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Bee Culture

May Features . . .

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Peaches and bees. Taken at Gala Springs, an organic orchard in Boardman, OR. Photo by Jan Lohman, Hermiston, OR

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Queen Excluder Cleaning

Having labored over my queen excluder with a hive tool, tried the heat gun, arrived at a solution that solved a myriad of problems for me.

The Result – Absolutely clean, and sterilized for everything including, virus, bacteria, insect eggs, insect larvae, et.al.

Method – Stick a queen excluder in the oven, turn on the oven self-clean function, and stand back while the stove works magic.

Caveats – Best bet, buy a used stove with a self-cleaning function that works and stick it outside under cover.

Read the instructions on oven self-cleaning before you start, special emphasis on keeping it clean.

Vacuum out the residual ash each time.

Resources – For best results, "Read The Fine Manual" that came with your oven.

Greg Carey

Recycling Old Equipment

In reference to Jim Tew's article in the June 2020 issue I want to thank him for giving me ideas for reclaiming my old bee equipment. I was particularly able to use the idea of cutting down old hive bodies into supers and have done so very well (a total of 10). But I didn't stop there! I was able to reclaim an old lid, and several hive bodies by gluing tiny pieces of wood on the worn places as well as saving a couple of hive bottoms. Somehow in our disposable society, it never dawned on me that these simple fixes could make something old new again. To some who are clever with woodworking these fixes might have seemed obvious, but until I read the article it never dawned on me that I actually could do this myself!

While I enjoy reading all of the *Bee Culture* articles to keep myself current with beekeeping, I am really glad you include the really simple ideas so people like me who are low budget beekeepers can get ideas that we might not have thought of without a little help from other beekeepers like us.

I was excited to see that you accepted one of my pictures in your 2021 calendar for the month of May. I am grateful or the extra calendars to share, so thank you.

Sandra Center, Omaha, AR

Beekeeper Of The Year

The Wateree Beekeepers Assn. of SC chose David McFawn, as 2020 Beekeeper of the Year and also a Lifetime Membership to the SC Beekeepers Assn.

David has contributed more to the advancement of beekeeping in SC than most clubs have done as entire working groups! His service has far exceeded the expectation of requirements for this acknowledgement. He has been a member of the SCBA since the early 1990s. He quickly adopted SC as his home base for bees and has been dedicating a majority of his life to improving the conditions of bees and the education of beekeepers since his arrival. He has learned to "not take anything for granted. [Your] ideas might be right and then they might be wrong under a different set of circumstances." His goals, as a beekeeper, when pressed on the issue include, "making a difference," for the apiculture society as a whole.

David has spoken to over 15 SCBA clubs in the past three years as well as Schools, churches, garden clubs, master gardener events, the Sierra Club, The University of SC Sustainable Carolina program, and anybody else who wants to know about bees! He is an accomplished writer and has, to his credit, over 40 articles for various publications.

He has written two books – *Beekeeping Tips and Techniques for the Southeast United States, Beekeeping Finance* published by Outskirts Press, and *Getting the Best for your Bees*, which was self-published. He has written award winning grant proposals about pollination of cucumber. He has been recognized as a leader in the Honey Bee industry by the USDA who relied on him to present a workshop for the Certified Crop Advisors workshop.

He can be found at educational events of all types representing the SCBA and Honey Bees. When the Mid-State Beekeepers Association decided to do a hands on, "Bees in the Backyard" program for its members David was one of the first to volunteer to teach both morning and afternoon sessions. He was instrumental in helping the USC Club get equipment and membership, by speaking on their behalf. He has volunteered repeatedly to teach Beginner Certified Classes, and numerous Journeyman courses.

Most recently David has worked tirelessly to manipulate schedules and secure speakers for the SCBA Spring and Summer conferences, the 2019 EAS Conference and has been instrumental in assuring the educational requirements of all types of beekeepers are being met. He does not discriminate between treatment free, natural treatment and beekeepers that treat for *Varroa*. His goal has been education and support for all.

Beyond the required research projects David did for his Master Craftsman certification in NC, he worked with Dr. Hood and Steve Tabor, two distinguished and respected apiarists. He did research on honey bees and bumble bees, comparing their effectiveness in pollinating cucumbers. Most recently, 2018, 2019 and now 2020 have found David in the woods of the Congaree National Park (a pesticide free zone) and surrounding lands looking for feral bee colonies to try to find elusive, genetically different, untreated, honey bees existing in the wild. The bees that were collected from the fringe of the park are in the process of being analyzed to determine if they are truly a feral, untreated population, or a population of bees from a seasonal swarm. His most recent analysis will be of the honey to determine what the bees are foraging on in the Congaree.

David makes regular trips to the Clemson University library to research the most current studies on the areas he is independently researching. He attends local meetings, State meetings, Regional meetings, and meetings with beekeepers in their home states.

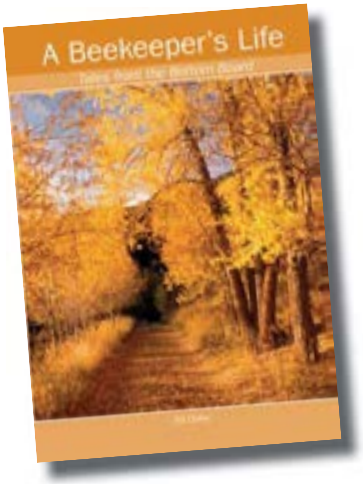
Rosalind Severt, SCBA

Summer Reading –

A Beekeeper's Life, Tales from the Bottom Board. By Ed Colby. Published by Northern Bee Books. ISBN 978-1-912271-86-3, 167 pgs., 9.5" x 6.75". $24.95, available from www.Northernbeebooks.co.uk, and where ever books are sold.

Ed Colby is a sideline beekeeper living in Colorado who writes a single page column in *Bee Culture* magazine every month. The title is Bottom Board because it is on the very last page of the magazine – the bottom as it were. This book is a collection of some of the best of Ed's Bottom Board articles, these drawn from his earlier days of contributing. The topics cover not only his beekeeping escapades, but adventures, mishaps, slips, falls, bounces and friends he has experienced over all those years, and even some before. During all this, Ed's day job for over 40 years was working for the Aspen Mountain Ski Patrol, which adds to the long list of people he's met, near misses he's had and yet another set of adventures he's experienced. He gets around, a lot.

Some of these are about his closest people. Neighbor commercial beekeeper Paul and the secret hand shake, bee club officer Tina, guest speaker Marla, his gal Marilin, professional athlete Terry among many. And places his bees have taken him – to the Apimondia meetings in Ukraine and Canada, to Mexican bees and scorpions in Mexico and Brazil (where he spent some of his growing up time), and even the trip to Medina to talk to my bee club, relating all the train adventures along the way.



His beekeeping experiences include stories about selling honey, sending his bees to the almonds, collecting pollen, and trying to keep his bees alive when they are dying from a thousand cuts. He has truck problems, spectacular views of his Rocky Mountains and interesting neighbors. And of course all of those stories are in one way or another related to his "Little Darlin's".

The best thing about this book is that each of these stories in only a couple of pages long. A whole story on only two pages. You can pick it up and read one of these short masterpieces before you finish breakfast, and do it again tomorrow. Ed's style is easy to read, organized and always finishes with a lesson earned, learned or commented on just because.

Ed was buried in an avalanche once, and was nearly killed. He learned that life is a gift. And his father told him to follow his heart in life, so Ed took the road less traveled. A beekeeper's life, and he never looked back. We're lucky he took notes along the way. *Kim Flottum*

What's Inside A Flower. And other questions about science and nature. By Rachel Ignotofsky. Published by Crown Books. ISBN 978-0-593-17647-4. 11" x 9.25", 44 pgs., hardcover with jacket. Color throughout, $17.99. Available wherever books are sold.

From the jacket – Have you ever wondered what's inside a flower? Or where flowers grow? Or how they bloom from a tiny seed? Every question about flowers is answered . . .

Well, I happen to know a lot about what's inside flowers, and they pretty much got it right. But the author got a lot more right, and then had her ideas illustrated like no other young children's book about nature I've ever seen, and I've seen quite a few over the years. We show the cover like we always do, but I wanted to show some of the inside art also. It's stunning in detail, and attraction. Look carefully. This was written for children four to seven, but even I learned something about flowers from this book.

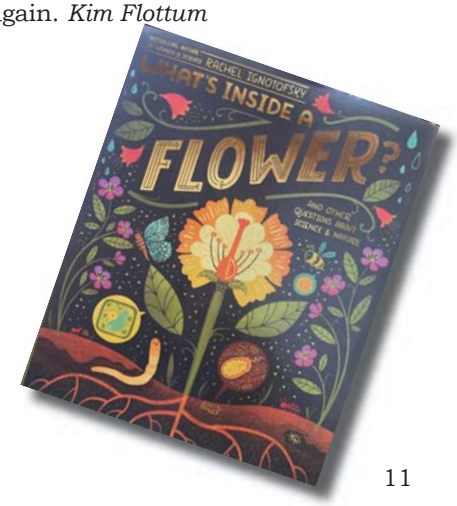
And there is so much more than just what's inside a flower. It talks about and shows how a flower develops, from a seed in the ground with nematodes and earthworms and nutrients and minerals, to developing roots and stems, the role of water and bugs that eat some of the leaves, why the sun is important for photosynthesis to help the flower grow, and to make oxygen for us. Then buds appear, and all the parts of the plant, each with a name, come to be, too. And flowers have petals and sepals and stems and leaves, pistils with stigmas and styles and ovules and ovaries, and pollen from stamens with anthers and filaments and styles and stigmas.

And then pollination happens, self pollination and cross pollination and why they are different, and how and who makes that happen. Birds and bees and moths and butterflies, wind and bats and water move the pollen from here to there and seeds begin to grow. To get them all together, flowers use colors, shapes, or smells. And then fruit appears protecting the seeds with husks and pods and some are good to eat.

When the seeds are ready they can travel near and far. Some by wind, some have wings, some have hooks and some are eaten and become scattered in poop. And when that seed finds just the right place a new plant will grow and a new flower will bloom.

At the very end there is a list of resources, including books, websites, and places to visit for both adults, like us, and children.

If you know a child, this is a wonderful way to spend an hour with them, again and again and again. *Kim Flottum*



Bee Culture

The Magazine Of American Beekeeping

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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. We plan to start registration on June 1.

Susan Cobey is an acknowledged international authority in the field of instrumental insemination and honey bee breeding.

Jackie Park Burris was born into the Park Beekeeping Family of Northern California and is owner of Jackie Park Burris Queens

Tammy Horn Potter balances her career as an English professor and hobbyist. She wrote *Bees in America*: *How the Honey Bee Shaped a Nation*, followed by *Bees in America* and *Beeconomy: What Women and Bees teach us about Local Trade and Global Markets*. In 2014, Potter became the KY State Apiarist.

Annette Meredith, Executive Director of BIP (Bee Informed Partnership)

Julianne Grose, Brigham Young University. Associate Professor. Microbiology and Molecular Biology

Maggie Lamothe Boudreau, Fédération des apiculteurs du Québec, Canadian Honey Council 3rd Vice Chairperson

Kathy Summers, Assistant Editor of *Bee Culture Magazine,* involved in the leadership of various local, state and regional beekeeping associations over the years

Kim Skyrm, State Apiarist, Massachusetts

Joan Gunter, one of the co-owners of Gunter Honey Inc. is also President of the American Bee Federation

Barb Bloetscher, State Entomologist at The Ohio Department of Agriculture.

Geraldine (Jeri) Wright is an insect neuroethologist in the United Kingdom. In 2018 she became the Professor of Comparative Physiology/Organismal Biology at the University of Oxford and Tutorial Fellow of Hertford College.

Tracy Farone, Professor of Biology at Grove City College, D.V.M, monthly columnist in *Bee Culture* 'Bee Vet'

Judy Bodenhamer, President of Revenue Resources LLC, Judy is an entrepreneur, business executive, coach, mentor, innovator and community volunteer

We are optimistically going forward with our planning of this event, due in part, to the apparent rapid advances in the public health situation.
We will continue to monitor the situation and make rational/safe decisions going forward.
The way it stands at this time, we will most likely limit attendance based on recommendations as we go forward.
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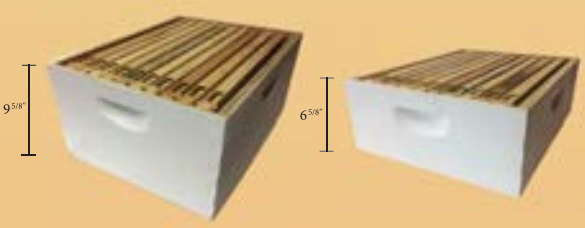

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The A.I. Root Co., and Bee Culture, The 'Magazine of American Beekeeping' will always be connected to the amazing history of Honey Bees and their Keepers. At our company headquarters we recently updated our pollinator friendly garden area in front of the offices along the main thoroughfare into our hometown of Medina, Ohio.

Many plants attract butterflies and can effectively add color and interest to your garden, however one of the best choices to attract butterflies as well as honey bees and many other pollinators is *Buddleia spp.*, known as Butterfly Bush or Summer Lilac. This bushy perennial is a magnet for many large and small butterflies including skippers, monarchs and swallowtails, as well as native bees, honey bees, syrphid flies, soldier beetles, hummingbird moths and other 3-6" insects you may never have noticed before. You may also see hummingbirds visit some colors of these flowers.

Several species of Buddleia exist today, and many more cultivars are available ranging in size (3-6') and color, however the most common in the U.S. is *B. davidii.* Interestingly, Buddleia was named after a seventeenth-century amateur botanist named Reverend Adam Buddle, when the plant was first discovered in England in 1774. Although most Buddleias are originally from China or the Himalayas, the species he developed was from Chilie (*Buddleia globosa*). We can thank a French Jesuit missionary, Pere Armand David who cultivated *B. davidii.* His popular introduction was planted in London's famous Kew Gardens in1896.

B. davidii – *Flutterby Grande 'Peach Cobbler.'*

Although it almost reaches the "weed" category in southern United States, Buddleia is hardy to zone 6 and with protection will return in colder climates. It tolerates most soil conditions but does best in full sun. It is mostly pest free although spider mites can attack during hot, dry periods. Be aware that butterflies not only visit the tall (3-6") cylindrical flower spikes, but some prefer it as a host plant for their caterpillars. Do not smash caterpillars found on the plant as they are most likely that of a desirable butterfly!

Buddleia is a scrubby looking perennial with narrow, pointed gray leaves that shimmer when the wind blows. Flower spikes contain multiple small scented flowers that range from purples, blues and mauve to pink to yellow or white that develop in June and will continue through late August if the dead flowers are removed. Interestingly, different colors of the blooms seem to attract different species of butterflies. Regardless of the color however, the bush will be covered with pollinators. For those who can't decide which color to choose, select one that has multiple colors on one plant! For best results in colder climates, prune dead wood in early Spring. Butterfly bush is late to show new growth in the Spring. Cutting dead branches in the Spring will stimulate new shoots. BC

https://butterflywebsite.com/articles/buddleia-butterfly-bush.cfm

https://www.gardenersworld.com/plants/10-buddlejas-to-grow/

B. davidii – *'Lo and Behold blue chip' at A.I. Rooot Company.*

NEXT MONTH

Region 1
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- Check for Swarm Cells
- Swarm Prevention by moving frames of brood up.
- Super
- Split colonies if growing too large
- Raise Queens
- Feed if needed
- Extract Honey from Spring Flow
- Build up Packages/Nucs, feed
- Check Brood pattern

Region 2
- Inspect Colonies for Queen Pattern
- Alcohol Wash for Mites
- Be careful what mite treatment you may use
- Check colonies every two weeks for swarm prevention
- Check for SHB on weak colonies
- Post flow, reduce space in colony
- Add supers if beginning flow
- Check for Swarm Cells
- Inspect for mites, diseases, SHB
- Rotate out old comb

Region 3
- Check colonies for when to extract honey
- Provide a reliable water source
- Add supers as needed
- Check for SHB populations
- Add SHB traps
- Continue monitoring for swarming
- More Alcohol Washes for Mites

Region 4
- Alcohol wash for mites
- Super ahead of flow
- Checking for swarming indicators
- Check colony strength
- Super, Super, Super
- Combine hives that have swarmed for added strength
- Requeen as needed
- Install Packages and feed.
- Mite management is a yearlong effort now

Region 5
- Lost all my colonies, UGH!
- Feed if needed
- Alcohol wash for mite check
- Check Queen for brood pattern
- Requeen
- Split colonies
- Anticipate when to super

Region 6
- In the middle of Honey flow, super
- Alcohol wash for mites – don't treat during flow!
- Feed if needed in desert before flow
- Be sure Splits have queens
- Keep watching, inspecting for Swarm Control
- Sell splits
- Add supers if ahead of flow

Region 7
- Do Queen and Brood health check
- Swarm control measures
- Anticipate supering
- Make splits
- Feed splits
- Alcohol wash for mites survey
- Requeen
- Combine weak colonies and requeen
- Be sure brood area has room to slow swarming

Honey Reporters Wanted

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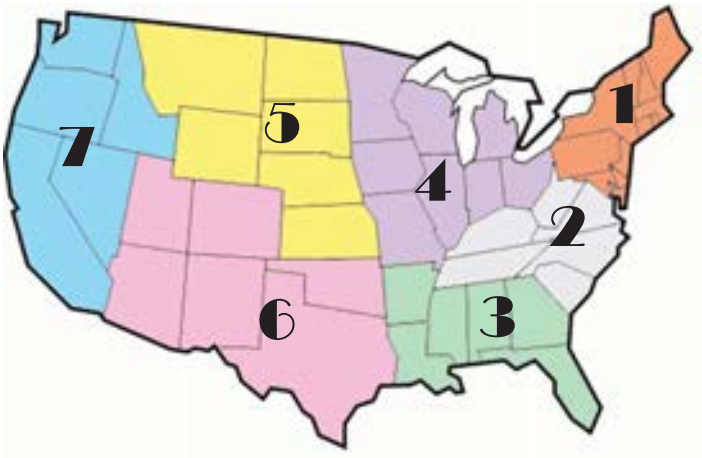
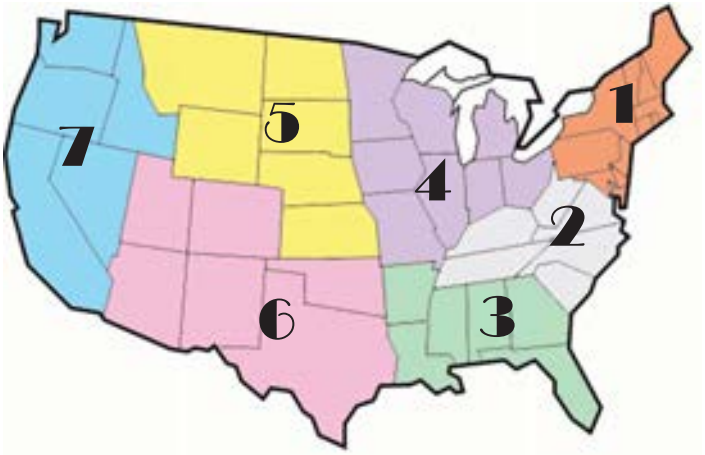


MAY – REGIONAL HONEY PRICE REPORT



	REPORTING REGIONS							SUMMARY			History	
	1	2	3	4	5	6	7				Last Month	Last Year
EXTRACTED HONEY PRICES SOLD BULK TO PACKERS OR PROCESSORS								Range	Avg.	$/lb		
55 Gal. Drum, Light	2.30	2.20	2.20	2.23	2.09	2.07	2.79	1.50-3.25	2.23	2.23	2.10	2.16
55 Gal. Drum, Ambr	2.71	2.10	2.11	2.09	1.50	2.83	2.49	1.50-4.98	2.19	2.19	2.12	2.11
60# Light (retail)	205.10	175.97	205.00	178.79	170.00	170.38	221.23	111.86-300.00	204.26	3.40	206.01	199.62
60# Amber (retail)	197.33	169.50	205.00	173.63	197.33	174.04	218.73	108.00-285.00	198.17	3.30	197.92	202.07
WHOLESALE PRICES SOLD TO STORES OR DISTRIBUTORS IN CASE LOTS												
1/2# 24/case	104.43	73.60	96.00	71.40	61.20	104.43	104.43	45.00-194.40	89.16	7.43	93.49	91.63
1# 24/case	153.25	111.20	134.48	105.92	152.50	94.92	156.00	45.00-300.00	134.01	5.58	144.57	137.07
2# 12/case	133.72	99.00	128.00	104.30	76.26	102.00	132.00	40.68-246.00	124.11	5.17	126.64	124.71
12.oz. Plas. 24/cs	112.65	123.85	106.67	89.30	102.72	101.88	114.00	52.99-182.00	107.81	5.99	105.52	95.24
5# 6/case	147.49	116.50	147.49	121.19	113.16	106.00	147.49	71.50-240.00	139.22	4.64	143.54	136.26
Quarts 12/case	184.07	182.73	137.20	139.42	160.90	119.88	186.00	109.20-300.00	163.53	4.54	170.66	166.00
Pints 12/case	100.01	106.33	80.33	86.47	95.98	80.00	108.00	60.00-150.00	95.03	5.28	96.63	97.49
RETAIL SHELF PRICES												
1/2#	5.62	5.40	4.38	4.85	3.87	5.62	7.50	3.00-9.00	5.25	10.49	5.49	5.44
12 oz. Plastic	6.93	6.87	5.86	5.32	5.12	5.99	6.47	3.50-12.00	6.11	8.14	6.48	6.33
1# Glass/Plastic	10.04	9.32	8.19	7.32	7.66	6.93	11.54	4.79-18.00	8.68	8.68	8.74	8.11
2# Glass/Plastic	15.00	13.43	14.52	12.77	13.22	9.94	14.50	6.89-25.00	14.06	7.03	14.82	14.19
Pint	12.20	11.68	9.66	10.37	9.61	9.66	13.03	4.00-23.00	10.90	7.27	10.88	11.52
Quart	22.16	18.78	14.65	16.77	17.02	15.66	21.46	8.00-44.00	18.31	6.10	19.09	19.51
5# Glass/Plastic	33.38	32.33	41.67	26.00	21.88	21.94	50.00	15.00-57.00	30.76	6.15	33.62	29.49
1# Cream	14.01	12.38	10.00	12.07	13.00	14.01	15.00	6.00-24.00	13.02	13.02	9.75	11.11
1# Cut Comb	14.01	12.38	10.00	12.07	13.00	14.01	15.00	6.00-24.00	13.02	13.02	12.55	12.63
Ross Round	11.46	7.63	11.46	11.33	12.00	11.46	13.75	7.00-16.80	11.02	14.70	11.91	10.67
Wholesale Wax (Lt)	7.98	7.72	5.86	5.93	6.06	4.00	9.36	2.50-15.00	7.20	-	6.79	7.08
Wholesale Wax (Dk)	7.20	5.44	4.52	5.67	6.00	3.00	9.75	2.00-15.00	5.90	-	5.52	5.79
Pollination Fee/Col.	103.56	72.50	67.50	109.00	158.67	103.56	76.33	30.00-200.00	92.11	-	98.42	86.46

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It's Summers Time –

Good News and Some Not So Good News!

Some of the good news is that Spring has finally arrived in Northeast Ohio – well kinda, sorta. This past Saturday was one of the perfect Spring days – we got to be outside all day pulling weeds, cleaning up the clutter that comes with wind storms and Winter. It was approaching 80°. A glorious day.

April 1 Kim and I had to drive to Cleveland and were literally driving at times in a 'white out' – for you west coast and southern folks, that's snow so hard you can't see where you're going. Day after tomorrow – mid April – we're having a high of 46°.

Forty+ years ago when I first came to Ohio my father-in-law told me you can never be sure of no frost until after Memorial Day. He was a very successful gardener. April and October are the tricky months around here. Some years you have your Easter egg hunt outside and all is beautiful. Other years you're doing in the basement because you dare not take the kids outside. Halloween, same thing. Some years beautiful, you just need a light jacket. Others snowing and blowing.

But mostly Spring is beautiful around here. It's refreshing when things start to turn green and now the redbuds are blooming and the pholox (one of my favorites) are just peaking through. And of course us beekeepers always get excited when we see that first little patch of dandelions.

One of many redbuds in our yard. They are beautiful, but boy do they spread.

Dandelions and Creeping Charlie. A sure sign of Spring in NE Ohio.

My weeping cherry. One of my favorite spots in our yard.

Other good news – we have exciting things happening here in *Bee Culture* land. We're anticipating getting back to somewhat normal conditions after this rough year that we've all had.

We're going forward with our Annual Event. See page 12 for tentative details. It won't look exactly the same as years past, but it will be good. We have an excellent line up of speakers and with the goal of keeping everyone safe and following the guidelines, we think it will be a great weekend. Watch these pages, our web page and Facebook for more details as they become available.

Other exciting news in *Bee Culture* land – our Amanda will be welcoming her new baby daughter around the first week of June. So she'll be going away for a bit, but she's promised she'll be back. And we'll have someone in place to help with all of the things that Amanda normally does – managing everything to do with subscriptions, our social media, Catch The Buzz and many other things. So we'll do our best until she returns around mid-September.

And now for some not so good news. About six years ago we started our quarterly publication called *BEE-Keeping, Your First Three Years*. Some of you subscribe to both and we appreciate that. But the powers that be here at A.I. Root have decided because of economic reasons that the quarterly is just not carrying enough weight. As a result we are ending the publishing of *BEE-Keeping*.

So if you are subscriber to both magazines we will extend your current *Bee Culture* subscription. Thank you for your loyalty. We have many that have subscribed to the magazine for longer than I've been here at *Bee Culture*. And that's a long time.

The other not so good news, at least in our area – a lot of bees didn't make it through the Winter. Ours included. The comforting thing is that several other really good beekeepers lost theirs. So I don't think it was just us being bad at our job. I'm not sure exactly what it was. But we're getting packages and a nuc here in a couple of weeks and we're going to give it our best shot.

Here's hoping you're having a good Spring and looking forward to Summer. I hope to see some of you somewhere along the way this year. I've missed you!

Kathy Summers

STUDY HALL

Q – *Hi Jerry. The way it sounds a lot of people are using an OA dripple this time of the year for their Spring mite treatments. What should the temperature be to safely apply that treatment? (So we aren't doing any harm from cooler temperatures.) Thanks! – Adrian Troyer*

A – At this time of the year when brood rearing has started most all the *Varroa* will be in cells reproducing and not exposed. If you do an alcohol wash your sample numbers will be way down because few mites are exposed/phoretic. All you will do is potentially hurt the colony/individual bees with this acid. Don't do it.

Q – *If our honey bees are endangered by the invasive insect species, called 'Murder Hornets', why not install a wire mesh tent over all of your beehives, that has holes in it large enough for the honey bees to move through it easily, but the holes are NOT large enough for the 'Murder Hornets' to pass through to invade the hive and kill the honey bees inside it? Best Regards, Robert Schreib*

A – Our honey bees in the U.S. and Canada are not endangered as yet. Authorities in Washington State and Western Canada have had a couple of finds but they have been very thorough in locating the 'nests' of these hornets and destroying them.

The wire fencing could be done at some stage for backyard hobby beekeepers but what do you do for commercial beekeepers who have thousands or 10s of thousands of colonies for contract pollination of fruits, nuts and veg. that fill the grocery stores shelves. We hope that time never comes?

Q – *How can I treat packages for* Varroa *mites safely before I install the bees? Annette*

A – Powdered sugar can be used as a 'mechanical miticide' by increasing grooming behavior and negatively impacting the *Varroa* Mites ability to cling to an adult honey bee. Doing this in Package Bees is very good because all the mites are exposed/phoretic none behind capped cells reproducing and out of harms way. Recall, two kinds of packages – screened and plastic This works for both.

The ultimate goal is to introduce Powdered Sugar into the package and remove *Varroa* mites then remove them and the excess Powdered Sugar before installing the bees. Ten to 15 feet away from any established colonies do the following.

