gustatory sensilla of the fore tarsi. Behavioral experiments showed that stimulation of opposite fore tarsi with sucrose and bitter substances or water yielded different outcomes depending on the stimulation sequence. When sucrose was applied first, thereby eliciting proboscis extension, no bitter substance could induce proboscis retraction, thus suggesting that the primacy of sucrose stimulation induced a central excitatory state. When bitter substances or water were applied first, sucrose stimulation could still elicit proboscis extension but to a lower level, thus suggesting central inhibition based on contradictory gustatory input on opposite tarsi. Electrophysiological experiments showed that receptor cells in the gustatory sensilla of the tarsomeres are highly sensitive to saline solutions at low concentrations. No evidence for receptors responding specifically to sucrose or to bitter substances was found in these sensilla. Receptor cells in the gustatory sensilla of the claws are highly sensitive to sucrose. Although bees do not possess dedicated bitter-taste receptors in the tarsi, indirect bitter detection is possible because bitter tastes inhibit sucrose receptor cells of the claws when mixed with sucrose solution."



"The gustatory **sensilla**, which are composed of cuticular hair, respond to sugars, salts, and amino acids. In the **honey bee**, although sugar detection is a crucial factor in determining the acceptability of nectar and **pollen** for collection, little is known about the molecular and neural correlates underlying sugar perception. Jung et al. (2015) determined that gustatory receptor 1 of *Apis mellifera* (AmGr1) responded to sucrose, glucose, **trehalose**, and **maltose** in a dose-dependent manner. AmGr1 showed full functionality, but it showed different sensitivity from a heterodimer (a protein composed of two polypeptide chains differing in composition in the order, number, or kind of their amino acid residues) of AmGr1 and AmGr2. That is, co-expression of AmGr1 and AmGr2 demonstrated higher sensitivity to glucose and lower sensitivity to sucrose, trehalose, and maltose compared with AmGr1 expression alone. AmGr1 and AmGr2 were co-localized or not in the antennal neurons, and especially AmGr1 was highly expressed at the distal segment of the antennae. This study suggests that sugar receptors of the honey bee function as heterodimers (or monomer or mono-dimers), indicating that AmGr2 is required for providing honey bees with variability of sugar perceptions (Jung et al. 2015)."

"De Brito Sanchez et al. (2005) combined behavioral and electrophysiological experiments to study whether bitter taste is perceived at the antennal level in honey bees. Their behavioral studies showed that neither quinine nor salicin delivered at one antenna at different concentrations induced a retraction of the proboscis once it was extended in response to 1 M sucrose solution delivered to the opposite antenna. Bees that extended massively their proboscis to 1 M sucrose responded only partically when stimulated with a mixture of 1 M sucrose and 100 mM quinine. The mixture of 1 M sucrose and 100 mM salicin had no such suppressive effect. No behavioral suppression was found for mixtures of salt solution and either bitter substance. Electrophysiological recordings of taste sensillae at the antennal tip revealed sensillae that responded specifically either to sucrose or salt solutions, but none responded to the bitter substances quinine and salicin at the different concentrations tested. The electrophysiological responses of sensillae to 15 mM sucrose solution were inhibited by a mixture of 15 mM sucrose and 0.1 mM quinine, but not by a mixture of 15 mM sucrose and 0.1 mM salicin. The responses of sensillae to 50 mM NaCl were reduced by a mixture of 50 mM NaCl and 1 mM quinine but not by a mixture of 50 mM NaCl and 1 mM salicin. They concluded that no receptor cells for the bitter substances tested, exist at the level of the antennal tip of the honey bee and that antennal bitter taste is not represented as a separate perceptual quality."

"Besides foraging for nectar and pollen, bees collect water and in this context they respond to salts and indeed electrophysiological responses to salts (NaCl, KCl, LiCl) have been measured (Whitehead and Larsen 1976ab; De Brito Sanchez et al. 2005) both at the level of the mouthparts and antennae. Additionally, bees collect resin for elaborating propolis and then should taste several compounds such as prenylated and non-prenylated phenylpropanoids, terpenoids and anthracene derivatives, which have been identified in the resin loads transported in the corbiculae (Weinstein Texeira et al. 2005) (De Brito Sanchez 2007)."

Research has shown that both the sense of taste and odor perception are strongly associated with foraging behavior, learning and memory. "Honey bees forage by using their sense of smell and returning to floral odors that they have previously learned to associate with high-quality food rewards. Foraging bees communicate with other bees in the hive about food sources by exchanging chemical and locational information. It is well established that bees transfer non-volatile information regarding taste and quality of nectar via trophallaxis and communicate location information via directional dances. However, volatiles carried by returning forager bees on their bodies has not been explored as another source of chemical information. Mas et al. 2020 investigated the cuticular-absorbed odors of bees when foraging on three different crops and compared their odors with the crops' flower headspace. They found that cuticular extracts were in majority correlated with the flower headspace where bees were foraging, specific to the crop and field. Their results support the hypothesis that the scent of returning forager bees can be communicated to hive mates and is associated with information about current floral resources. Some of the floral volatiles that they identified in bee extracts have been previously found to be key compounds learned from the crop, thus supporting a mechanism for the selection of decisive compounds."

"The level of response of sugar plays a role in many aspects of honey bee behavior including age dependent polyethism and division of labor. Bees may tune their sensitivity to sugars so that they maximize collection of high quality nectar, but they must also be able to collect from less profitable sources when high quality food is scarce. However, the mechanisms by which bees change their responsiveness to different sugars remains incomplete. To investigate the plasticity of sensitivity to sugar, bees were raised on different sugars either in vitro or in colonies. Bees raised in the incubator on diets containing mostly either fructose or glucose showed significantly more responsiveness to the majority sugar. In contrast, bees raised in colonies that only foraged on fructose or glucose responded equally well to both sugars. These data suggest that developmental plasticity for responses to sugar is masked by the feeding of worker jelly to larvae and young bees. The production of worker jelly from secretions of the hypopharyngeal and mandibular glands by nurse bees ensures that both glucose and fructose are experienced by young bees so that they respond to both sugars and will be able to exploit all future food sources (Mustard et al. 2019)."

"Honey bees will learn to respond to an odor when their antennae are stimulated with sucrose, even if they are not fed during the conditioning phase. However, if they are not fed, the memory of this association is significantly reduced 24 hours after conditioning. These results suggest that stimulation of proboscis with sucrose and/or the nutritional quality of the reward plays an important role in establishing a long lasting memory. Three sugars, xylose, sorbitol and mannitol, are used to investigate the relationship among learning, sensory perception and nutritional value. The proboscis extension reflex is used to show that honey bees cannot taste these sugars, whereas mortality data suggest that bees can metabolize all three sugars. Feeding with sorbitol or xylose during olfactory associative conditioning restores

robust 24 hour memories. However, when given a free choice between consuming sucrose alone or sucrose supplemented with these nutritional sugars, bees did not show a preference for food containing the higher nutritional content. Furthermore, bees did not ingest solutions containing only the tasteless sugar even when it was the only food source. Together, these results suggest that nutritional content and not just sensory information is important for establishing long term memories, but that bees may not be able to assess nutritional content when it is disassociated from taste (Mustard et al. 2018)." BC

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

Going For A Ride

How Bees Carrying Fungi Are Protecting Agroecosystems

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

In recent years, the global decline in pollinator populations has received a great deal of media attention. Since the 1970s, the decline of bees has been increasingly associated with pesticide use in agriculture, as well as other factors such as habitat destruction and climate change[1,2]. Pollinators play a crucial role in human food production that is mutually beneficial for the pollinators and crops. In many agricultural systems, managed pollinators such as honey bees and bumblebees ensure an abundant harvest. An innovative technology, apivectoring, uses the symbiotic relationship between bees and crops to improve the health of both crops and pollinators.

As managed bees fly from flower to flower, collecting nectar and pollen, they may pick up nasty hitchhikers, such as pathogenic microbes, which can cause harm to their colony and other wild pollinators, or may spread diseases throughout an agroecosystem. On the other hand, managed bees also supply pollination services and can even bring along friendly hitchhikers such as beneficial microscopic fungi that protect crops from pests and disease.

Employing the natural enemies of a pest or disease organism that harms crops can be part of a farmer's arsenal of crop protection tools. These natural enemies, referred to as biological control agents, can include fungi, parasitic wasps, nematodes, and viruses[3]. Biological control agents are an increasingly popular alternative to chemical crop protectants that can deteriorate ecosystem health and drive pesticide-resistance in pests[3].

Fungi are commonly used biological control agents as they are already naturally found on farms and can be highly effective against both pests and disease. Soil fungi can control pests by growing directly on them, simultaneously using mechanical pressure and enzymes to weaken the target insect's outer coat, allowing the fungus to penetrate the cuticle and kill the host after colonization[3]. This multi-pronged attack greatly decreases the chance of pest and disease resistance when compared to chemical pesticide methods.

Apivectoring: Innovating agricultural systems

While biological control agents have slowly become more commonplace in organic and IPM programs, their application method has mimicked traditional crop treatments using spray and soil applications. Why not use the same pollinators that are already visiting every flower to do the farmers' work and protect the crops from disease? Apivectoring uses managed pollinators as vectors to distribute biological control agents, particularly fungi, which are small enough to be easily carried by honey bees and bumble bees[3]. Figure 1 shows a bee visiting a strawberry flower dusted with fungal spores to protect against grey mold. Figure 2 shows a dead *Lygus* bug killed by infection of the soil-fungus *Beauveria bassiana.*

Besides improving the agroecosystem for both plants and pollinators, apivectoring also supplies economic benefits to farmers. It can lead to increased profits by producing a higher quality and quantity of crops due to the joint services of pollination and biological control agents[2], reduced fuel and water use, and decreased use of heavy machinery. Apivectoring is also efficient. Smaller amounts of biological control agents can be directly delivered to flowers where they are needed, thanks to the bees. Apivectoring uniformly distributes biological control agents and provides continuous crop protection during flowering, translating to an economically efficient crop protection method[3,4].

Importantly, apivectoring is an option in both conventional and organic farming. The implementation of apivectoring has occurred worldwide, in the Americas, Europe, Australia, New Zealand and Kenya[3]. There is a multitude of tested crops that benefit from apivectoring. Notably, fungi carried by bees prevent serious mold growth on strawberries, raspberries, and blueberries[3]. Apivectoring works well in greenhouses with bumble bees and has successfully targeted pathogens and insect pests on greenhouse-grown tomatoes and peppers. Other crops protected by apivectoring include field oilseed products such as sunflowers and canola. Apivectoring can also be used to fight coffee berry borer and other coffee pests, as proven in studies from Brazil and Mexico [3].

Registration of biological control agents for use in apivectoring has begun in several countries due to the thorough work of researchers showing that this

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Figure 2. *Each dead Lygus was kept on moist filter paper in a Petri dish and stored in the dark for 7 days to monitor disease (mycosis). The dead Lygus with white mycelia growth were scored as killed by the soil fungus B. bassiana.* Photo credit: Peter Kevan, used with permission.

technology is safe for insect vectors, the environment, and human consumption[3,4]. Government input and support is needed to implement apivectoring technology and its many benefits.

In 2019, the First International Advanced Course on Using Managed Pollinators for Dissemination of Biological Control Agents for Suppression of Insect, Fungal and Other Pests of Crops was hosted at the University of Belgrade, Serbia. The course was co-sponsored by the International Commission for Plant-Pollinator Relationships (ICPPR) which has significantly contributed to the research and development of apivectoring technology. The ICPPR assembled apivectoring experts from around the world to share their findings and methods using this novel technology. Their collaborative effort will hopefully result in the successful adaptation of apivectoring into farming communities globally.

How will apivectoring impact beekeepers? In addition to honey and crop pollination, in the future, beekeepers will be able to offer farmers crop protection through apivectoring. As the bees are very efficient at delivering biological controls, most crops only need a low hive stocking density. The expertise of beekeepers will be needed to maintain the beehives and manage the biological control agents. A bonus to beekeepers is that preliminary studies suggest that the health of honey bee colonies could also benefit from apivectoring.

At the University of Guelph in Ontario, Canada, the Peter Kevan Lab is currently investigating apivectoring to crops and into honey bee hives using biological control agents already approved for use on crops. For those interested in learning more about apivectoring, please contact the International Organisation for Biological Control (IOBC), the International Commission for Plant Pollinator Relations (ICPPR) (**https://www.icppr.com/**), the Peter Kevan lab website (link) or visit the Weston Project website (**https://www.facebook.com/2020BeeVectoring**). BC

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FLORIDA STATE SCIENCE FAIR

Atreya **Manaswi**

Most teens favor dogs, cats, or maybe fish. Atreya Manaswi, a 9th grader from Orlando, Florida, prefers a very different creature: *Apis mellifera*, the honey bee. In fact, after two successful research projects, Atreya is determined to save the world's honey bees from demise. "I think it can be easy to overlook such a small animal. But the truth is that we all need them," claims Atreya.

Manaswi can eloquently expound on how bees pollinate 80% of global crop supply and how important bees are to Earth's ecosystems and biodiversity. "Bees are dying across the globe, and more attention needs to be drawn towards this crisis. We can't afford to lose them," he explains.

Captivated by honey bees, Atreya attended the South Florida Bee College where he met Dr. Jamie Ellis, a Professor at the University of Florida Honey Bee Research and Extension Laboratory who specializes in honey bee husbandry, ecology, and conservation.

Atreya conducted his first-year project on bee nutrition where he ran a choice-test on popular commercial protein (pollen) supplements to help commercial beekeepers determine a suitable replacement in times of pollen unavailability. His findings indicated that AP23 is the most preferred protein supplement brand for honey bees.

For his second-year project, he decided to tackle a devastating predator of the honey bee, the small hive beetle. Discovered in the U.S. only two decades ago, this pest species continues to spread across the globe. "One female hive beetle can deposit over 1000 to 2000 eggs upwards in a single lifetime," notes Manaswi. Beetles wreak havoc once inside the hive and can destroy a colony in just a week's time.

In his research, Manaswi tested organic agents to discover a new, affordable, and safe alternative to the current treatment options. The most common, EPA-approved chemical for in-hive treatment is coumaphos (organophosphate) that is sold in the form of CheckMite+ strips. Studies have shown that this compound is deadly to honey bees in certain exposure scenarios. Moreover, research has also confirmed chemical residues in beeswax, honey, propolis, and other hive products.

In his experimentation, Atreya tested eight agents in beetle traps: apple cider vinegar with mineral oil (the natural currently used treatment), mango puree with boric acid, cantaloupe puree with boric acid, yeast, peanut oil, grapeseed oil, beer, and a control which had no treatment. Manaswi chose these agents because of their attractive odor compounds. The test was set up to determine which agent is most attractive to beetles in hive traps.

Through extensive testing and rigorous analysis, he discovered that beer was a clear winner. He concluded that beer was 33 times more effective for beetle treatment than apple cider vinegar. Manaswi claims his treatment is environmentally friendly and poses no adverse health risks to humans, wildlife populations, or bees. Beer provides cost benefits over the current chemical options, as well. It costs merely two cents for hive maintenance and a 12 pack of beer for five dollars is enough to treat over 215 whole hives.

Kenneth Griner, a Central Florida beekeeper, was extremely encouraging of Atreya's research. "Mr. Griner was amiable and understanding. I was privileged to work with him. He even allowed me to run tests on 24 whole beehives! That's over 1.2 million bees!" exclaimed Atreya.

Dr. Charles Stuhl, Ph.D., a Research Scientist at the USDA-ARS, Center for Medical and Veterinary Entomology, Gainesville, Florida mentored Atreya on his second-year project. "He educated me on how fatal hive beetles can be to a colony and informed me more about this ongoing global crisis," stated Manaswi. Being a middle schooler, Atreya learned from Dr. Stuhl about academic research and how to present findings in a public setting.

Atreya soon came to realize the struggles of field work. "Last year, working in a lab, I was not exposed to the difficulties and harsh reality that beekeepers face daily. The heat and working conditions in the field were unbearable at times. Beekeepers are truly our unsung superheroes. And, during times of crisis, it's even more important to appreciate the effort it takes for food to reach our dinner tables. Beekeepers and other agricultural workers alike toil endlessly to ensure we get food," Manaswi affirms.

COVID-19 had a significant impact on Manaswi's research. "It certainly did serve as a roadblock, but it taught me a lot. I had to be creative and find common household items to serve as lab tools for my work. I used items like aprons, scissors, paper towels, plastic bags, and even Tupperware. Because of the pandemic, I had to count beetles in my kitchen! My mother wasn't all that eager about that idea, though!" he states. "Admittedly, there were countless instances when the beetles would go loose. My family and I would play tag, darting around the house with tiny fish nets in hand!"

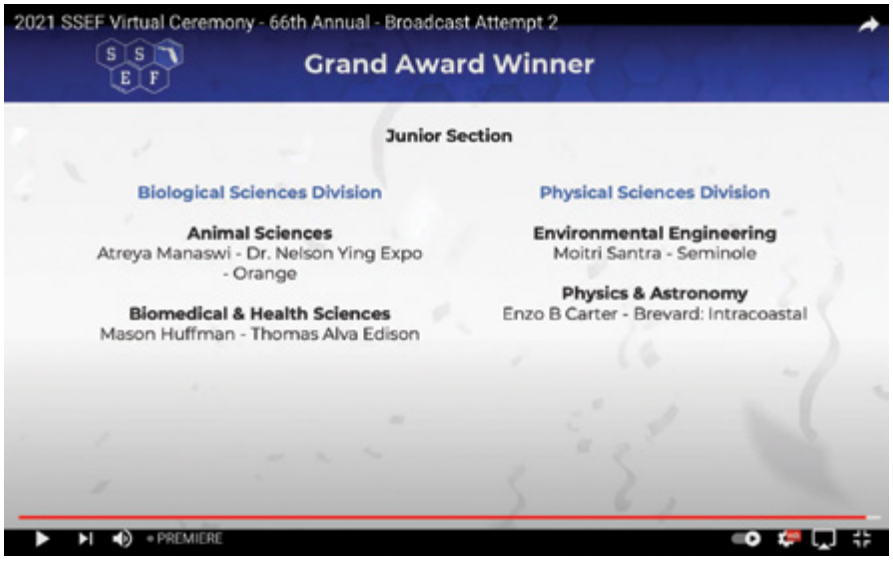
Manaswi entered his research into the State Science and

Engineering Fair of Florida. He was selected as the 1st place winner in the Animal Science category. Atreya was also presented the "Best in Fair" Grand Award for the Biological Sciences. Additionally, Manaswi was awarded other accolades for his work.

Although very appreciative, Atreya remarks, "the biggest prize for me is knowing that I am involved in something that could help save our bees." Food is such a precious commodity and more than 80% of all plants are pollinated by bees. If these plants cease to exist, biodiversity, ecosystems, and the food chain would collapse. Manaswi states, "Bees are the key to stability on our planet. My greatest satisfaction lies in knowing that I am contributing towards their conservation." He hopes to further his study of the honey bees in the future.