With some blocks or wood or concrete blocks or something to raise the Package above ground level take the Package and place it with ends on blocks and with one screen side down and with one screen side up.

On the top screen take a cup or two of Powered Sugar and pour it on the screen. You may have to take a brush to move the Powered Sugar back and forth until it all flows through the screen coating the bees inside the Package with the Powdered Sugar. The goal is to turn the bees all white with the Powered Sugar. The cool thing about Powered Sugar as a *Varroa* control is as the bees groom themselves and their sisters removing mites in the process they can eat the Powered Sugar. No collateral damage to the bees as with other *Varroa* control products. Most of the excess Powered sugar will flow out of the bottom screen with the dislodged *Varroa*. They are still alive but because of distance to the Package or an existing colony they cannot crawl that far.

This can be done multiple times if you want but wait 15-20 minutes between dusting. Then install the Package as usual.

Q – *Hi Jerry – all terrific articles in* Bee Culture!! *Can you elaborate on how dark comb can be productively used or recycled? Dan in SoCal*

A – Dark comb is dark because it was used to raise brood and the buildup of larval skins, dirt and debris from use for years. It has many layers of larval skins which may also have virus and bacteria that are trapped in it along with pesticide, fungicide, Varroacide residues that could potentially negatively impact the colony on several levels. That is why as valuable as comb is rotating it out every three or four years has been shown to support healthy colonies.

In the comb there is still some small amount of beeswax left that could be rendered out in a Solar Wax Melter or a commercial wax melter if quantity was sufficient. Many small beekeepers do this or if you like to fish using the old comb to raise wax moth larvae as fish bait works great too.

Q – *How can I control SHB (Small Hive Beetle) in my colonies. I see adult SHB all the time and some larvae too. Bill*

A – SHB adults are looking for a honey bee colony to reproduce in. They want their specie to continue and need a location with lots of food and protection from the outside elements to raise their 'babies' in. They can't do it in a large healthy colony because there are too many vigorous healthy bees harassing them and stopping reproduction. They want a weak colony that has a dwindling population and can't protect every inch of comb. SHB are looking for a sick colony. And in 2021 that is *Varroa* and the *Varroa*/Virus legacy. Control *Varroa* safely (Tools for

Varroa Management Guide from the HBHC, Honey Bee Health Coalition) and you will have a healthy colony and all the SHB will go to someone else's colonies that is not as good *Varroa* management.

Q – *When using Swarm Traps, should the bees who find the trap be left until they can build out some comb and settle in for a week or so or should they be transferred to an empty hive as soon as possible?*
William F.

A – If the swarm trap is an empty trap/container and you are not already using a piece of 'comb' as an attractant don't worry about having them build new comb and use up resources as they try to turn this container into a beehive. Relocate them as soon as possible. This allows them to begin consolidating their colony and begin brood rearing as soon as possible and doing what honey bees do to prepare for the next Winter.

Different Types of Honey

Nina **Bagley**

H E N P V M E S Q U I T E C A L O N A C
E L P A M S U T P Y L A C U E E K N C L
A V O C A D O N H L I F A C A C I A K M
R E V O L C T K N A P W E E D N J Q M E
M S O L E P U T E H E A T H E R M J T L
N O T T O C L S V K R E D N E V A L H I
E L P P A S R E W O L F W O D A E M I L
H G F S U H A W T H O R N Y P C G N S O
U B U C O C O N U T P A L M I V Y L T T
D L C B V D A N D E L I O N A S P W L H
E A H A T S W E E T C H E S T N U T E E
E C S S U N F L O W E R B O R A G E Y F
W K I S M A N U K A B U C K W H E A T E
E B A W P H U U X T U L I P T R E E H F
R E Q O A Y R R E B E U L B X V H Z Y N
I R H O L L Y V G O L D E N R O D S M A
F R D D D O O W R E H T A E L Y A G E P
S Y T D H G H C Y Z V E A W E R A W E R
P Y X C K S A I N F O I N L I N D E N G
H E Y R A M E S O R T E A L F A L F A H

WORD LIST:

ACACIA
ALFALFA
APPLE
AVOCADO
BASSWOOD
BLACKBERRY
BLUEBERRY
BORAGE
BUCKWHEAT
CANOLA
CLOVER
COCONUT PALM
COTTON
DANDELION
EUCALYPTUS
FIREWEED
FUCHSIA
GOLDENROD
HAWTHORN
HEATHER
HOLLY
IVY
KNAPWEED
LAVENDER
LEATHERWOOD
LINDEN
MANUKA
MAPLE
MEADOW FLOWER
MELILOT
MESQUITE
REWAREWA
ROSEMARY
SAINFOIN
SUNFLOWER
SWEET CHESTNUT
THISTLE
THYME
TULIP TREE
TUPELO

Find answers on Page 94

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U.S. Honey Industry Report – 2020

Released March 17, 2021, by the National Agricultural Statistics Service (NASS), Agricultural Statistics Board, United States Department of Agriculture (USDA)

United States Honey Production Down 6 Percent in 2020

United States honey production in 2020 totaled 148 million pounds, down 6 percent from 2019. There were 2.71 million colonies producing honey in 2020, down 4 percent from 2019. Yield per colony averaged 54.5 pounds, down 2 percent from the 55.8 pounds in 2019. Colonies which produced honey in more than one State were counted in each State where the honey was produced. Therefore, at the United States level yield per colony may be understated, but total production would not be impacted. Colonies were not included if honey was not harvested. Producer honey stocks were 39.7 million pounds on December 15, 2020, down 3 percent from a year earlier. Stocks held by producers exclude those held under the commodity loan program, which totaled 5.8 million pounds.

Honey Prices Up 2 Percent in 2020

United States honey prices increased 2 percent during 2020 to $2.03 per pound, compared to $1.99 per pound in 2019. United States and State level prices reflect the portions of honey sold through cooperatives, private, and retail channels. Prices for each color class are derived by weighting the quantities sold for each marketing channel. Prices for the 2019 crop reflect honey sold in 2019 and 2020. Some 2019 crop honey was sold in 2020, which caused some revisions to the 2019 crop prices.

Price Paid per Queen was 18 Dollars in 2020, essentially unchanged from 2019

The average prices paid in 2020 for honey bee queens, packages, and nucs were $18, $84, and $105 respectively, compared to $18, $85 and $100 in 2019. Pollination income for 2020 was $254 million, down 18 percent from 2019. Other income from honey bees in 2020 was $55.8 million, down 28 percent from 2019. These estimates along with expenditure and apiary worker information can be found elsewhere in this article.

Honey: Number of Colonies, Yield, Production, Stocks, Price, and Value by State and United States, 2020

State	Honey Producing Colonies[1]	Yield per Colony	Production	Stocks, Pounds Dec 15[2]	Average Price per Pound[3]	Value of Production[4]
	x1,000	Pounds	x1,000	x1,000	Cents	1,000 Dollars
AL	7	39	273	66	5.43	1,482
AZ	25	36	900	360	2.18	1,962
AR	20	49	980	176	1.80	1,764
CA	320	43	13,760	2,752	1.78	24,493
CO	30	41	1,230	455	2.09	2,571
FL	192	46	8,832	883	2.28	20,137
GA	101	34	3,434	412	2.36	8,104
HI	15	105	1,575	79	1.61	2,536
ID	107	35	3,745	637	1.75	6,554
IL	10	52	520	156	5.56	2,891
IN	9	55	495	149	4.14	2,049
IA	35	58	2,030	1,259	2.59	5,258
KS	8	62	496	164	2.93	1,453
KY	7	33	231	58	6.25	1,444
LA	33	69	2,277	228	2.42	5,510
ME	10	30	300	78	3.26	978
MI	95	47	4,465	1,384	2.70	12,056
MN	108	55	5,940	2,495	1.75	10,395
MS	25	73	1,825	146	1.94	3,541
MO	9	41	369	100	3.31	1,221
MT	110	81	8,910	3,208	1.57	13,989
NE	37	52	1,924	250	1.71	3,290
NJ	14	31	434	91	7.99	3,468
NY	58	56	3,248	844	3.39	11,011
NC	12	38	456	123	5.13	2,339
ND	495	78	38,610	8,108	1.60	61,776
OH	16	75	1,200	576	3.85	4,620
OR	95	29	2,755	1,102	2.47	6,805
PA	19	48	912	392	4.74	4,323
SC	16	46	736	66	3.28	2,414
SD	245	61	14,945	8,668	1.60	23,912
TN	7	51	357	54	4.39	1,567
TX	157	57	8,949	1,253	1.90	17,003
UT	28	34	952	171	2.07	1,971
VT	6	47	282	96	3.76	1,060
VA	5	40	200	54	5.44	1,088
WA	98	37	3,626	798	2.54	9,210
WV	6	46	276	58	3.89	1,074
WI	45	50	2,250	855	3.26	7,335
WY	38	40	1,520	608	1.66	2,523
Other States[5,6]	33	42	1,375	303	4.36	5,995
US[6,7]	2,706	54.5	147,594	39,715	2.03	299,616

[1]Honey producing colonies are the maximum number of colonies from which honey was harvested during the year. It is possible to harvest honey from colonies which did not survive the entire year.
[2]Stocks held by producers.
[3]Average price per pound based on expanded sales.
[4]Value of production is equal to production multiplied by average price per pound.
[5]Alaska, Connecticut, Delaware, Maryland, Massachusetts, Nevada, New Hampshire, New Mexico, Oklahoma, and Rhode Island not published separately to avoid disclosing data for individual operations.
[6]Due to rounding, total colonies multiplied by total yield may not exactly equal production.
[7]United States value of production will not equal summation of States.

One thing we would like to note is that this year we have provided the updated 2019 Honey Report for two reasons. First, NASS always has updated data provided by beekeepers, packers, importers, exporters and the like as some data wasn't collected due to being in transit, under or over reported initially, or other reasons. For this reason, when the next report is due out, the unreported or corrected data is added to the previous report so the historical data is then correct. We note this as there are changes in last years data that bear noting. Some confusion and reporting errors resulted. We wanted to make sure the you are aware of these corrections, and that you can now see what your state, and the whole of the industry did last year. Some states had significant changes, many hardly any, but the two columns to note for certain are the Average price per pound, and the value of production. This is how the 11% drop in average price per pound between 2018 and 2019 showed up. 11% is a significant drop in just one year, and one that will affect markets next season when it comes to honey production decisions. `

Honey: Number of Colonies, Yield, Production, Stocks, Price, and Value by State and United States, 2019

State	Honey Producing Colonies[1]	Yield per Colony	Production	Stocks, Pounds Dec 15[2]	Average Price per Pound[3]	Value of Production[4]
	x1,000	Pounds	x1,000	x1,000	Cents	1,000 Dollars
AL	7	42	294	44	3.38	994
AZ	23	46	1,058	201	2.04	2,158
AR	20	55	1,100	176	1.65	1,815
CA	335	48	16,080	3,216	1.60	25,728
CO	32	46	1,472	500	2.34	3,444
FL	205	45	9,225	830	2.46	22,694
GA	102	33	3,366	370	2.67	8,987
HI	16	80	1,280	51	1.30	1,664
ID	92	32	2,944	677	1.62	4,769
IL	11	39	429	116	4.12	1,767
IN	9	55	495	188	3.78	1,871
IA	38	55	2,090	1,170	2.35	4,912
KS	7	79	553	171	2.35	1,300
KY	6	41	246	44	4.66	1,146
LA	54	72	3,888	428	2.15	8,359
ME	15	35	525	110	3.28	1,722
MI	94	50	4,700	1,363	2.56	12,032
MN	118	59	6,962	3,063	1.83	12,740
MS	22	80	1,760	141	1.87	3,291
MO	10	43	430	73	3.35	1,441
MT	173	86	14,878	5,802	1.49	22,168
NE	39	52	2,028	223	1.44	2,920
NJ	15	28	420	155	4.68	1,966
NY	59	58	3,422	1,027	4.00	13,688
NC	14	42	588	118	4.11	2,417
ND	520	65	33,800	6,422	1.43	48,334
OH	15	67	1,005	442	3.46	3,477
OR	87	32	2,784	1,141	2.50	6,960
PA	19	50	950	409	4.41	4,190
SC	16	47	752	45	5.03	3,783
SD	270	72	19,440	7,582	1.56	30,326
TN	8	57	456	91	4.72	2,152
TX	126	60	7,560	1,663	2.32	17,539
UT	22	29	638	89	1.97	1,257
VT	6	48	288	84	4.48	1,290
VA	5	39	195	49	7.19	1,402
WA	81	35	2,835	1,191	2.18	6,180
WV	6	37	222	47	4.26	946
WI	46	47	2,162	692	3.00	6,486
WY	39	56	2,184	306	1.43	3,123
Other States[5,6]	30	47	1,418	351	4.65	6,594
US[6,7]	2,812	55.8	156,922	40,861	1.99	312,275

[1]Honey producing colonies are the maximum number of colonies from which honey was harvested during the year. It is possible to harvest honey from colonies which did not survive the entire year.
[2]Stocks held by producers.
[3]Average price per pound based on expanded sales.
[4]Value of production is equal to production multiplied by average price per pound.
[5]Alaska, Connecticut, Delaware, Maryland, Massachusetts, Nevada, New Hampshire, New Mexico, Oklahoma, and Rhode Island not published separately to avoid disclosing data for individual operations.
[6]Due to rounding, total colonies multiplied by total yield may not exactly equal production.
[7]United States value of production will not equal summation of States.

Honey Price by Color Class - U.S.: 2015 - 2020
[Producers with 5 or more colonies that also qualify as a farm]

Color class	Price Co-op and private						
	2015	2016	2017	2018	2019	2020	% Change in 5 years
	per pound						
Water white, extra white, white	1.89	1.85	1.89	1.98	1.63	1.69	-13%
Extra light amber	1.89	1.85	1.89	2.01	1.70	1.76	-5%
Light amber, amber, dark amber	1.99	1.89	1.95	2.10	1.95	1.87	-3%
All other honey, area specialties	2.38	2.44	2.46	2.64	3.16	2.36	-3%
All honey	1.96	1.88	1.92	2.03	1.73	1.78	-5%

Color class	Price Retail						
	2015	2016	2017	2018	2019	2020	% Change in 5 years
	per pound						
Water white, extra white, white	3.54	4.91	3.80	3.63	4.70	4.94	+0.6%
Extra light amber	4.12	3.78	4.59	3.44	3.63	4.64	23%
Light amber, amber, dark amber	3.98	4.36	4.84	4.89	5.30	5.26	+21%
All other honey, area specialties	6.47	7.93	6.24	7.17	6.62	7.62	-4%
All honey	4.09	4.62	4.78	4.38	4.82	5.22	+8%

Color class	Price All Honey						
	2015	2016	2017	2018	2019	2020	% Change in 5 years
	per pound						
Water white, extra white, white	1.91	1.93	2.02	2.01	1.70	1.77	-8%
Extra light amber	2.15	1.95	2.14	2.12	1.90	1.88	-5%
Light amber, amber, dark amber	2.31	2.25	2.32	2.51	2.57	2.35	+4%
All other honey, area specialties	3.30	3.86	3.74	3.62	3.99	2.87	-26%
All honey	2.09	2.08	2.16	2.21	1.99	2.03	-2%

Notable aspects of the information presented here include the steady downward slant in the price of Co-op and private honeys. Overall, there's only a 5% average drop across all colors, but there's a $0.20/cents per pound drop in the water white class, probably the most in demand color. Interestingly, that same drop occurs in the retail prices offered, while the slightly darker ELA and darker colors have increased significantly. Add to these figures the drop in specialty honeys, which include comb, chunk, creamed, infused and the like. We suspect this drop in prices stems directly from the drop in demand for these, and, the lack of outlets overall.

USDA Honey Prices 2001-2020

Cents/lb.	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
All Honey	70.4	132.7	138.7	108.5	90.4	104.2	103.2	141	144.5	160.3	172.9	195.1	212.6	216.1	209.0	207.5	215.6	216.6	197.0	203.0
Retail Shelf	142.2	152.5	188.5	188.7	183.3	191.0	196.1	197.6	278.4	305.4	328.4	340.5	373.5	406.6	409.6	462.	477.7	421.2	485.0	522.0
%Difference	51%	13%	26%	42%	51%	46%	29%	28%	48%	48%	48%	43%	43%	47%	51%	45%	45%	51%	41%	39%

Per Capita Consumption, 2020

We calculate this figure each year using data from USDA ERS, NASS, ERS, FARM SERVICE and the U.S. Census Bureau. From these sources we determine how much honey entered the system, how much honey left the system, how much was used, how much wasn't used, and the population on July 1, 2020. These figures include U.S. production, U.S. exports, honey put under and taken our of the loan program and honey remaining in storage, plus how much was imported from off shore. Essentially it's a measure of honey in, minus honey out. The resultant figure, divided by how many people were here on that particular date results in how much honey was consumed by each and every individual in the US last year. And yes, you are correct, not every person eats honey, but by producing this figure on an annual basis, we are able to compare apples to apples each year in honey consumption.

The chart below compares these figures for the previous 11 years. We've included the USDA's price of all honey for comparison too.

Honey Consumption, Population, Prices 2010 – 2020

Year	Million lbs Honey in	Million lbs honey out	millions population	lbs/person	Price/lb$
2010	398	29	307	1.20	$1.60
2011	470	80	309	1.27	$1.73
2012	487	53	312	1.26	$1.95
2013	500	49	314	1.44	$2.13
2014	547	56	318	1.55	$2.17
2015	544	58	321	1.51	$2.09
2016	573	55	323	1.62	$2.12
2017	600	43	325	1.71	$2.19
2018	594	46	327	1.70	$2.17
2019	585	60	328	1.60	$1.97
2020	617	58	330	1.69	$2.03

Honey Into The U.S., 2020

U.S. beekeepers with more than five colonies in 2020 produced, according to USDA, 147.6 million pounds of honey. The Honey Board calculates that an additional 7.5 million pounds or so were produced by those with fewer than five colonies for a total production of 155 million pounds. Using this figure would add another 142 thousand colonies or so contributing to the overall figure. Additional honey in figures include 39 million pounds taken out of warehouses from last year, 9.8 million pounds taken out from last year's loan program, and a whopping 411 million pounds imported for a rough total of 615 pounds of honey in, during 2020. This honey sold, on average, wholesale, retail and speciality honey for $2.03/pound, according to USDA figures. Commercial beekeepers in the U.S. will tell you to make a living, this price should be about the same price as diesel fuel. Take a look next time you are at the gas station.

Honey Out Of The U.S., 2020

For the Honey Out figure, we exported nearly 12 million pounds to other countries (up about seven million pounds from the previous year), have nearly 40 million pounds still sitting in warehouses (almost exactly the same), and put just under six million under loan, for a total of about 58 million pounds of honey produced in 2020 that were moved out of the U.S. figures for 2020.

The July 1, 2020 population was right at 330 million people in the U.S. So, to calculate per capita consumption, subtract honey out (put under loan, exported, or still in warehouses) from honey in (honey produced this year, left over from last, or imported) and divide by 330 million, for a total of 557 million pounds consumed in the U.S. last year. Divide this by 330 million people which gives you right about 1.69 pounds of honey, or 27 ounces, consumed by each and every person in the U.S. during 2020. This is actually up from the 2019 figure of 25.6 ounces per person by just under an ounce and a half. Granted, that's not much per person, but it adds up. The price in 2020 was up $0.6 cents/pound, so the increase comes to about $0.18 per person.

These figures represent the various categories of honey imported, how much of each, and the value. The price of comb honey to sell directly retail is the closest to the U.S. price, while extra light amber, a very comon honey, is very low. Basically, U.S. honey producers are at $2.03/lb, while imports are at $1.65. Elsewhere, you'll see income issues for U.S. beekeepers, and here is one good reason.

Breakdown of 2020 Imports

Category	Million pounds	Value	Avg price/lb
Natural honey, not retail, light amber	146,438,085	$96,135,960	$1.52
Comb honey and packaged for retail	10,759,773	$46,118,802	$4.29
Natural honey, not for resale, white	412,064,529	$458,879,233	$1.11
Natural honey, not for resale, ELA	113,745,388	$103,715,638	$0.91
Natural honey, not for resale, Amber	33,620,049	$43,285,949	$1.28
Organic	64,949,353	$74,525,113	$0.99
Total	410,919,177	$822,660,695	$1.68
US Produced	155,594,000	$299,615,000	$2.03

COST & INCOME					
	2016	2017	2018	2019	2020
	5+	5+	5+	5+	5+
Queen Costs	19	19	18	18	18
Pkg. Cost $	89	88	92	85	84
Nuc Cost $	117	138	110	100	105
Varroa Control Cost/ Colony $	-	-	5.52	5.81	4.33
Workers x 1000	24	22	23	25	24
Feed Cost/Colony $	-	-	-	-	15.30
Pollination Income	-	-	301.8	309.6	254.0
Other Income x 1000	-	-	94.6	77.7	55.8

For producers with five or more colonies, costs and income have significantly dropped is some areas. Varroa control costs are down 25% per colony this year over last, which is good. These figures include the cost of the chemicals, plus the cost of labor to apply them. Speaking of labor, those numbers are down from last year, but still remain higher or the same as the past few years. But it's the income figures that are most troubling this year. Pollination income is down just under 20%, which is troubling and one wonders is it due to fewer colonies pollinating, being paid less for each contract, or growers simply using fewer colonies on those crops needing bees. Other income, too, is down about 30% this year. Some of this is due, certainly to the reduced price in honey, and, the amount of honey kept in warehouses not yet sold. However, the sales of nucs and packages is pretty steady, keeping income and costs about the same for those, so the drop in income oveall is somewhat of a mystery.

Top Ten Producing States Each Year

2014			2015			2016			2017			2018			2019			2020		
State	x1000 Col	x1000 Prod lbs	State	x1000 Col	x1000 Prod lbs	State	x1000 Col	x1000 Prod lbs	State	x1000 Col	x1000 Prod lbs	State	X1000 Col	X1000 Prod lbs	State	X1000 Col	X1000 Prod lbs	State	X1000 Col	X1000 Prod lbs
ND	490	42.1	ND	490	36.2	ND	485	37.7	ND	455	33.7	ND	530	38.2	ND	520	33.8	ND	495	38.6
SD	230	24.4	SD	290	19.1	SD	280	19.9	SD	255	14.3	CA	335	13.7	SD	270	19.4	SD	245	14.9
FL	245	14.7	MT	146	12.1	MT	159	12.2	CA	335	13.7	SD	255	12.0	CA	335	16.0	CA	320	13.8
MT	162	14.3	FL	220	11.8	CA	310	11.2	MT	145	10.4	FL	215	10.5	MT	173	14.9	TX	157	9.0
CA	320	12.5	TX	126	8.3	FL	215	10.8	FL	205	8.8	MT	160	14.7	FL	205	9.2	MT	110	8.9
TX	116	9.0	MN	122	8.2	TX	133	9.3	TX	120	7.9	TX	132	7.4	TX	126	7.6	FL	192	8.8
MN	132	7.9	CA	275	8.2	MN	124	7.3	MN	126	7.8	MN	119	7.3	MN	118	7.0	MN	108	5.9
MI	91	5.7	MI	90	5.2	MI	89	5.3	ID	95	4.2	GA	98	3.3	MI	94	4.7	MI	95	4.5
GA	73	4.5	LA	44	4.3	LA	50	4.3	LA	43	3.5	ID	96	2.9	LA	54	3.9	ID	107	3.7
LA	48	4.0	NY	58	3.5	GA	96	3.7	WA	77	3.5	OR	93	3.3	NY	59	3.4	NY	58	3.2
Total	1957	139.1		1861	117.4		1941	121.8		1850	107.8		2033	110.4		1954	119.9		1887	111.4
All Sts.	2740	178.3		2660	156.5		2775	161.8		2669	147.6		2803	139.9		2812	156.9		2706	147.6
% of Tot.	71%	78%		70%	75%		70%	75%		69%	73%		73%	75%		69%	76%		70%	75%

But what about the Top Three producing states? Total, the top three contain 56% of the top 10's colonies, and produced 58% of the honey produced by the top 10 states. The rest of us are sitting somewhere way, way back on the list.

Top 10 Producing States

The places that yield the most honey every year are pretty much determined by the climate, the soil, agriculture and politics. The crops grown, or not grown in a region certainly play a role in what can be found relative to nectar, pesticides and regulations relative to how many colonies can you put on any given acre that won't starve after a couple of months. Of course, government conservation programs lend a hand here too.

We've been curious about this for last eight years or so, just because it's interesting to see what changes, and what doesn't. The Dakotas, California, Montana, Florida, Minnesota, Michigan, Texas are almost always in the top eight, with the last two changing occasionally, and New York, Louisiana, Georgia, Idaho, Michigan and perhaps a few others round out these performers.

This year provided few surprises in who is on the list, and the totals for the top 10 this year were essentially where they always are relative to the number of colonies counted in these states and the amount of honey produced. Again, these states produced 70% of all of the honey produced in the U.S., and had three quarters of all the colonies in the U.S. sitting somewhere within their borders. It's pretty clear that what happens in these few states is going to determine the U.S. crop.

But, just because we can, this year we looked at the contributions of the top three states, for almost every year, the Dakotas and California. Combined, they held on to 56% of the colonies used last year and produced just short of 60% of all the honey U.S. beekeepers made last year. This means, of course, that 44% of the colonies, and 42% of the U.S. honey crop is spread out over the remaining 47 states. You can see this comes to just about 1%/state. That sort of puts us in our place, doesn't it? This extreme unbalanced situation commands notice, then, as to what will happen when climate change erodes, or doesn't, weather patterns in these three states including rainfall, Summer and Winter temperatures, farming practices and conservation practives.

Colonies and Value of Production		
Year	Colonies (million)	Value (million US$)
2000	2.620	132.8
2001	2.506	133.1
2002	2.574	228.3
2003	2.599	252.1
2004	2.556	199.6
2005	2.413	161.0
2006	2.393	158.4
2007	2.443	159.8
2008	2.342	232.7
2009	2.498	215.1
2010	2.692	285.7
2011	2.491	261.9
2012	2.539	283.5
2013	2.640	320.1
2014	2.740	387.4
2015	2.660	329.7
2016	2.775	343.0
2017	2.683	334.2
2018	2.803	333.5
2019	2.812	309.1
2020	2.706	299.6

FOUND IN TRANSLATION

Genes For The Future – Epigenetics, Part II

Jay **Evans**, USDA Beltsville Bee Lab

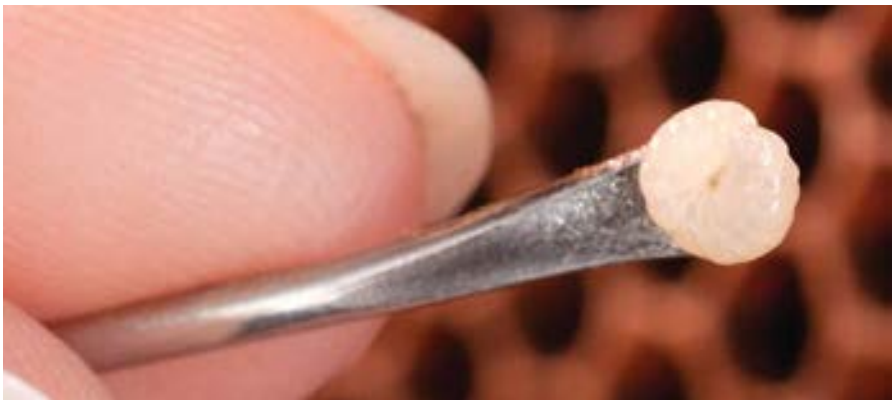
True genetics fans will remember from last month that epigenetic ('above the genome') mechanisms help turn whole blocks of genes on and off. This is important when going halfway is not good enough, as in queen production, where individuals that are halfway between queens and workers (inter-castes) are not great at being either. As promised, this month I will review recent research that suggests this ability to coordinate lots of genes at once is not a short-term switch but can last much of the lifetime of a bee and even change things for his or her offspring.