A youth researcher at heart, he believes everyone has the power to discover and learn. "Most kids find research boring or dull, but it's really quite the opposite. I have fallen in love with the essence of learning about the unknown and exploring what our world has to offer," Manaswi expresses, "I have come to understand the power of research and how, even as a kid, I can research ways to make life sustainable on our planet. I would tell anyone who wants to try something new to just look in their community and find the solution to an ongoing problem." BC

Well, this year, I actually couldn't gain lab access due to the COVID-19 crisis, so I had to be creative. Using some household items I made a mini "home-lab" in my mother's kitchen (though, she wasn't too eager about it). This is where I did all my treatment formulation, beetle collections, and analysis.



Optimizing Bee Gut Immunity

Varun **Madan**

We have all heard the statistics. The number of managed commercial honey bee hives has been declining by approximately 50% in the United States since 1940. We are also familiar with how important these animals are to our economy, pollinating over $20 billion worth of crops a year. Knowing the tremendous risks involved with letting these vital pollinators decline, why haven't we been able to find effective solutions to address these challenges within the last 80 years? This is the question that I strived to answer when I first started my research four years ago.

I found that previously, many scientists had focused their attention on containing just one external threat. This was not feasible, however because of the plethora of stressors threatening bees. I therefore looked for an effective solution that could improve overall immunity.

To do this, I created a probiotic mixture of various lactic acid bacteria to administer to the hives. I chose lactic acid bacteria because it is the only type found in both the human and bee gut. Though I have been stung a lot (42 times!), the early results proved to be very effective at the overall level, as the amount of honey, brood and bees were all significantly greater after treatment when compared to the control.

In recognition of my first year of research, I was named as one of the top 30 finalists in the Broadcom MASTERS, a national middle school STEM competition organized by the Society for Science, while also receiving a minor planet named after me. As the years have progressed, I tested my treatment's effects at a laboratory cage-level against a parasite called *Nosema ceranae*. I even successfully compared the probiotic's performance to an antifungal agent called Fumagillin, showing a statistically similar parasitical reduction while strengthening the gut microbiota (unlike its commercial counterpart).

Then the pandemic hit. Being trapped in my room for an extended period enabled me to thoroughly think through ways to improve my project. How could I commercialize my probiotic mixture? During this time of reflection, one problem stuck out to me in particular: farmers do not truly know how much of the treatment to administer to their hives. Instead, they used trial and error, an inefficient approach in addressing this problem. To combat these concerns, I have been developing a novel multiple linear regression model that can predict the optimal dosage of the probiotic treatment when given the initial *Nosema* concentration of the hive.

After training with carefully vetted data in three batches and testing the predictions against experimental test values, it was found that the model's accuracy significantly improved over time for all six initial hive scenarios. To put the accuracy in perspective, the difference between my model's predictions and experimental cage values for each hive scenario in the final batch of training data was statistically insignificant. Once this model is continued at an even larger scale, farmers might be able to determine the optimal dosage of the treatment moments after recording the hive's initial *Nosema* counts.

In recognition of my work over the last four years, I was honored to win first place in the **Animal Sciences category at the 2021 Regeneron International Science and Engineering Fair (ISEF)**, the world's largest international science competition for high school students. Even though the event was virtual this year, I was still able to meet so many amazing fellow finalists with a similar passion for agricultural sustainability and science as a whole. Additionally, getting to hear from some of the most distinguished scientists from around the world at ISEF further inspired me to continue my research beyond high school. When used in conjunction with the predictive multiple linear regression model, I truly believe that my treatment can improve honeybee hive immunity and agricultural productivity throughout the world. BC

All The Buzzz in...

Hello Friends,
Hope you had a great summer enjoying nature!

Bee B.Queen

Bee B. Queen Challenge

Send us a bee joke!

John Paul Antalek, 11

Loki Rucca, 5, PA

Heads Up!

Honey bees, like all insects, have three body parts – the head, the thorax, and the abdomen. Let's take a closer look at the head of a worker bee.

Mandibles

The mandibles are the strong and useful jaws of the bee consisting of two parts that can open and close. The mandibles of a honey bee are like a tool. They can cut, squeeze, or grasp.

Proboscis

The proboscis is a straw-like tongue used for sucking up nectar, honey, and water. The bees also exchange food with each other using their proboscises.

Antennae

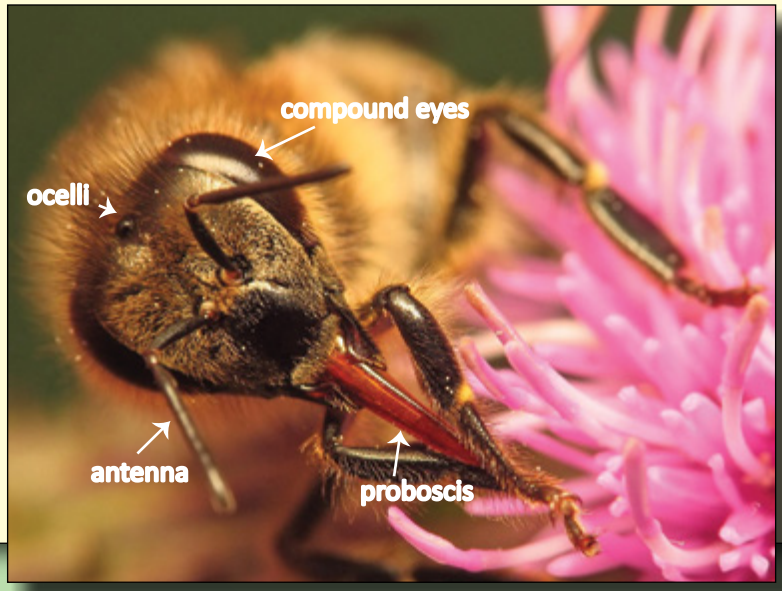
Antennae help insects find out more about what is happening around them. They are a sensing device. The antennae are covered in thousands of small sensory hairs that respond to touch and odor. Bees use their antennae to help measure the size and depth of each cell while building comb. They communicate by touching their antennae during the bee dances.

Eyes

Honey bees have five eyes: two large compound eyes on the side of their head and three simple eyes, called ocelli, on their foreheads. Imagine what you would look like with three more eyes on your forehead!

The compound eyes of a honey bee have thousands of tiny lenses or facets. The facets help the bees see color, movement, and patterns. In other words compound eyes are like thousands of eyes all in one. Scientists believe the images from all the facets are joined in the bee's brain to make one image kind of like a mosaic rather than the clear images that we see.

The ocelli have single lenses and use light to help the bee find their way home or to specific flowers. These eyes can also see ultra-violet light.



Across: 2 head, 3 proboscis, 5 compound eyes , 6 ocelli.
Down: 1 mandibles, 4 antennae

... Bee kid's corner

Produced by Kim Lehman -www.kim.lehman.com
www.beeculture.com
August 2021

L	X	P	W	U	C	S	G	E	O	O	E	T	M	S
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Bee Word Search

By
Walter Kanagy
9, PA

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propolis
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swarm
queen
flower
drone
larva
eggs

Beecome a Bee Buddy

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

Name
Address
Age
Birthday Month
E-mail (optional)

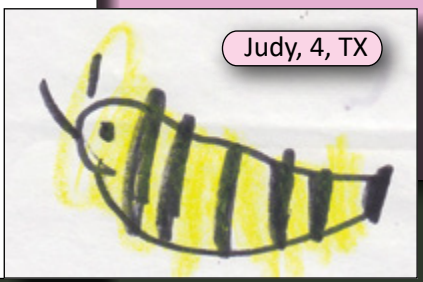
We will send you a membership card, a prize, and a birthday surprise!

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

Heads Up Crossword

ACROSS
2. Contains the compound eyes, ocelli, antennae, mandibles, and proboscis.
3. Straw like tongue used to collect and consume nectar, honey and water.
5. Eyes made up of thousands of tiny lenses.
6. Three simple eyes located on top of a bees head.

DOWN
1. Jaws of a honey bee.
4. Segmented feelers on the head of a bee with receptors to detect smell, touch, taste and sound.



Antennae Fact
A drone bee has 12 segments.
The worker and queen have 11.

Apiary Inspection Ohio

Brooke **Decker**

Barbara Bloetscher, Ohio – Ohio Department of Agriculture is a State Entomologist/Apiarist who oversees the Apiary Inspection Program. Ohio is unique compared to other states because each county appoints a Deputy Inspector each season which runs from April 1 until the end of October. Beekeepers are required to register apiaries annually with the Ohio Department of Agriculture so that colonies may be counted and examined for pests and diseases. Ohio has diverse agriculture with 13.9 million acres of fruit, vegetables, oil and seed crops, nursery and row crops.

This year, 6,220 beekeepers registered 9,455 apiaries and 46,282 colonies. About 75% of the beekeepers are hobbyists with the balance comprised of queen breeders, commercial honey producers and contract pollinators. Recently Ohio successfully implemented a new queen certificate and inspection process which provides a rapid certification process for queen breeders. This certification has allowed breeders to sell queens and nucleus colonies earlier in the beekeeping season, while ensuring buyers that they are purchasing healthy stock. BC

Off-Label *Varroa* Treatments

Pose Long-Term Risks For Beekeeping Industry

Matt **Mulica**

Commercial beekeepers are finding success treating *Varroa*, a parasitic mite that kills honey bees, in their hives without relying exclusively on off-label chemical treatments, according to a guide published this week by the Honey Bee Health Coalition. The guide is pivotal to the industry as *Varroa* mites are already showing signs of widespread resistance to existing varroacides.

"We set off to create a hands-on guide that covers what you might learn when talking to a commercial beekeeper in the hallway of a bee convention." remarked Chris Hiatt, Vice President of the American Honey Producers Association. "We stress the importance of not relying on one single product for your mite control. Commercial beekeepers helped develop this for commercial beekeepers and the info in this guide can be put to use into beekeeping operations now."

"In the short term, relying on off-label products to treat *Varroa* may seem to be the lowest-cost strategy. But overuse of amitraz, for example, increases the long-term risk of mite resistance and significant economic damage to the industry, as beekeepers may be left without effective control options. The operational decisions that each beekeeper makes will either promote or reduce the likelihood of developing resistance," writes the Coalition in the Guide.

The Guide to *Varroa* Mite Controls for Commercial Beekeeping Operations lays out a vision that addresses the risks of resistance created by off-label use. Widespread resistance to amitraz poses a serious threat to the long-term financial health of every commercial beekeeping business. Continuous use of off-label amitraz, with increasing dosages and frequency of use as it becomes less effective, is very likely to cause amitraz to lose its effectiveness more quickly, just as other products like coumaphos and tau-fluvalinate have become largely ineffective for controlling *Varroa* mites.

"This new Guide was developed to try and stave off amitraz resistance long enough for researchers to find the next reliable varroacide." said Matt Mulica, Honey Bee Health Coalition facilitator, "we developed the guide to show that you can be a financially viable beekeeper without consistency resorting to off-label products like Taktic."

This guide aims to help commercial beekeepers evaluate a variety of *Varroa* control methods that can be integrated into a management plan to protect their bees and their business. It highlights the experiences of beekeepers who are having success as they explore alternative strategies to limit their reliance on off-label amitraz and avoid using unregistered products.

"I'm extremely uncomfortable using unregistered products. Even if costs are higher short-term, I need to find other ways to control mites that will work and will work over time. That will cost more initially but make money down the line," said George Hansen, former president of the American Beekeeping Federation, whose approach to *Varroa* treatment is featured in the guide.

In addition to documenting six case studies examining various approaches to *Varroa* treatment, the guide also reviews the causes and impacts of *Varroa* mite resistance to varroacides. It also highlights control methods that can be used in an integrated pest management (IPM) strategy or a highly specific, knowledge-driven approach, referred to as precision apiculture.

The full guide is available for free on the Honey Bee Health Coalition's website at: **https://honeybeehealthcoalition.org/varroacontrolsguide/**

About Keystone Policy Center

Keystone Policy Center brings together crucial teams of stakeholders who have diverse individual perspectives but recognize a common need to address urgent issues with lasting solutions. For more than 40 years, Keystone has helped leaders move beyond fixed positions toward collaborative, action-oriented approaches to problem-solving. In this age of polarized debate on nearly every major topic in public policy, Keystone offers a refreshing yet proven blueprint for progress. BC

Bee Culture

The Magazine Of American Beekeeping

BEEing Diverse: Inspiring Leaders in Beekeeping

Mark Your Calendars for October 1-3, 2021

The Return Of Bee Culture's Annual Event

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

Susan Cobey runs Honey Bee Insemination Service and holds a 50% appointment with WA State University. She founded the New World Carniolan Program, now in its 40th generation. Her focus is enhancement of honey bee stocks and improvement of colony health through selective breeding. To diversify the U.S. gene pool, this includes the collection and incorporation of honey bee germplasm from their native European range. She provides training, instructional material and information in presentations, publications for both scientific and public audiences, worldwide to promote honey bee stock improvement. Her experience includes management of Honey Bee Research Laboratories at the OH State University and the University of CA, Davis.

Geraldine Wright is the Hope Professor of Entomology in the Department of Zoology at the University of Oxford, UK. Her lab specializes in research on the physiology and behavior of bees. She has over 25 years of experience in insect nutrition and has worked with honeybees for the past 20 years. Her research program includes expertise in bee chemical senses (olfaction and gustation), the mechanisms of learning and memory, and bee nutrition. Her group has made major contributions to what is known about the honey bee and the bumblebee's sense of taste. One of her contributions in this field published in the journal, *Nature*, showed that bees had difficulty detecting neonicotinoid pesticides in nectar. Her lab discovered that bees have special gustatory mechanisms mediated by gap junctions for sugar detection reported in Current Biology. Her group was the first to show that non-nutrient compounds like caffeine found in nectar influence the behavior of bees. Her lab is currently investigating the basis for addictive behavior in bees.

Nina Bagley has been an urban beekeeper for 17 years. Nina worked with a master beekeeper for eight years raising queens. She has several apiaries in the City, and she raises her own Queens. Nina has completed Dr. Joe Latshaw's instrumental insemination class. She completed the Master Beekeeping classes taught by Dr. Jerry Bromenshenk's program through the University of Montana. She is an avid collector of early bee books and history. Nina has managed the Bee Pavilion at the Ohio State Fair for ten years sponsored by OSBA. She over sees the State House Bees. She also over sees the Frank Fetch Park. In 2010 it was the first pilot hive placed in a park in Downtown Columbus, OH. She is currently the Franklin County Bee Inspector for OH.

Tammy Horn Potter helped her grandfather with his beehives beginning in 1997. In 2006-2010, she worked winter seasons with Big Island Queens in Hawaii. In 2008, she started Coal Country Beeworks, working with surface mine companies to establish pollinator habitat and apiaries in Eastern KY. In 2014, she became the KY State Apiarist, helping create the KY Department of Agriculture Pollinator Protection Plan, the KY Certified Honey Producers program, and the KY Queen Bee Breeders Association. From 2015-2020, she has coordinated the USDA Honey Bee Health Survey in Kentucky. She also serves on the boards of Eastern Apicultural Society, Project Apis M, Honey Bee Health Coalition, and Green Forests Work. She is the author of the following books: *Bees in America: How the Honey Bee Shaped a Nation* (2005); *Beeconomy: What Women and Bees teach us about Local Trade and Global Markets* (2012); *Flower Power: Establishing Pollinator Habitat* (2019); and *Work I Knew I Must: Reminiscence of Forty-one Years of Factory Life* (Root, 2021).

Kim Skyrm is the current President of the Apiary Inspectors of America (AIA) and the Chief Apiary Inspector for the MA Department of Agricultural Resources (MDAR). Prior to these appointments, Dr. Skyrm received a Ph.D from OR State University focused on the environmental impacts affecting bumble bees native to the Willamette Valley of Western OR, was a Research and Development Scientist for Koppert Biological Systems, Inc. specializing in commercial bumble bee rearing and a Post-Doctoral Researcher at the University of MA-Amherst evaluating bumble bee colonies in the cranberry agroecosystem. Dr. Skyrm is an alumni of GA Southern University (Bachelors in Science, Biology) and the University of NE-Lincoln (Masters in Science, Entomology with Education minor). In addition to being a bombiculturist (i.e. bumble bee rearing), Kim is also a hobby honey beekeeper. Kim has always been driven by an intense love of bees to serve in supporting roles informed by the latest scientific research. This is evident since Kim has been working with native and managed bees, beekeepers, farmers, and pesticide applicators for the past 14 years through outreach education, research, and extension. Kim has a "bees-eye view" of the world and is truly passionate about continuing to do work that preserves the viability and sustainability of bee populations!

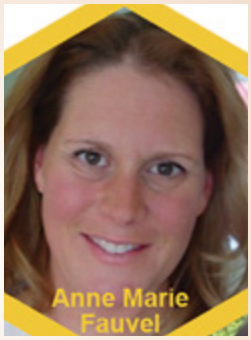
We hope to see you in October!

Be sure and visit www.BeeCulture.com

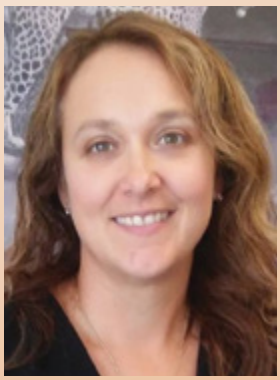
EST 1869 ROOT PUBLICATIONS

Barbara Bloetscher has been the State Entomologist/Apiarist at the Ohio Department of Agriculture since 2009, after 23 years at The Ohio State University Extension. As State Apiarist, she oversees the Apiary Program and identifies insects and other arthropods submitted from Ohio Nursery inspectors and businesses. Barb monitors the County Apiary Inspection Program and addresses honey bee issues in the state. Barb has kept her own colonies of honey bees for over 35 years and belongs to several beekeeping clubs as well as The Ohio Lepidopterists and other insect related organizations.

Joan Gunter was raised in rural ND on the family farm. She attended college and earned a degree in education and business. After graduating, she taught school on all levels for 10 years while raising two boys with her husband Dwight. Joan and Dwight of Towner, ND, have been commercial migratory beekeepers for over 30 years traveling to MS, TX and CA. The family-owned company is primarily engaged in honey production, queen rearing, pollination and the sale of bees. Joan currently serves as President of the American Beekeeping Federation (ABF) as well as Trustee for the Foundation for the Preservation of Honey Bees. She is also active with the National Honey Board, the Honey Bee Health Coalition and the state beekeeping organizations of ND, MS and TX.



The Bee Informed Partnership (BIP) is a small non-profit organization with a broad reach. Our mission is to improve honey bee colony health across the U.S. We do so by working closely with beekeepers, researchers and different sectors of the industry. We assess colony health and report back to beekeepers so they can make data-driven management decisions in real-time. Seven women support multiple BIP programs including the Annual National Colony Loss and Management Survey, the Sentinel Apiary Program for backyard beekeepers, the Tech Transfer Team program in five regions across the country working with commercial beekeepers and a variety of other projects ranging from IT products to specific product and/or management custom trials. Annette Meredith, PhD, BIP's executive director brings a much needed non-profit expertise. Nathalie Steinhauer, PhD is our Chief Science Coordinator and the brains behind BIP data. Jeri Parrent, PhD, our grants administrator keeps us funded and connected. Rachel Kuipers leads our Sentinel Apiary Program. Anne Marie Fauvel, the Tech Transfer Team Coordinator, facilitates field work and data collection. Our honey bee health database is designed, engineered and maintained by Mikayla Wilson, our IT and Database Engineer. Heather Eversole is the Univ of MD Bee Lab Manager who has been processing samples since the start of BIP. Learn more at **www.beeinformed.org.**



Tracy Farone is a Professor of Biology at Grove City College in PA. She has worked in various areas of private practice, academia, and research for over 21 years. Since 2016, Dr. Farone has been researching beekeeping and bee medicine. In 2018, she was granted a sabbatical to allow additional time to pursue apicultural studies and develop a teaching and research apiary at her college. In 2019, she worked in the field with dozens of backyard, sideline, and commercial beekeepers. She visited France, where she worked with multiple experts in bee medicine and research at ONIRIS College in Nantes and the OIE in Paris. Additionally, she visited The University of Edinburgh and the Roslin Institute in Scotland, meeting with additional bee experts. She traveled to Montana/Crow Reservation to work with 10K hive, migratory, commercial beekeeping operations. She has published several articles on bee medicine, including a monthly "Bee Vet" series for *Bee Culture*, written biosecurity industry guidelines for veterinarians entering beeyards, and developed an educational website, **https://www.gccbee-project.com/**. Dr. Farone's work has also been featured in the JAVMA. She is currently writing chapter on bee medicine for a veterinary textbook, consulting nationally and internationally (including Apimondia working groups) with industry stakeholders, and managing two beeyards with the help of her six research students.

Maggie Lamothe Boudreau is the sole owner of "Rayons de Miel" a 350 hive farm that produces 4000 queens/year. She recently enrolled for a Master's Degree in beekeeping at Laval University in order to keep improving her knowledge of beekeeping sciences with the goal of improving research throughout Canada and more particularly Quebec. All this for the purpose of helping the beekeeping industry in its quest for self-sufficiency in bees and especially in quality queens. Canadian commercial queen breeders are currently unable to supply queens before the beginning of June. Without access to queens early in the season, the opportunities for beekeepers to save their hives or create nucs very early in the season is greatly reduced, if not impossible. Her farm is directly contributing to her research project by producing queens during the previous Fall with the aim of inserting them in a "queenbank" until the following Spring so they can be used very early in the season. These queens would save a considerable amount of hives from which the queen died, or to produce nucs sufficiently early to contribute to the pollination effort of crops. She also has many volunteer involvements with official beekeeping organizations such as the Quebec Beekeepers Association AADQ, the Quebec and Eastern Quebec Beekeepers Committee and the national organization the Canadian Honey Council just to name a few.

Jackie Park-Burris was born into the Park beekeeping family of Northern CA. She managed the queen rearing portion of her parents' bee business and after the unexpected passing of her beloved father, she purchased the business from her Mother. In 1994 Jackie Park-Burris Queens, Inc. was started. She has concentrated on breeding a healthier, hygienic, honey producing queen, even incorporating genetics from Italy to improve the diversity of Jackie's line of popular Park Italian Queens. Jackie has also continued the family tradition of being active in the bee industry. She has served as President of the CA State Beekeepers Association, the first woman President of the CA Bee Breeders Association and the first woman Chairman of the CA State Apiary Board. She has served on the CA State Beekeepers Association's board of directors for over 25 years. She is currently serving as the Legislative Chairman and an Executive Director on the board. They have honored her with the Young Beekeeper of the year in 1997, Beekeeper of the year in 2009 and twice with the President's Award. Jackie is married to Jim Burris and is mom to Ryan (wife Kimberly) and Randal (wife Andrea) Burris. She is JJ to grandchildren Parker, Jack and Maverick Burris!

Julianne Grose is an Associate Professor in the Department of Microbiology and Molecular Biology at Brigham Young University. Her university position consists of 45% effort for teaching, 45% effort for mentoring/research and 10% effort for citizenship. She teaches approximately 12 credit hours of undergraduate courses per year (approximately six courses) and currently mentors three graduate students and 15 undergraduates in her research lab. Her teaching is dedicated to bringing novel research experiences into the classroom through an international program, Phage Hunters (HHMI SEA- PHAGES program). Research in her laboratory is dedicated to two main projects: 1) the study of metabolism and its relation to disease, and 2) the study of microbiomes and their contribution to the health of organisms, including bacteriophages that infect the Enterobacteriaceae family of bacteria. The latter is a continuation of the Phage Hunters course/program. Her long-term goal is to mentor students in the classroom and lab through high quality research experiences as well as to contribute novel scientific findings to our fields of study.

Cell Punch Queen Rearing

Roland **Gerner**

With this method, even beekeepers who have difficulties with grafting due to failing eyesight or other reasons can breed queens. It is based on the "Cell punch method" described by the late English beekeeper David Cushman.

Material

- one 2 ml disposable syringe per cell (a box of 100 costs less than five euros on the Internet. If you only need a few syringes, you can also get them at a pharmacy. Or ask your dentist or family doctor.)
- Express clamps 7-12 mm, for example from the hardware store
- a sponge cloth
- a sharp knife.

The steps of procedure

1. Pull out the plunger completely from the syringe and cut off the two ends of the syringe barrel with the knife.

2. Prepare your breeding frame by placing a crossbar in one frame and attaching the express clamps to it (see large picture above). If you want to cage the queen cells, you can drill a hole in a queen cell cup according to the outer diameter of the syringes and attach them to the syringe barrel with wax or superglue.
3. At the given time, remove a comb with open brood from the colony from which you wish to graft eggs and sweep off the bees. Then look for young larvae, which should be in the largest possible amount of royal jelly. Place the moistened sponge cloth on a flat surface and the comb on top of it. The area from which you want to punch out the cells should be above the sponge cloth. It prevents the wax from sticking to the table when punching out a cell. Pay attention to the wires so that you do not hit one.
4. Hold the syringe barrel so that the two rings visible inside are at the top and punch out the cells you have selected using circular movements. You must press until the cylinder hits the sponge cloth. Then pull the syringe cylinder out of the comb again, leaving the punched-out cell in the cylinder.
5. Then insert the syringe plunger on the side of the syringe where the punched-out piece of comb is located. Push the piece through the cylinder until the plunger is stopped by the lower ring in the syringe.

6. Make three vertical incisions in the walls of the cell with the knife, fold the cell walls down, and press them onto the outer surface of the syringe barrel.
7. Then insert the syringes with the cells into the clamps of the breeding frame. Afterwards put it either in an incubator or in a nursing colony. The acceptance rate by the bees is normally quite high.

Additional tips

Practice punching out first on old combs that you want to melt down anyway, or on drone combs. I recommend that you process all the cells you need up to step 4, then put the frame with the breeding material back in the colony and only then continue with steps 5 to 7. By the way, the holes created by the punching are rarely closed again by the bees.

If you give a syringe with a nursed queen cell into a hopelessly queenless colony 36 hours after punching out the cell, you don't need to cage the cell and the queen will hatch in the colony. The syringe can be hung between two frames.

Summary

The method is much easier in practice than the description might suggest at first. Since I need only a few queens, it is ideal for me. In contrast to grafting, it can be done anywhere, even if the conditions are not optimal. Try it and you will see, it is really quite simple!

The advantages of the method

- The larvae remain in their natural cells.
- The queen does not have to be found in the colony.
- The cost of materials is very low.
- With a little practice, the cells are punched out very quickly, and the comb can be hung back in its colony after a short time.
- The syringes with the queen cells can be easily removed and placed between two frames. BC

Reprinted with permission from Deutsches Bienen Journal

Bee Driven Mid-Life Crisis, Part 4
A Shout Out To My Friends

James **Masucci**

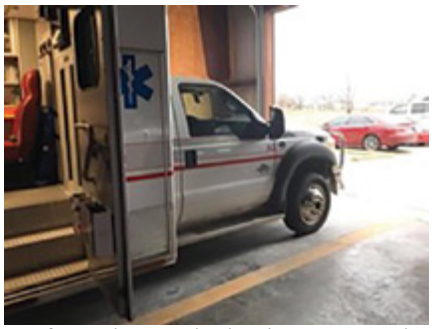
When I made my decision to focus on bees, I had several concerns. How big do I want my business to be? Where am I going to put all the bees? What equipment do I need? Where am I going to store it? My career was as a scientist, not a businessperson. Over the past six months, however, things have started to fall into place. What I realize is that it is not just me who is responsible for my success, I owe a lot to people who have helped me along the way. Beekeepers think of beekeeping as a solitary experience. Just us and our little flying friends sharing some time together. But the reality for me is that my success is dependent on a lot of people and the relationships I've developed with them.

First and foremost are the landowners. I now have more than a dozen yards and I don't own the property of any of them. Commercial beekeepers know this well and a good beeyard is more precious than gold. All they ask for is some honey, that I respect their land, and that I keep them updated. The ripple effect of my land-owner relationships has gone far beyond a place to put my hives. They've led to new yards, markets, and storage locations.

I have one yard at a small, all-natural vegetable farm. This is my only yard I got by knocking on someone's door. The family was just starting the farm and I was just starting with my bees, so we both hit it off. They have become successful, selling at farmer's markets and restaurants. Not only have we developed a friendship, but we work together. He sells my honey both at the farmer markets and to restaurants. A mutual benefit for both of us. He recently gave my number to a woman whose father-in-law was having trouble keeping bees. She called and we talked for a while about the various issues with keeping bees. During the conversation, she asked if I'd be interested in putting bees on her property. I went to visit, we toured the place and found a great site. We chatted for about an hour. As I was leaving, she told me she owns another four acres surrounded by fields . . . if I was interested. Of course, I was interested! Two new beeyards because I was willing to help someone out.

In my last article, I talked about needing a bee truck and a place to put it. My son-in-law recently came through for the bee truck. He is a firefighter/paramedic who also sells ambulances. He found me a used ambulance chassis (see picture) that I'm in the process of outfitting with a flatbed and lift-gate (I have a smile on my face just writing about it). However, I can't park an F450 flatbed in my suburban neighborhood! I went looking for property (still am) and I found an old gas station in a great location for my bee operation. I talked to one of my land-owner friends to find out the owner. The guy didn't want to sell. However, my land-owner friend said, "you know, you can have a corner of my barn if you would like." I went to see it a couple of days ago (see picture). It's perfect. When I told him that he chuckled and said, "well, the price just went up" (it didn't). Now I have a home base to store equipment, supplies, AND my truck. It buys me time to find the property I really want to buy.

The landowners aren't the only people I depend on. My personal beekeeping community, consisting of both commercial beekeepers around the country and local hobbyists, are constantly supporting my activities. After having the worst winter survival of my career by far, I called a friend of mine in GA who sold me a truck load of bees (the joke here is that for him, a truck load is a semi-load. I just filled up my pick-up (see picture)). These bees allowed me to expand into new areas without disrupting my sales of local nucs. Locally, we beekeepers provide each other with resources we need to get through emergencies. We help each other finding markets and point our customers to each other when we can't fill a need. Probably more importantly, we share information and troubleshoot each other's problems. It's become obvious to me that though I may work my bees alone, the list of people who help me in this endeavor is large, and I'll be forever grateful for their support in helping me succeed. BC



My future bee truck, thanks to my son-in-law and Osage Ambulance.

A perfect place for my stuff! Thanks to one of my landowners.

Forty-eight in the back and one in the front went from Southern GA to St. Louis. Thanks to Barry Hart who put them together for me.

Working To Protect Honey Bees From *Varroa*

Katie **Harrington**

You can tell the health of a beehive from its buzz. Just ask Barry Hart, who bought his first bees in 1987. Soon after, the Georgia farmer saw a five percent annual die-off of his hives. In the past decade, however, Hart experienced up to a 60 percent loss – a troubling trend mirrored in a recent U.S. Department of Agriculture report.

It's challenging to be a beekeeper these days, with colonies collapsing in the face of habitat destruction and pesticide pollution, but bee farmers also point to another mighty foe: the *Varroa* mite.

Resembling a tick, this destructive parasite damages bees at an individual and population level by depleting bees' fat reserves and carrying viruses that cause – in addition to other illnesses – wing deformation.

Current pest-management systems struggle to control the increasingly resistant mite while preserving the health of bees and their supporting ecosystem. GreenLight's solution, an RNA-based approach, targets the *Varroa* mite directly at all stages of its development while keeping the bees, their brood, and the surrounding biodiversity safe. A cousin to the mRNA used in some of the most effective Covid vaccines, GreenLight's product can be a more sustainable alternative to traditional chemical pesticides, protecting pollinators and plant life.

Beekeeper Barry Hart checks his hive of honey bees in Barwick, GA. In the background is a squash field where the plants are pollinated by the bees.

Originally associated with the Asian honey bee, the *Varroa destructor* spread throughout Europe when Russian beekeepers introduced the higher-yield European honey bee to Asia in the middle of the 20th century. Spreading westward, the small arachnid reached the United States in the 1980s and today, USDA figures show that about 40 percent of U.S. hives have been affected, with a level of mites high enough to cause significant bee mortality.

When a queen bee lays a new egg, it is placed in a hexagonal cell in the honeycomb. After three days or so, the egg hatches into larva, where worker bees feed it hundreds of times a day; five or six days later, the larva enters the pupal stage, where it transforms into the adult bee. When the larva pupates, the worker bees cap its cell with wax, sealing it off from the rest of the hive.

The female *Varroa* mite enters the cell to lay its eggs in the hive at a crucial juncture: just before the bee larva pupates and the cells are sealed. By the time the adult bee emerges, the mite larvae have already hatched and attached themselves to the bee. Fully grown on a bee, the mite resembles a tick on the bee's abdomen, equivalent in relative size to a human's fist held to the chest.

The mite population in the hive increases exponentially, doubling every few weeks while consuming the bees' fatty tissues, thus lowering their body weight. Affected bees take longer to return to the hive, perhaps because they are unable to navigate well or fly far due to their weakened state and the additional burden of carrying the mite.

James Masucci, a Missouri research scientist and beekeeper who works at GreenLight, says that although the mites themselves may not kill the bees, they weaken immune systems and transmit viruses – most notably deformed wing virus – that eventually destroy the bee colonies.

Although honey bees are susceptible to other parasites, climate stress, starvation, and pesticides such as neonicotinoids, Masucci is confident that the varroa mite is the chief culprit. "We consider mites to be 70 to 80 percent of the cause of decline in colony health," he says.

As U.S. farmers shift to crops like soybeans, which do not provide bees with much sustenance, it has become harder for colonies to survive "although beekeepers have been dealing with that since before the mites," Masucci says. By around 2000, varroa mites became widespread and a few years later, colonies started dying in large numbers, a correlation confirmed by the USDA.

Why *Varroa* mites are tough

There are several pesticides now used against *Varroa*. Three synthetic chemicals – coumaphos, fluvalinate, and amitraz – are put on plastic strips and hung outside the hive, where bees come into contact with them. Organic treatments, meanwhile, include formic acid, oxalic acid, thymol, and beta acids.

Fluvalinate and coumaphos have been used so much that the mites have started showing resistance: "If

Honey bee with parasitic Varroa *mite attached being held by beekeeper Barry Hart in Barwick, GA.*

Honey bees feeding on top of a GreenLight pouch full of syrup at the hive of beekeeper Barry Hart in Barwick, GA.

they develop resistance to amitraz," says Masucci, "the US industry is in big trouble." Meanwhile, the organic treatments mostly act as fumigants: The beekeeper takes a lump of the material and places it in the hive, where it releases the chemical over time. But that is temperature-dependent: if it's too hot, too much of the fumigant will be released and can damage or destroy the hive. Oxalic acid is safer but is only effective in Winter, when the colonies are broodless.

The broader problem is that the life cycle of the mite limits the effectiveness of all traditional pesticides. The female *Varroa* mite enters the larval cell and lays its eggs before the cell is capped; the cell remains capped for about two weeks. All the mites and their eggs inside capped cells are protected from any pesticides that are put into the hive. Fumigants rely on two weeks of steady temperatures while synthetic chemical pesticides often harm honey bees or their ecosystem.

GreenLight's advantages

GreenLight's *Varroa* treatment works differently. "We are targeting a protein that's necessary for the normal functions of *Varroa*," says Masucci. "Without it, their physiology is disrupted, and so this treatment is highly detrimental to the mites." A small amount of RNA, applied with gloves rather than a hazmat suit used when applying chemical approaches to pest control, is all that's needed to induce the effect. Mites have a receptor in their gut that allows them to import the double-stranded RNA into the cell, where it activates its normal cellular mechanisms.

"We are zeroing in on a different stage of their life cycle than current products," he says, "and what's novel about this approach is that we are targeting reproductive mites; we deliver it in sugar syrup, which the bees use as they would nectar." Bees place this syrup containing the dsRNA into cells right before pupation, where the mites get exposed.

The RNA in the syrup, which quickly degrades, measurably improves hive health. Masucci says that early studies show an extra frame's worth of bees per hive, or about a 20 percent bump in production plus a 10 percent increase in hive survival rate compared to conventional treatments. "It's a small bump," he says, "but it's meaningful."

Hart, the Georgian bee farmer, has participated in a GreenLight trial of the new RNA solution. Compared to oxalic acid and amitraz strips, he says, the RNA-treated hives seem much healthier. "It helped bring down mites," he says, and after 35 years of keeping bees, his conclusion: Bees were more active, their hair was glossier and fluffier, and "even the sound a hive of bees makes when you open the top – the hum" was promising.

Changes in the beekeeping industry in recent years led Hart to transition from 100 percent honey production to renting out many of his almost 4,000 hives as pollinators, trucking them around the country for blueberries, squash, cucumbers, watermelon, almonds, strawberries, pumpkins, apples. This Spring, six semis – each loaded with 480 hives – headed to California. He also sells hives to commercial and hobbyist beekeepers.

Hart believes that GreenLight's product promises a clear benefit. This year, mainly due to the varroa mite, he lost more than 300 hives. The cost of replacement hives ranges from $225 to $250, and although Hart splits his hives to lessen the blow, it does end up diminishing production. "We get paid on hive strength," he says, "so another two frames [per hive] could mean another $15, $20 in my pocket."

A vital part of plant health as well as a business, honey bees are an indicator of ecosystem health. "You can sit a hive of bees in one location, collect the pollen, and it will tell you the health of the environment within a mile of that hive," says Hart. "You can see what's growing from the pollen. If a bee can survive there, the environment is pretty good."

GreenLight's RNA-based solution, which targets just the mite, could go a long way toward helping beekeepers manage the varroa mite while promoting sustainable farming. "You take care of the bees," says Hart, "and they'll take care of you." BC

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4 Easy Steps

Jason **Carr**

Four easy steps to minimize pollinator impact when spraying

Through my lifelong experiences in agriculture and as a beekeeper, I have sometimes observed conflict between my fellow apiarists and row-crop farmers. For legitimate reasons, beekeepers are very protective of their apiaries, and farmers need crop protection products to battle pests in their fields. These two goals can sometimes lead to conflict, with beekeepers worrying about the health of their colonies and farmers viewing managed beehives as an annoyance they are forced to consider when managing their crops. However, as in most conflicts, communication and education go a long way in helping row-crop farmers co-exist peaceably with their beekeeping neighbors.