Methylation-related enzymes help paint sections of the genome such that genes under that paint tend to be slowed down, i.e., the proteins encoded by those genes are produced at reduced levels. New enzymes can repaint the same site even after cells divide, adding a sort of permanence to the paint marks. Last month I showed initial evidence that the proteins that are at different levels in queens versus workers get that way in part thanks to epigenomic acts, and especially methylation of genes and their neighborhoods. This work was expanded recently by Yao Yi and colleagues from China and Australia, as described in the *Apidologie* paper "Effects of commercial queen rearing methods on queen fecundity and genome methylation" (2020, **doi:10.1007/s13592-020-00817-7**). First, they confirm that queen-destined larvae grafted as two and three-day old larvae are sub-par when compared to grafts made with eggs or 1st-day larvae. Specifically, older larvae adults have smaller ovaries and lower body weight. This is not news. What is neat, though, is how this queen/worker track is reflected by methylation, or epigenomic paint, on the larvae. Late-graft queens were battling against a worker-typical paint pattern that they overcame in shape (they looked like queens) but not in true queenliness. It leads to the question of whether bee breeders can work with epigenetics to ensure their developing queens are at their best. Or, they can just graft those eye-straining 1st-day larvae.

So, there is strong evidence that epigenetic signals last through development. What about from parents to their offspring? If cells with marked chromosomes divide to become sperm or egg cells, their epigenetic paint just might hitch a ride into a new generation and affect unsuspecting offspring. Bear in mind, these signals are driven by an imprecise pathway run by enzymes, not by what we think of as standard parenting 'behavior' (in humans, yelling at your kid to stop eating dirt and stay out of traffic or in bee colonies, placing eggs in cells where they will receive enhanced nutrition).

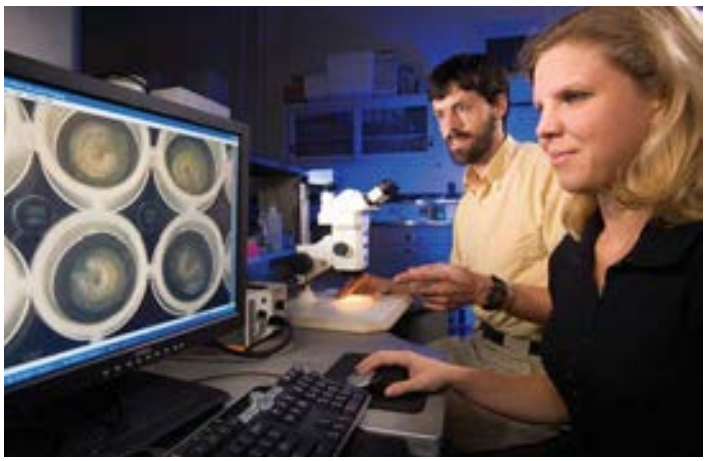
One longstanding question in honey bees is whether behaviors, including defensive and hygienic behaviors, are driven more by drone or queen genetics. Knowing this can be a big deal for breeding programs, for example, and there is evidence from past studies that drone-provided behavioral traits are more faithfully expressed in worker bee offspring than are those linked with the queen's genome. Xin Wu and colleagues at Georgia Tech and Pennsylvania State Universities provided new answers to this question by tracking genes donated by drones versus queens to their female worker offspring (Lineage and parent-of-origin effects in DNA methylation of honey bees (*Apis mellifera*) revealed by reciprocal crosses and whole-genome bisulfite sequencing. *Genome Biology and Evolution*, 2020, **https://doi.org/10.1093/gbe/evaa133**). In the end, their results were more complicated than those seen previously. Certain genes tend to be expressed in patterns that matched drones more closely than queens, including some related to worker behavior. However, far more were marked based on the race of the studied honey bees (in their case *A. mellifera scutellata* versus European lines of *A. mellifera*). Nevertheless, they showed that methylation can play a role in the levels of proteins involved with offspring behavior, i.e., the paint marks from specific parents were reflected in their offspring in important ways.

Aside from sex and honey bee race, how can a queen or male's own



experiences drive the expression of genes in their offspring? And, is that ever a good idea?? The current thinking is that if a parent can predict risks in their offspring's environment, then that parent might pre-tune their offspring's gene activity to deal better with that risk. A holy grail for such 'priming' involves whether queens or drones exposed to a pathogen are able to set the stage for better disease responses by their offspring. I reviewed so-called transgenerational immune priming (TGIP) in *Bee Culture* in May, 2017 (Prime time-passing along immunity) and it remains a hot topic. Hongmei Li-Byarlay (now at Central State University in Ohio) and colleagues showed that epigenetic marks are laid down in response to infection, in this case by Israeli acute paralysis virus ("Transcriptomic and epigenomic dynamics of honey bees in response to lethal viral infection", in the open-access journal *Frontiers in Genetics*, 2020, **https://doi.org/10.3389/fgene.2020.566320**). Five hours after being infected with viruses, worker pupae showed huge differences in both gene activity and methylation when compared to control bees. Some of these responses, and some of the methylated regions, were tied to known immune genes. Other responses seemed to be tied to more subtle ways bee cells might deprive viruses of bee resources and processes needed to make new viral copies. Interestingly, methylation patterns decreased significantly after 24 hours, perhaps reflecting a general shutdown of sick bees or perhaps reflecting a counter-attack against bee defenses led by the viruses themselves. In support of the latter, it seems that viral infection leads to a general reduction of the very proteins needed to maintain methylation, perhaps limiting the abilities of bees to respond optimally.

So . . . can parents transmit a signal to their offspring that helps them prepare for a disease-ridden world? On the epigenetic front the jury is still out, but several recent papers point to the great potential there. In honey bees, Esmaeil Amiri and colleagues showed that eggs produced by honey bee queens exposed to IAPV have a distinct gene-expression pattern, suggesting their queens delivered a signal through the egg ("Egg transcriptome profile responds to maternal virus infection in honey bees, *Apis mellifera*", *Infection, Genetics and Evolution*, 2020, **https://doi.org/10.1016/j.meegid.2020.104558**). On the other hand, longstanding studies by Gro Amdam (Arizona State University), Dalial Frietak (University of Graz, Austria) and their colleagues suggest that epigenetic mechanisms are not the only game in town for TGIP. They have provided evidence that non-infective pathogen fragments hitchhike their way from queens to offspring via the ubiquitous protein vitellogenin. Arriving there, they trigger an adaptive immune response by larvae toward the priming pathogen, in this case the bacterial cause of American foulbrood. Recent work from their group, led by Gyan Harwood, is described in "The role of Vitellogenin in the transfer of immune elicitors from gut to hypopharyngeal glands in honey bees (*Apis mellifera*)" in the *Journal of Insect Physiology*, 2019, **DOI: 10.1016/j.jinsphys.2018.12.006**) and this is a good place to start to understand how this essential bee protein might also serve as a messenger of threats. This team now has a commercial venture aiming to exploit this pathway for bee health.



Finally, viruses are near and dear to us, and some of us have tried over the years to trigger the potent bee antiviral response within and across generations. New hope that this can be done effectively for bee health comes from a study outside of bees but in some well-studied flies. The model proposed by Juan Mondotte and colleagues ("Evidence for long-lasting transgenerational antiviral immunity in insects", *Cell Reports*, 2021, **https://doi.org/10.1016/j.celrep.2020.108506**) is that short DNA copies of infecting RNA viruses are produced in the bodies of insects. These copies work their way into offspring and trigger species-specific responses against those viruses. Remarkably, while protection was not 100% it lasted for *several* generations of flies, a remarkable memory for viral attack. Assuming something like this is functional in bees, this is indeed an exciting direction for an epic means of reducing the impacts of bee viruses.

And that is enough genetics to digest for now, Spring will have sprung by the time you read this and next month I plan to cover new research into how your management style affects bee colony health. BC

All photos are ARS-USDA photos.

A Closer Look

HONEY COMPOSITION AND PROPERTIES

Clarence **Collison**

Properties Vary Depending On Botanical Source and Geographical Origin

"Honey is a concentrated aqueous solution composed of a mixture of glucose and fructose, but it also contains at least 22 other complex carbohydrates, various amino and organic acids, proteins, antibiotic-rich inhibine, enzymes, phenol antioxidants, aroma compounds, vitamins, minerals, pigments, waxes, and pollen grains (White and Doner 1980). Honey is viscous and acidic in nature, with a pH ranging between 3.2 and 4.5. Because sugars are its main constituents, the physical features and behavior of honey are attributed to its sugars. Tests conducted on sugar will indicate its sweetness due to the high sugar content, with the most plentiful sugar being fructose. Minor constituents such as flavor compounds, minerals, acids, pigments and phenols are largely responsible for defining each specific type of honey (White and Doner 1980; Bogdanov et al. 2008). The U.S. Food and Drug Act defines honey as "the nectar and saccharine exudation of plants, gathered, modified and stored in the comb by honey bees which contain no more than 25% water, 0.25% ash and 8% sucrose." This definition was based on a survey published in 1908. In a more recent study, the composition of honey based on 490 samples of different floral origins indicated that honey is composed of 17.2% moisture, 38.19% fructose, 31.28% glucose, 1.31% sucrose, and 0.17% ash (White and Doner 1980), (Solayman et al. 2015)."

"Honey is a natural sweetener with a complex composition. Honey properties vary depending on the botanical source and geographical origin, as well as climate, processing, and storage conditions. Honey is mainly composed of carbohydrates and water, parameters that influence its shelf live and some of its properties, including color, flavor, density, viscosity, hygroscopicity, and crystallization. Honey also contains small amounts of other components, such as nitrogen compounds, organic acids, minerals, vitamins, Maillard reaction products, volatile compounds, and several bioactive substances that affect sensory and physical characteristics, as well as biological potential (Machado-De-Melo et al. 2017)."

"The causes of darkening in honey have been attributed to the Maillard reaction, fructose caramelization and reactions of polyphenols, however, no systematic studies exist on this subject. The influence of composition and initial color on the rate of darkening of several Argentine honeys submitted to storage at 37°C (98.6°) for 90 days was evaluated through spectrocolorimetric measurements. The most suitable color functions to evaluate darkening of honeys [lightness (L_{ab}), browning index (BI), metric chroma (C_{ab}), metric hue (H_{ab}) and1/Z] increased linearly as storage time increased, after an initial induction period of extremely low browning development. The slope of the linear browning development zone with time was an index of browning rate, and it was analyzed in relation to the initial color and the composition of honeys (moisture content, total nitrogen, total lipids, and polyunsaturated fatty acids, fructose and glucose content). Of the analyzed variables, the initial color was the parameter which better described the rate of darkening of honeys (Gonzales et al. 1999)."

"Tests were carried out on various types of Western Australian honey to determine the relationship between time, temperature, and color deterioration. The darkening in color at 43, 46, 50, 60, 70, and 80°C (109.4°, 114.8°, 122°, 140°, 158°, 176°F) was measured; results are tabulated to show the time and temperature required to produce an increase of 1, 5, and 10 mm on the Pfund scale. A Pfund grader is a device that measures the color of honey. It was found: a) that honey from *Dryandra sessilis* darkened approximately twice as rapidly as the other honeys, and b) that the period at a given temperature which produced 10 mm Pfund darkening in honey was of the same order as the period producing three mg/HMF (hydroxymethylfurfural) per 100 g honey (Smith 1967)."

"Hydroxymethylfurfural (HMF) accumulation and color change are two major quality degradations in honey during storage. Bulut and Kilic (2009) investigated the effects of moisture content and temperature on HMF accumulation and color change in honey during storage. HMF accumulation and color change followed first- and zero-order reaction kinetics, respectively. The moisture content affected the rate of the two degradation reactions

depending on the storage temperature. Reduction in moisture content caused an increase in rate constant for HMF accumulation at 20°C (68°F) and 30°C. (86°F), but there was no significant effect of moisture content at 40°C (104°F). Rate constants for change in lightness and total color change values increased with increasing moisture content at 20 and 30°C. The highest rate constant for change in color values was obtained at a moisture content of 18% at 40°C. This study shows that the rates of these two degradations are dependent on the moisture content of honey. In addition, effect of moisture content on the rates of reactions was dependent on temperature of storage. Therefore, producers need to consider the effects of both moisture content and storage temperature in reducing quality loss in honey during storage."

"Crystallization is an undesirable property in handling, processing, and marketing, except for the purpose of producing creamed honey. Glucose is the principal component that crystallizes in honey as it exists in a supersaturated state. Bhandari et al. (1999) summarized some of the methods proposed to stop crystallization of honey: storage at freezing temperature (-40°C), heat treatment to dissolve crystals and crystal nuclei, removal of air bubbles, dust, and pollen particles by filtration, filling at higher temperatures (>45°C) (>113°F) to avoid air bubbles incorporation during filling, addition of inhibitors such as isobutyric and sorbic acid, and adjusting the glucose to fructose ratios or the water content. Ultrasound processing has also been reported for preventing crystallization in honey. Heating is a common method to control the crystallization. It helps to melt invisible crystals in honey. After melting all the crystals and nuclei, even the most crystallizable honey can remain liquid for many months. Presence of air bubbles in the packaging containers can provoke nucleation and crystallization of honey. Filling at higher temperatures eliminates air bubbles and avoids air incorporation during packing due to low viscosity (Subramanian et al. 2007)."

"Honey crystallization or granulation is a natural and spontaneous complex physical process. Glucose, which is less soluble than fructose, separates from water and precipitates out of the supersaturated solution, becoming glucose monohydrate crystals by water losses (Gleiter et al. 2006). Honeys rich in fructose such as acacia and sage, may remain liquid for a long period, while honeys rich in glucose such as rape or dandelion, often granulate immediately after harvesting or sometimes within the cells of the comb (Dyce 1931; Maurizio 1962). Crystallization only affects the honey color and texture, preserving the flavor and quality characteristics of the liquid honey. In principle, crystallized honey is not a spoiled product, but if a non-homogeneous crystallization occurs, the sugar concentration of the upper part decreases, increasing the moisture content of the liquid phase. Honey crystallization depends on factors such as temperature, viscosity, water content, sugars (mainly glucose and melezitose content), dextrin content, the glucose supersaturation coefficient and the presence of particles that could act as crystallization nuclei (proteins and other colloids, pollen grains, dust and other suspended particles, yeast, wax, propolis or air bubbles (Machado-De-Melo et al. 2017)."

"Natural honey contains small amounts of enzymes, of which diastase, invertase and glucose-oxidase are the most important. Other enzymes that have been found in honey are acid phosphatase, catalase and ß-glucosidase. Enzymes such as invertase or glucose oxidase are mainly produced in the hypopharyngeal glands of the bees (animal origin). Honey bees add these enzymes in order to accomplish the honey ripening process. Some enzymes come from nectar, honeydew or pollen (vegetal origin), such as catalase and acid phosphatase. And finally, enzymes such as diastase have a double origin. Other possible origins could be honey microorganisms and in the case of honeydew honey, some enzymes could come from the plant sucking insects that produce honeydew (White 1957). Enzymes are thermolabile (substance readily destroyed or deactivated by heat), being used as indicator of aging and/or overheating, since their activities decrease in these conditions. In general, honeys that come from fast and abundant nectar fluxes (process of flowing) to be processed contain fewer enzymes because bees have less time to process the nectar. Moreover, nectars with a high sugar content require lesser manipulation to become honeys than diluted ones, thus containing fewer enzymes (mainly diastase and invertase). The enzyme content also depends on temperature, honey botanical origin, nectar abundance flow and transformation degree, state and strength of the colony, seasonal activity of the bee hypopharyngeal glands and diet, age, and physiological stage of the bee (Maurizio 1962; Persano-Oddo et al. 1999). Diastase (amylase) is the honey enzyme with the best resistance to heat, so it is widely used as an indicator of honey freshness. Diastase hydrolyzes starch and dextrins, resulting in smaller carbohydrates. Its function in honey is not well known since nectar does not possess starch, but probably takes part in the pollen digestion by bees (White 1978). In addition to its animal origin (the hypopharyngeal glands secretions), it has a vegetal origin (nectar or honeydew) (Persano-Oddo et al. 1990). Invertase (α- glucosidase) is an important honey enzyme, since it converts nectar and honeydew into honey, hydrolyzing sucrose into fructose and glucose. Furthermore, the transglycosilase activity of invertase produces some oligosaccharides in the intermediate steps (White and Maher 1953). Invertase activity is maintained after honey extraction and during storage (Machado-De-Melo et al. 2017)."

"Honey is well known for its antibacterial activity. The high sugar concentration, hydrogen peroxide, and low pH are well-known antibacterial factors in honey and more recently, methylglyoxal and the antimicrobial peptide bee defensin-1 were identified as important antibacterial compounds in honey. The antibacterial activity of honey is overly complex due to the involvement of multiple compounds and due to the large variation in the concentrations of these compounds among honeys (Kwakman and Zaat 2012)."

"The microbes of concern in honey are primarily yeasts and spore-forming bacteria. Total plate counts from honey samples can vary from zero to tens of thousands per gram for no apparent reason. Most samples of honey contain detectable levels of yeasts. Although yeast counts in many honey samples are below 100 colony forming units per gram (cfug), yeasts can grow in honey to extremely high numbers. Standard industry practices control yeast growth. Bacterial spores, particularly those in the *Bacillus* genus, are regularly found in honey. The spores of *C. botulinum* are found in a fraction of the honey samples tested – normally at low levels. No vegetative forms of disease-causing bacterial species have been found in honey. Bacteria do not replicate in honey and as such high numbers of vegetative bacteria could indicate recent contamination from a secondary source. Certain vegetative microbes can survive in honey, at cool temperatures, for several years. However, honey has anti-microbial properties that discourage the growth or persistence of many microorganisms. Typically, honey can be expected to contain low numbers and a limited variety of microbes (Snowdon and Cliver 1996)."

"Honey also contains minerals and heavy metals, which play important roles in determining honey qualities. The mineral content varies, ranging from 0.04% in pale honeys to 0.20% in darker honeys (Bogdanov et al. 2007). The major minerals are mainly derived from the soil and nectar producing plants, but they may also come from anthropogenic sources, such as environmental pollution (Solayman et al. 2015)." BC

References

Bhandari, B., B. D'Arcy and C. Kelly 1999. *Rheology and crystallization kinetics of honey: present status.* Int. J. Food Prop. 2: 217-226.

Bogdanov, S., M. Haldimann, W. Luginbuhl and P. Gallmann 2007. *Minerals in honey: environmental, geographical, and botanical aspects.* J. Apic. Res. 46:269-275.

Bogdanov, S., T. Jurendic, R. Sieber and P. Gallmann 2008. *Honey for nutrition and health: a review.* J. Am. Coll. Nutr. 27: 677-689.

Bulut, L. and M. Kilic 2009. *Kinetics of hydroxymethylfurfural accumulation and color change in honey during storage in relation to moisture content.* J. Food Process. Preserv. 33: 22-32.

Dyce, E.J. 1931. *Crystallization of honey.* J. Econ. Entomol. 24: 597-602.

Gleiter, R.A., H. Horn and H.D. Isengard 2006. *Influence of type and state of crystallization on the water activity of honey.* Food Chem. 96: 441-445.

Gonzales, A.P., L. Burin, and M.P. Beura 1999. *Color changes during storage of honeys in relation to their composition and initial color.* Food Res. Int. 32: 185-191.

Kwakman, P.H.S. and S.A.J. Zaat 2012. *Antibacterial components of honey.* IUBMB Life 64: 48-55.

Machado-De-Melo, A.A., L. Bicudo de Almeida-Muradian, M.T. Sancho and A. Pascual-Maté 2017. *Composition and properties of* Apis mellifera *honey: a review.* J. Apic. Res. doi :10.1080/00218839.2017.1338444

Maurizio, A. 1962. *From the raw material to the finished product: honey.* Bee Wld. 43: 66-81.

Persano-Oddo, L., E. Baldi and M. Accorti 1990. *Diastatic activity in some unifloral honeys.* Apidologie 21: 17-24.

Persano-Oddo, L., M.G. Piazza and P. Pulcini 1999. *Invertase activity in honey.* Apidologie 30: 57-65.

Smith, F.G. 1967. *Deterioration of the colour of honey.* J. Apic. Res. 6: 95-98.

Snowdon, J.A. and D.O. Cliver 1996. *Microorganisms in honey.* Int. J. Food Microbiol. 31: 1-26.

Solayman, M., M.A. Islam, S. Paul, Y. Ali, M.I. Khalil, N. Alam and S.H. Gan 2015. *Physicochemical properties, minerals, trace elements and heavy metals in honey of different origins: a comprehensive review.* Comprehensive Reviews in Food Science and Food Safety. 15: 219-233.

Subramanian, R., H.U. Hebbar and N.K. Rastogi 2007. *Processing of honey: a review.* Int. J. Food Prop. 10: 127-143.

White, Jr., J.W. 1957. *The composition of honey.* Bee Wld. 38: 57-66.

White, Jr., J.W. 1978. *Honey.* Adv. Food Res. 24: 287-374.

White, Jr., J.W. and L.W. Doner 1980. *Honey composition and properties.* Beekeeping in the United States, U.S. Department of Agriculture, Agriculture Handbook 335: 82-91.

White, Jr., J.W. and J. Maher 1953. *Transglucosidation by honey invertase.* Arch. Biochem. Biophys. 42: 360-367.

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Beekeepers' Guide To Honey Bee Viruses

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All life forms, including bees (wild and domesticated species) are threatened by various viruses. They can be singular species-specific or infect a broad range of host (i.e. pollinators). Viral particles are basically a genetic material (RNA or DNA) encapsulated in a protective layer made of protein. Viruses can multiply only in living host cells.

Most viruses are so small that they can be observed only by using highly specialized techniques like electron microscopy (EM). However even in the EM many particles of non-related viruses, that cause very different diseases, look strikingly similiar. That is why the most reliable diagnostic methods are those using serological techniques (i.e. AGID) and molecular biology (i.e. PCR). In some cases the virus can be identified by the symptoms it causes in the colony.

Many viruses, causing severe, often deadly diseases, multiply and spread between single hosts for a long time before causing any visible symptoms. This trait is typical for bee viruses.

The occurence of some viral diseases is dependant on the presence of parasites, i. e. *Nosema spp.* or *Varroa destructor*, and others on unfavorable environmental conditions i.e. bad weather making it impossible for bees to fly out, a break in forage sources, etc.).

Many viruses are very commonly present in bee colonies that show no symptoms of infection. There are actually more viruses in bee colonies than any other pathogens. To date 36 bee viruses were found in *Apis mellifera* colonies. Their phylogenetic origin and target developmental stage of the bee (or the caste) is shown in Table 1.

Table 1. Phylogenetic origin of respective viruses and the target stage/caste of bees

Family	Virus	Target stage/caste of bees
Dicistroviridae	Acute bee paralysis virus (ABPV)	Brood, workers, drones
	Israeli acute bee paralysis virus/Kashmir bee virus (IAPV/KBV)	Eggs, larvae, pupae, workers, drones, queens
	Apis dicistrovirus (ADV)	Workers, drones
	Aphid lethal paralysis virus (ALPV)	Workers, drones
	Big Sioux River Virus (BSRV)	Workers, drones
	Black queen cell virus (BQCV)	Larvae, pupae, workers, drones, queens
Unclassified	Chronic bee paralysis virus (CBPV)	Workers, drones, queens
Iflaviridae	Deformed wing virus (DWV) (A,B and C)	Eggs, larvae, pupae, workers, drones, queens
	Sacbrood virus (SBV)	Brood, workers, drones
	Slow bee paralysis virus (SBPV)	Larvae, workers, drones
Unclassified	Lake Sinai virus (LSV)	Workers, drones
Tymoviridae	Bee macula-like virus (BeeMLV)	Pupae, workers
	Bee macula-like virus-2 (BeeMLV-2)	Pupae, workers
	Varroa tymo-like virus (VTLV)	Workers, drones
Unclassified	Cloudy wing virus (CWV)	Workers, drones
Nodaviridae	Apis noda-like virus	Workers, drones
Noraviridae	Apis nora virus (ANV)	Workers
Rhabdoviridae	Apis rhabdovirus -1/ Bee rhabdovirus-1 (ARV1/ BRV-1)	Workers, drones
	Apis rhabdovirus -2 (ARV-2)	Workers, drones
Bunyaviridae	Apis bunya virus-1 (ABV-1)	Workers, drones
	Apis bunya virus-2 (ABV-2)	
Flaviviridae	Apis flavivirus (AFV)	Workers, drones
Picorna-like	Berkeley bee picorna -like virus (BBPV)	Workers, drones
Secoviridae	Tobacco ring spot Virus (TRSV)	Workers, drones
Secoviridae	Seco-like virus	Workers
Iflaviridae	Moku virus	Workers
Orthomyxoviridae	Varroa Oorthomyxovirus-1 (VOV-1)	Workers
Partitiviridae	Partiti-like virus	Workers
Unclassified	Bee Y virus	Workers, drones
Unclassified	Bee X virus	Workers, drones
Unclassified	Egypt bee virus	Workers, drones
Unclassified	Arkansas Bee virus (ABV)	Workers, drones
Iridoviridae	Apis iridovirus (AIV)	Workers, drones
Unclassified	Apis mellifera filamentous virus (AmMFV)	Workers, drones
Circoviridae	Circo-1	Workers
	Circo-2	

Most of those viruses multipliy in bees and brood asymptomatically. Those that pose the biggest threats are described below.

VIRUSES ASSOCIATED WITH VAROOSIS

Deformed wing virus (DWV)

It's one of the viruses that causes no symptoms in bees and brood without *V. destructor*. With this parasite (that is a vector and activator of the virus) however DWV can be deadly for individual bees, but often also the entire colony.

By feeding on bees and brood, the mites impair their immunity, which allows the virus to multiply freely. There are emany variants of the virus that differ in virulence (the ability to penetrate, multiply in and damage cells, and in consequence, tissues) in bees. The coexistence of mites and highly virulent viral strains leads to colony deaths. However, regardless of the strain, the longer the mites stay on adult bees, the longer the viral titres, and the more often it leads to emergence of crippled bees from brood cells that the mites entered. Also the more mites in the colony, the more crippled bees emerge.

DWV can be transmitted with royal jelly, sperm (from drones to queen), from queen to egg, from mite to brood and bees.

The symptomatic infection takes many forms from brood death to emergence of crippled bees. Those bees usually have ill developed wings (from gray to brown in color, deformed and shortened), shortened abdomens, movement and orientation impairments. Usually they don't live past 67 hours. They are removed from the colony earlier and die outside.

It is possible that healthy looking bees will emerge. It is however just apparent health, because those bees have severe nervous system impairments. Their life span is significantly shortened.

Severely infected colonies may rapidly dwindle after feeding for winter and they die shortly after. If the weather allows the bees to fly out, they die in the field, and in the nest only a handful of bees with the queen is left. However, if it is already cold outside, and they cannot fly out, they die in the hive.

DWV is found practically everywhere in the world, but in colonies, in which *Varroa* control is performed properly (or where *Varroa* is not yet present), there is no symptoms of this infection.

But in colonies in which *V. destructor* had a chance to multiply to greater numbers and persist there for extended periods of time, bees with deformed wings begin to appear. The more neglected the colony (treatment wise), the more crippled insects.

Sometimes, after a period of heavy mite infestation, the beekeeper treats the colony well and even kills almost all the parasites. This however does not mean that he gets rid of the virus, because usually DWV manages to multiply so much, that it leads to the colony death anyway, even with a big delay in relation to the treatment.

Acute bee paralysis virus (ABPV)

In the presence of *V. destructor* this virus can kill both bees and brood. Similar to DWV, the mite impairs the immune response in bees, which allows the virus to multiply freely. *V. destructor* is also a vector of ABPV.

Heavily infected bees are carriers of the virus and spread it (in huge amounts) with royal jelly and pollen moistened with their saliva to larvae, but also to other adult bees via trophallaxis (food sharing). Transmission of ABPV with food however isn't usually effective enough for the symptoms to appear. The main role here is played by the mite, that transfers viral partlicles directly into the hemolymph of bees and brood. This route allows fast multiplication of ABPV.

Often the beekeeper doesn't see any symptoms until the colony dies. It's because the virus (in the presence of many mites) multiplies very fast, and kills the bees just as rapidly, so the time when the symptoms appear is very short.

Heavily infected bees cannot fly, show symptoms of paralysis and tremors of different magnitude, and in the end they fall off of the combs and are thrown out of the hive by their sister bees.

If it is warm enough so the bees can fly, they usually die in the field leaving food, some brood, a handful of bees and the queen behind.

It may happen that heavily infected bees feed huge ammounts of the virus to larvae with royal jelly, and the brood dies before it is capped. However the beekeeper sees that symptom rather seldom, because the dead larvae are quickly removed by the nurse bees.

Larvae that survive become carriers of ABPV as adult bees and transfer it in big amounts to other larvae during feeding. If, at the same time, there is still a heavy mite infestation, the beekeeper will see foulbrood like symptoms.

Heavily infected colonies usually die in late spring or early Winter.

VIRUSES ASSOCIATED WITH NOSEMOSIS

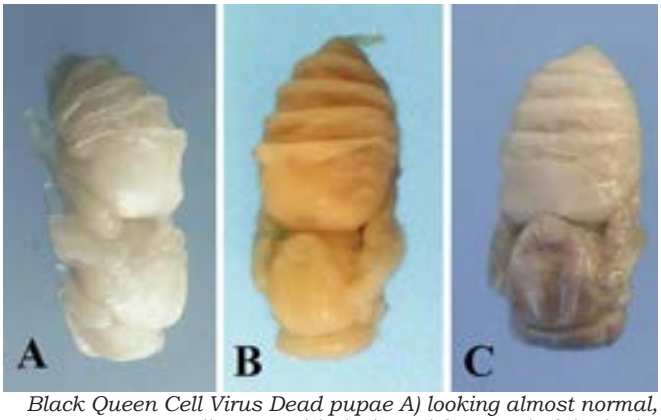
Black queen cell virus (BQCV)

This virus plays the key role amongst other viral co-infections with nosemosis. It is transmitted similarly to *Nosema* spores, via the alimentary route, and is found in considerable ammounts in workers suffering from *Nosema* infections.

BQCV infection shortens the lifespan of bees significantly. Often they die in early spring, before the new generation of bees can be reared. It results in the course of nosemosis being much more severe and more often leading to colony death (it rapidly dwindles before it can be reinforced with newly emerged bees). Besides the much shorter lifespan, in adult bees there is no other symptoms of BQCV infection.

Darkened queen cell. (A. Gajda photo)

Black Queen Cell Virus – Dead larvae A) yellow, B) with darkened head. (G. Topolska photo)



Black Queen Cell Virus Dead pupae A) looking almost normal, B) yellow, C) with darkened front end of the body. (G. Topolska photo)

Distinctive symptoms can be observed in queen larvae and pupae, however, in natural conditions, when the bees decide about queen rearing on their own, we do not observe this disease. Bees infected with *Nosema* and BQCV are withdrawn as nurse bees and become foragers faster (they physiologically get older faster).

In contrast, especially in first batches of queen rearing material, there are not enough nurse bees, so infected bees (that normally would be foragers already) still feed the larvae, that is why they can infect queen larvae.

Queen larva or pupa infected with BQCV become pale yellow, it's cuticle hardens. With time, due to melanin deposition it darkens, leading, by contact, to darkening of the queen cell walls. The virus was named after this specific symptom. One must however remember, that even though dark queen cell walls are commonly associated with BQCV, in reality queen cells with dead queen brood can look completely normal, and contain almost normally looking, pale yellow larvae or pupae inside.

Larvae get infected by eating royal jelly supplied by nurse bees that are carriers of the virus. The larvae get sick only after they have been capped.

During a heavy BQCV infection also worker brood can start dying and the symptoms resemble very closely those of sacbrood disease.

BQCV is a very commonly present virus. Practically in all the apiaries, in which colonies suffer from nosemosis, it can be also found. It is by far the most common cause of queen brood death in queen rearing apiaries.

Bee virus Y (BVY)

It also is transmitted via the alimentary route. It multiplies in the alimentary tract of the bee most efficiently, when the bees are kept in 35°C, whereas when the temperature drops even by 5°C, it stops the multiplication completely. BVY shortens the life span of bees and exacerbates the pathogenicity of *Nosema spp.*, however other symptoms were not discovered to date.

***Apis mellifera* filamentous virus (*Am*FV)**

The particle of this virus is very big compared to most bee viruses, and can be observed in light microscopy (LM), however, recognition can only be done by electron microscopy (EM), because in LM it is visible as a tiny dark speck. *Am*FV multiplies in fat body and ovaries of infected bees (it is not however transmitted from the queen to the egg). Similarly to BQCV and BVY it is transmitted with food. The hemolymph of heavily infected bees becomes milky-white and contains huge ammounts of the virus. In the last phase of the infection, the hemolymph expands its volume and its hemocytes start dissapearing. The influence of *Am*FV on the course of nosemosis is not as clear as the one of BQCV or BVY. It is commonly thought to be a minimally harmful virus.

Unfortunately, to date there is no available antiviral drug for bees, that is why controlling viral diseases that are associated with other pathogens, consists of this latter pathogen control. It looks similar with viral disease prevention in this case. One should primarily prevent other pathogens from spreading in the hive in order to lower the risk of those viral infections. Namely**:** proper mite control, hygene (to prevent nosemosis). It is always advised to replace the queen with a young and healthy one, that lays eggs properly, preferably bought from a good breeder, that offers queens producing bees with highly developed hygenic Instinct. It is also known, that endemically occuring bee genotypes always do better with diseases, than the newly introduced ones, that is why one should buy queens from local breeders with long traditions in the region.

VIRUSES NOT ASSOCIATED WITH OTHER PATHOGENS

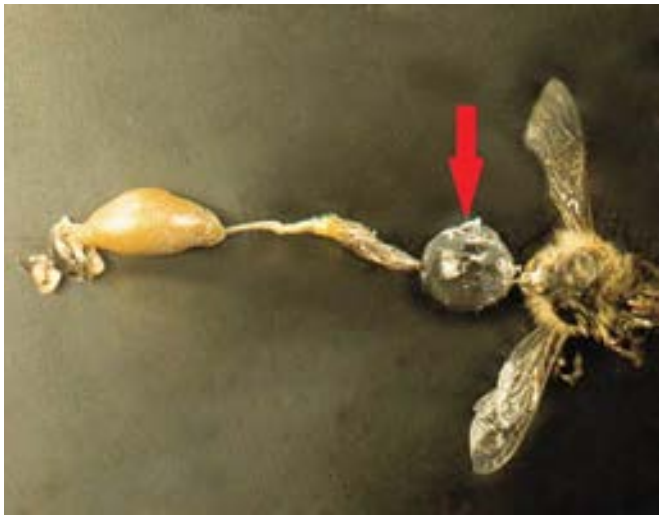
Chronic bee paralysis virus (CBPV)

It is a very commonly occurring virus.

Just as in case of most viral infections in bees, this one also is often covert, however, with proper conditions occurring, the symptoms start.

CBPV enters hemolymph mostly via wounds from broken hairs on adult bees, but it can also be transmitted via food: with pollen, honey and feces of infected individuals.

The most hairs are broken when during an active beekeeping season the foragers are forced to stay in the hive for too long, which mainly occurs during a sudden brake in forage availability (cold, rainy weather, drought), but also when there are too many colonies in the area (not enough flowers for all the bees). In such conditions CBPV spreads fast in the colony and the symptoms occur in adult bees. However the presence of the virus was confirmed independently of the season in all developmental stages of bees. In very heavily infected colonies also pupae death was observed.



Chronic bee paralysis virus – Alimentary tract and thorax. The arrow shows expanded crop. Spread wings are also depicted. (G. Topolska photo)

CBPV causes two sets of symptoms (two syndromes). Both lead to death of bees. They can occur simultanously, but always one of them is dominant (it's genetically conditioned).

Syndrome I. The symptoms result from active multiplication of CBPV in the nervous system of bees, towards which it has the strongest tropism. They are classical progressive paralysis symptoms. Bees tremble unnaturally (body and wings), paralysis of different body parts also occurs, and bees become unable to fly. Sick bees gather in warmer areas of the nest, but later, as useless, they are thrown out of the hive, where they crawl on the ground or up the grass leaves. Their crop is entirely filled with food, which causes the abdomen to be prolonged. Wings are often spread to the sides. The movements of sick bees are wobbly and uncoordinated. Bees die quite fast (but not as fast as in case of ABPV) from the occurence of first symptoms. It often happens in great numbers. The biggest viral loads in this syndrome are found in the crop and salivary glands of sick bees.

Syndrome II – black robbers. Sick workers gradually lose body hair. They become almost black (if the cuticle is black) and shiny, like they were covered in grease. They appear smaller and thinner than healthy bees (body hair makes healthy bees look more chubby). They are attacked by their sister bees and are not let in the hive. Since at the beginning of symptoms they are still able to fly, they circle around the entrance trying to get in. This makes them look like they are trying to rob the colony.

After a few days symptoms of ataxia and paralysis occur, which later results in death.

The colony usually dies in the middle of Summer. Bees die outside of the hive, in which only a handful of bees with the queen is left.

In case of CBPV prevention is based on not letting foragers stay in the hive for too long. It is crucial to provide constant forage, especially in areas where CBPV occurs endemically. For this purpose bees can be transported to forages in other areas or bee friendly crops can be grown near the apiary.

In a sick colony the queen should be replaced with a young one, from a good local breeder. It is also crucial not to place the apiary near forages that already have many hives around.

One absolutely should not try and place crawling/sick looking bees back in the hive! They should immediately be send to the lab to investigate the cause of such symptoms.

Sacbrood virus (SBV)

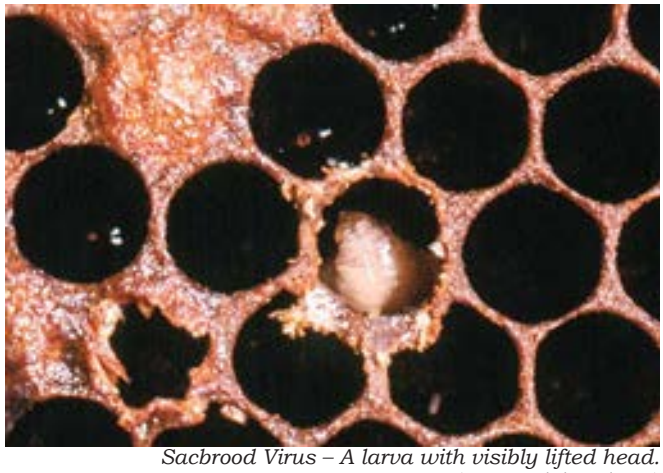
This virus is pathogenic to brood. Adult bees are only carriers of it. Even though it does not cause symptoms in adults, it can shorten their life. In nurse bees huge amounts of SBV can be found in hypopharyngeal glands. They feed the larvae with their secretion (royal jelly) that contains millions of viral particles. Considerable ammounts of the virus can also be found in pollen stored by the bees. It stays infective for long periods of time in this pollen.

During the first three days of their life, all larvae are fed with royal jelly, that is why they are the most susceptible to SBV infection. If larvae get infected later on, they become carriers of the virus as adults.

Symptoms however occur only after the larva stretches under the capping. The virus impairs secretion of chitinase, an enzyme responsible for shedding, which prevents the larva from getting rid of old skin, and as a result, from pupating.

Larva remains in the stretched position with its head lifted. A liquid containing millions of viral particles builds up between the old (unshedded) and the new skin, and the larva resembles a sac with liquid inside, thus the

Chronic bee paralysis virus – Black robber bees. (A. Gajda photo)



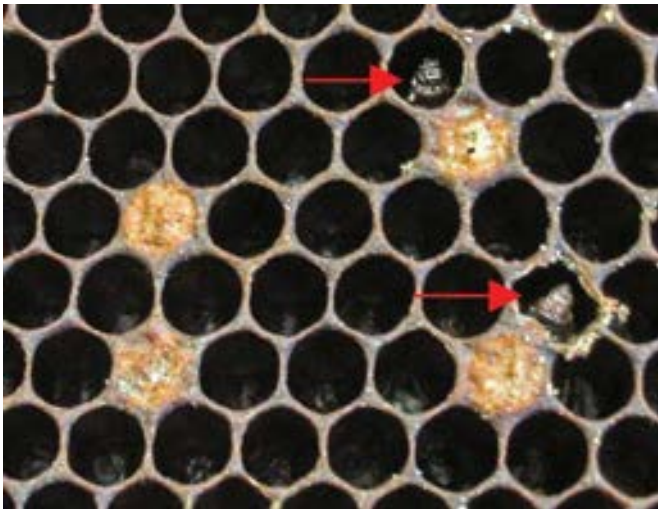
Sacbrood Virus – A larva with visibly lifted head. (G. Topolska photo)

Sacbrood Virus – A larva turned into a sac with liquid.
(G. Topolska photo)

Sacbrood Virus – Larva with darkened head.
(G. Topolska photo)

Sacbrood Virus – Dead, dried larvae in the shape of a boat.
(G. Topolska photo)

name of the disease. The larva becomes yellow in color, and darkens even more with time (first head becomes brown, then the rest of the body), and dries out taking the shape of a tiny boat (edges and head lifted). Brood becomes scattered on the comb, and the cappings are punctured by the bees that try to remove dead larvae, and get infected in the proces. Hypopharyngeal glands in those bees degenerate, and they physiologically age and become nectar foragers, which prevents them from infecting pollen which is fed to older larvae.



Sacbrood Virus – Scattered brood. Dead larvae with lifted heads are visible as well as a puncture in the cell capping.
(G. Topolska photo)

Symptoms occur in the Spring and usually they retreat spontaneously in Autumn.

Prevention of sacbrood disease consists mostly of ensuring good, constant forage, so the colony can grow evenly and the carrier bees can become foragers. Queens should not be stimulated to lay eggs intensively after forage breaks, because then infected bees that normally would become foragers are forced to feed larvae.

If the disease occurs, the beekeeper should replace the queen and remove the combs on which the brood shows symptoms as well as combs with bee bread (and replace with bee bread from a healthy colony).

DIAGNOSTICS OF VIRAL DISEASES

For many years the diagnosis was only based on the symptoms. It is however now commonly known, that those symptoms may be similar to many diseases and it can lead to misinterpretation, which is dangerous, because most diseases are treated/controlled in very different ways. Hence it is always advised to confirm the preliminary diagnosis with laboratory tests.

There is a spectrum of diagnostic methods to distinguish viral diseases, we are going to describe the ones most widely used.

The AGID test (Agarose Gel Immune Diffusion) is relatively inexpensive and easy to perform, yet not many laboratories perform this test due to difficulties with obtaining proper antisera. It is however recommended as a diagnostic tool here, because it only detects severe infections – the ones which will actually give symptoms and harm the colony.

Rapid development of molecular biology techniques allows also to detect viruses on the genetic level. There are two options: qualitative (end point PCR) – which means it detects the virus without stating the level of infection, and quantitative (real-time PCR) – which tells us how much of the virus is in the sample. This second method is however usually quite expensive.

A proper sample to detect bee viruses should consist of bees and/or brood that are symptomatic. They should be frozen right after collection and sent to the laboratory with icepacks. BC

FEEDERS FOR DRY SUPPLEMENTS

Dwight **Wells**

Honey bees, like many insects, require a balanced diet of protein and carbohydrates to maintain good health, and as one of the social insects, they need to contribute to the well being of their colony. Honey bees obtain pollen and nectar from flowers within a two to three-mile radius of their colony from Spring through late Fall when food resources are still available. Colonies in northern climates must store enough honey and pollen to provide critical food resources necessary to maintain cluster temperature during the long winter months and to feed larvae until spring when flowers begin to provide nutrition for the colony.

With today's environmental challenges, beekeepers must provide both carbohydrates and protein when needed, to supplement a lack of natural resources. Typically, the colonies have enough honey but many lack sufficient protein to maintain the health of the adult bees which provide nutrients for the larvae. If the larvae are underfed, they will not perform well as adults nor can they provide adequate nourishment to larvae and often die one to two weeks earlier than bees that were well fed. Three or more successive generations of poor nutrition can lead to decline of the colony.

One successful way to provide protein to multiple colonies is to feed dry protein flour either in large commercial feeders or homemade thin wall four-inch PVC feeders. Advantages of the homemade feeder is not only is it inexpensive to make, but they are versatile and can be modified for your operation. Details on the 4" PVC feeder are below.

The main body of the feeder should be about eight inches long with a white cap on one end. The other end is the entrance which is a white down spout adapter with 1/2" wire screen to prohibit wildlife interference (See photo). The feeder holds approximately four pounds of protein flour, typically enough for about four to six weeks during cold weather. Use protein flour with the highest crude protein level from beekeeping suppliers. The PVC feeders can be placed four to five feet from the ground about 100' from a known colony. You will see bees flying to the feeder within hours of proper placement.

Face the entrance south or southeast, with the entrance slightly tilted down to prevent rain from blowing in the feeder. Also, if possible, provide a rough surface (even masking tape helps) for the bees to grasp while they are collecting the pollen.

Tape the connections of the feeder to prevent rain from leaking onto the flour.

Wrap the feeder with yellow, orange, blue and/or green tape to make the it look like a flower; bees can easily see those colors. Use yellow or orange straps to mount the feeders on barrels or use a tree limb that is oriented such that the feeder entrance faces south. Locate the feeders in sheltered areas where bees can easily see the colors from a distance. The feeder must be secured so wind can't move the feeder. The feeder location should be easy to reach for easy monitoring and to take photos. By looking at the photos you may notice foragers with different colors. See photos.

Having the screen on the front of the feeder makes refilling more difficult, however an easy way to refill it is to take it down when bees are not feeding and put it in a bucket with the entrance up and dump pollen sub through the screen. The bucket catches the pollen that doesn't go into the feeder.

The feeders serve two purposes: it feeds managed colonies and also feral colonies. Experience has shown feeding protein substitute in the Fall allows honey bee colonies to supplement their stored pollen and extend the life of the colony over the Winter.

We have observed bees flying to the feeders which don't appear to be from our beeyards which we suspect are from feral colonies. To determine their flight path, stand about 50 feet from the feeder and watch the forgers orient after feeding to fly back to their colony; they will fly two or three circles above the feeder then fly in a bee line back home. Within a few minutes, other foragers will appear and begin feeding on the flour.

In West Central Ohio, on a warm sunny ~42°F morning bees will start feeding on the protein flour. The higher the temperature the more bees are feeding from longer distances from other colonies. Foragers can't fly unless their body temperature is 80°F. Bees can only fly a short distance on cool days, especially when it is overcast or cloudy. Once a colony finds a feeder, the foragers will return to the feeder every day it's warm enough to fly.

Parts of dry pollen feeder.

Dry pollen feeder attached to branch with yellow strap. Side view.

As soon as natural pollen is available in the Spring, the foragers will start visiting the flowers and stop feeding on the dry protein flour.

After you observe feral bees at the feeders, set swarm traps near the area with the feeders. Our success

of finding new areas to place swarm traps with protein feeders has been very successful. We have found many new gene pools using protein feeders in isolated areas of six square miles minimum.

Look for wood lots with older trees (100 years or more), plus a year-round water supply away from row crop farms, with natural nutrition from trees in the Spring and forage in the Summer through Fall. Feral honey bees have high color diversity; a high percentage will be dark with minimal orange on their bodies.

Feeding dry protein flour is important in the Spring while colonies are replacing their Winter fat bees and starting to build populations for the spring honey flow. Feral colonies are at risk especially if they are in a first-year cavity. Research shows less than 20% of swarms survive their first Winter.

Helping feral bees by providing dry protein feeders can help them survive their first full year. In return, beekeepers may catch bees through Natural Selection that control *Varroa* at low populations. BC

Dry pollen feeder attached to branch with yellow strap. Note the screen on the opening.

Double pollen feeder on barrel.

BEE VET

The Next Generation

Dr. Tracy **Farone**

Strong positive mentorship is of critical importance in so many fields and beekeeping is no exception. For those of you who have served as mentors for others, this one is for you. This month, I am stepping aside to allow my research team to describe their experience in beekeeping science, and research. Four of my students are seniors, so it is appropriate that this article prints in May, the month they graduate. They are all moving on to careers in health care, public health and conservation and will be leaders in our future. Over the last two years, these four ladies have helped me start a program from the dirt and even became mentors for new students along the way.

Kat Bailey and Deidra Ressler chilling in the bee shed.

The following is by Maura Ashley, Alliefair Scalise, Deidra Ressler, Katerina Bailey, Sydney Hanson, and Abigail Treusch – Young Women in Beekeeping Science

The Oliver Apiary was founded at Grove City College in the Fall of 2019. Like many apiaries, we have hives surrounded by several gardens brimming with pollinator friendly plants. Unlike some other apiaries, however, our apiary is managed by our professor (Dr. Tracy Farone, DVM) and biology research students, all who happen to be women. In a profession where women are not as prevalent, stepping into this field has been exciting and empowering to our work as biologists, and has provided us with many new opportunities to grow as young women beekeepers.

We have learned the ins and outs of beekeeping through detailed training and study of bee biology, bee ecology, bee pathology, and beekeeping techniques. Of course, this was not just an academic endeavor. Before we acquired bees of our own, we were welcomed into other apiaries to observe and participate in honey harvests and hive inspections, learning from experienced members of the trade. We accumulated many hours of field experience, getting our hands in hives and developing our apiary sensibilities. From catching swarms, to harvesting the Fall nectar flow, to administering medical treatments against *Varroa*, we have enjoyed many experiences within our own thriving apiary.

Project Start:

Our building project began late in the Summer of 2019 behind one of the parking lots on our campus, non-affectionately called "Siberia". At first glance, this area had little to offer. Surrounded by uncut grass, weeds, and the occasional plastic bag, we certainly had our work cut out for us. However, upon further investigation, we realized that the grassy patch would later make a great clearing for our hives. Fortuitously, the wildflowers surrounding the 30-acre site were goldenrod with many other great pollinator friendly plants and trees. We cleared out invasive weeds, transferred gravel to create a sound foundation for the hives, and planted flowers, bushes, and trees throughout the area. After putting in long hours, in the Spring of 2020 our apiary was finally ready to welcome our new hives. These hives produced a Fall flow that was collected, bottled, and distributed on campus. The goal of this project is to raise awareness to the important role pollinators play in our everyday lives and to familiarize people with the biology of honey bees. By heading up this project on campus, we hope to encourage more young people, especially young women, to explore new fields in science that may traditionally be male dominated (1). While we very much appreciate the wisdom of older experienced beekeepers, promoting interest in our generation will help sustain the profession for years to come.

Community Outreach Projects from Alliefair Scalise

One of the most important aspects of our project has been raising community awareness on honey bee health, beekeeping techniques, and common misconceptions regarding honey bees. Through creating educational resources for these topics, I have been able to deepen my understanding for beekeepers and extend this knowledge to the college community. The most important aspect of beekeeping is that of medical care. As bees face increasing adversity, medical attention becomes even more critical. I have developed resources to educate about a variety of diseases, such as American Foulbrood, and *Varroa* mites. These brochures include brief overviews of the main aspects of various pathogens as well as prevention tips and techniques. I also created the informational sign at the entrance to our apiary; this sign provides visitors with knowledge concerning the purpose of our project, what an apiary is, and the importance of bee medicine and pollinators. Another major aspect of our project has been creating a website to facilitate online learning and spread our findings even farther. Our website can be found at gccbeeproject.com and contains resources pertaining to taking online

beekeeping courses, finding local bee veterinarians, and providing more education on common diseases and preventative measures that can be taken. We also periodically write blog posts on our experiences or beekeeping topics that interest us, such as informational articles on propolis, swarms, and biosecurity.

Garden Development and Artistry with Maura Ashley

When I joined the bee research team in the Fall of 2019, I had precious little experience with beekeeping. However, I had worked for many years as a gardener and had always been fascinated by the relationship between plants and pollinators. I was excited to bring my knowledge of plants to the project as we developed the grounds of the apiary. Through collaboration with a botany professor, we performed a site characterization of dominant species of plants in the back 10 acres surrounding the apiary. Using this information about the existing flora and creating a holistic plan for additional plantings directly surrounding the bee yard, I secured our status as a "Pollinator Friendly Garden" through the Master Gardener program at Penn State. Of course, horticulture is a dynamic and continual endeavor, and so I continue work as a garden manager to expand our gardens and organize year-round nutrition for both our bees and native pollinator species.

Yet, on a project like ours, we each wear many hats. It is important as a beekeeper to be both a scientist and an artist. As a scientist, I have delved into the ecology of bees and written several articles for our blog about the relationships between bees and plants. From advice on starting your own pollinator garden, to where propolis comes from, I have enjoyed sharing my love of the bee-to-plant ecology. On the more artistic side, I have done everything from designing a label for our honey jars (Figure 1) to deciding what flowers will look best in our gardens. Throughout all my activity in and outside of the beeyard, beekeeping has proved to be an exhilarating new challenge and adventure every day.

New pollinator friendly plantings.

Apiary Management and Collaborative Research from Katerina Bailey

Joining this research team, I had a basic understanding of beekeeping. I had helped my father with beehives in our backyard, but I soon realized all the things that I still needed to learn about being a proper beekeeper. Most of my contribution has been through the general management of the beeyard. I have been writing inspection logs since we installed our hives last Summer, and I have found keeping track of what we have been doing extremely helpful. I was amazed this Summer how fast you can forget what happened during your inspection two weeks earlier, especially the more hives you get.

I have also overseen managing our involvement in two mega-studies through the Penn State Center for Pollinator Research: Beescape and Landscape4Bees. Beescape looks to gain information on how landscape affects bee health, while Landscape4Bees uses an innovative technology called Broodminder to track colony health through weight and temperature. We were able to install the Broodminder scales in June of 2020, seeing how our hives' weight fluctuates throughout the seasons has helped us visualize how dynamic a bee colony really is.

Figure 1. *Label for our honey.*

Kat and Deidra at the entrance of the new apiary.

This research team has helped me grow in so many ways and given me opportunities I would have never guessed I would have. For example, these past couple of months I have been able to help Dr. Farone write for Elsevier on registered medications in beekeeping. I was able to help research medications and then organize them into tables that will hopefully help veterinarians better understand beekeeping. Being on this research team and helping with our teaching apiary has given me a lifelong passion for beekeeping that I do not think I will be able to shake anytime soon.

Project Imaging and Education by Deidra Ressler:

When I began to participate on the research team in the fall of 2019, I had never worked with bees before, so my beginning experiences on the team involved large amounts of education regarding beekeeping, anatomy, ecology, and other topics. My initial excitement about the project largely tied in with my interest in public health, and it was interesting to make connections between honey bees and health. Since there are so many diseases that affect bees, I was fascinated that there were options for treatment and management of disease in these insects. Additionally, they are considered sentinels for environmental quality, and this information inspired me to write blogs on the project's website about beekeeping in Latin America and how Spotted Lanternflies may affect honey.

New apiary entrance.

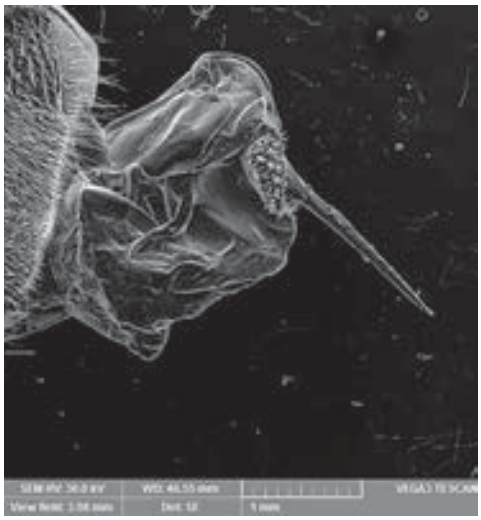
I began taking pictures for our outreach endeavors and as an individual project for the team. Along the way, I have used my camera and various microscopes, ranging from a light microscope to a scanning electron microscope, to capture some of the anatomical features, pests, and plants that bees are involved with. I was able to build upon my academic foundation visually, and I had the opportunity to physically experience some of what a beekeeper does to care for their hives. Of course, that involved getting stung and witnessing the occasional swarm, but I have gained an immense appreciation for honey bees throughout my time on the team. Since the Summer, I have used my images in blogs and a research poster, and I will be publishing a short book with some of my compiled images as an educational resource for the community. Some of my images have also been published elsewhere, and I am excited to know that I can help others learn about honey bees through my photos.