An important point to remember is that bees and row-crops are mutually beneficial to one another. Despite the fact that soybeans are self pollinated, studies have shown yield increases of over 15% when fields are in the vicinity of managed apiaries. Honey bees also benefit from having soybeans on which to forage, and the crop provides a reliable pollen and nectar source throughout the summer, even when other flowers may not be blooming. As with food consumed by humans, all pollen sources are not equal in their nutritional value. Soybean pollen is high quality and contains many antioxidants which contribute favorably to colony health. Consumption of these antioxidants helps the bees survive exposure to toxins that they may encounter while foraging.

With these facts in mind, here are some practical tips for soybean growers to avoid negative effects on honey bees and other pollinators when applying pesticides.

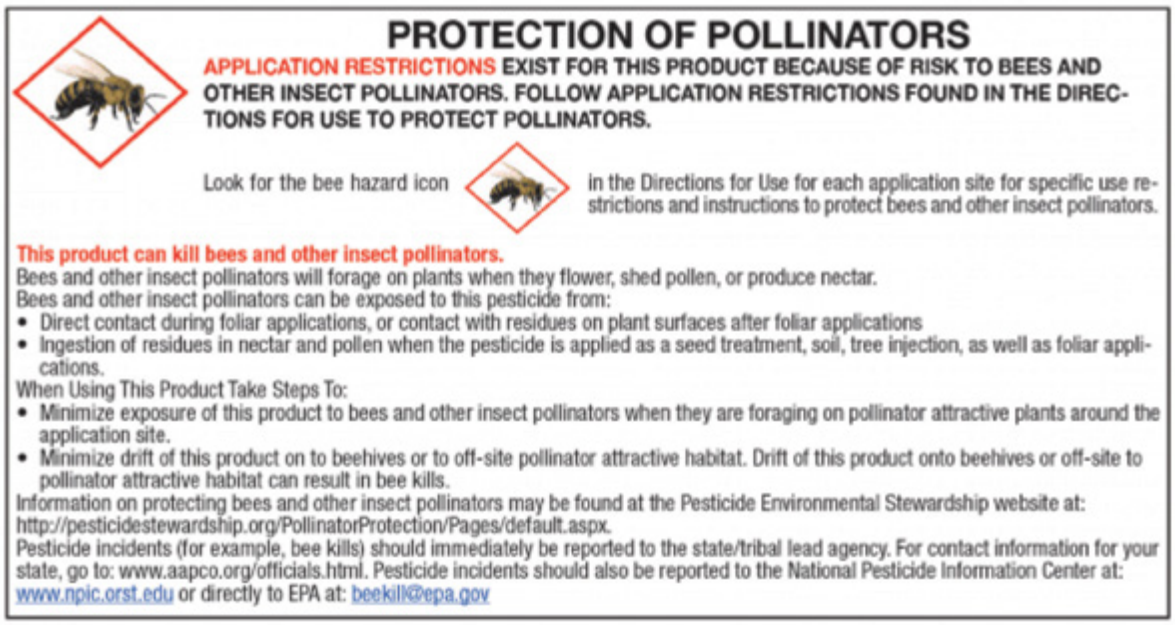
Communicate with your neighbors

It may seem obvious, but good communication is key to healthy relationships. Farmers are comfortable discussing herbicide platforms with their neighboring farmers, and conversations with residential neighbors can also help alleviate misunderstandings. Backyard beekeeping is a popular hobby, and it's a good practice to help neighbors understand why crop protection products are being applied, why they are used, and when they are going to be sprayed. Explain that pesticide labels are developed with non-target species such as bees in mind and the precautions that are taken to limit the impact on pollinators. By letting beekeeping neighbors know of your plans in advance, they can shut their bees in the hive the evening before pesticides are applied to limit their exposure.

Since farm families account for only about 2% of the U.S. population, misconceptions about farming abound. Take time to explain why crop protections products are important tools in maintaining the global food supply. Tell the story of modern agriculture in a positive way. The adoption of genetically modified crops has reduced insecticide use. When coupled with the improvements in insecticides themselves, crop production is much safer for pollinators than it once was.

Check Driftwatch

Fieldwatch is a database maintained by Purdue University. Beekeepers and specialty crop growers register their locations, and applicators can quickly check for sensitive areas when planning to apply crop protection products. Go to **https://il.driftwatch.org/map** and enter your location to view neighboring registrations.



PROTECTION OF POLLINATORS

APPLICATION RESTRICTIONS EXIST FOR THIS PRODUCT BECAUSE OF RISK TO BEES AND OTHER INSECT POLLINATORS. FOLLOW APPLICATION RESTRICTIONS FOUND IN THE DIRECTIONS FOR USE TO PROTECT POLLINATORS.

Look for the bee hazard icon in the Directions for Use for each application site for specific use restrictions and instructions to protect bees and other insect pollinators.

This product can kill bees and other insect pollinators.

Bees and other insect pollinators will forage on plants when they flower, shed pollen, or produce nectar.

Bees and other insect pollinators can be exposed to this pesticide from:

- Direct contact during foliar applications, or contact with residues on plant surfaces after foliar applications
- Ingestion of residues in nectar and pollen when the pesticide is applied as a seed treatment, soil, tree injection, as well as foliar applications.

When Using This Product Take Steps To:

- Minimize exposure of this product to bees and other insect pollinators when they are foraging on pollinator attractive plants around the application site.
- Minimize drift of this product on to beehives or to off-site pollinator attractive habitat. Drift of this product onto beehives or off-site to pollinator attractive habitat can result in bee kills.

Information on protecting bees and other insect pollinators may be found at the Pesticide Environmental Stewardship website at: http://pesticidestewardship.org/PollinatorProtection/Pages/default.aspx.

Pesticide incidents (for example, bee kills) should immediately be reported to the state/tribal lead agency. For contact information for your state, go to: www.aapco.org/officials.html. Pesticide incidents should also be reported to the National Pesticide Information Center at: www.npic.orst.edu or directly to EPA at: beekill@epa.gov

Table 1. Economic Threshold Recommendations for Some Common Agronomic Pests in Illinois

Crop	Pest	Sampling Method	Economic Threshold
Corn	Corn rootworm (continuous corn)	Sticky card traps	2 beetles per trap per day
	Corn rootworm (rotated corn)	Sticky card traps	1.5 beetles per trap per day
	Western bean cutworm	Direct counts	8% of plants with egg masses or small larvae
Soybean	Defoliators (combined defoliation after bloom)	Visual estimation	20% defoliation
	Soybean aphid (prior to R6)	Direct counts	250 aphids per plant
Alfalfa	Alfalfa weevil	Direct counts	3 larvae per stem with 25% of leaf tips damaged

Always read and follow label directions

As we all know, pesticide labels are the law. These labels are developed with protection of pollinators and the environment in mind. Be especially cautious when applying a product that has a bee hazard label (Figure 1). Labels often recommend spraying at a time when bees are less likely to be visiting, generally early morning or late evening. Follow label instructions to limit off-target movement. Observe wind speed, application rate, nozzle type and other label restrictions.

Use an Integrated Pest Management (IPM) approach

One of the main principles of IPM is to consider the economics of a pesticide application. The University of Illinois publishes economic thresholds for common pests: **https://extension.illinois.edu/blogs/aroundcounty/2018-10-24-integrated-pest-management-what-are-economic-thresholds-and-how-are**. If insect damage does not reach the threshold, application of a crop protection product will most likely result in a negative ROI. Additionally, use the most specific pesticide possible for the target insect. Don't apply a broad spectrum product if a more targeted one is available.

By following these simple steps, farmers can limit their negative impact on honey bees and other pollinators. This is beneficial to all, as 35% of our food supply is dependent upon these insects. Additionally, improved relationships with our neighbors are always desirable! BC

*This article was first published on **ILSoyAdvisor.com**, an agronomic content hub funded by the Illinois Soybean Association checkoff program.*

UNREAL DRONES IN THE APIARY

Dewey **Caron**

AgDrone courtesy HoneyComb corp

Have you ever flown a drone? Not the live drones you find in your bee colony or tethered drones you might fly at a bee display but instead have ever flown a robotic drone or hired someone to do so? Drones, or unmanned aerial vehicles (UAV), sometimes referred to as "Bot flies," were initially developed for war and espionage. Today they are responsible for those breathtaking photos you see when you open your computer. They are the best seat in the house for coverage of sporting events. Real estate loves them. They help spot forest fires as they start and their use is expanding in research and farming.

Research is demonstrating how drones can help blueberry farmers. Flying drones can quickly spot troubled areas in a massive blueberry patch in a fraction of the time it would take on foot. Their use can help solve labor shortage problems and help blueberry farmers improve their bottom line. "Flying robots" can fly over a field as high or as low as needed. Equipped with cameras with different lens, farmers can use drones to recognize potential issues that cannot be seen by the human eye or easily detected from the ground.

Oregon Blueberry Commission Administrator Bryan Ostlund points out new technologies. He states drones have become important "to help farmers lower production costs and get an edge over climate change. Efficiency is key, and that's what drones are all about." In states with rapidly expanding blueberry acreages of Oregon and Washington, David Bryla, USDA horticulturist, along with Scott Orr, a USDA biological research technician, are seeking to develop an app farmers will be able to download on their phones. The pair demonstrated drone use at a blueberry pre-pandemic field day hosted by Oregon State University's Extension Service. The audience was impressed.

It is predicted that unmanned drones are a technology that will continue to advance in agricultural applications. A camera carried by a drone enables crop farmers to quickly and inexpensively capture information to identify potential issues. They are especially useful in detection of cultivation issues around water, pests, soil, and fertilizers. The drones can sense leaf color variation, densities, crop stress, and even irrigation leaks. They might even protect foraging honey bees by helping farmers target their pesticide applications. Drones are only part of the equation. Also needed is computer support, broadly termed AI (artificial intelligence), to analyze aerial images and provide farmers with real-time data to monitor crop health. **https://www.ordermentum.com/blog/how-drones-computer-vision-and-ai-are-transforming-the-agricultural-industry**

Startup companies are seeking ways to assist the agricultural sector to expand drone use. A key is to use the drones over a period of time. This will enable farmers to see changes in plant health and canopy structure of their crop. It is not one and done. Changes can be due to insufficient soil nutrients, inappropriate soil moisture, or pest attack, so ground-truthing is needed. When a negative situation is detected, the drone then can be equipped to deliver corrective measures such as additional fertilizer or spot application of a pesticide.

An example of a startup is Viewpoint Aerial Agriculture in Salem Oregon. Before the pandemic they started to fly drones commercially over farms, fitted with multi-spectral and infrared cameras to detect areas where crops may be experiencing stress from pests, disease or drought. Our farmers, although having worker availability issues with the pandemic, were reluctant to contract for the technology. To keep afloat Viewpoint then partnered with Parabug, a California company, to use drones in biological pest control. They fitted the drones with special holding cylinders to airdrop beneficial insects into fields to help farmers combat crop pests reducing the use of chemical pesticides. During the rainy fall and winter, they move to Florida to work the drones in citrus and other crops. **https://www.capitalpress.com/ag_sectors/nursery/farm-drone-company-turns-to-beneficial-insects-amid-pandemic/article_c6b1ecc8-7dd5-11eb-b50d-733596f229be.html**

One giant in the ag field, Wilbur-Ellis Agribusiness, a well-known prominent ag service and supply company,

Dropcopter.

perhaps better known for their seeds and biocontrol beneficial agents, are experimenting with AgDrone. This flying robot is made by startup HoneyComb Corp. of Wilsonville, Oregon. The company, started by three young entrepreneurs, makes a battery-powered winged drone equipped with visual and spectral-imagery cameras that can map fields and spot crop problems. Most drones have four rotors rather than fixed wings. Wilbur-Ellis calls their drones a critical tool in precision agriculture.

Precision Agriculture offers the opportunity for a farmer to apply the right amount of treatment at the right time and at the right location for crops/animals. Using drones and the support technology built into a computer, is an evolving tool that helps a farmer collect timely high-resolution data. The key, in addition to the use of drone-based sensing, is the program of highly sophisticated image interpretation required to interpret what the drone can sense.

For beekeepers, the parallel is Precision Apiculture. Beekeepers sample hives on a regular basis, count mites and keep records of things like seasonal weight gains and mite numbers. Sampling is especially important before and after mite treatments to assess both treatment necessity and, once a control is used, to measure its effectiveness. Drones, the real ones, can be raised and then eliminated before they emerge as adults, to assist in limiting increase of mite populations in the spring. For many beekeepers, precision apiculture also means selecting the best colonies to use to improve stock based on overall colony performance. It is not just one quality but an overall performance; record keeping is critical for mite control and stock improvement.

Parabug.

Use of drones has not yet developed to the point to help beekeepers with such selections but there are still numerous uses for aerial drone service. A drone can check on apiaries to insure there is nobody bothering them, to check for colonies blown over or knocked over by irrigation booms. During winter, they can check on how the apiary is doing, saving having to go out and check. Following storms, they can likewise check to be sure all is OK in the apiary. They can be used to determine land patterns to possibly avoid an apiary site that might be flooded.

Drones can be used to search the 8042 acres (two-mile radius) your bees are currently visiting so you might better ID floral resources or find better floral opportunities. Or maybe you could use them to find an alternative apiary site since you made so many splits (for mite and swarm control) this year. We always need another apiary site. It has been suggested they can find Drone Congregation mating sites. A word of caution, however -- Drones can and reportedly have been used to find your apiary site and how you access the location to enable hive thievery. Also, worker bees do not "like" the drones and can be seen "attacking' them when they are flown in the immediate vicinity of colonies.

We know in beekeeping that drones, the real living variety, are critical in helping maintain stock lines. You may have heard about a new honey bee being developed in Hawaii – not on the west side but in the Hilo area. Hilo breeding site has focused on refining lines of bees that previously were identified as having mite resistance/tolerance but were not consistently effective in controlling mites. The process produced a pool of *Varroa* resistant/tolerant bees. Drones with the same resistance/tolerance are critical to the stock improvement project.

The Hilo Bee project is a public-private partnership developed with the **USDA**, **Project Apis m.**, Hawaii Island Honey Company, and **Arista Bee Research**. Combining breeding tools and expertise in a commercial beekeeping operation, these partners have been working to develop a honey bee that is naturally resistant/tolerant to *Varroa* mites with traits to be successful in commercial beekeeping. Maintaining sufficient drone mother colonies is key.

Kim Flottum discussed drones in his June 2019 *Bee Culture* editorial. He also included other perhaps more familiar present and future technology innovations in beekeeping. One drone technology firm he mentions was Dropcopter. Dropcopter reports they can help growers produce ". . . way more fruit using a drone than when using honey bees – a 25-60% pollination set on cherries and almonds and significantly increasing the pollination of king blooms on applies." King bloom provides the best apple of a blossom cluster. They also report use of their drone with pears. They operate in California, New York and Washington State.

They collect dry pollen from the targeted crop and then fly over trees in bloom to release the pollen. They use a large multi-rotor drone. They identify their service as specializing ". . . in dispensing the right pollen at the right time to the right places in an orchard to help growers achieve a better fruit set and harvest." Bar graphics supplied show this advantage for almonds, cherries and apples. They suggest they can supply pollen to areas not covered well by rental honey bee colonies.

May Berenbaum Buzzwords columnist in *American*

Entomologist discussed "bot flies" (artificial drones) in her summer 2019 column**.** She says Walmart the mega-marketer has taken out a patent on Pollinator "drones" entitled "Methods for pollinating crops via unmanned vehicles.**"** According to Berenbaum, Walmart wishes "control over its future food supply chain in the post-bee-apocalypse hellscape". Berenbaum, May. 2019. Bot-Flying. *American Entomologist*, 65(2), 76-78 **https://doi.org/10.1093/ae/tmz029**

The smallest drones are being investigated as substitutes for real flower pollinators. Harvard University Wyss Institute has developed a robot suitable for pollination. The project was funded by DARPA (Department of Defense Advanced Research Project Agency). The drone named "RoboBees "weighs less than two grams, beats its wings 120 times per second and can perch, fly and swim but still can't navigate around other flying objects." That might limit their field-worthiness. **https://wyss.harvard.edu/technology/robobees-autonomous-flying-microrobots/**

The Robo-Bee website calls their microbots "Insect-inspired robots with potential uses in crop pollination, search and rescue missions, surveillance, as well as high-resolution weather, climate, and environmental monitoring". With a slightly greater than one inch wingspan, RoboBee, which took 12 years to develop, is the smallest man-made device modeled on an insect to achieve flight. Currently it is controlled with a tether line, but further development is seeking to make flight completely independent.

Eijiro Miyako, a chemist at Japan's **National Institute of Advanced Industrial Science and Technology** (AIST) Nanomaterial Research Institute, demonstrated use of an artificial 4X4 cm (slightly more than 1½ inches) sized drone to move pollen from one flower to another. He simulated the bee's hairy skin by using horse hair coated with a gel. The drone hovered over pink-leaved Japanese lilies (*Lilium japonicum)*, to attract and hold the **pollen** and then flown to a second flower, where grains were deposited accomplishing artificial pollination. Control drones (without the gel and hair) did not pollinate. Dr Miyako states that "the findings, which will have applications for agriculture and robotics, among others, could lead to the development of artificial pollinators and help counter the problems caused by declining honey bee populations". Chechetka. S.A. et al. 2017. Materially engineered artificial pollinators. Chem 2(2):224-239. **http://www.cell.com/chem/fulltext/S2451-9294(17)30032-3**

Ready to fly.

It is intriguing to think that maybe the pear growers of southern China that rely on humans with chicken feather staffs might someday be replaced by artificial drone pollinators. What will be the cost-point of this technology replacing human/bee pollinators? Currently the growers find human pollinators less expensive than rental of bee colonies for the necessary pollination. Technology is expensive and RoboBees and other drones are no exception.

Where the development of artificial flying drones will eventually go is not clear. What is clear is they have the potential to change how farmers and eventually beekeepers do business. Stay tuned for further developments in artificial drone technology. BC

Minding Your Bees And Cues

Genetic Diversification and Tracking Results

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

So you're a new beekeeper and need to purchase a new queen (Who squashed the old one? Definitely not you). You are presented with various choices: you could get an Italian or Carniolan, a Saskatraz or a Buckfast queen. We get a lot of questions from new beekeepers about what kind of queens to invest in, or where to purchase those queens. And the answer is complicated, because it's beekeeping.

Genetics matter, but subtly. It's like playing the guitar. Plenty of guitar nerds will recommend bidding on Jerry Garcia's "Tiger" guitar at auction, but if you haven't mastered your basic chords, the guitar you play isn't going to matter much. Beekeeping is a total collaboration between bees and beekeeper, and the nuances of different stock matters more as a beekeepers' experience and skills grow.

When we are talking about bee stocks, we mean genetics. There are different subspecies or races of honey bees, like Italian, Carniolan, and Caucasian (Delaplane, 2007). There are also genetic lines or stocks of bees that have been bred from any subspecies for specific behavioral traits like increased honey production, gentleness, resistance to diseases and pests. Some researchers are digging into the DNA of some of these lines to determine the genetic diversity of these stocks and identify important traits (Saelao et al., 2020). Others select colonies that display particular behavioral traits that confer disease or mite resistance, like hygienic behavior (like the MN Hygienic bees that were bred by Dr. Marla Spivak and Gary Reuter at the University of Minnesota Bee Lab in the 1990's) and *Varroa* Sensitive Hygiene (VSH; bred for *Varroa* resistance by the USDA-ARS Bee Breeding lab in Baton Rouge, Louisiana) or grooming behavior ("Ankle biters", bred for *Varroa* resistance at Purdue University). The goal of these bred lines of bees is to decrease your need to use chemicals in your hives (see links below for more information).