Thoughts From the "New bees" by Abigail Treusch

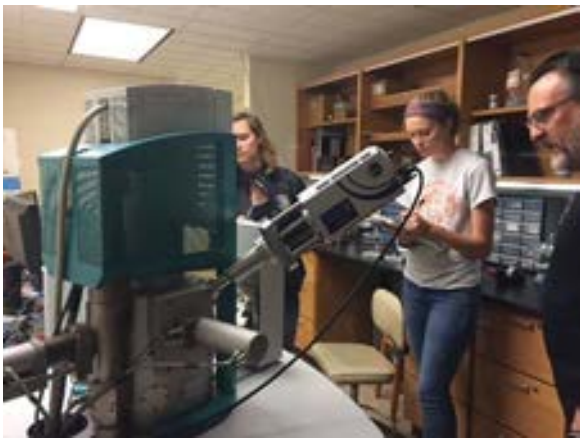
As a sophomore, pre-med biology major and the newest addition to the team, it may appear a bit odd to the outsider why I would choose to get involved with apicultural studies rather than research directly involving the human body. To me, the reasoning for this decision is obvious. As we all know, honey bees play a vital role in maintaining the ecosystem and in the production of crops, and in turn, the importance of maintaining the health of the honey bee population cannot be stressed enough. The "Bee Project" here at Grove City College not only investigates health concerns of the bees but has an added focus on teaching the community about pollinator health. My decision to apply for this research position was largely driven by the all-encompassing nature of apicultural studies. In the short months, that I have been involved with this project thus far, I have learned about bee anatomy and physiology, the role of bees in the environment, bee health, and the basic practices of keeping bees, to name a few. With the warming of the weather, the coming weeks will see hands-on time spent out in the apiary to visualize and put into practice all that I have learned during the cold Winter months. Additionally, I will be spending my Summer months here on Grove City's campus, tending the hives and conducting some research of my own, adding to the ever-growing list of projects within this overarching "Bee Project." I am enjoying the quietness of the time now, spent inside learning about how to best care for our little research subjects, but with the nearing of springtime, so grows my excitement about seeing those busy bees in action!

Ideas from a Budding Member by Sydney Hanson

While I have not been on this project for long, bees have held some fascination to me for quite a while. I am a sophomore biology major, and for as long as I can remember my love of the sciences has heavily involved animals and bugs. Many years ago, my mom had a few small honey beehives. From that point on, I have had a quiet appreciation for the bees, and have wanted to learn more about them. Eventually I hope to be able to pursue veterinary medicine, perhaps using the valuable information I will learn in the next few years to bring more veterinarians closer to beekeepers. Alongside Abby, I have been learning about bees and



Smashed bee stinger.



In the SEM lab.

their interactions both with each other and with the world around them. Quite frankly it is astounding the way these small creatures work together and even their individualistic behaviors and biology. I cannot wait till the weather warms up and I get to spend more hands-on time with the bees and learn more "real life" application of what we are learning in the classroom right now!

Kat and Deidra among the hives.

Generational Involvement

One of the most eye-opening experiences during our time of studying to be beekeepers was visiting a local chapter of a beekeeping club. As college students, we were the youngest in attendance by over a decade. Even so, as we have gotten more involved with national and local communities of apiary-enthusiasts, we have observed how beekeeping as an industry, a hobby, and a science connects people of all ages and backgrounds in a community. As public attention increasingly turns towards bees and beekeeping, the younger generation of beekeepers will hopefully continue to benefit from the traditions and knowledge of the older generations of beekeepers that have experienced the rhythms of bees' lives for many decades.

Four seniors in the beeyard – Alliefair, Maura, Deidra and Kat.

Moving forward, we will continue to utilize our apiary as an opportunity to reach and create communities that appreciate and support the ecology of bees. We are excited to bring in future generations of beekeepers and to pass on our love of bees. BC

Touring Ernst Seed Company.

Reference

1. Colopy, Michele. *Women In Beekeeping.* Bee Culture -. 20 Nov. 2015. Web. 04 Mar. 2021.

Minding Your Bees And Cues

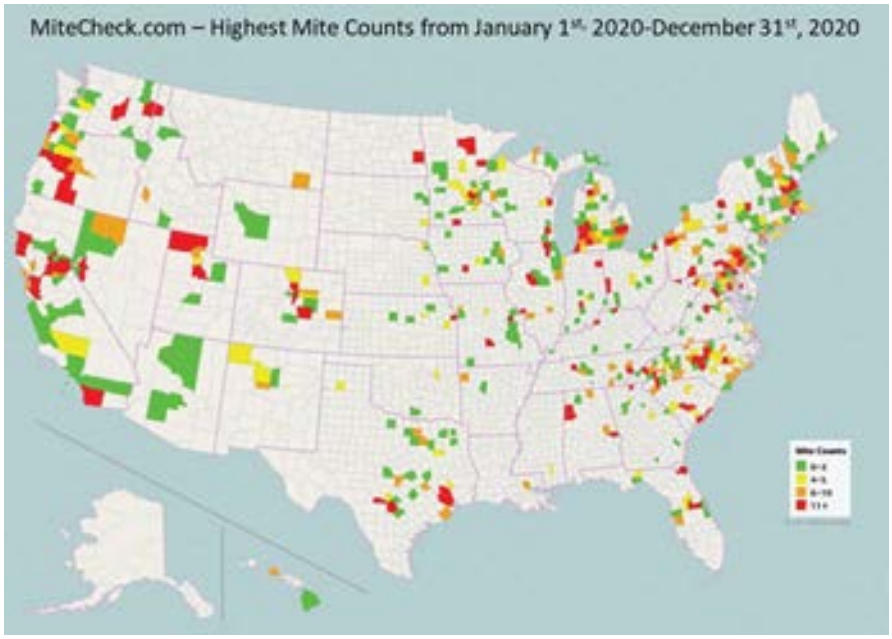
Share Your Data

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

Beekeepers: did you know there's a whole class of citizen science just for us? We think it's important to participate. It's a complicated moment for beekeepers, as we are each charged with looking beyond the health of our colonies to consider the health of our neighbor's colonies, and, yes, the health of native pollinators who can be negatively affected by our honey bees.

Sharing the seriousness of keeping your honey bees healthy is one reason to participate in MiteCheck, a nationwide collaborative project to collect honey bee health data. MiteCheck enables us to co-create and then study a shared picture of mite levels nationally, allowing us to react and reform our practices accordingly. In the midst of blossoming trees and swarming bees, mite numbers are a drag, certainly, but the MiteCheck initiative is crucial for getting all beekeepers on board to monitor their mites, and for helping beekeepers see themselves as part of a larger community with the shared goal of healthy bees. There is a free MiteCheck app with mite monitoring instructions and videos available at your app store. MiteCheck is also the platform used by Mite-A-Thon, an effort to collect mite data across the US and Canada at key times during the management season.

The University of Minnesota Bee Squad participates in another citizen science project, the Bee Informed Partnership's Sentinel Apiary program, which allows beekeepers to closely track colonies through detailed hive reports (a good skill to practice). Participants send monthly bee samples into BIP's University of Maryland lab for analysis, and receive data on their monthly mite and nosema levels. You could (and should) be sampling your bees for mites monthly anyway, but participating in the Sentinel Apiary program adds your data to a national picture of honey bee health: how do your bees compare to others in your region? To other parts of the country? To last year's mite trends? This information is available online for all beekeepers to view. The Bee Squad has been participating in this project since 2017 and had a total of 13 sites in 2020. Imagine how rich and useful the information would be if every bee club across the US participated in the program.



The MiteCheck project invites all beekeepers in the U.S. and Canada to report their mite counts (powdered sugar roll or alcohol wash) throughout the season. You can search dates on the map a ***www.mitecheck.com****. You can download the free MiteCheck app and start sharing your data!*

Once you've joined these initiatives, you can add "citizen scientist" to your list of identities, and you might be inspired to support a citizen science project focused on native bees, as well.

While the (confusing) term, coined multiple times in the 1990's, can refer to either the scientist or the community volunteer, for our purposes, citizen scientists are members of the public participating in scientific research.

Scientists often depend on data collected by non-scientists, whether or not those non-scientists identify with the term "citizen science." Think crowdsourcing, think archives. American naturalists in the 1940's may have been out collecting specimens for their own personal collections, but today those same collections might be used by scientists to understand the historic geographic distribution of a particular species.

Today, we are all hyper-aware of the fact that at least here in the U.S., we've pushed nature to the extreme margins, making a myth of wild places. When we go out looking for insects, there's the urgency of being almost too late. One reason to participate in a citizen science project like Bumble Bee Watch, is that it is useful for scientists. We know that many insect populations are in precipitous decline, but we don't know enough. Citizen scientists are needed to collect data to help understand what species are thriving, which ones are declining, and, importantly, what species are found where.

There's another reason we encourage everyone to participate in citizen science today, and this is the same reason naturalists have always voluntarily spent their free time out birding or collecting natural specimens: it's fun. The more we attend to the natural world around

us, the more rewarding and alive it becomes; and the more we care about it. Attend to the differences in bumble bee color patterns, learn the names of forest wildflowers, or tune in to the behavior of ants, and you will never regret it. Beekeepers know this: a person's first fascination with bees is nothing compared to the awe of a long-time beekeeper who has spent decades absorbed in her bees. The more you look, the more you see.

Let's all commit to at least one citizen science project this season: download an app, join a club, get out and do something fun that helps researchers out while you're at it. After a season of participation, what unexpected skills, or pleasures, will you have gained? BC

Resources

Mitecheck www.mitecheck.com

BIP Sentinel Apiary **https://beeinformed.org/citizen-science/sentinel-apiaries/**

Bumble Bee Watch **https://www.bumblebeewatch.org/**

Acknowledgement

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Author

Becky Masterman led the UMN Bee Squad from 2013-2019 and currently alternates between acting as an advisor and worker bee for the program. Bridget Mendel joined the Bee Squad in 2013 and has led the program since 2020. (Photo of Becky and Bridget from 2014, before social distancing).

The Bee Squad has participated in the Bee Informed Partnership's Sentinel Apiary project since 2017 at their Bee Veterans Apiary located at the Minneapolis-St. Paul International Airport. (Masterman photo)

A Honey Bee Driven Mid-Life Crisis, Part 3

James **Masucci**

Where Do I Put It?

This February, I had the opportunity to tour the almond pollination with John Miller, of Miller Honey Farms, and Sandy Honigsberg, a beekeeper in the El Dorado bee club. "So, besides feeding, what other problems are you dealing with as you are expanding?" The question came from Sandy on my first day in CA. Sandy is in a similar place in her career, looking at how to make beekeeping her full-time endeavor. That question hit the nail on the head. It's in part why I'm here. Suck out as much information from the experts to help me make the transition from large hobbyist to large side-liner/small commercial. Maybe, a good starting point is coming up with a good answer to the question.

The topic of feeding came up as I was explaining why I'm having a rough Winter. I make mid-Summer splits for mite control and to expand. Because of Covid (always need to blame something, right?), I couldn't buy sugar when the bees needed it. Therefore, my bees went into the Winter small and light. John offered his first of many gems, "check out soda manufacturers in the area. They get tankers of syrup, you can buy totes from them". When I explained that I get 50 pound bags of sugar from Restaurant Depot, I got the, "oh, you still mix your own syrup?" If I'm going to expand, I need to focus on the bees and not menial tasks that can be easily avoided. At some point, I will need to buy syrup and not dry sugar.

But this little transition, from sugar to syrup, highlights all the other issues I need to figure out. I have an F150. I love the truck. It has a payload rating of around 1500 pounds. Plenty for 50-pound bags of sugar, but a 300 gallon tote of syrup is over 3500 pounds. Not going to work. Next, I go to the source, get my tote, and drive home. How many neighbors does it take to move a 3500-pound tote? Ugh, I need a truck AND a forklift. I was thinking that since I'm not a migratory beekeeper and don't move hives around, much, I could get away with a pickup and maybe a trailer. Certainly, many of my daily activities and hive checks can be done with my pickup. But there will be times, like now when I'm cleaning out yards full of empty boxes, when a bee truck and a forklift will greatly facilitate my job. First, for feeding. Make it fast and easy. Second, for moving bees and equipment. How many trips between yards do I need to make? Third, for transporting honey supers. Again, I can take several trips with my F150 or one trip with a bee truck. Finally, and maybe most importantly, to save my back. As I get older, I'm going to hurt my back lifting. I need to minimize that. Utilizing pallets and a forklift will minimize the heavy lifting and, hopefully, prolong my beekeeping career.

The next, big change associated with expanding was highlighted by George Carlin. I need a place for my stuff! My garage is full. I inherited a small container and that is already full. I haven't even expanded, yet, and I'm out of space. I live in suburbia, so I can't park my bee truck and forklift on the street. Then, there's the whole honey-house side of things. In MO, if you sell more than $50,000 of honey you are considered commercial and must have a health-inspected facility to extract. So, if I expand as much as I want to, I can't just buy a piece of property in the middle of nowhere and store all my stuff there. I need water, sewer, electricity, and a building with the right zoning and structural make-up.

Let's summarize. That's a truck, a forklift, a piece of property, and a honey house. That's after just being told during one of my CA trip meet and greets that people who are in the business for thirty years (referring to almond growers but John agreed it pertains to beekeeping as well) should expect to go bankrupt twice in that time. WHAT? What am I thinking? Why would anyone do this?

Here, too, my trip was invaluable. Not only was I

Syrup vs. dry sugar. At some point during my expansion, I will need to convert from mixing my own syrup to buying syrup in totes. Totes will save time and help prevent back injuries from lifting thousands of pounds of sugar.

Converting to sugar syrup will require a forklift to move the tote and a "tonner" flatbed to transport it. Cha-ching. But they will also help in moving hives and honey supers. The F550 or 5500 class of flatbeds can handle 80 double-deep hives. Rather than making multiple trips to all my yards, the truck can handle all that I need to carry. The forklift uses hydraulics instead of spine and back muscles. The former is much easier to repair.

Investment in the future: It costs an almond grower about $6,000 per acre to plant and $1,000 per acre in inputs per year to establish a bearing fruit crop. I'm sure this picture represents over a million dollars of investment. Every business takes investment to succeed. The trick is to truly understand the risks vs the reward before taking the leap.

I'm out of space: My container is full of hive components. My garage, (my wife won't allow a picture of the inside) is full of extracting equipment, sugar, buckets, etc. I'm out-growing the garage as my "honey house." My current size already has used up our available space. Any growth requires more...

getting sage advice about all the things I should consider, but I was observing almonds and pollination at an incredible scale. 1.2 million bearable almond acres with two hives per acre. I learned that it costs $6,000 to plant an acre of almonds and a $9,000-$11,000 investment before you even start to produce almonds. It takes about nine years to break even. Yet, almonds are the most lucrative crop in CA. I really began to understand that it takes investment to be "successful". Even John, who is fourth generation beekeeper, just invested an enormous amount of money on a climate-controlled warehouse to overwinter his bees in North Dakota. I have a lot of respect for people who have the courage to invest in their own business. In my career as a scientist, I got paid whether the company had a good year or not. The worst that could have happened to me was that I lose my job. There was no way I was going to go bankrupt twice in my career. Then it hit me, I did make an investment in my career. I went in debt to get a great college education. I spent six years in graduate school and five years as a post-doctoral fellow. I didn't get my first job until I was in my early 30s.

Maybe my dice were a little loaded, but I did roll them for my "success". I did it once, I guess it's time to do it again. I've already decided that I am not a high stakes gambler. I won't put my retirement in jeopardy for this endeavor. But I am going to make some investments to allow me to expand – at least to give it a go as a serious sideliner. Next step? A place for my stuff. BC

Mentoring?

Being Mentored?

Mentoring – *Whether you are mentoring someone, or being mentored, there are certain things you will want to keep in mind.*

Almost all beekeepers have benefited from having a mentor at one point or another. Whether it was when we first started our beekeeping adventures, moved to completely new area with very different climate, honey flows and forage availability than we were previously familiar with, or making the transition from beekeeping as a hobby to beekeeping as a sideline business, having someone with more experience than us to give us advice, bounce ideas off of, and provide feedback is invaluable. What separates a mentor from your average network of friends and contacts is a long-term, deep seated investment in your future. Once you have benefited from having a mentor, it then becomes incumbent upon you to pass it forward and mentor others.

There are also a lot of potential pitfalls associated with being a mentor and with being mentored. I have certainly run into my share of issues as both a mentor and mentee. While I am not an expert in this area by any stretch, I have enough experience and made enough mistakes that I can explore some of the potential problems through this article and suggest some ways that both mentors and mentees might avoid them.

Set Clear Expectations

A sure way to ensure a productive mentor/mentee relationship is to set clear expectations at the start to prevent each party from expecting a different relationship. One method to achieve clarity is to define the tasks each will take on.

For example, it is a good idea to agree on the times and methods you will use to communicate. As a mentee, you will want to respect your mentor's time by not calling too late at night, too early in the morning, or at meal times. Are weekends fair game or just week days? Perhaps texting to schedule an appointment when needed will work best, or using email when possible. You might even want to set up a fixed schedule for regular communication so you don't get distracted when the busyness of the season kicks in.

What is the role you will play as the mentor? My suggestion is to make it clear that you are not there to provide personalized one-on-one beekeeping instruction or private lessons in all things apicultural. Nor are you there to babysit a newbee, holding their hand through every hive inspection and manipulation. Ideally, you want to be the back-up support system, advisor, motivator, and a emotional support system who can be called upon when the mentee is stuck, not sure what to do, or confused about which direction to take. At its best a mentor is part coach, part teacher, and part friend. Through sharing their knowledge and experience, a mentor helps the mentee feel more competent at the work of beekeeping. Feeling like they can care for their bees well can increase their happiness, and therefore boost the mentees' overall satisfaction with their new avocation.

As a mentee, when you communicate with your mentor, it is good to be prepared with specific questions regarding your situation that indicate you have done some research and already given the issue at hand some thought. Perhaps you are trying to confirm that the plan you have come up with is a sound one or are weighing the pros and cons of two or more paths and would benefit from being able to bounce the options off a more experienced beekeeper in order to help you make your decision.

Ultimately, a mentor is at their best when they do not tell the mentee what to do. Discussing and evaluating the available options together and then letting the mentee decide what they think is the best path to take, empowers the mentee to step up and take responsibility for their bees.

Set Agreed upon goals

It is important that the mentor understand the mentee's motivation. This understanding can be used to help develop and prioritize the mentee's goals. By working together to prioritize goals the mentor will be in the best position to help the mentee achieve them. Setting a timeline for when the goals can be expected to be achieved can help avoid misunderstandings. What will a successful year look like to the mentee? From the mentor's perspective, is this a reasonable expectation? Consider writing down the goals and expectations to help keep everyone on the same page.

Be a good listener

While a mentor will have more experience than the mentee, it is important for the mentor to not assume that they know what the mentee wants or needs. This is why setting goals and being clear on expectations is so important. Both parties should use the technique of asking clarifying questions to show they are listening carefully and to help ensure what is being said is being understood. The mentor should also be careful not to overwhelm the mentee with too much information all at once, especially if the mentee is not taking notes.

Another great technique to use as a mentor is to challenge the mentee to answer their own questions and think through issues for themselves. I have come to believe that helping mentees think through their questions by asking them questions such as "What are you trying to accomplish?", and "What do you think the best approach should be and why?", may well be the ideal mentor/mentee relationship. This was the technique Vermont beekeeper Franklin Heyburn says was used by Ed Hazen, a former teacher and master comb honey producer from Grand Isle, Vermont. As his mentee, when Franklin asked Hazen a question, he would find a way to turn it around and ask a question in return. Franklin found this to be a subtle way of bolstering his confidence as a new beekeeper. If the more experienced beekeeper keeps asking the mentee for their opinion, they may start to realize that they have more knowledge and ability than they were aware of. As a mentor, you encourage the mentee to pay close attention to what is going on with their hives and develop critical thinking skills, by regularly asking them what they are seeing in their bee yard and what they think is going on with their bees. This approach can also prevent the mentor from always coming across as the expert "know it all" and potentially developing a condescending attitude. Of course this approach will only work if both parties are practicing good listening skills.

Be Humble

As a mentor, you don't have to know everything. In fact none of us do. You empower a mentee by guiding them to where they can find the resources they'll need to find answers for themselves. This can be critical since the trajectory and solutions one person experiences in their bee operation may or may not be the right solution for others. Each person needs to be able to find the solutions that fit their own situations. This also means knowing your limitations and being honest about what you can and can't help with.

Cultivate a Trusting Relationship

Trust can be obtained initially when others choose to temporarily suspend their disbelief, but a strong and stable trusting relationship is built up over time. Actions that build trust include; being honest and always telling the truth; being reliable and available by showing up on time and prepared when expected; and not shying away from difficult subjects such as colony loss, money, pesticide issues, etc. Trust can also be built up by sharing your mistakes, as well as what went well. Don't be afraid to show some vulnerability. It is also a good idea to set boundaries where necessary.

Mentoring can take place at any age and at various stages of beekeeping experience."

Consider the Historical Context

Anyone with one or more years of beekeeping experience can act as a trusted advisor and mentor to others. As Bill Mares and I discovered while writing *The Land of Milk and Honey*, history is rich with examples that indicate mentorships are the number one way that the craft of beekeeping is learned, shared and carried forward from generation to generation. Consider entering into a mentoring relationship this year. While finding a mentor can be daunting, and in many instances, it won't happen overnight, keeping in mind the above issues during your search, while being open and amenable to all avenues of human connection can prove rewarding. Networking with other beekeepers and being open to the possibility that sometimes, a mentor may even find you, is just another facet of the extraordinary beekeeping adventure we apiculturists embark upon when we choose to obtain that first bee hive. BC

Ross Conrad is author of *Natural Beekeeping* and co-author of *The Land of Milk and Honey: A history of beekeeping in Vermont.*

Cleared For Takeoff

A U.S Air Force C-17 cargo plane approaches a landing over a beeyard at PIT. S. Repasky photo

"Cleared for takeoff" is a common phrase heard at airports all over the world referring to the clearance given by air traffic control to all aircraft wanting to depart the airport. This time though, it refers to the Honey bee Project at Pittsburgh International Airport (PIT) located approximately 15 miles west of downtown Pittsburgh, PA.

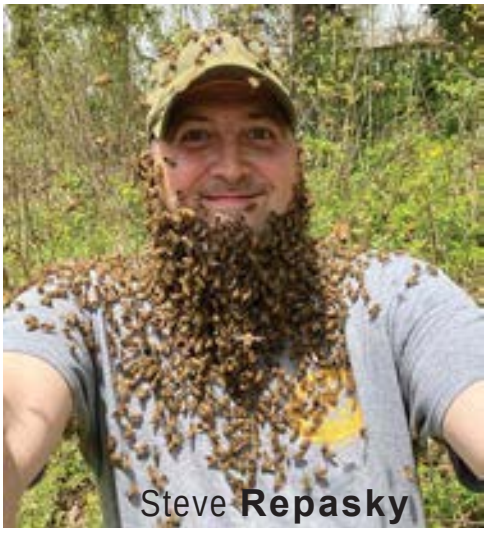
Honey bee swarms had more than likely always been present at PIT, but they weren't monitored and probably weren't seen as a threat to the safety of the employees and passengers. That all changed in 2012, when PIT had honey bee swarms show up in various locations around airport property, including around the terminals. That August, a late season swarm of honey bees landed on the wing of a Delta CRJ aircraft parked on the ramp that was preparing to depart PIT for JFK Airport in New York.

It was that event that sparked the idea for today's Honey bee Project. The timing was fortunate for this swarm in a way, because on duty was PIT's Wildlife Administrator Ben Shertzer. Ben began his position in 2011 and like many people, he had been aware of some of the issues that honey bees were having, including Colony Collapse Disorder. Not wanting to eliminate the swarm but concerned about the safety of the airport employees and passengers as well as the welfare of the bees, a phone call was made to a local beekeeper. I was that beekeeper and took that call. A short time later I arrived at the airport and was escorted by Ben to the awaiting plane and swarm. There on the right wing was a cluster of honey bees and above them, faces of passengers peered through the plane's windows. The pilots and luggage handlers gathered around but stood at a distance – the societal fear of stinging insects was no doubt intact! Due to the presence of jet fuel, I couldn't light a smoker, so the decision was made to gently scoop some bees into a cardboard nuc box and let the others walk in. After a short 60-minute delay, the passengers and the bees were on the way to their respective destinations.

The following day, a local TV station picked up on the news of this swarm and wanted to do a story on it. I was heading out of town with a group of beekeepers for a weekend with Dr. Larry Connor but managed to meet up with the reporter to sit for an interview. We talked about how rare and interesting it was to capture a swarm on a plane. Twenty-four hours later, as we gathered for breakfast at Larry Connor's homestead in Kalamazoo, MI, a local news station was on TV and at the bottom in the scrolling ticker was the headline "Bees Delay Delta Flight at Pittsburgh International Airport". The story of this now famous swarm continued to flow in and 24 hours later, the story was picked up by the Associated Press, NBC, ABC, CNN the New York Post as well as several aviation news outlets. It also drew attention in the U.K, numerous European countries, Japan and Australia.

The relationship between PIT, with Ben as Wildlife Administrator and myself as beekeeper continued to grow in 2013 as additional swarms appeared on the airfield and I was called to remove and relocate them. As beekeepers, we are always looking for new places to place beehives, so in conversation during each time Ben and I were dispatched to relocate a swarm, he and I would talk about bees and beekeeping and some of the great locations that the airport was likely hiding that could house a beeyard. We also discussed how bees were gentle but there was a concern for airport personnel and how it may or may not affect airport operations. Even as I caught and relocated swarms, Ben and other employees would step away or not get out of the truck in fear of these stinging insects. It was comical in some ways, yet I understood the fear. I would even approach and capture swarms without protective gear just to show that honey bees were fairly docile while in swarm mode. By 2014, Ben's fear of honey bees had dispersed but the swarms continued to show up and his interest in bees and beekeeping grew.

Pittsburgh International is an ideal location for honey bees. Comprising of 8,800 acres in total, of which 2,000 acres encompasses the Air Operations Area (AOA) and is off limits. The remaining 6,800 acres is a mosaic of stream bottoms, wetlands, fields and woodlots – remnants of the



Steve Repasky and Ben Shertzer looking over a beeyard at Pittsburgh International Airport (PIT). Beth Hollerich/Pittsburgh International Airport, photo

rural farms that were in the area prior to the development of the airport in the late 1940s. These "undeveloped areas" provided the potential for a variety of blooms from early March through October.

Of course, there are rules to follow in order to get approvals from the appropriate people in order to do something that is rather new. The Allegheny County Airport Authority operates PIT and keeping bees at this airport was new. We were aware of a couple of other airports that had some hives on property but it wasn't a common practice. We wanted to be sure that we addressed a number of things. How many hives, environmental conditions (forage availability), how the hives would be managed, operational issues as far as access, security and liability would all play a role in the success of this project.

Several locations for an apiary were identified and vetted for access, forage and the possibility that a chosen site may already be earmarked for airport development and expansion. Besides being a passenger-focused airport, PIT is also home of the Pittsburgh Air Reserve Station and the Air National Guard as well as air cargo facilities. In addition to the previous categories, Ben and I also assessed each potential site for possible conflicts as they may relate to the airport's Wildlife Hazard Management Plan (WHMP). The FAA requires each airport to maintain a safe operating environment for its employees and all aircraft operations via the use of Wildlife Hazard Assessments and the WHMP.

A swarm lands on a directional sign just off a runway at PIT. Ben Shertzer/Pittsburgh International Airport, photo

Over the course of the winter of 2014/2015, our first proposal to airport officials didn't go anywhere and was rejected. The following year, in early 2016, we pitched to new CEO Christina Cassotis. Christina had taken over as the new CEO of PIT in 2015 and as it turned out, her grandfather had been a beekeeper. A new set of meetings was set up and this time our proposal was met with open arms and a level of excitement we had not seen previously. This project was unique. It would technically be overseen by the Wildlife Administrator, but managed by me as the beekeeper, a non-airport employee. In August of 2016, the first set of 10 hives was placed at a location just one mile south of the airfield.

Over the next couple of years, another four more locations were set up and swarms continued to show up in the AOA. In order to assess ways that the project can be of greater benefit to the airport, we also initiated an extensive and strategic swarm capture program. This program is simple. Swarm traps were hung at ¼ mile increments along the western and southern edge of the AOA beginning in April and were monitored on a weekly basis. This area was chosen due to the "ruralness" of the property with woods, fields and stream bottoms. The north and eastern side of the airport abuts industrial and urban landscape. The trapping program began in 2019 and it was clear from our data that the trapping program was having an impact on how honey bees affected air operations. From 2012-2016, PIT averaged approximately 15 swarms a year on the AOA. Honey bee colonies were placed on the property in the late Summer of 2016. Between 2017 and 2018, an average of five swarms made it into the AOA and additional beeyards were installed in the following years. In 2020, only three swarms made it into the AOA. The swarm traps placed around the perimeter were working and keeping bees away from sensitive areas. With the collaboration of airport officials and myself as a beekeeper, we are able to show decreased disruption. In addition, a once cautious Wildlife Administrator was trained and was confidently responding to swarm calls to identify and assess location and needs prior to my arrival.

As honey was beginning to be produced on site, many airport employees began asking about it and soon enough, we had a list of people purchasing honey that was produced

right where they worked. Some were shocked to hear that there were honey bees at the airport; some were intrigued but they all loved the idea and the taste of the locally produced honey. The once rural landscape turned airport proved to be valuable to the honey bees. As part of the airport's habitat management, no pesticides are used and mowing is kept to a minimum as part of their WHMP. Because of this, there is always something in bloom.

By the time 2020 rolled around, the Honey bee Project, as it became known to all at the airport, had grown to nine beeyards with approximately 110 colonies. Names for each bee yard were assigned for easy identification. There are some yards that are used solely for honey production. Other yards are used for queen production where some of the queens used in the PA Queen Bee Improvement Project are mated and assessed. Another yard is used to house swarms that are caught to assess for health and viability. The popularity of the project continued to gain momentum. One of the goals for PIT, that CEO Cassotis has pushed for and presented, was to think outside of the box when it comes to ideas for land use at PIT. Her message has always been that the Pittsburgh Airport is more than just an airport. There are uses for the airport and its property in ways people don't envision and the Honey bee Project is just one of those uses. It garnered the attention of United States Congressman Conor Lamb when he recognized PIT as a cornerstone of economic development during one of his visits to PIT. Congressman Lamb and former PA Senator Pam Iovino toured the apiaries at the airport and acknowledged their benefit to not only the environment but the local economy as well – "it's a really good example of how [PIT] is thinking out of the box" said Congressman Lamb of the bee project.

The accolades continued as PA Governor Tom Wolf and the Pennsylvania Department of Environmental Protection recognized the Honey bee Project with Governor's Award for Environmental Excellence in 2020 for its continued efforts toward environmental stewardship. Pittsburgh International is always looking to find innovative solutions and this project not only enhances the safety and efficiency of their operations but it also supports key environmental initiatives.

The Honey bee Project has grown to be something more than we had ever envisioned. The success of the project has led to collaboration with the Airport Cooperative Research Program (ACRP), which is designed to develop practical solutions to problems faced by airport operators. PIT is one of a handful of airports across the United States that has honey bee colonies located on property. A few other airports that have honey bees include Seattle-Tacoma, Portland, Chicago O'Hare, and St. Louis.

As we move forward into 2021, the Honey bee Project at Pittsburgh International Airport will continue to grow. Honey produced will be offered for sale at locations inside the terminals to travelers coming and going to locations around the world, carrying with them honey that was proudly produced at Pittsburgh International. Continuance of the queen improvement program, swarm capture program and the production of honey, pollen and other products of the hive will also continue to move forward. Our hope is to continue to educate employees and the general public about honey bees and how beekeepers and airports can work together. PIT is among the first U.S airports to have a beekeeping program and there aren't many with beekeeping programs of this size and scope. It continues to support Pittsburgh International Airport's commitment to preserving the environment and supporting conservation and sustainability efforts.

A swarm lands at the base of a lamp post at the PIT airport parking lot. S. Repasky photo

Swarm on the Delta jet bound for JFK. The swarm that started it all. S. Repasky photo

A big "thank you" to the management and employees at PIT for opening up their arms to this project. The enthusiasm continues to grow as more people become aware of the many non-aviation activities that take place there. A special note of thanks to Ben Shertzer, Wildlife Administrator, for taking this project on and supporting it all the way to the top. This project benefits greatly from his support both administratively and physically when it comes to obtaining authorizations or checking swarm traps and relocating swarms.

BC

Stephen Repasky is an author, lecturer, consultant and EAS Certified Master Beekeeper from Pittsburgh, PA. He is the owner of Meadow Sweet Apiaries and is the author of the book Swarm Essentials. In addition to his own beekeeping operation, he can be found managing the bees at PIT and speaking to numerous clubs and conferences across the United States.

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Small Hive Beetles

David **MacFawn**

Predators Of Weak Hives

Small Hive Beetles (*SHB Aethina tumida Murray*), originally from Sub-Saharan Africa, present a unique problem, especially in warmer, high hive humidity and temperate environments. SHB can overtake a weak colony and "slime" honey stores rendering them unusable.

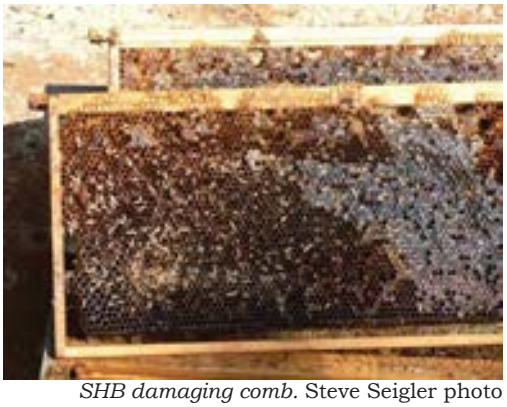
European honey bees (*Apis mellifera*) control SHB to an extent by herding SHB in jails, removing beetle eggs and larvae, and in worst cases absconding with the entire hive. Anecdotal observations have shown SHB to consume bee eggs. SHB are attracted to bee colonies by honey, pollen, and worker bee odors. They feed on honey and pollen. Honey and pollen are also spoiled by the yeast (*Kodamaea ohmeri*) that SHB harbor which renders the honey and pollen stores unusable by the bees and humans, with the worst cases resulting in comb damage and the fermented honey running out of the comb.

SHB hide from the bees in crevices, recesses, and cracks in the hive. The bees will often "jail" the SHB in propolis jails above the inner cover and other recesses in the hive. When the hive is opened, the SHB escape from these jails.

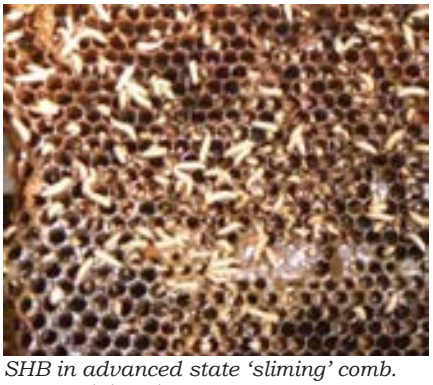
SHB females lay around 1,000 eggs in their lifetime, with the eggs laid throughout the colony. The SHB pupate in soil with most of the pupae "burrowing in the first 10 cm of soil and over 80% of small hive beetle pupation occurs within one foot of the hive entrance; nearly all pupation occurs within three feet of the hive entrance."[1] However, SHB can crawl much farther if needed. Moist, sandy loose soil results in optimal SHB pupa development. In colder regions, SHB will overwinter in the bee cluster. Pollen-substitute patties may increase SHB infestations. Only very small patties that the bees can consume in a day or two should be placed directly over the brood nest.

Nematodes (*Heterorhabditis indica*) can also be used to control SHB pupation. Nematodes are applied to the soil around the hive and typically kill SHB within 24 to 48 hours. Nematodes can be purchased on-line.

After removing honey supers from the colonies, the honey should be extracted within one to two days. SHB eggs hatch within three to five days. The moisture in the honey extracting facility should be controlled and minimized as much as possible to aid in controlling SHB. The humidity in the extracting facility should be controlled (typically below 70 percent, 50 percent is better, in the southeast) to keep the honey from absorbing moisture from the air and controlling SHBs. A low-humidity, temperature-controlled storage room for supers also helps with Small Hive Beetle control. To prevent honey from standing too long awaiting extraction, only enough honey should be removed at a time that can be extracted in approximately one day. The extracting facility should be above 80° F. to get most of the honey out of the combs. Freezing honey supers below 10°F./-12°C. for 24 hours will also kill SHB.



SHB damaging comb. Steve Seigler photo



SHB in advanced state 'sliming' comb. Steve Seigler photo

Note the SHB propolis jail on frame four. Larry Coble photo

Small Hive Beetle on unscented Swiffer pad. Joy Deer/Kim Pettit photo

SHB on unscented Swiffer pad. Steve Seigler photo

Dadant photo

Beetle Bee-Gone result. Dadant photo

Beetle Towel. Mann Lake photo

Beetle-blasters side by side mini-regular. Dadant photo

If you have SHB issues, reduce the hive size to fit the number of frames of bees in the brood chamber, and remove any extra equipment if the nectar flow is not occurring. This reduced hive size will allow the bees to patrol a hive that they can manage. Keeping colonies in the sun also helps with SHB control. Most of the bee equipment suppliers carry a full line of controls for SHBs.

Unscented "Swiffer" pads can be placed in the hive to aid in controlling SHB. Sometimes, in a hive with heavy propolis, the pad can get stuck to the top of the frames, under the inner cover, making the inner cover difficult to remove. SHB gets tangled

Beetle Jail Jr. on frame. Dadant photo

Beetle Blaster above and Mini Beetle Blaster left. Dadant photos

Beetle Blasters. Mann Lake photo

SHB trap. Dadant photo

The Beetle Baffle™ forms a full perimeter, the downward-facing ledge that permits normal bee traffic but makes it very difficult for beetles to climb over, depriving them of access to the combs. Bees quickly adapt their herding behavior to drive beetles down. Mann Lake photo

Beetle Trap Oil. From the manufacurer: Our special blend will attract beetles better than plain oil. Pint fills 23 traps; quart fills 47 traps. Mann Lake photo

in unscented "Swiffer" pads but, for the most part, bees do not.

Telling the Difference Between SHB Larvae and Wax Moth Larvae

"You can differentiate the beetle larvae from wax moth larvae by examining their legs. Small hive beetle larvae have three sets of legs just behind the head. Wax moth larvae, like all moth and butterfly larvae, have three sets of legs behind the head but they also have a series of paired prolegs that run the length of the body. Prolegs are absent in beetle larvae."[1]

In conclusion, SHB can damage and overcome a weakened colony, especially in the high moisture southeast United States. Bees control SHB by herding them in propolis jails, removing SHB eggs, and in the worst-case abscond with the entire hive. When removing honey supers, the supers should be extracted within one to two days in a temperature and humidity-controlled extracting facility. Only enough honey that can be extracted quickly should be removed and extracted. BC

1. Mid-Atlantic Apicultural Research and Education (MARC), "SMALL HIVE BEETLE (Aethina tumida)," Revised January 2015 MAAREC Website at **https://agdev.anr.udel.edu/maarec/**

Southwest Summer Bloom

Connie **Krochmal**

Many Summer blooming bee plants thrive in the Southwest. These include both native and cultivated species.

Let's begin with some of the cultivated crops. This is a good region for growing vine crops of all sorts since the dry climate minimizes the presence of fungal diseases.

Some of the widely grown vine crops include cucumbers and various types of melons. The plants are typically rich in pollen and nectar.

Cantaloupes provide nectar as well as a slightly sticky, heavy pollen. With large plantings, the honey surplus can average over 30 pounds per colony. This mild flavored honey varies from pure white to light amber.

Cotton is also a major crop and a major bee plant in the Southwest. The drought tolerant plants thrive in this warm, sunny climate. If left to grow naturally, cotton will continually bloom and fruit throughout the Summer and Fall until a killing frost.

Assuming growers don't apply desiccant agents to the foliage prior to harvest, the cotton plant Cotton is capable of yielding enough nectar for two generous honey crops per year. On the whole, this is a very reliable honey plant. Under good growing conditions, cotton can result in 100 pounds of honey per colony.

The extrafloral nectaries actually yield more nectar than the blossoms. Bees prefer these nectaries to the flowers.

Generally cotton honey is light colored and almost clear. But, it can be extra light amber. With a thin body, this honey can granulate and develop fine grains. This premium quality honey has an excellent flavor.

Myrtle (*Myrtus communis)* is a beautiful evergreen shrub with leaves that are used as a spice. The lovely, pure white, wonderfully scented blossoms appear during July and August in the leaf axils and occasionally in few flowered cymes. They can have rose tinges. These flowers are sources of pollen and nectar.

Hottentot fig (*Carpobrotus spp.)* is an introduced succulent grown widely in the Southwest. Also called trailing sea-fig, it is hardy to zone nine. This species has naturalized in California and Oregon.

About three inches tall, it features creeping stems several feet in length. The thick, fleshy triangular leaves are several inches wide.

The scented purplish-rose to mauve blossoms appear in June and July. Two inches wide, these bring nectar and pollen. When enough Hottentot fig plants are present, a surplus of very light or almost white honey with a wonderful flavor can result.

Japanese stonecrop (*Sedum spectabile)* is a drought tolerant perennial succulent that begins blooming in mid to late Summer and continues into the Fall. It does well in zones four through nine. The most widely grown cultivar by far is the very popular and very floriferous Autumn Joy.

When the small blooms of Japanese stonecrop first emerge, these are white and then change to pink and finally rose-red. All of the stonecrops are considered excellent bee plants.

They yield a premium quality honey that is superior to clover. Very easy to grow, the plants require minimal care.

Various other kinds of perennials are well suited to this region. **Red hot poker** (*Kniphofia uvaria)* features long, narrow, blade-like foliage that resembles grass. This species begins flowering in mid Summer, but there are several early flowering varieties, such as Flamenco, that bloom several weeks earlier.

The vivid blooms appear on tall, stately, thick stems,

Cantaloupe

Japanese stonecrop

Mimosa

two or more feet in height, depending on the variety. The long, tubular blooms are beautifully layered all along the length of the flower spike. The typical flower colors are red, orange, and yellow, but some varieties have creamy white blooms.

Well loved by bees, these blossoms are rich in nectar and pollen. The nectar is so plentiful that it drips onto the stems and makes the blossoms sticky to the touch. Red hot pokers are easy to grow.

Lavenders are excellent perennials for the Southwest. At least three lavender species are highly recommended, including English lavender. French lavender and Spanish lavender are less hardy than the English – only to zone nine.

Both the English lavender and the Spanish lavender bloom during the Summer. French lavender differs by flowering pretty much any time of the year.

Bees love lavender blossoms, which yield lots of nectar. The flowers are also sources of pollen. Lavenders can provide a surplus honey crop of at least 45 pounds per colony.

This premium quality herbal honey has a pleasing unique flavor, usually mild but sometimes stronger. The mild aroma is similar to that of the plant.

Varying widely in color, lavender honey can be white, gold, yellow, or any shade of amber. Often granulating, it becomes smooth and buttery with fine grains.

The various species of **blanket flowers** (*Gaillardia spp.*) are common natives in the western half of the country. Some of these also occur in the East. Species that are found throughout the Southwest include red dome blanket flower (*Gaillardia pinnatifida),* and Indian blanket (*Gaillardia pulchella).* Additional ones that occur in some of the Southwestern states are *Gaillardia aristata, Gaillardia spathulata, Gaillardia arizonica, Gaillardia parryi, and Gaillardia multiceps.*

The blanket flowers are drought tolerant, sun loving plants that are mostly perennials, although some are annuals. Most of the perennials will usually bloom the first year when grown from seed.

The bicolored, daisy-like blossoms are usually yellow and red. Around three to four inches across, these can emerge pretty much throughout the Summer.

These easy to grow plants require a well drained soil, especially during the Winter. Bees eagerly seek out these flowers from which they obtain pollen and nectar.

The blanket flowers are major nectar plants in some regions. Surplus honey can result. Considered good quality, this can be yellow to dark amber.

Mimosa or silk tree (*Albizzia julibrissin)* is an introduced, leguminous, short lived tree that has naturalized in some areas including the Southwest, the South, and most of the Northeast. Very free flowering, this blooms when very young. Typically appearing in early to mid Summer for about three weeks or so, the blossoms form round, compact heads.

The flowers, two inches across, can be pale pink or white. The long stamens, which resemble brushes, are quite conspicuous. Much loved by bees, the blooms yield pollen and nectar.

Adam's needle or yuccas (*Yucca spp.)* are very common perennials in the Southwest. Various species are native to the region. Some species are also found in the East.

For the most part, these species are most likely to bloom during the Summer. However, there is one Spring flowering one called soapweed that occurs in the western states.

All of the yucca blossoms are well liked by bees. Yielding large quantities of pollen and nectar, they can provide a good surplus of honey.

Safflower is grown as an oilseed crop, dye, and as an ornamental. This provides both pollen and nectar. It is a great nectar source when temperatures are favorable. The nectar has a higher sugar concentration than alfalfa nectar.

This quick blooming annual is a major honey plant in the West and Southwest, particularly in New Mexico. The plant provides a small crop of mild flavored honey.

Some other Summer flowering bee plants that are either native or cultivated in this region include buckwheat, chicory, corn, crownbeard, Russian thistle, sunflowers, and some sumacs,

Rocky Mountain Bee Plant (*Cleome serrulata)*

While the species above have appeared in previous articles, the Rocky Mountain bee plant hasn't. This native is also known as Rocky Mountain honey plant, stinking clover, Indian pink, and pink cleome. It is found in the western half of the country as well as the Midwest. In addition, the plant also occurs in New York, Connecticut, Massachusetts, and Maine.

This species was one of the plants collected by the Lewis and Clark Expedition on August 25th, 1804 in South Dakota. Adapting to challenging situations, it can be found in prairies, open woodlands, waste places, rocky sites, rangelands, and along roadsides, railways, and windmills. The plant prefers a moist to moderately dry alkaline soil.

Rocky Mountain bee plant has been widely planted as a bee plant over the years. A member of the caper family, this annual features an erect stem that is unbranched and rather bare towards the top. Towards the base, it is branched and very leafy.

The height varies according to the growing conditions. In good situations, this can reach two to five feet in height.

The compound leaves consists of three lance-like leaflets, one to two inches long. One reason this species

Rocky Mountain Bee Plant

is such a valuable bee plant is that it blooms for a very long period, typically from June through August. In California, flowering can begin as early as March or April and continue for three months.

Eagerly sought by bees, the showy pink or purple blooms open in racemes at the ends of the stems. As the growing season continues, the stems grow in length with new flower buds emerging on the new growth. The flowers consists of four clawed pink or purple petals, four sepals, and six stamens.

The long, slender, pink stamens, which can remotely resemble spider legs, extend an inch beyond the petals and are quite prominent.

The three inch long seed pods are bean-like capsules with pointed tips. All parts of the plant have a slightly offensive odor and taste. The aroma has been compared to that of a wet dog.

Related Species

There are a number of related species in both the eastern and western states. The flower color can vary widely according to the species. Often, these blossoms can be yellow, purple, or pink.

One of the more common related species is the yellow spider flower (*Cleome lutea).* This is native to Washington, Oregon, Idaho, California, Montana, Wyoming, Nebraska, and the Southwest. It can be found along creek bottoms and mountain valleys.

This species grows very quickly and can bloom almost all season from May until frost in Oregon. The flowers yield a nectar with a low concentration of sugar. The deep colored, strong tasting honey has a pleasant flavor.

In addition to these native cleome species, some introduced ones from the tropics have naturalized. That is the case with the widely cultivated annual, the common spider flower (*Cleome spinosa).* This species, which has naturalized in Florida, has appeared in earlier articles. It produces lots of nectar.

Bee Value of Rocky Mountain Bee Plant

Rocky Mountain honey plant is a major honey plant in California and Colorado. USDA lists this as a major bee plant in most of the western states. It brings both a greenish pollen and nectar, which has a sugar concentration of 21 to 29%.

Charles E. Bessey, author of "A Preliminary List of the Honey-Producing Plants of Nebraska," refers to this as "one of the best native plants for the production of honey." The nectar flow can be erratic and somewhat less reliable in some years. More nectar is produced during cloudy, cool spells.

The honey is usually light colored to whitish-green but is sometimes darker. Improving with age, the flavor is typically pleasing although it can sometimes be stronger tasting.

This can provide about 100 to 116 pounds of honey per colony in a 10 day period or two to three supers over a number of weeks. The related species are also top rated bee plants as well.

Growing Cleomes

Xerces recommends all of these species for wildflower meadows, prairie restoration, ornamentals, pastures, and hedgerows. Generally, these plants prefer a gravelly, rocky, sandy, or light soil. They adapt to both dry and moist soils. These are well suited to the South for they're tough, heat tolerant species that require little care.

Easy to grow from seed, the sun loving plants often self sow. Direct sow the seeds where they are to grow 1½ feet apart or plant seeds early indoors. Barely cover the seeds to a depth of 1/8 inch. Seeds sprout in around 10 days.

Typically, most will begin flowering around eight weeks from the time the seeds are sown. The plants are suited to both dry and wet soils. BC

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

The Bellevue "Bee Man"

Linda **Miller**

Henry Quirin

Since beginning beekeeping I have heard stories about the Bellevue "bee man", Henry Quirin. It was said that when he would be seen on the streets he was often mistaken for a transient and people would offer him a few coins for a meal. He would kindly thank them and move on. Henry was small in stature. He was usually dressed rather shabbily and only got one haircut a year at the start of the bee season. Most people never realized he was one of the wealthiest men in the area.

Henry Quirin was born in Groton Township, Erie County, Ohio in 1872. He was the son of Nicholas and Barbara (Gross) Quirin and one of six children. He was raised on a modest farm at the corner of State Route 4 and Strecker Road where his father owned about 40 acres of tillable land. This spot would later be known as Honey Corners. From humble beginnings, Henry began his bee business. At the time of his death in 1959 he had grown his estate to a value of near one million dollars.

When Henry was 10 years old, his father had become ill and developed a craving for honey. He would send young Henry to a neighbor to purchase the "amber fluid" to satisfy his father. After making frequent trips to retrieve the honey he became intensely interested in the science of honey bees. Henry is quoted as saying, "I remember I wanted to get a colony right away, as soon as I learned how they lived, but my father objected that I might get stung".

Henry persisted however, and by the time he was 12 years old he took a gold dollar he had earned himself and purchased his first colony of honey bees.

Henry's formal education never went beyond the fourth grade but he set out to learn all he could about the tiny workers. He got all the bee culture books he could find and soon taught himself every aspect of keeping bees. He discovered that the real problem was obtaining queens and soon started experimenting how to raise his own.


QUERIN, THE BEE MAN.

By 1891, when Henry was 19 years old, he discovered a novel way to commercially produce queens. Using an old chicken incubator he was the first beekeeper to perfect a way to raise queens in such a manner. "It is no easy matter to control 500 queens in one incubator, every one of whom is born a scrapper, so it is necessary to cage each one, as soon as hatched, in little wire bottles. In short time they are moved to roomier quarters, and after 10-12 days are ready to ship", he later said.

Henry was very particular about choosing the queen he would graft from. They had to be prolific, gentle and splendid honey gatherers. Once he found the perfect queen, he said, "I would not sell her for $200!"

He soon began placing ads in bee magazines and newspapers across the United States. Orders began pouring in. He also became a favorite among commercial beekeepers because they could order queens in large quantities. At the peak of his enterprise he could produce as many as 1,500 queens a week.

Within a short period of time his queens became so well known for their excellence that he began shipping to far corners of the world including, but not exclusive to, New Zealand, Australia, Japan, China, West Indies and all across Europe. He soon became known as the "Queen Breeder of the World". His specialty was Golden Italian and Leather Colored bees. In a good season he expected to raise 5,000 queens.

During the Winter months Henry would busy himself making his shipping cages. The cages were fashioned in three-inch wooden blocks with one open side covered with screen. For shipping he would place an adequate amount of food for the queen and about a dozen "escorts." He could ship via postal service for eight cents per queen.

Over the years many tried to discover his secret to raising such an abundant amount of queens. Reporters would come to his apiary hoping to discover his method but would usually end up being free labor for the day. When asked how many employees he had he would simply reply, "50,000,000". He rarely hired help because he couldn't find anyone that would share his passion for the honey bee.

In 1906 he owned 15 or more farms where he kept his apiaries. They were mostly located in Erie, Huron and Sandusky counties. By that time his "secret" had been discovered and competition increased. When profits decreased he gradually turned his main focus to honey and comb honey production, still managing 450 colonies.

Henry may have had only a fourth grade formal education but made his way in the world quite well. He invested wisely in stocks, securities and property. In 1925 he purchased the Woodward-Ellis Mansion at 400 Southwest St. in Bellevue, Ohio where he lived until his death in 1959.

Henry was once quoted as saying, "Bees are smarter than most people. They don't have any divorces, any wars, or any depressions." I tend to agree. He was known about town as eccentric, a bit of a recluse, preferring the company of his bees over people. I have days like that, too. I find comfort in watching the bees go about their work with purpose and joy, the gentle hum of the beeyard drowning out the static of the outside world, creating its own bubble of peace with nature.

As beekeepers, I believe we can all find a kindred spirit with Henry Quirin. He was quite a remarkable man and I wish I could have known him. BC

THE SOURWOOD FLOW

Katherine **Lacksen**

BeeCo Apiaries is a small, woman owned and operated beekeeping business located in Sparta, Georgia that produces and sells queens, five-frame nucleus hives, and honey. I work alongside my mom, Mary Lacksen, who has served as past president of the local beekeeping club and is heavily involved in other regional and statewide organizations.

Personally, one of the silver linings of COVID-19 has been time and space in my schedule to work alongside my mother who started her beekeeping journey thirteen years ago. She will be the first to tell you that she is still learning, and as a beekeeper that's a given. However, her 13 years of experience has given her tremendous knowledge and intuition that she generously shares with me and so many other new and experienced beekeepers.

This past Summer was our fourth consecutive year of moving hives up to the Blue Ridge mountains for the Sourwood flow. The process of moving bees back and forth from the Blue Ridge Mountains to our apiary in middle Georgia and extracting the sourwood honey is always an adventure – one that Mother Nature controls. The weather, timing of the sourwood bloom, and health of the bees are all key factors. We know that none of this would be possible without helpful folks at both ends of the road who make this a smooth process. From the secure site and location in North Carolina for the bees, to the many helping hands that load, unload, and pull supers from the hives, to the strong arms that help move the very heavy five-gallon buckets of honey, it definitely takes a team to make this happen. Collaboration, synchronization, and teamwork – all lessons that we take from our bees for inspiration and wisdom.

We use a hive carrier tool to lift the hives up onto the trailer. You need two people to use, but it makes moving and lifting hives much easier.