Three-day-old queen cells. Photo by Daniel Whitney, Whitney Lone Star Queen Co.

Before you set out to find the one perfect bee stock for your area and operation, we suggest you don't search for a single perfect bee line for your apiary. Your apiary isn't static, so depending on the season's weather, nectar flows, or disease pressures, the perfect bee for your apiary is subject to change. Stocking your apiary with multiple queen sources spreads your risks among different genetic traits. For an easy-to-read chart of some of the different bee stocks available, check out the article by Dr. David Tarpy referenced at the end of this article.

While you can't have the perfect bee, we do suggest that you research traits and have a list of them that you want checked off when selecting queen stock. Definitely put disease and pest resistance at the top of your list; it's a crazy world out there. We are excited about Spivak's new breeding program that reinvests in natural disease and pest resistance by focusing on traits like propolis collection, low mite population growth over the season, and hygienic behavior. Breeding programs take time, so you will have to wait a few years to add these bees to your apiary.

What else should you consider when selecting queen stock? We love the way Italian bees brood up in cold Minnesota springs, despite a serious lack of flowers. Italian bees are kind of like Minnesotans who will immediately head for a rooftop bar in a tank top on that one day the temps graze 50 degrees at the highest, even though there's snow in the forecast. **They. Are. Ready.**

But we also love the more conservative Carniolan bees who tend to be keyed into our Minnesota's erratic spring weather: they will shut down brood production if the weather turns cold, and even cannibalize their larvae waiting for warmer days. In fact, Carniolans can look queenless when they go from brood to broodless, but really they are just being efficient with resource management. It is okay to hedge your bets with different stocks of bees that perform differently, allowing for some success whether the weather.

Sourcing Queens

There are many ways to source queen bees. Understanding these options will help you put together a solid, well-performing bee portfolio. Professional queen breeders use inseminated queens for their grafting operations. This process controls both the genetic stock of the mothers (queens) and fathers (drones). Inseminated queens are expensive and are ideal for queen breeders and researchers who want the most control over their bee genes.

Some queen breeders sell both queen cells and mated queens. Commercial beekeepers who produce queens also maintain multiple gene stocks in their operations. Another advantage to the professional queen producer is that they are able to flood mating areas with drones in order to control the genetic contributions of both the queens and the drones even without using artificial insemination.

Commercial queen breeders rely on healthy, well fed and populous colonies to rear grafted queens. Daniel Whitney photo

DIY beekeepers might just want to raise their own queens. Whether you learn to graft your own queens or incorporate walk away splits into your operation, there are some advantages and disadvantages. You will save money and if you are letting the bees raise their own queens via walk away splits, you will be incorporating a nice brood break which can help with *Varroa* management. The disadvantages include your inability to control the genetic contributions of area drones, which depending on your apiary locations can be quite limited. You also need to have a larger apiary to solve queenlessness should your rearing or mating efforts fail. One way to combat at least some of these issues is to create a bee network like the one organized by Dr. Meghan Milbrath of Sand Hill Bees and Michigan State University. Milbrath's Northern Bee Network (**http://northernbeenetwork.org/**) is centered in Michigan, but there are members from other Northern states. One of the goals of this network is to make local queens and bees available for sale or exchange. It's a great way to support local queen breeders while incorporating locally-adapted genetics into your operation.

Tracking Stock

Excellent record keeping is the key to tracking the queen stock that you use in your apiary, allowing you to learn what works and doesn't work for you. Painting queens is helpful [include national colors below, or you can invest in a diverse set of bricks and rocks that allow you to track multiple traits (highly NOT recommended) or you can join the Bee Informed Partnership's Sentinel Apiary Program and let them get you started with some accountability. There are also great tracking programs like HiveTracks (**www.hivetracks.com**), that will help you keep track of how different queen stocks fare in your apiary. Bricks and rocks on top of your colonies is not a good way to track traits; writing things down or logging colony information into an app is the only way to really gather reliable information.

The goal of tracking is to understand how different bees perform under the different environmental conditions (like the behavioral differences of Italian and Carniolan stock differ in a cold spring); to note any supercedures or swarms (so you know what you are tracking), and closely monitor diseases and pests. Tracking your queens from the beekeeping get-go sets you up for a future of geeking out on stocks and genetics (**https://carolinahoneybees.com/mark-your-queen-bee/**). And yes, naming individual queens after Game of Thrones characters is appropriate for most beekeepers (see list of queens past and present below **https://gameofthrones.fandom.com/wiki/Category:Queens**). BC

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Minnesota Hygienic Bees: **https://www.beelab.umn.edu/https%3A/www.beelab.umn.edu/honey-bees/publications**

Varroa Sensitive Hygiene Bees: **https://beehealth.extension.org/varroa-sensitive-hygiene-and-mite-reproduction/**

Purdue Ankle Biters: **https://extension.entm.purdue.edu/beehive/our-breeding-program/**

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Authors

Becky Masterman led the UMN Bee Squad from 2013-2019 and currently alternates between acting as an advisor and worker bee for the program. Bridget Mendel joined the Bee Squad in 2013 and has led the program since 2020. Photos of Becky (left) and Bridget (right) each demonstrating why meticulous notetaking is the best way to track your colonies. Both of these hives need more supers.

Preparing Honey For Market

Honey Processing

When it comes to processing honey, beekeepers have it relatively easy. The bees do the lion's share of the work.

They gather the nectar, convert the disaccharide sucrose into primarily monosaccharides of glucose and fructose, and drive off the moisture so the water content is below about 18 percent. Honey is the only sweetener we use that can be eaten and enjoyed directly after harvesting. All other sweeteners require significant processing often using energy intensive (and green-house gas producing) methods to render a final product. The only processing honey requires is to make the honey filled combs acceptable for marketing, or to separate the honey from the comb and maybe filter it in order to package the liquid honey for the marketplace.

In the old days, hives were killed off and the harvested honeycomb was squeezed by hand to separate the honey from the wax. While inexpensive, it was a very inefficient and messy job. Today, extracting machines efficiently remove honey using centrifugal force in much the same way that water is forced out of clothing in our washing machines. Removal of honey without destroying the comb allows the bees to reuse the frames of honeycomb, and allows beekeepers to harvest honey without destroying the comb or the hive.

The comb is the furniture, pantry, nursery, and communication aid that makes up the honey bees' home and represents a substantial investment on the part of the hive in terms of time, labor, and resources. It is estimated that worker bees must consume approximately seven to eight pounds of honey for every single pound of beeswax that they excrete through their wax glands. Aside from sacrificing some of the honey harvest to allow combs to be built, the beekeeper's investment lies in the cost of acquiring foundation and inserting it into each frame, or repeated timely inspections to ensure foundationless frames are being drawn out straight within the frame and not curved or cross-combed.

Before frames of ripe honey sealed neatly within the comb can be extracted, the wax cappings must first be removed so that the honey contained in each cell can flow out freely. Ways of uncapping frames of honey range from the use of machines that mechanically uncap each frame to manual methods such as the uncapping knife or the capping scratcher (aka uncapping fork). An uncapping knife with a serrated edge is the best way to effectively remove cappings by hand and without heat. The handle of the uncapping knife should be offset and the blade long enough so that each end of the knife will ride along the bottom and top bar of each frame, helping to guide the cut and prevent gouging into the delicate combs. Care must be taken to hold the knife at the appropriate angle so that the blade will not shave off parts of the wooden components of the frame like a wood planer. To increase the ease of the uncapping process, some beekeepers will dip their knife into hot water to heat the blade. Others will invest in an electrically heated uncapping knife. The uncapping fork comes in handy for removing cappings from the areas of comb that the bees do not draw out past the edges of the wooden parts of each frame.

In large operations when extremely high numbers of supers need to be extracted, a large automated electric-powered

Remember to keep your fingers well out of the path of the blade when using an uncapping knife."

When extracted honey is stored in a settling tank, wax and other hive components in the honey will float to the top of the tank. By rigging up settling tanks to each other in series so that the clean honey moves up a tube from the bottom of each tank before running over to the next tank, the wax gets left behind and the extracted honey gets progressively cleaner and cleaner. Very little wax will make it to the third tank in this photo, allowing almost all the honey in the final tank to be bottled without the need to use a sieve or filter.

uncapping machine helps keep one's wrists from tiring out, although there are smaller, less expensive models designed for backyard and sideline beekeepers.

The decision whether to use deep supers, shallow or medium supers to collect and harvest the honey is a personal one that each beekeeper has to make for him- or herself. In terms of strict efficiency, the choice is simple. The deeper the honey super, the more honey it will hold and the faster the honey will be extracted, since it takes about the same amount of time to uncap a shallow frame and run it through an extractor as it does a deep frame especially when uncapping by machine.

On the other hand, the larger the super, the heavier it will be when filled by the bees with the ambrosial gifts of their labor. Today, bee supply companies promote smaller boxes that hold a maximum of eight frames as an alternative for those who wish to save their backs. Whether you choose to utilize eight-frame or ten-frame hive bodies and supers, I strongly recommend that once you have made your choice you stick with one type or the other. Otherwise, the day will inevitably come when you find yourself needing a hive body or super for an eight-frame hive, and the only empty equipment you have available to use is made for ten frames, or vice versa.

Once the honey is removed from the hive and ready for extracting the sooner it is processed the better. There are a lot of problems that can crop up and plague the procrastinating beekeeper that leaves honey supers sitting around. Honey can crystallize, wax worms can get into the combs, or even worse, small hive beetle larvae can ruin the entire honey crop. If stored in a place with high humidity, the moisture content of the honey may rise leading to fermentation.

Once honey extracting commences, variables such as temperature and the types of materials that are allowed to come in contact with the honey become important factors. As with all good production practices, uncapping, extracting, and bottling equipment must be clean and free of foreign materials and debris prior to use. Resist the temptation to get by with cheap plastic or metal materials and equipment. Plastics can leach and off-gas toxic chemicals and many metals will react with honey and can contaminate it. Stainless steel, food-grade plastic, and other food-grade materials must be utilized to reduce the possibility of compromising the harvest's integrity. In keeping with this train of thought, the temperature that honey is exposed to should not exceed the 95° to 120°F (35° to 49°C) range. This is because all the enzymes in honey are adversely affected at temperatures approaching 120°F, and high temperatures will affect the honey's color and flavor. This temperature recommendation refers to the temperature range of uncapping and bottling equipment, not room temperature. Room temperatures below 70 may cause the honey to cool and thicken so it does not run out of the combs as readily which slows down the extracting process.

Conventional honey that has been heated will stay liquid on the shelf for a much longer period than unheated honey before crystallizing, and because it is clear, it is typically filtered to remove the tiny particles of pollen, propolis, and beeswax that may have entered the honey during the extraction process. Not only do these minute particles detract from the clarity of the final product, but they also act as nuclei around which crystals may form, speeding up the crystallization process and shortening the shelf life of the liquid honey. Non-filtered honey preserves the nutritional and medicinal benefits that the bits of pollen, beeswax, and propolis impart to the final product. As a result, most natural and organic honey that is available will be unheated and not filtered and therefore crystallized, with the exception being honey that has been freshly harvested and honey from floral sources that naturally resist crystallization, such as Tupelo honey or Sourwood.

While not necessary for taste or storage, honey being prepared for market has the majority of the beeswax, pollen, and propolis removed from the honey. To do this without using heat, a screen or sieve can be used. However, running honey through a sieve can be a slow process, and when harvesting large amounts of honey, settling tanks are the preferred method of making the final product presentable if one is not heating and filtering the honey. As honey sits, miscellaneous hive material that has found its way into the honey will slowly rise to the surface, where it will float. The relatively clear honey at the bottom of the tank can then be drawn off and bottled. This process is slow however, which is why most commercial beekeepers will filter the honey and use a machine that separates the cappings wax from the honey rather than relying on gravity.

No matter how you decide to go about it, processing honey is a sticky job. Just resist the temptation to lick your fingers and not wash them before you stick them back into the honey. BC

Ross Conrad is the author of *Natural Beekeeping: Organic approaches to modern apiculture* and co-author of *The Land of Milk and Honey: A history of beekeeping in Vermont.*

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WHOLESOME REMEDIES

Alexandra **Nastasa**

Somewhere in a Dutch laboratory, bees are reportedly being trained to test for COVID-19. Coaxed into smelling samples, they're rewarded for positive identification with sugar syrup in a textbook effort to harness animal senses using classical conditioning (InsectSense and Wageningen Bioveterinary Research 2021). It's just the newest in a string of attempts to reap medical wisdom from the animal world stretching back throughout human history, attempts that have often been dazzling successes. But before we turn to the (unspecified) bees to solve our human health problems, there are first questions to be asked about the medical wisdom (or folly) of bees when it comes to their own health.

Medication is an integral part of the modern human experience. From the occasional Advil before a physically demanding dance performance to lifesaving insulin, human beings have developed therapeutics that change the way our bodies interact with problems and pathogens that might otherwise have been incapacitating – and we aren't the only animals to do so. Scientists define self-medication in the animal kingdom according to these rules: 1. the medicine is purposely sought out; 2. the medicine hurts the pathogen; 3. the medicine helps the animal; and (somewhat debatably) 4. in the absence of illness, the medicine hurts the animal, creating a trade-off (Spivak et al. 2019). When it comes to eusocial animals like honey bees and bumblebees, however, the question of self-medication is complicated by the group structure of a hive. Unlike most animals generally discussed when talking about self-medication (such as primates, birds, and elephants), the functional unit of these species is not the individual but rather the hive, and this leads to shifting definitions of cost and benefit: to the part, and to the whole.

On an individual bee level, self-medication in honey and bumblebees makes plenty of sense. The primary sources of nutrition for bees, nectar and honey, have been shown to have vast assortments of active proteins, volatiles and other phytochemicals that vary between plant species, and both honey and bumblebees should be able to detect potential medicines in these nectars and pollens even at low concentrations, due to their sensitive sense of smell (Schmitt et al. 2021). Honey bees are also known to remember the location of quality floral resources and could likely remember more specific characteristics of these resources. In other words, all the equipment is there; the trouble appears to be that the bees refuse to be seen using it.

Over the last decade (and stretching back several more), numerous papers have characterized the effects of naturally occurring plant compounds on various bee pathogens. In bumblebees, sunflower pollen (specific chemical as yet unknown), the iridoid glycoside catalpol, as well as the alkaloids anabasine and gelsemine, have been shown to reduce loads of *Crithidia bombi*, an intestinal parasite (Adler et al. 2020, Richardson et al. 2015, Schmitt et al. 2021). Coumaric acid had antimicrobial effects on American foulbrood without being overly toxic to honey bees (Szawarski et al. 2020). Honey bee survival of Israeli acute paralysis virus was improved by dosing with caffeine at naturally occurring levels, and a mixture of caffeine and arginine was shown to even improve honey bee learning (Hsieh 2020, Marchi et al. 2021). Many of these studies have also confirmed the toxic effects of these compounds in higher concentrations or in the absence of a pathogen. However, evidence for the first criterion of self-medication – the most important – is lacking. Pathogen-dependent bee choice of nectar or pollen has not, thus far, been confirmed in scientific publications.

Although many studies of medicinal phytochemicals have tested for bee choice, the majority have failed to find any significant preference and few results actually support its existence. One study found an increased likelihood of a second visit to a flower containing higher concentrations of a medicinal compound in bumblebees parasitized by *Crithidia bombi* (Richardson et al. 2016). Another found that nurse honey bees infected with *Nosema ceranae* regularly chose sunflower honey over sugar syrup and other honey options, while healthy nurse bees did not show the same preference (Gherman et al. 2014). These findings, in particular the second, are promising indicators that honey bees may be able to make strategic choices based on their health and medicate themselves, or in the case of nurse bees, even those around them, but they are not, on their own, conclusive evidence of honey bees seeking out or having an understanding of medication, especially since far more choice assays have failed to show a pathogen-dependent effect.

The lack of cooperation (or perhaps the outright lack of self-medication instincts) on the part of individual bees suggests that an interrogation of *social* immunity and medication might be more successful. Eusocial bee behaviour frequently supports a "hive over individual" mentality in defensive behaviours like self-sacrificial stinging, and social immunity behaviours like hygienic behaviour. And the potential for social medication among honey bees in particular is high; honey storage is often well-organized by nectar source and can be accessed and used on larvae, young adults, queens, and drones by nurse bees, providing the perfect vehicle for medicating most of the hive, provided the nurse bees can differentiate between the honeys and select for certain characteristics, which there is some evidence for (Erler and Moritz 2016, Gherman et al. 2014). The closely shared space of a bee hive also makes these sorts of social immunity behaviours vital to hive survival, since

Reprinted with thanks to BeeScene and the BC Honey Producers.

the proximity and genetic similarity of the bees would otherwise make them extremely susceptible to disease and parasites (Spivak et al. 2019).

One well-known strategy that bees use to reduce the spread of pathogens in such close quarters is propolis, which acts as a sort of blanket antibiotic, partially sterilizing the hive environment (Simone-Finstrom and Spivak 2012). Multiple species of eusocial bees, including the Western honey bee, have significantly reduced immune activity in the presence of more propolis, suggesting that propolis acts a little like an external immune system protecting the whole hive (Pusceddu et al. 2019). Bees fed propolis have also shown decreased pathogen loads, although so far there is little evidence that bees ever purposefully eat propolis, except accidentally while consuming pollen (Mura et al. 2020). Most excitingly, however, propolis is the most convincing avenue for social medication. Propolis gathering in hives was shown to increase due to both increased *Varroa* mite counts and chalkbrood (Pusceddu et al. 2019, Simone-Finstrom and Spivak 2012). This behaviour was a clear response to the hive's condition and reduced the number of pollen foragers available to the hive, which can be considered a negative side effect, while also causing a decrease in the hives' pathogen loads (Erler and Moritz 2016, Simone-Finstrom and Spivak 2012). The propolis gathering response fulfills all four requirements for "self"-medication, provided that we consider the whole hive the "self".

Although propolis gathering is not as recognizable a form of "medication" as seeking out therapeutic nectars might be, medication in the human world can also involve a variety of creams, sprays, environment adjustments, etc. The intention shown in increased propolis gathering to control outbreaks in the hive is still fascinating, and further reinforces a "superorganism" way of thinking about eusocial bee behaviour because it tackles the needs of the hive over those of the individual. As for the nectars, pollens, and honeys, research is ongoing and the articles reviewed here are by no means exhaustive. Each compound found to improve bee health is another potential candidate for less harmful therapeutics beekeepers might be able to treat hives with in the future, even if the bees do not seek them out themselves. The question of bee self-medication is still understudied, but expanding it to include social medication can only improve our ability to understand eusocial bee defenses. And although the usefulness of bees in sniffing out COVID-19 is still up in the air, the lessons we can learn about how to protect a highly social community are perhaps worth a listen. BC

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Can Solar Energy Fuel Pollinator Conservation?

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Abstract

As the expansion of solar power spreads through much of the United States, members of the solar industry are working to change how solar energy facilities are designed and presented to the public. This includes the addition of habitat to conserve pollinators. We highlight and discuss ongoing efforts to couple solar energy production with pollinator conservation, noting recent legal definitions of these practices. We summarize key studies from the field of ecology, bee conservation, and our experience working with members of the solar industry (e.g., contribution to legislation defining solar pollinator habitat). Several recently published studies that employed similar practices to those proposed for solar developments reveal features that should be replicated and encouraged by the industry. These results suggest the addition of native, perennial flowering vegetation will promote wild bee conservation and more sustainable honey beekeeping. Going forward, there is a need for oversight and future research to avoid the misapplication of this promising but as of yet untested practice of coupling solar energy production with pollinator- friendly habitat. We conclude with best practices for the implementation of these additions to realize conservation and agricultural benefits.

Key words: *pollinator conservation, sustainability, renewable resources*

Land dedicated to solar energy production continues to increase as solar energy becomes more competitive with nonrenewable sources (Anon. A. 2020). Solar developers buy or lease land accessible to the existing energy grid; in addition to technical concerns, this need presents other hurdles. Solar developments composed of gravel or mowed turf grass surrounded by security fencing (Fig. 1) increase ambient temperature (Barron-Gafford et al. 2016) and are considered unsightly by the public. These factors invoke 'not in my backyard' (NIMBY) opposition to the expansion of solar into urban or suburban areas (Larson and Krannich 2016). Resistance can also be high in rural areas, where the removal of land for agricultural use will have economic impacts, especially where farmers rent land for production. Ignoring environmental and social considerations produces unhappy communities, generates negative media attention, increases costs, and can eventually derail solar development.

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One way to counter this resistance is to add elements to solar farms that provide additional benefits for the local community. A novel approach is the replacement of onsite gravel or turf with well-planned landscaping intended to add conservation or economic value. Pollinator conservation requires adding flowering vegetation and nesting habitat back to the landscape (Goulson et al. 2015). The native, perennial, flowering plants of the Midwest are attractive to both wild and managed bees (Tuell et al. 2008), and when planted in a mixture (Gill et al. 2014), increases the abundance of pollinators throughout the growing season. Adding flowering plants to solar farms could provide much-needed forage for native bees which are in decline throughout the United States (Koh et al. 2016).

The addition of native, flowering vegetation could also expand the use of solar farms for agriculture, or 'agrivoltaics', in which land developed for solar energy generation is concurrently used for farming (Dinesh and Pearce 2016). This can include planting shade-tolerant crops under panels or allowing certain livestock to forage within a solar farm (e.g., sheep). Incentivizing a 'pollinator-friendly' habitat for the conservation of nonmanaged, native pollinators can support an agrivoltaic practice by contributing to more sustainable beekeeping. Honey production has declined over the last two decades (Sowell 2020), thought to be related to the transformation of foraging habitat for corn and soybean agriculture (Otto et al. 2016). Even in areas with pollinator-dependent crops that are a floral resource for honey bees, a dearth of forage occurs before and after crop anthesis. Providing honey bees access to a location with plants that flower at key points in a growing season, like when the surrounding crops cease flowering, has been shown to be a valuable contribution to beekeeping (Dolezal et al. 2019). Expanding the definition of agrivoltiacs to include beekeeping would add a form of agriculture that produces a product (honey) that reveals the quantifiable benefits of the flowering plants. While some small solar establishments may not provide sufficient flowering resources to significantly affect honey production, others are seeing implementation at a very large scale. For example, the Aurora Solar farm in Minnesota spans over 1000 acres (Swinterton Renewable Energy 2021), and 15 developments of at least this size are currently planned or in progress in Indiana (Weaver 2021). In addition to increased honey production, diverse sources of pollen have been shown to improve the response of honey bees to pathogens (DiPasquale et al. 2013, Dolezal et al. 2019), and could help reduce colony losses and thus improve profitability and sustainability.

Adding pollinator habitat can appeal to communities that value conservation or agricultural production. These two activities may be in conflict, with growing evidence revealing that wild pollinators and managed honey bee hives compete for resources and share pathogens (Mallinger et al. 2017). We have recently observed this in Iowa prairies, where honey bee viruses are frequently found across many bee species (Dolezal et al. 2016), and an increase in viral infections occurred in *Bombus* spp. when managed honey bees were present (Pritchard et al. 2021). To what extent this may occur at a solar farm is unclear, especially when the surrounding landscape no longer offers flowering resources. Ultimately, the risk

of this interaction should be considered by the project managers and the local community. The decision to use a solar farm for wild bee conservation or apiculture will likely vary by site and the local community's needs. If conservation is a goal, the potential costs to wild pollinators could be minimized by limiting access to managed honey bees. Regardless of which pollinators benefit, the cost of this habitat is a small portion of the overall solar development budget with benefits that may affect energy production. The vegetation may improve solar efficiency (Barron-Gafford et al. 2016) by reducing the ambient air temperature under solar panels.

While the addition of flowering plants is an intuitive approach for pollinator conservation and has been adopted by some solar farms (Fig. 1), we lack empirical evidence of the impact these farms may have on pollinator diversity, abundance, and honey bee productivity. Despite this deficiency, we discuss several examples where habitat was added back into agricultural landscapes, resulting in a positive response by wild pollinators and honey bees. We recommend that the shared basic principles of these success stories be adopted by the solar industry, noting key aspects for future investigations to ensure the anticipated improvements of linking solar farms to pollinator conservation are realized.

Can solar energy increase land for pollinator conservation? Research-based recommendations for achieving conservation goals within working landscapes indicate a need for restoring a significant area with communities of native plants. However, transforming privately-owned land from agricultural production to conservation is challenging as landowners require compensation to justify this conversion. Federal conservation initiatives, like the USDA Conservation Reserve Program (CRP), provide economic incentives for this transformation, but are publicly funded and with goals that are broader than pollinator conservation. The CRP program is comprised of many different conservation practice (CP) programs, including native grasses (CP2), shallow water for wildlife (CP9), contour grass strips (CP15), filter strips (CP21), wetlands (CP30), and various tree plantings (e.g., CP3) (U.S. Department of Agriculture (B) et al. 2021). While several of these may provide resources and habitat for pollinators, and at least one (prairie strips, CP43) has been confirmed to increase pollinator abundance and diversity (Schulte Moore et al. 2017, Kordbacheh et al. 2020), only CP42 ('Pollinator Habitat Planting') is explicitly designed for pollinator conservation. As of 2020, CP42 made up only around 2% of all CRP land (505,395 acres from a total of 21,950,920 acres) (U.S. Department of Agriculture (C) et al. 2021). While land enrolled in CRP peaked in 2006 at 36 million acres, it has fallen to just under 22 million acres as of 2020 (U.S. Department of Agriculture (A) et al. 2021). This reduction has been linked to increases in corn cultivation driven by previous incentives to support renewable fuel production (i.e., ethanol; Hart 2015, Otto et al. 2016). Therefore, there is a critical need for other mechanisms to facilitate conservation practices.

With many states experiencing expansions in the acreage covered by solar facilities, these have the potential to rival and exceed the amount of pollinator habitat added by CP42. Currently, Indiana has at least 15 planned solar energy farms in development, each projected to

Figure 1. *Top left – a conventional solar farm with gravel substrate (Anon 2020). Bottom left – mature pollinator-friendly solar farm. Right – solar farm with a honey bee apiary* (photo credit, Dennis Schroeder, National Renewable Energy Laboratory).

cover >1000 acres. One of these is planned to cover approximately 4500 acres (Weaver 2021); if planted with pollinator habitat, this one development will provide almost as much habitat specifically for pollinators as the entire state's CP42 enrollment, which is at 5309 acres as of 2020. In Minnesota, the North Star Solar project is already in place, covering approximately 1000 acres with on-site pollinator habitat (Swinerton Renewable Energy 2021). This site alone covers more than 6.5% of all CP42 plantings in Minnesota for 2020 (14,982 acres). Thus, if even a fraction of the land allotted to future developments can be planted with effective pollinator habitat, these contributions could be substantial.

Habitat enrolled in CRP is valuable for pollinators, but when commodity prices increase and crop production becomes more profitable, the 10–15 year contracts that support these practices can be broken or not renewed (Secchi et al. 2010). Solar developers, on the other hand, follow other energy producers (Ziegler et al. 2018) using private capital to lease land through long-term contracts with landowners. This compensation can exceed that provided by public initiatives (on a per-acre basis), representing an attractive pathway to privately-funded land conversion. To what extent solar farms will add to publically-funded attempts to conserve pollinators is not clear, as there is the potential to replace land in CRP with future solar developments. If solar farms are placed within land currently enrolled in CRP, there is the risk that there could be a net loss in habitat for pollinators. We recommend that pollinator-friendly solar farms not be a replacement for CRP but rather a supplement to increase the amount of land available for conservation.

While solar energy is rapidly expanding (Wintle et al. 2019), land dedicated to these developments will remain small relative to commodity crops (e.g., corn, soybean – each projected to be planted on more than 90 million acres of the United States in 2021 [U.S. Department of Agriculture (D) et al. 2021]). Can small pollinator habitat enhancements scattered through a matrix dominated by agriculture make a meaningful contribution? An inference drawn from island biogeography theory is that a single large area will provide greater conservation value than several smaller areas (Diamond 1975). However, a recent synthesis of literature spanning four continents revealed unexpected value to plant and animal conservation in preserving or restoring small (2½ acres) patches of native habitat when surrounded by cleared

or degraded areas (Wintle et al. 2019). This provides quantitative support that the thoughtful development of small patches of habitat, especially in regions committed to agriculture where little native habitat remains, can attain conservation goals. While the impacts of pollinator-friendly solar farms are still unknown, predictions can be made by evaluating similarly-sized habitats containing native, perennial flowering vegetation within agricultural landscapes.

Achieving pollinator conservation through re-integration of native vegetation: Lessons from the Heartland.

Recognition that pollinators suffer from nutritional deprivation and habitat restriction has led researchers, government agencies, and non-governmental organizations to encourage the reintroduction of floral resources into disturbed landscapes. Focusing on native species can reverse declines in plant communities, reestablishing co-evolved relationships with native pollinators while providing additional ecosystem services (Isaacs et al. 2009). For example, the tallgrass prairie ecosystem once covered the U.S. Midwest, but conservation efforts in this region are focusing on reintegration within agricultural landscapes, leading to increased pollinator abundance and diversity. Small patches (1.2–5 ac) of flowering perennial plants increased pollinator abundance and diversity while also improving yields of adjacent blueberries, a valuable pollinator-dependent crop (Isaacs and Kirk 2010); solar-based habitat is predicted to add to these effects (Walston et al. 2018. Larger patches (5-10 ac) have also been integrated within commercially managed corn and soybean fields through the 'Science-based Trials of Row-crops Integrated with Prairie Strips' (STRIPS) project in Iowa. Despite the close proximity to conventional herbicide and insecticide use, prairie strips increased pollinator abundance and diversity (Kordbacheh et al. 2020 These prairie strips increased plant biodiversity with the addition of 55 blooming forb species within conventional commercial farms, helping to realize multiple conservation goals. Outside of the Midwest, other native habitats (i.e., hedgerows) added to geographic areas also conserve beneficial insects (Grass et al. 2019), and could be considered if they fit the constraints of solar development infrastructure. The successes achieved by these case studies can be replicated within solar farms if the habitat under and around the solar panels is embedded with native, perennial flowering species appropriate for the location.

However, concerns have been raised about the value of pollinator habitat in agricultural landscapes due to the potential for nontarget pesticide exposure. The use of pesticides within the adjacent crop may negatively impact bees foraging on these resources (Mogren and Lundgren 2016). Solar facilities have little or no use for insecticide applications, though herbicides may be used to aid habitat establishment and reduce weed pressure. Further, most state scorecards specifically deduct points for insecticide use. While solar developments may include other aspects that negatively affect habitat use, their potential as a refuge from insecticides could be of extra value. Future work will be necessary to see if and how much reduction in insecticide exposure occurs when these facilities are available to pollinators.

If solar developments implement these habitat features into areas where intensive agriculture is practiced, they could provide important connections with existing conservation practices. Established solar farms could be a valuable addition to existing practices supported by CRP, like prairie strips (CP43), pollinator habitat (CP42), and nongovernmental organization efforts to conserve pollinators and Monarch butterflies. By actively modifying the habitat within and around solar farms, this addition to the landscape could be part of a larger plan to improve habitat availability through a mixture of public and private funding, i.e., as part of a land-sharing approach that fills gaps and improves connectivity (Grass et al. 2019).

What are the administrative challenges? Currently, some US states administer the definition of solar pollinator habitat through a 'scorecard' system providing defined standards (Fig. 2, Box A). This approach 'scores' habitat contributions, giving points for increasingly ideal characteristics, and with enough points, earning a development a 'pollinator friendly' designation. In some states, this terminology has been encoded into law, requiring scorecard content oversight from a third party, e.g., a state university or department (e.g., Illinois [Anon. B. 2020]). Rather than prescribing specific seed mixes and habitat plans, this approach allows developers and landscapers flexibility to choose plants and arrangements appropriate for a site's unique growing conditions. This flexibility can ensure that habitat enhancements are compatible with the realities of the solar array itself (e.g., shade vs. sun, soil conditions).

Once a solar farm is built and efforts made to establish the habitat outlined in the scorecard, success will require post-establishment evaluation. Many of the plants suggested for pollinator conservation (Tuell et al. 2008) often require years before significant above-ground biomass and flowers are produced. Cultivation of these native plants may require management to ensure that competition with annual, nonnative plants (i.e., weeds) is suppressed. A best practice for confirming that the policy produces the desired outcome may require a third party to certify that the desired score has been achieved. In Illinois, for example, developers must complete a 'planning' scorecard, followed by an evaluation of habitat establishment after three years and a follow-up evaluation every five years thereafter (Illinois Department of Natural Resources 2021). The most rigorous approach, however, would require these progressive evaluations to be performed by independent, certified third parties, an approach that currently faces logistical hurdles. To make the most lasting impact, however, these evaluations will be critical.

While habitat within a solar farm is appealing on the surface, the real-world application will take rigor to achieve a meaningful impact. Beyond the initial 'score' assigned to development, local involvement will be critical for success, especially since the definition of success may vary by community. For example, concerns about competition between native bees and managed honey bees (and thus benefits to conservation or agriculture) could be addressed at a local level, with stakeholder input determining access to beekeepers. Perhaps most importantly, installation of perennial plant communities does not occur instantly as the many native perennials require years to successfully establish. A maintenance plan is critical to ensure the habitat is not degraded by

invasive weeds. Ideally, those responsible for the scorecard policy should include timelines for reassessment to ensure if the habitat goals were achieved and continue through the lifetime of the solar farm.

Conclusions

Energy policies influence land use and biodiversity (Konadu et al. 2015); for example, incentives for biofuel production drove conversion of CRP land to crop production, removing floral resources and reducing insect-derived ecosystem services (Landis et al. 2008) and significantly reducing resources for pollinators (Otto et al. 2016). If energy policies can drive habitat loss, could new policies ameliorate or reverse these effects? The continuing surge in solar energy development could support the implementation of pollinator conservation on privately-owned land, helping address a nationally recognized need. For this practice to provide tangible results, cooperation between policymakers, researchers, and industry stakeholders is critical to producing recommendations or requirements that benefit pollinators while remaining realistic within the framework of utility-scale solar developments. If pollinator habitat improves public perceptions of these facilities by tapping into widespread interest in pollinator health, without rigorous implementation, assessment, and independent oversight, these efforts could be seen as little more than a form of 'greenwashing' that touts benefits to pollinators without providing them. BC

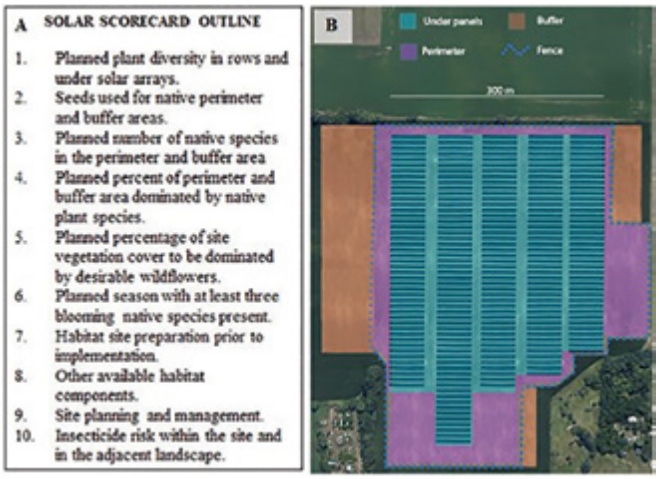

Figure 2. ***A****) This outline highlights categories noted in the Illinois pollinator scorecard to determine whether a solar site can be legally defined as 'pollinator- friendly'. Each state has different points allotted to different categories based on stakeholder input, and point values can, and should, be reevaluated as new data become available. Solar developments include land both under solar panels and in the area surrounding them, each with different constraints. The diversity of plants are evaluated in the 'solar array' 1) and 'buffer/perimeter' areas (2–4). Plants chosen for cultivation under panels are limited due to height and shade restrictions; thus, plants are judged primarily on diversity and coverage with the understanding that nonnatives may be needed. The buffer/perimeter, however, has fewer restrictions, so the scorecard incentivizes natives. For the whole site, coverage by flowers (5), flower availability throughout the growing season (6), proper site preparation, e.g., weed control (7), availability of other benefits, like nesting habitat for wild bees and water sources (8), proper site and administration planning (9), and insecticide use restrictions (10) are evaluated.* ***B****) Artistic rendering of a solar development in an agricultural landscape; colors denote different components of the land referred to by the scorecard.*

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BIGGER PICTURE

Jessica **Louque**

The Devil's In The Details

Most of us have our bees in fairly rural places. It can be shady, sunny, pristine, wild, in a backyard, in the woods – so many options. My neighbor has a swarm trap on his porch roof, probably to lure away our miscreant hives. Almost all of ours are in some place that will end up with muddy tires in the lightest of rains and hitchhikers stuck to your pants. Apparently, some of these places aren't deterrent enough since we had four hives stolen from one of our study sites a week ago – must have been too close to the highway. It's hard to not blame yourself for things like this, but really it shouldn't matter how I had my bees to not have people steal. Anyway. My first thought of these bees when I went to check and see exactly what was stolen (they left the accompanying hive tools, lids as stands, and cinder blocks, but they were ratcheted and ready to move because we were coming to get them in the next couple days), I noticed that there was poison ivy everywhere. I hope the bee thieves are covered in bee stings and rashes. They were our most aggressive hives, after all. It made me think about how many times I've ended up with ivy rashes just from checking bees or wandering near them.

Eastern poison ivy is scientifically named *Toxicodendron radicans* and can grow just about anywhere. It can grow into just about any habit, and it can look wildly different just a few feet away from another of its own kind. When it's tiny, it appears to be an innocent little plant with sweet soft leaves and happy little growths. Then, it starts getting bigger, bushier, or vining and can overtake trees and put kudzu to shame. The trunks of the vines can easily be larger than your forearm and produce aerial roots all over. Mowing my mom's yard, I pushed a tree branch out of my way that made sure to gently caress my cheek on my way by. Then I realized it didn't have the right leaves to match the rest of the tree. Then I realized again that it was not part of the tree but a poison ivy vine that was making its own branches off of the tree and just tried to eat my face. My first reaction was to use a potato peeler and just take the skin off my face because it would be better than the rash, but I just went to the bathroom and washed my face instead.