Moving 26 Hives from Middle Georgia to North Carolina – We are able to move 26 hives from middle Georgia to North Carolina using a custom trailer outfitted specifically for moving bee hives. Our friend and beekeeping partner, Bruce Morgan purchased it almost fifteen years ago from Bobby Colson, club president of both the Ogeechee Area Beekeepers and the Altamaha Beekeepers Association. The trailer was previously used as a pollination trailer in the watermelon fields of Florida. It's configured to hold 26 hives securely and permanently so that the hives never have to be moved from the trailer during their time pollinating, or in our case, producing honey. We carefully load hives and winch them down with ratchet straps. The hive entrances are closed up earlier in the morning with foam window piping insulation to ensure the bees are in the hive prior to moving. You could definitely feel the weight and pull of the trailer as we navigated the back-country roads and traveled straight through without any stops to our final destination – a cattle pasture outside Franklin, North Carolina. There, we met the landowner who generously allowed us to keep the hives on his property. We took the trailer and backed it into the back corner of his pasture where the bees spent the next six weeks. We brought all of the equipment to set up an electric fence, but thankfully we were able to tie into his already hot perimeter fence around the pasture saving us the headache of having to set up our battery and solar panel system. Within 30 minutes everything was unhitched, fenced in, and ready to go. Mom and I did a final pass through pulling the gray, foam plugs from the hive entrances. The bees were eager to get out after being plugged for six plus hours. Thankfully, the journey was seamless and the weather ideal. No rain and cooler temperatures so we didn't have to worry about them overheating on the drive – a valid concern when doing anything in Georgia during the Summer months. Before leaving, we took a few minutes to admire the scenic view and friendly pasture mates – the curious cows who were smelling and licking our truck. Thankfully, the electric fence successfully deterred any curious cow and more specifically, black bears, during the six weeks of the sourwood flow.

Mary Lacksen with a frame of capped Sourwood honey at Morgan Apiaries in Sparta, GA.


After extractng the honey, we place the supers back in the beeyard so the bees can clean out the bits remaining in the frames. From this stack of medium supers, we harvested about 1,000 lbs. of Sourwood honey equivalent to about 17 five-gallon buckets full.

Harvesting 1,000 Pounds of Sourwood Honey – Once the hives were transported back to Georgia in early August, we opened them hoping to see signs of white wax indicating fresh, capped sourwood honey. This year, we opted to use the uncapping roller because it's less invasive to the wax comb structure, thus the bees can quickly repair the frame for more honey storage. In addition, since the honey bees don't have to completely replace and rebuild all of the wax when we put the frames back on the hive, they can direct more energy and resources towards tending to the queen and frames of brood, pollen, and honey. Each of these is critical to having a strong, healthy hive going into the Winter months. After we uncapped a frame, we placed it in the extractor that Bruce Morgan allows us to use at Morgan Apiaries. After extracting the final frame, we ended up with 17 five-gallon buckets of sourwood honey, or roughly one thousand pounds. When we finished extracting, we placed the harvested frames back into the supers and put them out in the beeyard for a few days. There, the bees cleaned out the remaining bits of honey before we store the supers away until next Spring when it's time to do it all over again.

Fun Fact: BeeCo Apiaries Sourwood honey was awarded "Very Highly Commendable" for the Light Extracted Honey Category during the Georgia Beekeeping Association 2020 Fall Virtual Honey Show. Our award-winning Sourwood honey is available for purchase at **www.beecoapiaries.com**. BC

BIGGER PICTURE

Jessica **Louque**

Hive Assessments

Learning to check your colonies is a major part of being a good beekeeper. After being on the Beekeeping Today podcast, I thought it might be useful to go more in-depth about how we do our Colony Condition Assessments (CCAs). Of course, not everyone is going to want to assess in the crazy detail that we use, but if you only have a few hives, it could be a way to monitor your hives over time . . . especially if you happen to like to play with numbers. You can see what is normal for each time period both for your individual colonies and for your general area/environment.

The basis of our assessments is that we go through each frame and determine how much of everything is there. You always sit on the same side of the hive, taking the frame closest to you, and that is frame 1. The "a" side is the side closest to you, and the "b" side is the opposite. You would first decide what percent coverage of adult bees is on each side. It's important to do this quickly because it changes constantly and they will leave the frame the longer it is out. Once you look at adult bees, you go back to the "a" side and start looking at all of the matrices. For us, each matrix is an important data point. A "long" time ago, these assessments counted honey and nectar together as one matrix, but as of about five years ago, they became separate matrices. This is important to us because it tells how much stored honey there is in a hive as compared to new nectar coming in. Typically, when looking at a frame, I call in order of: Honey, Nectar, Pollen, Capped brood, Open brood, Eggs, and Empty space. We use percentages of five, but I have seen our beekeeping counterparts in Europe assess in eighths. The important part is to find a percentage that works for you. Looking at 5% increments may be more detail than most people need. It's also fairly important when you do this that you can do basic math in your head, and quickly. You need to keep up with your percentages, matrices, and totals to make sure no matter how you count it, you have 100% total at the end. It is possible to have more than 100%, typically in events of drone brood that is drawn on the bottom or top of the frame if you don't scrape it off (I usually take it out because it's basically a varroa trap). I would not particularly recommend doing this type of assessment to a new or beginner beekeeper because you would need to be extremely familiar with what can be expected in a colony.

Training yourself to do this can be a daunting task if you let it. Consistency is the most important because if you are inconsistent, the observations aren't really meaningful. I personally have assessed over ten thousand colonies that range from nuc-sized to quads and it is incredibly time consuming and physically taxing if you have to do a lot of colonies in a day. We try to limit our assessments to an absolute maximum of 18 a day, although we have done as many as 21 a day in extenuating circumstances. Once you do a lot of colonies, the eye strain through a veil can give you a headache. Sometimes I don't wear a veil, depending on the season, but a sting in the face or the eye can make a really long, hot day a whole lot longer. We also use this time to take samples in the colonies for pesticide residues, so that's something the typical beekeeper won't be spending time doing. If two people are assessing (one recording, one observing), then I can usually assess a colony in 15 minutes per box, if that's a 10 frame fully drawn box with a lot of bees and the hive has to be unratcheted and then ratcheted again after you're done. A quad can take up to 45 minutes if it's full, but usually the top two boxes are capped honey or in the process thereof, and can be assessed a lot faster. There's also typically less bees in these upper boxes, making it quick. Once you start looking for the queen, it goes a LOT slower. We try to always find the queen, although time constraints don't always make that possible for us. It's important to us because we want to see if our marked queens are losing their mark, or if perhaps it's a different queen than the last time we checked, or if the queen is absent. If we don't find her, we look at the eggs and typically make a note if the colony seems calm and there's eggs, or occasionally even the age of the eggs. If you can find eggs less than 24 hours old, usually the queen is nearby, but if the hive is busting at the seams with bees she can be right in front of your face and you'll never find her (especially if her mark is gone). Making a note that there are calm bees and eggs indicates the presence of a queen and can be enough to decide the colony is functioning properly.

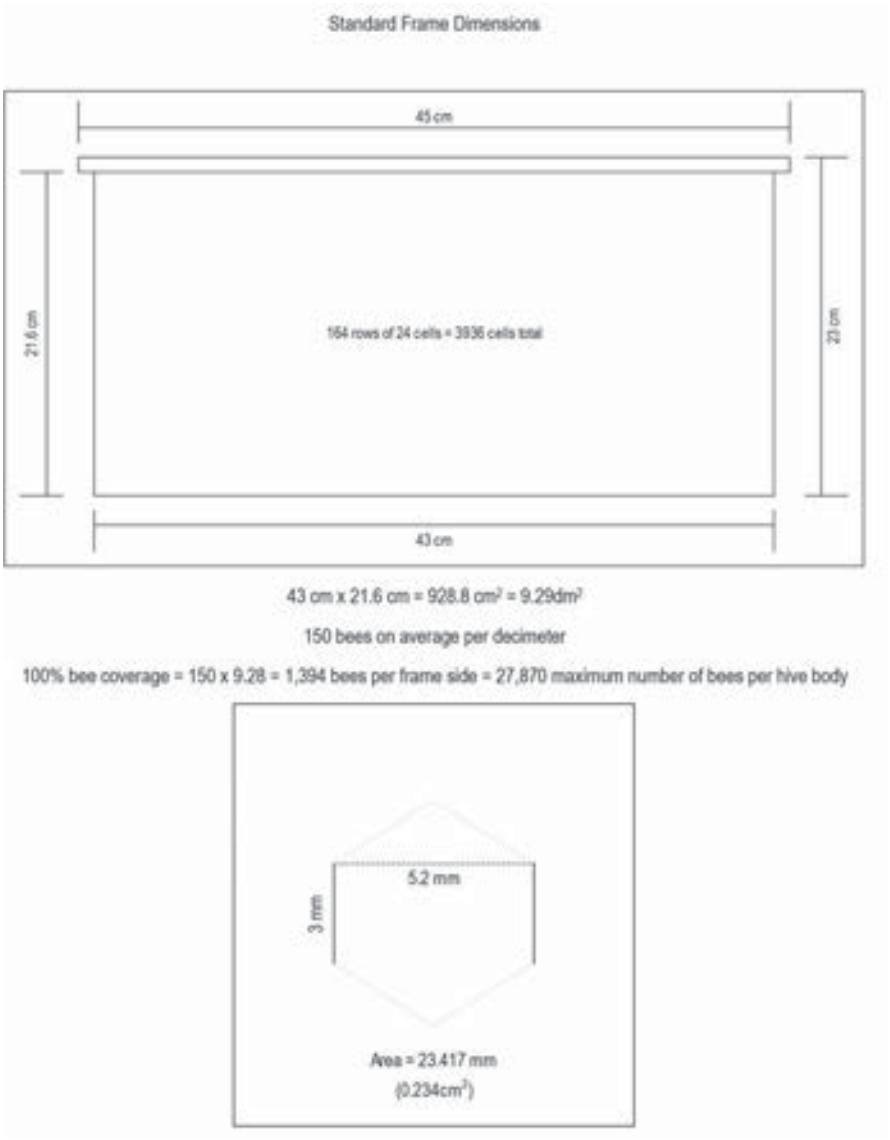
Besides the queen, you're also looking for a myriad of other things while you assess frame coverage. You want to scan the workers for signs of disease or pests. *Varroa* mites in extreme cases can even be seen wandering across the frames. Although *Varroa* is the devil, and the most likely pest, it's safe to assume that there is indeed a population of *Varroa* there. The important part is determining how bad it is. If you can see *Varroa* on the abdomens or thorax of your worker bees without trying too hard, you probably have a problem. You should also be looking for symptoms like Deformed Wing Virus (DWV) that indicate *Varroa* presence without seeing them. Hive beetles can be running around, but they aren't usually a problem in strong colonies if there aren't many beetles. I have seen an SHB infestation overrun strong hives in some circumstances, but they are fairly hard to control without damaging your bee colony. They are particularly important to document if you are in the process

of feeding pollen to your colonies, since they will use this to boost their own numbers. If anything else is concerning, such as wax moths, make a note for yourself so you know to either try to treat, do some damage control on the colony, or keep an eye on them. This is definitely something that should get easier with time, but new beekeepers are often similar to students in nursing school that have just learned about diseases and are sure they have all of them. If you are truly concerned, you always have either mentor beekeepers from your local association or even the apiary inspectors from the state to turn to. Local beekeepers don't want you to have garbage hives because it will end up in their bees if left unchecked and they are going to be closer to your apiary site and more likely to have a working relationship with you, but the apiary inspectors probably should be called if something serious is happening. Again, this is probably not a colony maintenance method I would recommend for anyone with less than a few years of experience.

Watching for queen cells or signs of swarming is also important. If there are swarming or supercedure cells, can you tell the difference between them? Where are they on the frame? Is the old queen missing, dead, or already swarmed? It's important to know your hives well enough to understand their behavior to keep up with these things. If the old queen is dead but there are supercedure cells, you can just let the colony take care of itself. You can also squish them all and throw in a cell that you've purchased, put one in you've made, or buy a mated queen and introduce her. If there are signs of swarming but your old queen is present, you might be behind the game on adding space (or they were going to do it anyway). You can take this opportunity to split your hives and move the queenright colony into a new hive a little farther away, and leave the new ones to make their on queen from the queen cells.

For those of you that enjoy the numbers game, let me break down the frame dimensions. We only use plastic foundation just because it's more consistent with numbers. A plastic frame (we purchase from Dadant; I have no idea if everyone sells the same frames) is 45 cm across the top, 43 cm across the bottom, 23 cm top to bottom, and 21.6 cm from under the frame grip to the bottom. The usable frame space on each side is 928.8 cm^2 which equates to 9.29dm^2. Decimeter is an odd measurement, but we know that there are approximately 150 bees per decimeter in full coverage. This means that on each frame side if there is 100% coverage, you can expect to have about 1,394 bees per frame side, making 27,870 bees in a single deep if every frame, front and back, was 100% covered. Of course, this is an approximation, and does not account for foraging or flying bees or bees on the inside of the box or the ones that dropped onto your shoe and are currently on their way up your pants.

There are 154 rows of 24 cells on each frame side, totaling 3,936 cells. The cells are 3mm for each length, and 5.2mm at their widest point, making an area of 23.417mm or 0.23 cm^2. This means that 50% coverage is 1968 cells. A different way to think about this is that if you only have 5% frame coverage of eggs, that's still roughly 200 cells (196.8). There are a few biological liberties that have to be taken with this because your numbers won't be exact, and neither will the bees. The important part is to be able to get a good idea where your bees are and where they're going so you know how much intervention they need from you. A healthy hive means happy beekeepers! BC



Jessica Louque and her family keep busy with all things beekeeping and all manner of other living things in NC.

Beehives That Don't Hold Bees

Part 3

Jim **Thompson**

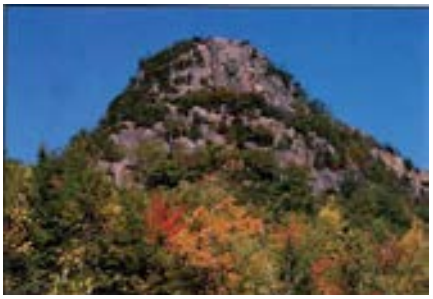
Bee Hive Company of Newark and Wilmington Delaware at one time sold a Ream–N-Klean packet that is something you probably haven't seen before. It seems that smoke shops don't stay in business very long or keep changing their products. Maybe people aren't cleaning their pipes as they used to or are using other things, but I have a package of nine pipe cleaners and a cleaning tool that reams the draught hole, spoons out the tobacco and packs it in the bowl. I figure that the Bee Hive Company was in business in the 1950s as there is no clue to their existence on the internet today. However a similar packet is available under the Tim West name and the packet is called a sleeve. Most pipe cleaners are made of cotton or chenille and are used in craft items, where the real pipe cleaners are more abrasive.

Beehive Hairdo was created in 1960 by Margaret Vinci Heidt for the cover of *Modern Beauty Salon Magazine*. Heidt designed the beehive by thinking about a velvet fez. The cap had beaded decorations that looked like bees and maintained the shape of the hair. She also used a lot of hair spray. The beehive hairdo was made popular by Jacqueline Kennedy and actress Audrey Hepburn.

Beehive Hairdo

The Beehive in Acadia National Park, Bar Harbor, Maine stands 520 feet tall. There are many hiking trails and you can get a really good view from the top, but one should be in good physical shape and use common sense as some of the trails are treacherous. Randi Minetor wrote a book that covered 78 deaths that occurred at Acadia National Park from 1853-2017. However in my research I found that only two deaths occurred on the Beehive. In August 2000, a 57 year old man was about five minutes from the top of The Beehive and lost his balance and fell about 100 feet. It is suspected that he had some difficulty with the iron rungs and hand holds. The other death occurred June 7, 2016 when a man fell while trying to get the perfect photo of a sunset.

Some of the iron rungs on a trail going up the Beehive.

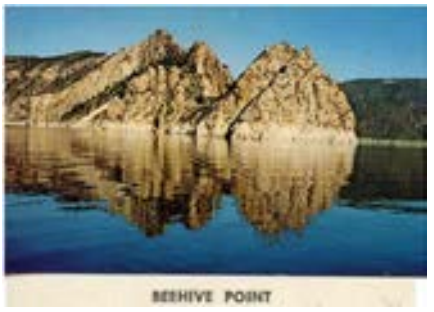


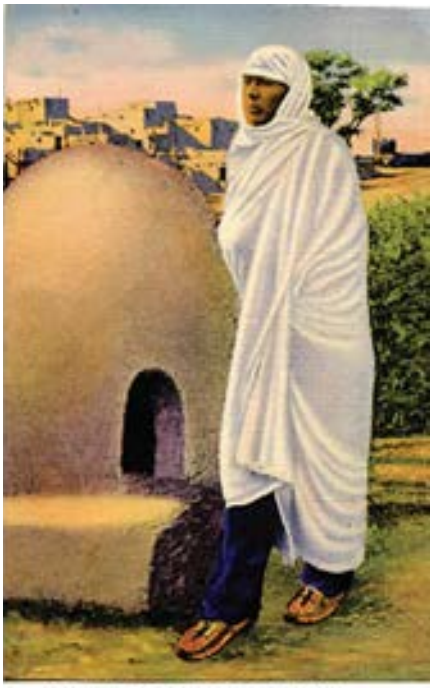
Acadia National Park, The Beehive.

Big Beehive in Banff National Park, Alberta, Canada was named by J. Willoughby Astley in 1890. The Big Beehive is 656 feet tall and was named for its shape and a smaller shaped beehive mountain is nearby. A popular 6.4 mile long loop trail will let you see the Big Beehive. However if you want to spend a full day and see Lake Louise, Lake Agnes, the Big Beehive and the Little Beehive, which is an 8.0 mile trail.

The Beehive and Bridal Falls, Lake Louise.

Beehive Point was named by John Wesley Powell in 1869 due to the many swallows that nested there. In 1962 to 1963 a dam was built that provided the Flaming Gorge Reservoir area with electric power. It was dedicated in 1964, and now most of the Beehive Point is submerged. However there are many swallows nearby.



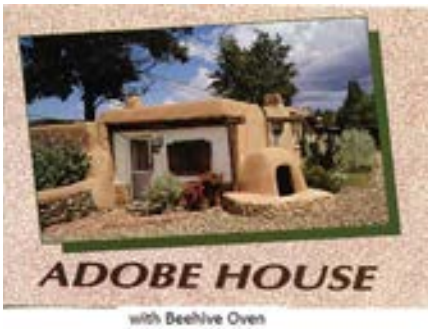


WHITE ROBED TAOS INDIAN

Taos Bee Hive Oven and the **Adobe House** both feature the bee hive oven which was used for baking bread and other food. Before gas and electric ovens the beehive ovens were used. The ovens were typically made of bricks or blocks and placed in a dome shape. A fire was built in the oven and more fuel was added and the fire was pushed to the center with a hoe. To heat all the bricks would take two to three hours, a form of preheating. The cooking was done by the hot bricks and the heat was an even heat due to the shape of the oven. When the oven was hot, bread would be added as it required a higher temperature. As the temperature decreased other foods were added. Beans typically were placed near the side of the oven and cooked over night.

Ward Beehive Charcoal Ovens or more correctly, **Ward Charcoal Ovens State Historical Park** is located in Ely, Nevada. The six beehive shaped charcoal ovens were used from 1876 through 1879 to

WARD CHARCOAL OVENS

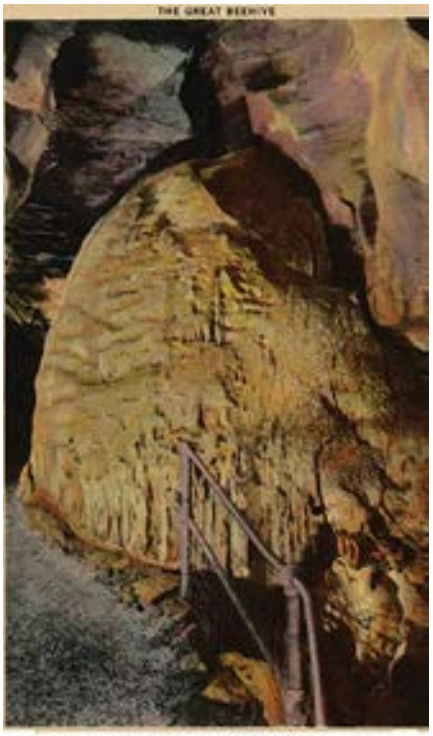


help process rich silver ore. When the mining ended, the ovens were used for shelters for travelers and even hideouts for stagecoach bandits. Today the ovens are open for tours.

The postcard shows the **Bee Hive Coke Ovens** – Norton, Virginia, but there were many coke ovens all over the United States. It was found that if coal is heated and made into Coke, the Coke can be used to fire blast furnaces with a higher temperature and process iron into steel. The ovens were usually placed in rows called batteries or banks, so that they shared at least a side. Most often the walls were double thicknesses. In 1910, there were 48,000 beehive ovens used for industrial purposes in the Pittsburgh area. In 1910, Coke ovens made 80% of the coke used, but by 1930 the percentage dropped to 6%. Most of the declining use of the coke ovens was because they are harmful to the environment, due to the emissions.

Beehive Coke Ovens, Norton, Virginia – one of the oldest methods of manufacturing coke from coal. Wise County is one of the few places in the U.S. where such ovens may still be seen.

The **Bee Hive at the Valley of Fire** was formed by the years of water and wind removing some of the material. The Valley of Fire is 50 miles northeast of Las Vegas, Nevada, next to Lake Mead National Recreation Area.



THE GREAT BEEHIVE
Howe Caverns, near Cobleskill, NY

The Great Bee Hive at Howe Caverns near Cobleskill, New York was actually discovered 20 years before the Civil War. The Native Americans called it "Otsgaragee" which means "Cave of the Great Galleries" or "Great Valley Cave". Perhaps the first person to enter the cave was Johnathan Schmul, a peddler, who used the protection of the cave from the Native Americans. Lester Howe rediscovered the cave when his cows kept gathering in one spot on his neighbor's property. Lester found a cool spot where air was

coming from a "Blowing Hole". He and Henry Weitsel, his neighbor, spent days exploring the cave. Lester gave tours in the cave starting May 22, 1942. He purchased the land from Henry, February 1943. An attraction in the cave is a stalagmite named the Great Bee Hive. A stalagmite is a mound of calcium salts rising from the floor of a cave.

Beehive Geyser is a four foot tall geyser in the Upper Geyser Basin of Yellowstone National Park. It was named September 18, 1870 when the Washburn-Langford-Doane Expedition entered the Upper Geyser Basin along the Firehole River. It has been noticed to erupt 219 feet in height, not deflect more than four or five degrees from vertical and last 18 minutes. The interval between eruptions, range between 16-18 hours in the Summer and the Winter eruptions being very erratic.

Bee Line Ferry from Point Pinellas to Piney Point across Tampa Bay was just 22 miles long and would take an hour. However the Sunshine Skyway Bridge was built and opened in 1954, causing the ferry to stop running. May 9, 1980 the MV Summit Venture a freighter collided with a pier supporting column causing 1,200 feet of bridge to fall into Tampa Bay. In 1993, both spans of the intact 1950 bridge were demolished and in 2008, the approaches were demolished. The new bridge was built in 1982 but was delayed in opening until April 20, 1987, due to a crack in the supporting tower. A major problem of the bridge is the corrosion of the steel cables. BC

Bee Hive Geysers at Yellowstone Park - 7/14/1906


Postcard mailed 1954

Sunshine Skyway Bridge

References:
Bee Hive Geyser Wikipedia
Beehive Hairdo History.pdf
Bee Hive Oven History.pdf
Bee Hive Ovens Wikipedia.pdf
Bee Line Ferry.pdf
Coke ovens steel Pennsylvania.pdf
Howe Caverns 1.pdf
Man fall on Beehive.pdf
New Sunrise Skyway Bridge.pdf
Overview of Beehives in Valley of Fire
Personal Postcard Collection
Ward Beehive Charcoal Oven Nevada.pdf

Technology Tips For Beekeepers

Malcolm T. Sanford

THE 4TH INTERNATIONAL BEE & HIVE MONITORING CONFERENCE: INTRODUCTION AND OVERVIEW

Frank Linton, Colony Monitoring Website; fnlinton@gmail.com

The 4th International Bee & Hive Monitoring Conference, hosted by the University of Montana, provided attendees worldwide with a virtual collection of the latest colony monitoring developments, ranging from products on the market today to research that may result in future innovations. The technologies presented take advantage of low-cost sensors, powerful batteries, communications technology, cloud storage, information processing algorithms, interactive visualizations and other concepts. The event included 50 presentations from 14 countries with more than 400 registrants. Edited abstracts and links to full video presentations are presented here, published by Bee Culture Magazine. 12 minutes: https://tinyurl.com/fourth-linton

TECHNICAL INNOVATIONS IN BEEKEEPING

Huw Evans; BeeHero; Italy and USA; huw@beehero.io

Beekeeping can be considered both an art and science; therefore, it benefits from technology, as technology applies science to solve problems and extend our abilities. Historically, the evolution of beekeeping technology has been characterized by long periods of steady state, punctuated by significant developments that dramatically changed the craft's nature. The late 1800s heralded the dawn of honey production on a commercial scale thanks to three key technological innovations; the movable frame, smoker, and centrifugal honey extractor. Today beekeeping technology is experiencing another sharp disruption as electronics and information technology help our understanding and abilities as beekeepers.

Over the last few years, the market has seen a surge in gadgets that offer a myriad of services. Beekeepers that benefit from these innovations tend to fall into three distinct groups; while there is an overlap in application, the value extracted from the information is tailored to each. Hobby beekeepers can track nectar flows, compare colony development and receive automated alerts for broodless colonies, the need to add/remove a honey super, when to feed, even when the queen goes on her mating flight. Technology has enabled commercial beekeepers to increase efficiency within their operation, improve management practices, and increase production. Growers can now better track the pollination of their crops. Scientists can collect unprecedented volumes of highly granular bee and environmental data simultaneously and precisely coupled with reliable data management. The question is not if but when will these technologies become the mainstay of modern apiculture. 15 minutes: https://tinyurl.com/fourth-evans.

PRACTICAL HIVE MONITORING FOR THE SERIOUS BEEKEEPER

Etienne Tardif; Serious Hobbyist and Asker of Questions; Yukon Territories; yukonhoneybees@gmail.com

One challenge that new beekeepers have is learning and understanding that all beekeeping is local. Most beekeeping is done in locations where some knowledge or history is already in place through Beekeeping Association/Groups or an established network of experienced, knowledgeable beekeepers. In my talk, I will describe what a serious beekeeper/club can do where there is no prior knowledge/experience or critical gaps exist. In the next 15 minutes, I will describe the approach I took to fill some of these gaps quickly. Hive monitoring is most effective if multiple data points are captured simultaneously.

My approach has been to capture critical internal hive metrics (temperatures, weight), local weather data, forage, and environmental information, disease and pest trends (microscopy, mite counts), and most importantly, colony progression observations collected through routine inspections.

https://beekeep.info/vita_details/

The information can be collected individually or as part of a club/group activity over a couple of years. The information collected can then be used to improve/test hive management approaches,including feeding and hive configuration, to understand critical environmental queues (seasonal changes, nectar flows/dearths), to understand critical bee stressors (i.e., nutritional gaps, weather impacts, forage types, diseases & pests), concerning bee biological processes, brood-rearing cycles, and queen health. 17 minutes: https://tinyurl.com/fourth-tardif

Let Go

John **Miller**

"Let Go Or Be Dragged," is a fridge magnet given me by Pennsylvania beekeeper, Mike Angelo.

He's really handy. Mike and I stick a million queen cells each spring in the Sierra Foothills near Auburn, CA. Ok, maybe it's not quite a million cells. I've gained an appreciation for the Orland beekeepers. I Let Go of calling them knuckle-draggers. Sticking cells, checking queens, whether in mini's or singles, or multi's: it does not matter, the work is done bent over.

This transition stew is messy, it has a big dollop of Letting Go in the recipe.

As convinced now as I was in 1997 that it's time for others to Let Go – now applies to me.