I have always been severely allergic to poison ivy. Some of our farm workers when I was younger could pull it up by their bare hands and never get anything. They used to tell me it was because they were in 'nam and nothing else could bother them after that. I had no idea what that meant at the time, but I was definitely jealous. As I got older, it just got worse and I would have to go to the doctor for cortisone creams or steroid shots, especially if it was close to my eyes. The problem is the chemical in poison ivy called urushiol. Poison Ivy is in the Anacardiaceae family, which is pistachios, cashews, mangoes, and other toxic plants. People who are allergic to urushiol do not build up a tolerance by exposure as happens with some things (like bee stings). Instead, it causes hypersensitivity with repeated exposure and can make you more sensitive to other carriers of urushiol. This chemical can be found throughout the cashew family. Improperly treated cashews can carry it, as can mangoes. Mangoes have their own irritant that can cause a reaction, and sometimes it can cause a severe reaction by responding to urushiol as well. The fruits from this family, such as cashews, mangoes, and pistachios, all have urushiol in them. With mangoes, the chemical is found in the skin and the stalk, and little beads of urushiol can be found around the break from the tree on what used to be the flower petiole. Cashews and Pistachios are always steamed or cooked to try to remove urushiol from the nuts, and cashews are not sold with shells ever. Even with these precautions, people who are sensitive to urushiol can still have allergic reactions to these fruits and should probably avoid them. It's an odd reaction because basically no other animal has an issue with urushiol, whether it be from lack of skin contact (fur, feathers) or just no immune system response.

Poison ivy is actually really good for local habitats. A lot of animals eat it with no ill effects. Birds eat the berries, and lots of pollinators, including bees, like the flowers. We have had poison ivy pollen show up in our pollen IDs multiple times in decent quantities. It's really only a bad plant if it is near humans. You can get the oil from your pets, if your pet has it and you touch them. The oil is pretty aggressive and can stay on pet fur for a long time. If you get it on your skin, you have about ten minutes before it takes up permanent residence inside your epidermis. Soap and water will work to get rid of it, or some alcohol if you have it on hand. It is not water soluble so just rinsing

Massive poison ivy.

won't help. After that 10 minutes of grace, it's going to be cortisone cream and Benadryl for you after about three days. It normally takes at least 48 hours for the rash to show up on people, but it can be three or four days. It normally only lasts a week, but if you're really lucky, you'll keep your blister rash for almost a month. It also can't spread like some people think. You can't catch it from other people, or spread it around your body. The rash comes up exactly where the oil touches you. Now, if you take the oil and scratch a few places, not knowing it's on your hands, you can spread it around on yourself pretty rapidly or put it in places you might not want it to be. It's the same with your pets. If you have dogs or cats or goats that go outside and then come in and hop on your furniture or bed, there's a chance you're going to end up with the rash from secondary exposure. It's not a bad idea to wipe down your pets when they come in the house if you can. I gave up on this because we leave all our doors open and there's just too many animals to deal with.

There are a ton of things on the market that are sold to prevent or get rid of poison ivy. I'm pretty sure most pharmacies or medicine sections have a shelf dedicated to it. These aren't really useful. I mean, I guess they would work, but regular soap is just as good. Especially instead of something that scrubs. Never do that. You don't want to potentially expose yourself more by causing microtears and giving the oil a free ride in your body. Regular soap is fine. Dish soap is probably better just because it's meant to break up grease on dishes, but in general, buy yourself a drink and snack or save your money instead of buying fear products. If you already have it, nothing is going to make it go away. If you're the hippie type or like home remedies, jewelweed is probably the best thing I've seen for it and I've bought a few variations off the internet for friends of mine that have been exposed. Just be careful with medicinal plants because you might have an allergic reaction and not expect it since you might not have been around it before. This post is inspired partly by my beautiful friend Cathia, who moved to Texas and had her kids in the emergency room with nearly necrosis after climbing trees covered in ivy and having some of the worst reactions I've ever heard of. Her daughter required hospitalization and both her and her little brother had to have medical intervention to keep from suffering long-term damage. Poison ivy is no joke and you shouldn't take it lightly, even if you don't have a reaction at the present time. As a side note, this same friend gave me a remedy with monkshood(aconite) in it for Henry's muscle issues when he ran track and that's how we found out he's allergic to Aconite. Luckily the jewelweed couldn't have made their problem much worse even if it didn't work!

Pumpkin and Pickle getting into the poison ivy.

Now, in the panic to get rid of this devil plant, you may start pulling up all the ivy around your bees and house. Make sure you pay attention and leave your Virginia Creeper alone. They look pretty similar, but creeper is a great bee plant that they love and has no detrimental qualities to humans unless you just don't like vines. They are typically a larger portion of our pollen source ID's over the Summer than poison ivy, and would be considered an important food source. If you are particularly anti-human, you may be like me and consider putting up a fence and training poison ivy to grow on it around your property. I don't think it would stop the bears, but at least you know where your bees went when the bears come. Either way, wash your hands and exposed skin frequently and hopefully you can avoid rashes and illness for the summertime! BC

Book Reviews . . . Cont. from page 21

is an expensive but, it is worth the money.

Terry Ryan Kane is a vet, a beekeeper, and owner of A2 Bee Vet, a practice devoted to honey bee medicine in Ann Arbor, MI. Cynthia M. Faux is a Professor of Veterinary Medicine at the Univ. of Arizona, College of Veterinary Medicine in Oro Valley, AZ.

But when you look at particular chapter authors, you gain an even better idea of the value of this book: In section 1, Biology and Medical Foundations covers these chapters by these authors;

Robin Radcliffe and Tom Seeley on the Superorganism and letting nature solve the health crisis; Cynthia Faux on Anatomy; Rolfe Radcliffe on Physiology; Randy Oliver on the Honey Bee Queens; Dewey Caron on Honey Bee Strains; Margarita Lopez-Uribe on Wild Bees; Kasie Raymann looking at Antimicrobial Resistance; and Gigi Davidson on Honey Bee Pharmacology.

Section two covers these chapters on Beekeeping Principles for Veterinarians, by these authors:

Equipment and Safety, by Adam Ingrao; the Apiarist, with Katie Lee and Gary Reuter; Apiary Design, by Brandon Hopkins; Clinical Examination of a Honey Bee Hive, by *Bee Culture's* Jerry Hayes; Vet Regulations, by Better Bee's Chriss Crips; Medical Records, with Marcie Logsdon and Terry Kane (which includes a vet-client agreement and a sample hive record; then Epidemiology and Biosecurity, by Kersten Oblink and James Roth, which includes a biosecurity and BMP checklist.

Part three covers Honey Bee Diseases, Disorders, and Special Topics, including these topics and their authors:

Varroa, David Peck; Viral Diseases, with Esmaeil Amiri, Olav Ruepppell, and David Tarpy; Bacterial Diseases, by Meghan Milbrath; Fungal Diseases, with Judy Chen and Jay Evans; Parasites, by Britteny Kyle; Pesticides, by Reed Johnson; Sampling, with Dan Wyns; Necropsy of a Hive, by Dewey Caron; Husbandry Issues, by Charlotte Hubbard; Queen Rearing and Bee Breeding, by Krispn Given; and finally, the Future Direction of Honey Bee Veterinary Medicine, by Jeffery Applegate.

Also included are the biographies of all of the authors, along with the institutions they are associated with and the positions they hold.

All told, there are 33 authors contributing to this book. Simply put, this is a Who's Who of Health Science. I do not believe there is a better collection of what is known about honey bees, beekeeping and honey bee science anywhere. It is immensely impressive, and a needed tool to equip the leaders of honey bee health groups and organizations to succeed.

Kim Flottum,
Growing Planet Media

Be Sure And Check Your Mailing Label. It Will Tell You How Many Issues Of Bee Culture You Have Left! You Don't Want To Miss A Single

A Tanging Tempest In The Beeyard

If it doesn't work, why do so many beekeepers still perform this swarm-catching ritual?

Should I apologize?

Should I immediately apologize for spending your reading time on an antiquated subject like *"tanging"* while other writers – in this very publication – are properly writing informative and current pieces for your beekeeping edification? In my defense, my involvement in this legacy swarm management topic started innocently enough and, ironically, some of my beekeeper friends caused it. In a real way, this saga is not my fault.

A wearying zoom presentation

Last April, I presented a zoom talk on swarms and swarm biology to the Broward County Bee Club in Florida – an energetic and organized group. I thank you for inviting me. Though the group was engaged and supportive, it has been my sense that, after a short time, most Zoom talks have a numbing effect on the brains of both the listeners and the presenter. Try as I might, as the Broward session went to Q&A, I had the typical unfulfilled sense that somehow, I had not done my job as a presenter, and I just hate that feeling.

James E. **Tew**

I don't remember who did it...

Since the topic had been on honey bee reproductive swarming, and since we had previously discussed the frustration of losing a swarm, either I or someone else mentioned *"tanging"* a swarm before it escaped. It's an old recommendation to tang the swarm to get it to settle.

Several participants had no opinion, but several did have strong beliefs that tanging did work – and it worked dependably. I admitted to the group that night, as I admit to you readers now, that I have no technical information that could explain how this old process works or why it would work. At the time, I was caught unawares and after thinking for a few days, I convinced Kim Flottum that we should use one of our podcast segments at *Honey Bee Obscura* to discuss the swarm concept of tanging.

The results of our tanging podcast were much like the earlier experience I had in Florida. Beekeepers who believe in tanging, devoutly believe in it. We had follow-up communication with experienced beekeepers who wanted to be on record as being *"tangers."* They tang and they recommend it.

A primer on tanging a swarm

In today's language, a simple definition of the process would be a swarm is tanged when noise – usually made with metal pieces such as a metal pan being struck with a metal spoon – is produced near the moving swarm. It is generally thought that a swarm cannot be prevented by tanging, but it can be convinced to "pitch" (or land) at a nearby location. Believers feel that the tanged swarm will come down – or at least – will *usually* come down. No one has said to me that ***all*** swarms come down ***all*** the time. On the other hand, unbelievers feel that nothing is changed by implementing the noise-making process, and that the swarm either lands – or not – on its own.

Here's the enduring tanging quirk – there have been believers and unbelievers for hundreds and hundreds of years. Yet, this concept has clearly not passed into history. It perseveres. Does this process work or not?

The Hive and the Honey Bee and *ABC & XYZ of Beekeeping*

The two hallmark books of U.S. beekeeping, *The Hive and Honey Bee* and *ABC and XYZ of Beekeeping* have insightful input (or not). So far as I could find, the current *Hive and the Honey Bee* makes no mention of the procedure – at all. If the procedure was invaluable in its deployment, and established in beekeeping lore, would not this respected book have contained detailed information?

Authors of the *ABC and XYZ of Beekeeping,* wrote, *"There is no evidence that tanging has any effect on swarm behavior, although some beekeepers still believe that it does."* As is the usual case, the ABC & XYZ author presented the justification for tanging a swarm was to keep it in sight and retain ownership of the mobile swarm as it crossed property lines.

Nearly 400 years ago

In 1623, Charles Butler wrote *"The Feminine Monarchie: or The Historie of Bees.* In chapter five of his book, he discussed *tinging* the swarm. He did not use the more recent term, *tanging*. Still other authors, eons ago, used the word *tinkling* in lieu of tanging or tinging.

Engraving of a swarm tanging event. nearly 200 years old.

As best I can translate Old English to English, beginning at the third paragraph of Butler's work, in the reproduction that I have presented in this article, he wrote the following description.

> *When the swarm is up, and busy in their dance, it is a common way, for want of other music, to play them a fit of mirth with a pan, kettle, basin, candlestick, or other like instrument, for to stay them, forsooth, from flying away. Indeed, where other bee-folds are not far off, this way hath a good way: for thereby, the place and time of their rising is publicly noted, and for a clear and open claim laid unto the swarm that otherwise some neighbor might challenge for him, which undoubtedly was the original cause of this custom. But the pretended reason is to me a mere fancy: but I know it to be as ancient as common. (At this point, Butler includes several comments made by much earlier scholars and writers – all relating to tanging and in other languages. In fact, in other publications, references are made to Columella describing tanging 500 B.C. Pliny (AD 23-79), Virgil (BC 70-19), and Claudian (c. 370-404) instructed swarm chasers to "strike brazen vessels." (This process of striking metal vessels to bring down a swarm is clearly a very, very old swarm-gathering recommendation.)*
>
> *Butler continued: If you see them begin to fly aloft, which is a token that they would be gone, cast dust among them to make them come down. If they cannot be stayed, hastening on still, go beyond your bounds, the ancient laws of Christendom permits you to pursue them, where to fore, for the recovery of your own. Notwithstanding, do what you can, sometimes they will away, and perhaps fly too far before they settle, that though follow them never so fast, you must be content to leave them happily to the happy finder.* ***For when you have lost the sight and hearing of them, you have lost all right and property in them*** *(JTew bolding)***.**

Yet another older literature review on tanging

Harrod-Hempsall[1] published a thorough discussion of tanging in volume one of his two-volume beekeeping tome, *Bee-Keeping, New and Old*. He cited John Keys[2] who, in his earlier 1814 book, *Treatise on Breeding and Management of Bees*, gave explicit support to "tinkling" bees and offered several specific recommendations that I present below.

> *"If prime swarms, were not in the habit of settling in a usual spot, would most likely be lost by the "apiator" if not tinkled."*

Secondly, *"For prime swarms (first swarms), the noise should not begin till such a quantity of bees have arisen as will for a good swarm, for fear of terrifying the* princess (JTew comment: the queen) *from issuing; and if so, all the bees will return, though hived."*

Thirdly, *"The noise should be made on the contrary side to that which will be most proper for settling."* (JTew comment. Essentially, tang on the opposite side of the swarm at the site where you would like them to settle.)

Forth, *"Nor should it* (tanging) *continue longer than the bees begin to cluster; there is no danger, but the rest will follow on hearing their buzz."*

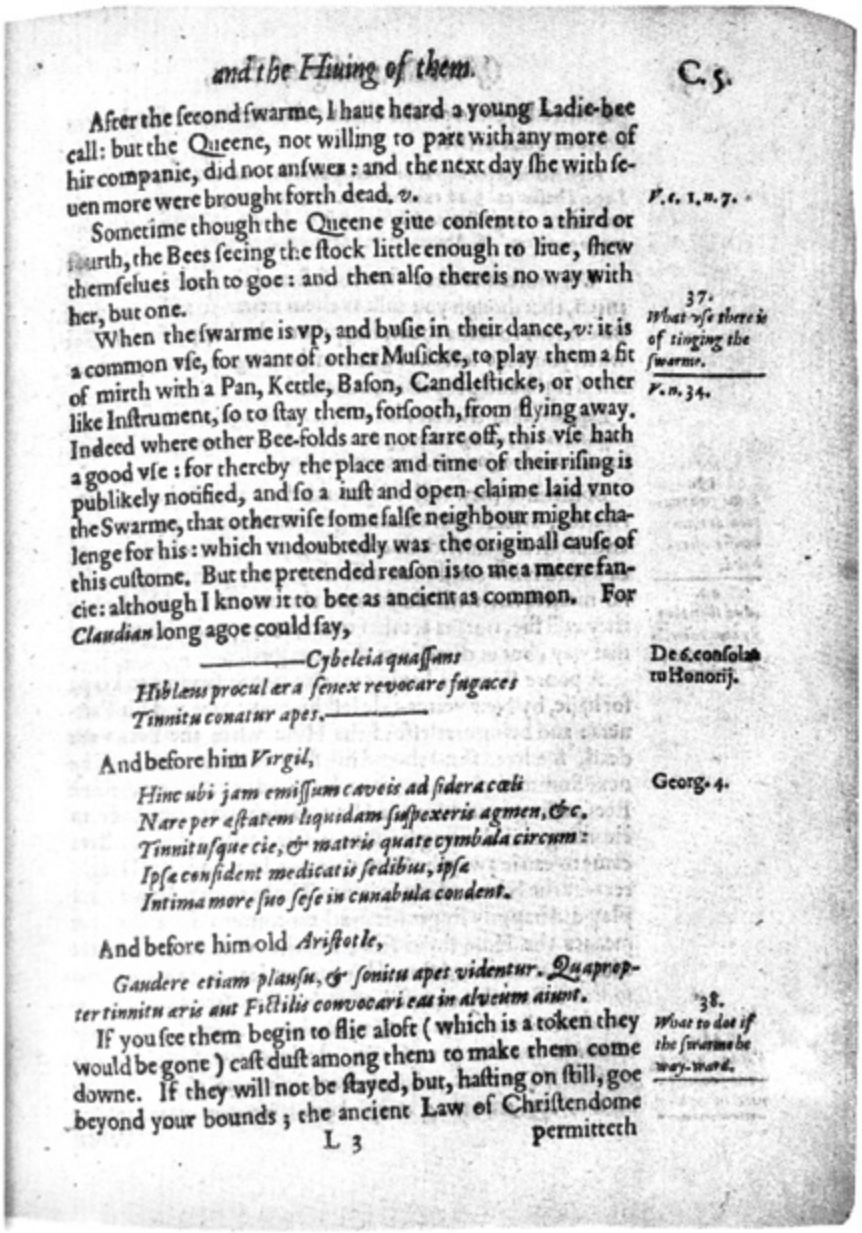
Fifth, *"The greater the noise, the sooner it* (JTew comment: tanging) *is likely to succeed. I find a watch rattle (used about London) the most efficacious, and that when the common method has failed."*

A *watch rattle* is a noise ratchet. It was used by British and later, also used by US police, as a noise maker for attracting both attention and other police persons. It now has musical uses or sound effect uses. Also, I have seen children's' toys that were similar rachet devices. The watch rattle is nicely explained and shown at: **https://www.youtube.com/watch?v=BViVjh9mTeU**.

Harrod-Hempsall wrote that the during the last century, it was felt that an

[1]Harrod-Hempsall, William. 1930. *Bee-Keeping, New and Old, Described with Pen and Camera*. The British Bee Journal. London, England. Vol. 1. 772 pp.

[2]Keys, John. 1814. *Treatise on the Breeding and Management of bees*. McDonald and Son. 308 pp. London **https://archive.org/details/treatiseonbreedi00keys/page/96/mode/2up**



and the Hiuing of them. C. 5.

After the second swarme, I haue heard a young Ladie-bee call: but the Queene, not willing to part with any more of hir companie, did not answer: and the next day she with seuen more were brought forth dead. v. V. c. 1. n. 7.

Sometime though the Queene giue consent to a third or fourth, the Bees seeing the stock little enough to liue, shew themselues loth to goe: and then also there is no way with her, but one. 37. What vse there is of tinging the swarme. V. n. 34.

When the swarme is vp, and busie in their dance, v: it is a common vse, for want of other Musicke, to play them a fit of mirth with a Pan, Kettle, Bason, Candlestick, or other like Instrument, so to stay them, forsooth, from flying away. Indeed where other Bee-folds are not farre off, this vse hath a good vse: for thereby the place and time of their rising is publikely notified, and so a iust and open claime laid vnto the Swarme, that otherwise some false neighbour might chalenge for his: which vndoubtedly was the originall cause of this custome. But the pretended reason is to me a meere fancie: although I know it to bee as ancient as common. For *Claudian* long agoe could say,

——Cybeleia quassans
Hiblæus procul ære senex reuocare fugaces
Tinnitu conatur apes.—— De 6. consolatu Honorij.

And before him *Virgil*,

Hinc vbi iam emissum caueis ad sidera cœli
Nare per æstatem liquidam suspexeris agmen, &c.
Tinnitusque cie, & matris quate cymbala circum:
Ipsæ considunt medicatis sedibus, ipsæ
Intima more suo sese in cunabula condent. Georg. 4.

And before him old *Aristotle*,

Gaudere etiam plausu, & sonitu apes videntur. Quapropter tinnitu æris aut Fictilis conuocari eas in alueum aiunt. 38. What to doe if the swarme be way-ward.

If you see them begin to flie aloft (which is a token they would be gone) cast dust among them to make them come downe. If they will not be stayed, but, hasting on still, goe beyond your bounds; the ancient Law of Christendome permitteth

L 3

Tanging description from Butler's 400-year-old book.

iron frying pan and door key were the most efficacious tanging instruments. Obvious, this was the large, heavy keys much like the ones that always hang on the wall in jails in old western movies, and not the little flimsy key that I have in my pocket at this very moment.

Harrod-Hempsall wrote that John Keys presented very full instruction, *"but they contain the only valid reason for tanging, viz., as a means of claiming the swarm."*

The swarm, the law, and polite society

What if you saw a swarm issue from your colony and settle on your neighbor's property? Then, what if, you watched that neighbor put what had been your bees in a hive box of his? What would you feel? Rest assured that such feelings were long ago experienced by others. As is so often the case, the law has a long history of involvement in determining, *"who owns the transient swarm?"*

I am in no way qualified to write about legal ramifications, so I cite some dated (and tedious) material from Harrod-Hempsall on this subject. At the time, British law was based on Roman law. Roman law designated honey bees as *ferae naturae* – being of a wild nature - and were *res nullius* or belonging to no one. So, let's say that I hive a swarm, *ferae naturae*, and I confine it (so much as possible), so they do not escape and reclaim their natural liberty. If they abscond or swarm again, and regain their natural liberty, my ownership of the swarm immediately ceases.

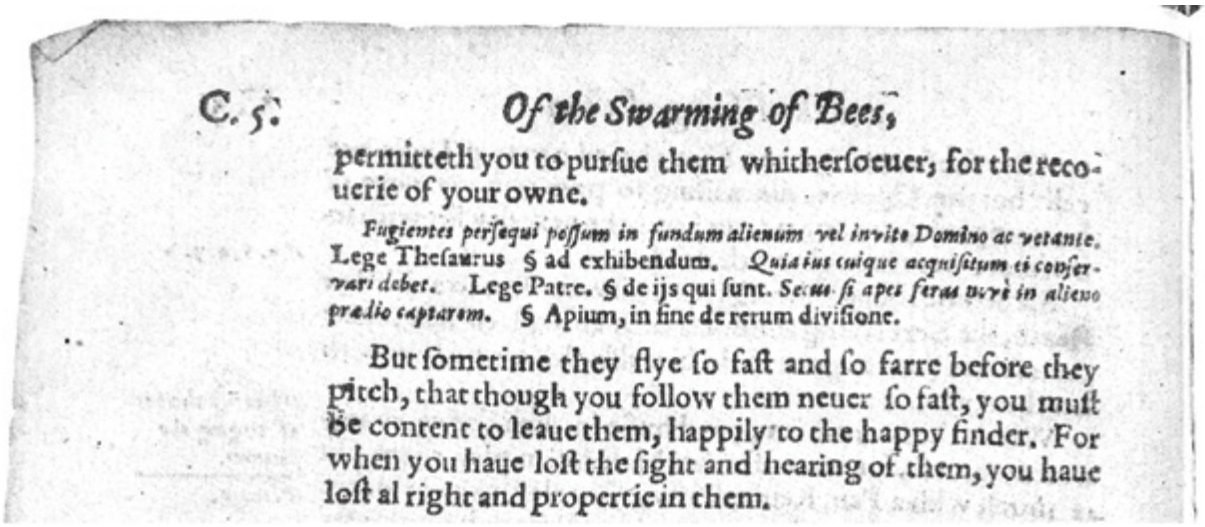
Readers, at this point, things really become contorted. Apparently, a summary of the situation could be that I have wild animals (bees) in a box on my property. They swarm, and I see them go. I make noise to alert others. The bees are mine so long as I can keep them in sight and so long as others confirm that the bees were mine. Maybe the bees, which I have kept in sight, land on a tree not on my property. Though they continue to be my bees, I am not free to trespass at will. Essentially, my wild animals are near to regaining their natural liberty, but by doing so, the ownership of the bees is now *ratione soli* (by reason of the soil). The person who owns the soil on which the tree stands becomes entitled to the bees. From above, I cite Butler again, *"For when you have lost the sight and hearing of them, you have lost all right and property in them."* If they have been kept in sight, a claim of ownership could be justified. As it were, the bees have simply temporarily gone astray.

Harrod-Hempsall wrote, "When an action is fought, much depends on the attitude of the Judge with regard to defining the law, circumstances vary, and points which are debatable crop up." He finished his comments by admonishing the reader that it was better to sacrifice the swarm than to go to the law.

My reason for putting you through this discussion.

The legal issues surrounding lost swarms and ownership, in years past, were complex and complicated. Bee skeps were common and provided essential components for life. Swarms were coveted both then and now. Indeed, swarms were valuable enough to hire either the very young or the very old to watch for issuing swarms.

When the swarm did finally issue, noise was made to alert the community that bees were on the move and to maintain visual record of the bees in order to defend ownership when landing on the property of others. Though I have never read this, I know that the noise would also alert others to help watch for the



C. 5. Of the Swarming of Bees,

permitteth you to purſue them whitherſoeuer, for the recouerie of your owne.

Fugientes perſequi poſſum in fundum alienum vel invito Domino ac vetante. Lege Theſaurus § ad exhibendum. *Quia ius cuique acquiſitum ei conſervari debet.* Lege Patre. § de ijs qui ſunt. *Secus ſi apes feras vere in alieno prædio capturem.* § Apium, in fine de rerum diviſione.

But ſometime they flye ſo faſt and ſo farre before they pitch, that though you follow them neuer ſo faſt, you muſt be content to leaue them, happily to the happy finder. For when you haue loſt the ſight and hearing of them, you haue loſt al right and propertie in them.

Butler telling the reader, when you have lost sight and sound, you have lost all rights to the swarm.

directional movement of the swarm – or worse – alert others to deviously try to capture the swarm.

Don't blame the messenger

Herrod-Hempsall bluntly wrote, *"The noise made by tanging has no effect whatever upon swarming bees, therefore, instead of wasting time and annoying neighbors by making an abominable din, advantage should be taken of the known habits of bees."*

Some good news

Realizing that after hundreds and hundreds of years, no one's current mindset has been changed on this subject by my comments, I can confidently say that tanging a swarm does no harm. In the excitement of the swarm meandering along, at least it is something to the *"apiator"* can do while the swarm is in motion.

Whether or not tanging works, when beekeepers use noise to entice a swarm to settle, they are employing an ancient method that has been passed through many generations of earlier beekeepers. At that swarming moment, you are feeling what so many other now departed beekeepers have felt. You are "in the moment." Feel free to tang. At least you are doing something. BC

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

Honey Bee Obscura Podcasts

A Royal Drama

Stephen **Bishop**

[While working a hive, a BEEKEEPER carried on a thoughtful conversation with HER MAJESTY, who just happened to be in a chatty mood. As you likely know from reading the tabloids, there's been some royal intrigue, mostly concerning the relationship of the queen and her daughters, the latter of whom have been spotted by paparazzi lazing about the landing board. Meanwhile, her good-for-nothing sons have done diddly squat, except drain the royal coffers of honey. During all this drama, the queen had remained quiet – in fact, she hadn't been seen for weeks – but upon opening the hive, the BEEKEEPER saw her majesty frequenting a top bar, no doubt searching for a stiff drink.]

HER MAJESTY: Barkeep, a gin and tonic please. I need a break from all this royal fuss. You would think, living in a palace, I could find some peace and quiet somewhere, but I can't go anywhere without these dratted attendants.

BEEKEEPER: (*looking around to see who said that*): What the heck?

HM: Hey, yeah, you – you're the barkeep right? This is your queen speaking, and I'm ordering you: bring me a gin and tonic.

BK: But you're a bee. You can't speak. That's not possible.

HM: Ha! Funny, I needed a good laugh. All I do is speak, lay eggs, and host garden parties. Last week, we had representatives from the colonies of Australia – real delightful people, but all the press wanted to focus on was my children, who, let's be honest, need to be taken behind the London Tower and whipped.

BK: Tower of London? We're in the foothills of North Carolina.

HM: Ah, yes, whose capital is named after old Queen Elizabeth's good friend, Sir Walter Raleigh. You know, rumor has it, she and Raleigh had a thing for one another. Too bad my great-great-great-great-great-great grandfather, King James I, had Sir Walt sent to the chopping block. Judging from his portrait, Raleigh wasn't a bad looking chap, but don't tell Prince Albert that I said that – I wouldn't want to make him jealous.

BK: Wait, Prince Albert? Who are you exactly?

HM: Dear sir, I am Her Majesty Victoria. By the grace of God, I am Queen of the **United Kingdom of Great Britain and Ireland** – and Empress of India.

BK: You can't be Victoria; she died over a century ago.

HM: I assure you, sir, as the dot on my thorax signifies, I am your Queen, and as such, I command you, Royal Barkeeper, to bring me that gin and tonic. Were I not so desperate for a drink, you would already face stiff punishment for your wanton disregard for royal protocol. To think a mere barkeep has the gall to question his Queen!

BK: But I'm not a barkeeper; I'm a beekeeper. All I have is isopropyl alcohol for *Varroa* mite washes. And the only protocol I know is that six mites per three-hundred bees means I need to treat the hive for *Varroa*.

HM: Do you continue to disobey the direct order of the Crown? Guards, seize him! *[guard bees start circling and buzzing aggressively]*

BK: I swear I'm not a barkeeper. I don't even drink. And you're not a former Queen of England – you're a talking bee!

HM: Seize Him! Off with his veil!

[guard bees start pelting BEEKEEPER's veil; he starts smoking hive heavily, while taking stings in both arms. Then, in anger, he grabs his hive tool and smashes HER MAJESTY. Suddenly, ALL BEES stop moving.]

ALL BEES *(in unison)*: The Queen is dead! Long live the Queen! BC

Stephen Bishop is a humor writer who lives in the foothills of North Carolina. Remember: if you talk to your bees and your bees talk back, it's best to change your smoker fuel. You can see more of Stephen's work at ***misfitfarmer.com*** *or follow him on twitter @themisfitfarmer.*

Summer Recipes –

Shana **Archibald**

Honey Garlic Pork Chops
15 oz. (430 g) center cut boneless pork chops (3 pork chops)
salt
ground black pepper
1 tablespoon vegetable oil
2 tablespoon unsalted butter, melted
3 cloves garlic, minced
1 teaspoon chopped Italian parsley, for garnishing

Honey Glaze
2½ tablespoons honey
2 tablespoons warm water
¼ teaspoon salt
½ teaspoon apple cider vinegar
3 dashes cayenne pepper

Season the pork chops with salt and ground black pepper, on both sides of the pork. You can even add a dash of paprika, if you'd like! Mix all the ingredients in the Honey Garlic Glaze together. Stir to combine well.

Heat up a cast-iron skillet (preferred) on high heat. Add the vegetable oil and one tablespoon of the butter. Add the pork chops to the skillet and pan fry each side of the pork chop, uninterrupted, for three to four minutes each, or until the surface turns brown. Flip over to the other side and repeat the same.

Push the pork chops to one side of the skillet, add the remaining butter. Add the garlic and saute for about 10 seconds, or until they turn light brown. Add the Honey Garlic Glaze, cook to reduce the glaze to a thicker consistency or until the sauce turns amber brown. Spoon the glaze over the pork chops. Turn off the heat, garnish with the parsley and serve immediately. BC

CALENDAR

♦INTERNATIONAL♦

2021 Beekeeping Tour To Slovenia September 9-24.

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

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

♦ARKANSAS♦

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

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

♦GEORGIA♦

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

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

For information visit **gabeekeeping.com**.

♦INDIANA♦

Michiana Beekeepers Association Summer Meeting will be held August 21 - James Tew.

For information visit **Michianabees.org**.

♦MISSOURI♦

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

Speakers include Bob Binnie and Cameron Jack as keynote speakers.

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

♦NEW MEXICO♦

The New Mexico Beekeepers Association Summer Conference will be held August 7. Conference is free with NMBKA membership.

Randy Oliver is one of our featured speakers.

Visit **mbeekeepers.org** for more information and to become a member.

♦TENNESSEE♦

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

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

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

♦WISCONSIN♦

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

Sue Cobey is the keynote speaker.

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

♦VIRTUAL♦

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

Online registration coming soon.

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

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.

Did you know that if you replace "W" with "T" in "What, Where and When", you get the answer to each of them?

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VSH Queens 66
Weaver, R Apiaries 77
Wilbanks Apiaries 66
Winters Apiaries 38
Wooten's Queens 77
Z's Bees 58

Associations/Education
2 Million Blossoms....11
A Closer Look....74
A.I. Root Autobiography....83
ABC & XYZ....42,91,Back Cover
American Bee Journal....29
American Honey Producers 62
Backyard Beekeeper....6
Bee & Butterfly Habitat....38
Bosler's....87
Farming Magazine 67
Honey Bee Health Coalition....47
In Business With Bees....82
Lorain County Beekeepers 73
Project Apis m....13
UMT Master Beekeepers 95
Wicwas Press 65

Equipment
Bee Smart Designs....39
Cowen Mfg.....70
Dakota Gunness 42
Forest Hill Woodworking....85
Humble Abodes Woodenware ...76
Pierco Frames 18
Superior Bee....39

Related Items
Angel Bottles 51
ApiaryBook.com....31
Barkman Honey....94
Beekeeping Insurance Ser.....4
Betatec Hopguard 83
BIP 35
BL Plastics....87
Bucko Gloves....39
Complete Supplement....66
Draper's Bee Pollen....42
Global Patties 7
Help Wanted....51
Hive Tracks....62
HiveAlive....2,23
Koster Keunan Inc. .... Ins. Front
Mother Lode Products....36
NOD 26
OxaVap....70
Rayonier Land License 67
Root Candles 3
Sailor Plastics 51
Strong Microbials....36
TipZstand 67

Seeds & Plants
Ernst Seeds 77
Rockbridge Trees 83

Suppliers
Acorn Beekeeping Equipment 8
Beeline Apiaries 59
BetterBee....1
Blue Sky Bee Supplies ....Inside Back Cover
Dadant 22,30
JZsBZs 42
Maxant Industries 67
Miller Bee Supply....50
New England Beekeeping Supplies 54
Queen Right Colonies 25
Ross Rounds....50
Rossman Apiaries 62
Simpson's Bee Supply....42
Western Bee Supplies 58

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My bee-hauling rig is a 1983 converted E350 Ford van. A former owner cut out the middle of this poor vehicle and welded the last couple of feet of the van shell onto the front, right behind the driver's seat. Then this Rube Goldberg attached an 8 X 20-foot wood-decked flatbed behind that. So now it's a flatbed truck with a compressed van for a cab.

It has an aftermarket four-wheel drive, with issues. If I bump the four-wheel-drive shifter lever a touch too far, it goes from four-wheel right past two-wheel, into neutral. Now the beast won't move, and gears grind if I try to get back into two-wheel drive. I also can't shut the engine off, because gears grind when I try to shift into park.

Solution to a truck with automatic transmission that won't move, coupled with an engine that won't stop running? Simple! Pop the hood and pull the distributor wire. Be careful not to get shocked! Of course the engine stops, and I can now coax the shifter lever into two-wheel drive.

Paul found this mechanical marvel somewhere out in Utah decades ago. I bought it for $2,300 in 2004, when I ran bees for Jack Holzberlein, out of Meeker, Colorado.

My truck hauls 30 colonies with ease. A practically new battery-powered lift mounted on the receiver hitch takes the struggle out of loading bees. The lift is worth its weight in gold. This 74-year-old no longer needs to hand-truck hives up a ramp, onto the flatbed.

Under the hood, a 1976 rebuilt 460 engine with only 60,000 miles purrs at 65.

Most peculiar truck you ever laid eyes on, and not exactly pretty, but it works for me. I put fewer than 1,000 miles a year on this relic, but driving it down the road at dawn with a load of bees is my idea of waking up in Heaven.

I'm kind of a rebuilt 460 engine myself, trying to stay in the game, against all odds. Like my ancient truck, I do require continual maintenance. I suppose I could retire, but what would be the point of living without bees?

Back in my Aspen Mountain ski patrol days, I rode the gondola with ski legend Klaus Obermeyer, then deep into his nineties. He still turned 'em left and right. "Klaus," I said, "What's your old-man secret to health and vigor?"

He smiled and did not hesitate. "Never stop doing what you love to do." he proclaimed.

It's early June as I write. Yesterday I got up before the robins, to load bees bound for two new yards, on open-space land owned by Pitkin County, up towards Aspen. The deal almost fell through over liability insurance concerns, but once the county got the message that I wasn't buying any more insurance, they began to see things my way. For some reason, they really wanted bees on these properties.

The two yards are only a mile or two apart. I'm downsizing, but when the county offered me these locations, I was intrigued. I already take care of my billionaire's bees just down the road, and they do pretty well. I thought I'd split 10 hives between two yards and see what happens.

My apprentice Megan likes to learn, and she offered to meet me at my second bee drop-off first thing in the morning. I say "apprentice." That's not really the right word. She doesn't want to become a stressed-out sideliner like me. But Megan does have the bee bug. She's obsessed, that's all. And obsession is the most critical requirement for becoming a successful beekeeper.

I dropped off four colonies at the first location. The yard seemed a little too close to a road and a bike path, and I wondered why I hadn't noticed this before. I unloaded the six remaining hives at

the second location, where I already had a bear fence in place. Megan hooked up the solar panel, battery and electrical charger for the fence. She's handy and requires very little supervision.

By the time I got back to the first yard, it was mid-day. The road and the bike path were alive with bicyclists, dogs, runners, walkers and gawkers. Like people, bees can get cranky. These colonies sat only 40 feet from the road. My gut told me this was all wrong.

The forecast high was 95 degrees. There was already a bear fence here, from a previous beekeeper, but it was a mess. I was short on sleep. Megan was long gone. My post pounder was too hot to pick up without gloves. I looked at my bees, at the parade of passing humanity, at the steel posts and woven-wire bear fence I still had to erect. All this for four hives too close to the road? I'd clearly blundered, but I'd given my word.

I reflected on the teacher Aristotle, for whom all decisions were grounded in ethics. What would he have done, facing such a dilemma?

Just as I felt I was about to succumb to heatstroke, I had an epiphany. I drove home and slept the rest of the afternoon. At sundown I came back, picked up my little darlings, and brought 'em home.

Ed **Colby**

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