I'm happy to Let Go of hiring and firing. I was never good with employees, and gladly Let Go of it long ago. I am good at logistics, and flexibility. I watched as my successors mastered logistics and flexibility – because if there is one constant in beekeeping – it's change. Weather changes abruptly changes a good plan. An order of queen cells is lost: it happens. An early April three-day rain is a real pain – and Letting Go of mastering spring does not bother me. No one ever masters spring. Even Jim Powers once starved 600 nucs in Parker, AZ. It happens.

I happily Let Go of watching the weather. I have no influence over the weather, no matter how hard I stare at the radar screen. I also Let Go of getting out of bed by six so I had a full hour to fret over the upcoming day, before the actual day began. Beekeeping used to be a low-margin sliver of agriculture. I was happy to Let Go of low margin beekeeping when it became really, really difficult to keep a hive alive.

I happily Let Go of hammer and nail.

I happily Let Go of the two-wheel cart.

I happily Let Go of the 610's and everyone who knows a 610 gets to smile with me.

I happily Let Go of the vacuum two-speed rear end on that 1962 Chevy truck.

Have not looked back, not once: Let Go.

I Let Go of staple guns and nail guns, because everything is now delivered assembled, painted, stenciled, and branded. Let Go of the idea a hive body has a 20-year life. Hive bodies die violently; impaled, crushed, shattered usually by a forklift/human tag team.

If I never Let Go of another five gallon can – that's fine.

I Let Go of the end-bar rack atop the work bench – and I Let Go of the beeswax sheet embedding contraption. Can you wire a deep frame in your sleep? Let Go.

I Let Go of the 2d 'blue' nail, the pencil line, the hook, and the permanent left thumb-nail indent – occasionally complimented by a deep blue hammer bruise.

I also Let Go of deep supers filled with newly embedded foundation [7s, btw] no longer terrified of a shattered foundation when dropped too hard on a too cool morning. Let Go.

I joyously Let Go of the CA DMV Day of Terror: Each year, a day was sacrificed supplicating an openly hostile clerk, to re-register the fleet. Sent with one, and one only check that had to be perfectly made out lest the entire paper flotilla came hurtling back through what I thought was bullet-proof glass.

I Let Go of hand-loading and off-loading semis.

I Let Go of a 20' – ½ horse-powered square hay bale elevator. In the old days – honey was extracted on the upper level of the honey house, and gravity moved the honey to the basement. In the basement were two galvanized steel tanks. The tanks held about 120 cans of honey. On an exceptional day, you could fill them both. Woe be to the poor fool who ran over a tank. Hence, the honey crop was in the basement. To get the honey crop out of the basement, you needed a strong back, or a 20' – ½ hp square hay bale elevator. You can only put a can of honey on every other tooth – because the little motor that could – can't lift more than four cans or bales at a time. Still: 4 > 1.

I also Let Go of signing personal guarantees on loans.

I Let Go of selling my home, then renting it back, so I had cash flow to get to new crop honey. Everyone should experience that once. Once is enough.

I Let Go of my way of dealing with *Varroa destructor*. Smarter people succeed me, using IPM and new materials to push back on Ms. *Varroa* and her children. Ms. *Varroa* is a 34-year prelude for the next mite; and I hope we Let Go of stupidity. The next mite is worse.

I see agriculture Let Go of diversity. I Let Go of the idea of ever seeing another 200# crop.

I Let Go of smooth skin, good eyes, and endless energy. I Let Go of youth before I was ready to Let Go of youth. Now I see smooth skin, good eyes, and endless energy in grandchildren, the ultimate do-over; a chance to invest time and effort in a young life before Letting Go.

I don't Let Go of industry service. We all get the same 24 hours each day. I Let Go of distributing, supering, weeding, supering, robbing, cleaning up. I Let Go of three rounds of supering. Now? We toss two shallows atop a double deep, and are pleased as punch if they fill. In place of this work, I work to improve bee research and forage. We need more flowers. Pitting one beneficial against another beneficial is not conservation. I Let Go of yard sheets and grab more books. A treasured book was given me by Karen Rennick, former Bee Informed Partnership CEO; Originals – How Non-Conformists Move the World by Adam Grant.

Beekeeping is perhaps the most non-conformist occupation ever. Look around. If you check the dictionary for non-conformist, you'll see a picture of Darrel Rufer smiling right back at you.

Non-conformists Let Go of many things, hang on to some things. Life is full of Letting Go and hanging on. Best wishes with this whole beekeeping trip. It's been a great run. I had a great time. I have a front row seat witnessing the most tumultuous era in beekeeping since beekeeping began. I Let Go; sorta smiling. **jrmgkia@daktel.com**. BC

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Make Sure You Renew!
Check Your Mailing Label – It Will Tell You How Many Issue You Have Left!

I-CORP FOR BEEKEEPERS, REPORT #3

National Science Foundation (NSF)

Jay **Evans,** Raymond **Peterson,**
Jerry **Hayes,** David **Hawthorne**

This is our third installment aimed at summarizing a journey by scientists, an entrepreneur, and an industry leader to learn from each other and from beekeepers. The March, 2021, essay told a story around our lofty ideals to find and deploy precision disease diagnostics and treatments for honey bees. In April, one of us drew the short straw and had to admit that they have lived through numerous such efforts to modernize beekeeping. While treatments have succeeded fairly well, the parasites have always beaten them in the end. This April essay concluded that we have not changed our habits much, and bees and beekeepers continue to suffer because of it. This month the goal is to describe the journey and current efforts to improve bee health.

Formally, the four of us took part in a National Science Foundation Innovation Corps (I-Corps) course starting in Spring 2020. Planned for an exciting western city, in fact the entire program has taken place from our homes, for reasons you know well. We are still in the midst of it as we sort through results and make plans. During the first few months we met regularly with teachers and our fellow teams. We joined with teams who hoped to use science to optimize cell phone signals, automate surgeries, and inject light into bodies to tackle disease (really!), among other ventures. It was a stimulating crowd and, for those of us outside of the business world, both humbling and fascinating. At the start, the instructors told us we would be wrong most of the time, and they were right. We were given overviews of value propositions, funding, production, advertising, and the varied types of business ventures. These are topics we science nerds dozed through in past school opportunities but have become drawn to as a way to get our science out to beekeepers. An early lesson involved identifying which science efforts were most likely to have an impact and which industry needs could even be addressed by current science. There was an abundance of colorful flow charts, but one that stuck with us looked something like this: Scientists are pretty self-confident that their efforts will be on the 'Great/Super' side of this chart. What we and potential industry partners need most are assurances that the results of this labor will be anywhere close to 'Big/Huge' on the beekeeper impact axis. Consequently, a large part of this course, and this essay, will address that axis.

Stage #1 focused on the overall economics of beekeeping, pollination services, and disease control. Much of this information is available in studies and writing. One recent effort, by Alex Jordan and colleagues at the University of Pittsburgh and Pennsylvania State University, suggests that insect pollination of crops boosts the agricultural economy by over 30 Billion dollars in the US alone ("Economic dependence and vulnerability of United States agricultural sector on insect-mediated pollination service" Environmental Science & Technology, 2021, https://doi.org/10.1021/acs.est.0c04786). Honey bees are the primary, but not sole, contributors to these pollinator benefits. While only a fraction of that economy is passed on to beekeepers, it clearly shows the large financial roles bees play in agriculture. We also explored the costs to beekeepers from disease and colony losses, and the economic appetite for reducing those costs. On the human side, whether people simply want to learn and benefit from a backyard beehive or want to sustain a business for their families, honey bees continue to be an integral and threatened part of US agriculture.

Stage #2, which has been the hardest and most rewarding, involved directly surveying beekeepers and industry members as to their needs, wants, and struggles. We spoke via Zoom with 75 beekeepers, from newbies to the leading commercial beekeepers, and asked them a range of questions around their pressure points and price points for being a beekeeper. In the future, we will cover some of their answers, but if you want to see the pre-interview questions (and even submit your own thoughts), the link remains live at (**https://app.pipefy.com/public/form/S3kZnckY**). This was a

very brief survey to get to know beekeepers prior to in-Zoom interviews, and is not related to the critical annual bee management and health surveys run by the USDA National Agricultural Statistics Service, Bee informed Partnership and others. Given their background stories, we were able to ask beekeepers in more detail how their last couple years have gone, where and how any losses beset their operations, and their visions of what it would take to address those losses. Given the many research efforts into disease diagnostics and new treatments, we were mostly curious to know where beekeepers stood on those issues, and what they yearned for. We assessed potential causes of any recent losses, treatments used, and available diagnostics. Each story was fascinating and each beekeeper wanted nothing more than to reliably see bees entering and exiting their boxes.

Stage #3 involved interviews with various community members who are already helping with these issues, from apiary inspectors (**https://apiaryinspectors.org/**) to bee-friendly veterinarians (e.g., **https://www.hbvc.org/**), scientists (**https://aapa.cyberbee.net/**), and vendors. These community members were asked slightly different questions at the start but always with an aim to understand how they use science to advise on bee health. Veterinarians are a relatively new force in beekeeping, and their expertise is fresh and absolutely focused on the issues we hope to address through research. Many of them, including Dr. Tracy Farone in this magazine, are willing to write about their insights and explore how they might fit into the beekeeping world. ALL of them were humbled by how much there is to learn from bees and beekeepers and how different many aspects are from their own training and business models. The Apiary Inspectors of America were another key target audience, since they are often the first on the scene when losses occur and outbreaks commence, and their decisions often have the most immediate impacts on beekeepers. We also contacted fellow scientists, some not fully in the 'applied' world, for their thoughts on translating science into a practical outcome. Some have successfully bridged the gap from hardcore research to beekeeper consultations, including former USDA researcher Dr. Humberto Boncristiani (**https://www.linkedin.com/in/insidethehivetv/**) who is pushing the limits of research, science communication, and beekeeping extension. Bee supply vendors gave their thoughts on their bottom lines and willingness while supply-chain vendors gave sobering advice on the costs to turn a research product into a bee-meeting product.

Watermelon. (ARS photo)

We were immensely lucky to get three months of insights from an incredible gang of NSF and industry teachers. We also shared our fears, insights, and successes with some great science companions in this course. Every beekeeper who participated gave a new insight into the trade, and we hopefully took good notes. It has been a fun and new journey and we and others in the research community are committed to capping it with some useful solutions to some of the challenges to our bees. BC

Dogs Can Smell Honey Bee Disease

Maryland's Distinguished AFB Dogs

Dewey **Caron**

Dogs are famous for their sense of smell. A dog's sense is so advanced they can smell disease in bees or a host of medical conditions in humans (cancer, diabetics, sleep apnea) and lots of other stuff (whale poop, firearms, toxic waste sites, child pornography and even covid 19). With about 220 million scent receptors – compared to five to 10 million in humans – dogs can detect odors 10,000 to 100,000 times that of humans. They can detect some odors in parts per trillion and they can detect countless subtleties in scents.

Dogs are being used in an ever-growing number of detection scenarios. A news story from Texas Tech and Virginia Tech announced a "$475,000 Agriculture and Food Research Initiative grant" to study whether dogs can detect agricultural pests and pathogens. This effort proposes to use dogs of several breeds to determine if they can be used for detection of spotted lanternfly (a cicada/aphid related plant pest) and spotted mildew in agricultural crops. Nathan Hall, Texas Tech University assistant professor of Companion Animal Science, said "he hopes dogs eventually save farmers many millions of dollars in damage annually." University of Penn Veterinary School currently has three dogs in training, a Labrador retriever, a German shepherd, and a Small Münsterländer searching for Spotted lanternfly egg infestations. The German Shepard, named Lucky, is already being used by the Penn Department of Ag in the field **https://www.npr.org/2020/12/11/944185028/pennsylvania-turns-to-mans-best-friend-to-sniff-out-spotted-lanternfly-infestation**.

Maryland AFB dogs, Tukka (left) and Mack (right), with Cybil Preston, MD Apiary Inspector. B. Ostendorf photo

Humans can train our noses to recognize bee colony disease conditions including the foulbroods and even PMS. American Foulbrood (AFB) is most easily distinguished, described variously as the odor of a chicken house, or an athlete's locker, left uncleaned. Maryland, uniquely among states, has been training and using dogs to detect American foulbrood (AFB) since 1982. Training involves a rigorous training schedule lasting six months, a source of AFB (not just an infected colony), a close relationship of trainer with a well-disciplined animal, an indoor space for the training and for continuous reinforcement of the smell conditioning without contaminating the space and a great deal of patience. Safety protocols must be followed to avoid that dogs do not get stung. Defensive colonies, such as Africanized bees, kill and injure dogs and many other animals each year. If they get stung, most dogs would lose their concentration and not be useful for a period.

The use of dogs in detection of AFB for Maryland Apiary inspection was started by Maryann Frazier before her move to Penn State. Jerry Fischer, regional, then state apiary inspector, utilized two Labrador retrievers, Max then Byno and then regional apiary inspector Bill Troup trained a 3rd dog Thorn around 2000, followed by Klinker, also both Labs. Klinker and Bill retired in 2015. The 5th Maryland AFB dog, a yellow lab named Mack, went through his six-month training period as a two-year-old and began field work in 2017. He currently works alongside owner and handler, Cybil Preston, the chief apiary inspector for the Maryland Department of Agriculture (MDA). MDA uses AFB sniffing dogs in their regulatory authority for the certification of honey bee colonies as disease-free.

As with the previous dogs, Mack was enrolled in the scent training program with the Maryland Department of Public Safety and Correctional Services. This facility trains dogs for drug and contraband (especially cell phone) interdiction along with a few dogs for other purposes such as MDA dogs for foulbrood detection. Each group of dogs "are trained on scent detection through a series of drills and games," says Preston. Training Mack, Cybil says involved "playing games with toys and training aides saturated in the AFB bacteria." Cybil had to wear rubber gloves and training was done indoors so as not to contaminate or possibly transmit any AFB. According to Mark Flynn, K-9-unit commander at the state's

Department of Public Safety and Correctional Services, "when a dog is searching, he believes in his heart he's trying to find his toy". Although the dogs may play as a reward in targeted scent detection, the dogs are trained to "work" following commands and must be continuously retrained to keep their detection and working skills current.

After Mack was trained, a second dog was authorized for the Apiary inspection program. Cybil worked a year with a beagle-cross named Clark. Although Clark was smart and a good sniffer, he "did not work out". One issue with beagles is they tend to prefer a food reward which is a "no-no" in scent training. During his training, Clark simply refused to take the tests. Cybil, by then attached to Clark, retired him to become part of her farm. The Preston farm raises chemical-free produce and provides a rescue service of senior animals (Cybil calls it their "Senior Equine retirement village"). Currently, besides dogs, the farm menagerie includes five donkeys and three goats.

When it became clear Clark was not going to cooperate, Cybil was offered Tukka. Tukka was part of a litter of springer spaniels bring trained to detect prison contraband. Although an excellent search and find dog, Tukka had one problem – he was scared of noises. The clanking of a jail cell door for example would result in his cowering along the wall, terminating his desire to work. Believing he was better suited as an outside than inside dog, Cybil took him on. Tukka trained from June to October and passed his final test without a single miss.

In the field, when Preston commands them to "find," the dogs move from beehive to beehive, sniffing each one for the distinct odor of AFB. They work along the front of the colonies and then along the back of the same row. If Mack smells the disease, he sits to alert to his detection. Tukka is an aggressive alerter. He gets super excited, pulling at his leash trying to paw the ground to alert to the AFB scent. Mack works slow and steady while Tukka works faster and at a higher energy level. He is usually held on a leash because he wants to dart between and circle around and between colonies. If disease is detected the dogs are praised, get special loving, given water and rewarded with a special ball to chase that they do not get at any other time. They then are bedded in the state van.

Cybil then manually goes through the indicated colony. The colony is flagged, samples taken to be sent to the USDA Bee Lab at Beltsville, MD for AFB confirmation and the apiary is quarantined until results come back from the lab. Most often though the infestation is moved onto a burn pile right away by the beekeeper. Before the bees might be certified for movement to a pollination site or as clean for sale of nucs the dogs are put to work again – at a different section of the apiary. Cybil is not satisfied until they fail to alert this attempt.

Cybil says the dogs are "incredibly efficient – in a span of three weeks, Mack inspected over 1,600 bee colonies that were being sent to California for almond pollination. And he is accurate – in field testing, he correctly identified 100 percent of infected hives," she says. "It would take us a year to work on that many colonies." Cybil hopes to use Mack another year or so.

The dogs work November into March/April, mainly in the morning and only when temperatures are below 52 degrees. Mack does not like bees and if he hears them or there are bees at the entrance, he loses his concentration.

Mack alerting C. Preston.

Cybil believes he has been stung on her farm but never during work. It is just his gentile nature. Tukka is a bit more fearless but he too does not like bees on his fur.

Both dogs must be continually reinforced. Inside her basement she uses boxes or takes the dogs to the state training facility where they train inside among crates and boxes. On her farm Cybil will use her own colonies as part of the training but not with the AFB for fear of contamination. Cybil says they are the best of friends at work and at home. And they get summers off to play on the farm. They especially like the swimming pool according to Cybil.

New Zealand also has a program to use dogs for AFB detection. Since foulbrood antibiotics are not permitted in New Zealand and queens and packages are shipped worldwide from New Zealand, including to Canada, they have recently refined their use of dogs for AFB detection. Their plan is to use just AFB scent to train, which Maryland is doing as well. Results in the past when dogs were trained just to infected colonies has apparently not worked as well as hoped for. **https://beemission.com/blogs/news/new-zealand-sniffer-dogs-are-training-to-detect-afb**

Mack and handler Cybil Preston were honored as the second recipients of Maryland Governor Hogan's Customer Service Heroes Award. The award, presented monthly, recognizes and celebrates front line workers for customer service excellence. The program is designed to foster improvements in customer service across Maryland state agencies. **https://news.maryland.gov/mda/press-release/2017/05/10/mack-the-bee-dog-cybil-preston-receive-governors-customer-service-heroes-award/**

Mack was a feature of Disney+ show It's a Dog's Life. Check it out on Season One Episode Five Filmed November 2019, aired March 2020. A good article on Maryland's use of dogs for AFB was published in the New York times: **https://www.nytimes.com/2018/07/03/dining/dogs-bees-colonies-sniff-bacteria.html**

BC

Perpetual Queen Management Frustrations Part 2

One hundred and sixteen years ago –

One hundred and sixteen years ago, E.F. Phillips wrote in his publication, *The Rearing of Queen Bees*[1],

In fact, modern apiculture has come to be a study of the modification of conditions under which bees can thrive to bring about the best results for the beekeeper.

If I may repeat for emphasis, ***116*** years ago, Dr. Phillips wrote that modern beekeepers subject bees to foreign precures and techniques to bring about *"the best results for the beekeeper."* Did his statement unintentionally mean that if anything positive should happen for the bees during these beekeeper explorations, that would be a good thing, but it would be secondary?

Think about it . . .

We set up beeyards for beekeepers. We use straight combs for beekeepers. Smoke and smokers – for beekeepers. Wax inserts are for beekeepers' convenience. Heated uncapping knives. Honey extractors. Protective gear is for beekeepers. Yes, it would appear that beekeeping is for beekeepers. The bees themselves have always been oblivious partners. Importantly, within this relationship, we raise queens and manipulate bee genetics to meet our human needs. In oh so many ways, it's what we do – not just in beekeeping.

E.F. Phillips, 1921

Beekeeping as a human enterprise is constantly adapting

In my actual lifetime combined with my beekeeping historical familiarity, beekeeping has passed through several distinct paradigms. I am not a historian and I offer the categories and the estimated time frames that follow in a conversational atmosphere rather than a technical review. *(In other words, I could easily be wrong.)*

My Perspective – Beekeeping – Then and now

(First Epoch) (Long before my time). Initially, we were primarily honey hunters. Find a bee nest. Rob it. During this time, we had no concern for the bees. There was plenty of them. I have talked to people who were still honey hunters as late as the early 1950s.

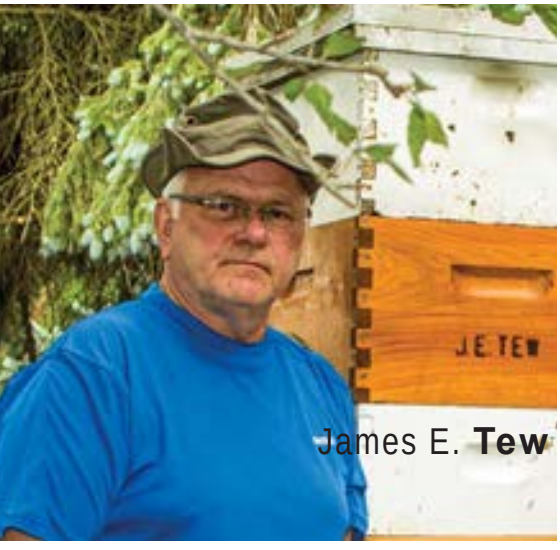
(Second Epoch). (1800s - Early 1900s). An artificial nest box system in order to limit randomness of finding and harvesting wild honey developed. Hundreds of designs were considered, and most were tossed onto beekeeping's historical scrapheap. The Langstroth hive design was the culmination of this beekeeping time period. At the time, it was not loved by all.

(Third Epoch). (Early 1900s - 1950s) Honey production – the idea was to generate as much of this commodity as "*humanly*" possible. Comb honey extracted honey and even creamed honey crops were the goals of beekeepers. Extractor designs and capacities abounded. As a byproduct, wax production and processing were dragged along in this phase. The queen and package industry flourished during this time.

(Fourth Epoch). (1950s - 1970s) The fourth phase was transitional. Honey as a commodity was very important and commercial producers, if necessary, went wherever required to harvest large honey crops. Therefore, migratory beekeeping evolved.

However, with little interest in honey, some growers, would pay modest fees to have honey bee colonies brought to their fields and orchards for supplemental pollination. While this pollination service had very little to do with honey production, increasingly, beekeepers would provide this service so long as honey production schedules were

[1]Phillips, E.F., 1905. The Rearing of Queen Bees. USDA Bulletin No. 55. 32pp. Digital reprint at: https://ufdc.ufl.edu/AA00018943/00001/1x



unaffected. Increasingly, pesticide effects hindered common beekeeping practices.

(Fifth Epoch). (1970s - Early 1980s) Honey imports into the U.S. became increasingly common. Invariably, the market price for imported honey was lower than production costs within the U.S. As this competition was ongoing, the California almond industry continued to grow, resulting in almond pollination services being in demand. Quietly, *the bee industry flipped.*

Commercial pollination became paramount and commercial honey production essentially dropped into second place. Importantly, during this time Africanized honey bees and the establishment of *Varroa* mites duly stressed the public, growers, and especially – beekeepers. Tracheal mites deserve honorable mention, but they only served as a practice run for *Varroa*. It is an understatement to say that this period in beekeeping's development and evolution was huge.

(Sixth Epoch). (1988 - 2018). *All the bees are going to die, and humankind will have a major food cri*sis! *Varroa* mite predation was killing bees at levels never experienced by U.S. beekeepers. Entire commercial operations were failing. This was a dark, cloudy time in this industry.

Ironically, just as some control was being developed for *Varroa*, *Colony Collapse Disorder* (CCD) struck an already hysterical bee industry and an insecure public. The US bee industry had already historically survived *"Spring Dwindling," "Autumnal Collapse,"* and *"Disappearing Disease"* – all *apparent* earlier forms of something like CCD. The bee industry and its related research facilities went into high overdrive. Possible issues caused by viruses, insecticides, nutrition were aggressively evaluated. We still do not fully understand what these periodic mystery die-off events entail or when the next one will come around. It will come.

(Seventh Epoch). (Present time). This is where the industry presently sits. The bee industry is now bifurcated into two groups - (1) the commercial industry comprised of fulltime beekeepers and (2) all other beekeepers. In most instances, large commercial operations use technology and procedures that are foreign to small scale beekeepers. Due to all the publicity during the fifth and sixth epochs, beekeeping currently enjoys a high interest level from the public. *"Newbies"* or new beekeepers, abound.

As epochs have come and gone, beekeeping management procedures have changed. U.S. agriculture has radically changed. While it is commonly acknowledged that bees are critical to our food production system, that importance should not imply that somehow beekeeping is fundamentally easy. It's not. Keeping bees alive is now more difficult that it has ever been before. Winter kill rates are too high and bee replacement costs are significant. *Varroa* is an admirable foe. It can be written that keeping bees is now expensive and too often, uncertain.

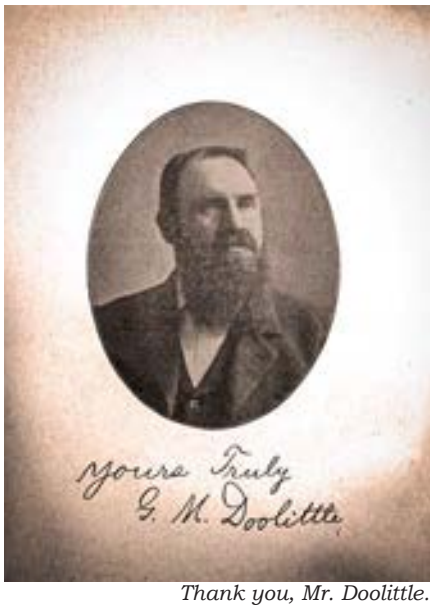
Queen production and management – stuck in time

The evolving development of beekeeping procedures and appliances can only be described as impressive. Web pages, podcasts, videos, Wi-Fi-capable bee hives, digital photography – bees and beekeepers have been both innovated and innovators. Consider how great the scope of beekeeping change has been and how many of those changes beekeeping has endured – both good and bad.

Yet, I proffer that one significant area has noticeably lagged – *queen production and management.*

Commercial queen production is still essentially following G.M. Doolittle's procedure presented in his book *Scientific Queen-Rearing as Practically Applied* that was published in 1915. To make the point clearly, the queens we are buying are produced by the process that G.M. Doolittle described one-hundred, six years ago. Yes, we are more efficient, and we use more plastic, but no mistake – it's Doolittle's 1915 method of queen production system that is producing our 2021 queens.

I wrote an article last month in which I addressed the routine questions and concepts associated with queens and queen management. While I wrote that article in 2021, if I had written the same article in 1921



Thank you, Mr. Doolittle.

- one-hundred years earlier – except for costs, it would have been mostly unchanged.

It's not the queen producers

Decades ago, I was responsible for about a 150 mating nucs. We grafted and produced mated queens. Initially, it was great fun and a rewarding event, but it quickly became work – hard, monotonous work. Modern day queen producers must work efficiently, and they must work on a rigid schedule. Then there's mites, small hive beetles, and absconding baby nucs. There's bad weather. There are mystery ailments. A great deal of time and investment is required to dependably produce queens. It's not cheap, and it is predictably tedious.

So, clearly stated, my angst is not with producers and breeders. Heavens knows, we need them and their work. But the fundamental question is begged, "Why is queen production and introduction still so tedious and demanding?"

Where did everyone go?

For no other reason other than happenstance, an antique copy of *Gleanings in Bee Culture*, August 1929, was out on a worktable in my shop. Though August is not a particularly great time for queen replacement procedures, I took time to count the advertisements for honey bee queens listed in that old back issue. I found seventy-one (71) advertisements. I then counted queen advertisements in the August

2020, issue of *Bee Culture* and I noted fourteen (14) advertisements. In 91 years, that represents an 80% decline in companies offering queens for sale. If I may, I'd like to keep going on this thread.

Of the 71 advertisements found in the 1929 issue, 27 were from Alabama. That represents 38% of all 1929 queen advertisements were from Alabama. In 2020, there were *no* advertisements from Alabama. What happened? I don't know why this dramatic decline in Alabama queen production occurred.

50¢ queen

Fifty cents was the average selling price per queen in 1929. Some producers were even selling at 40 and 45 cents. The last queens I bought in 2019 were $35.00 each. In ninety-one years, that is a 6900% increase.

I am not trying to write a firebrand expose but for comparison, a gallon of milk in 1929 was 26¢ and is about $3.59 today (1281% increase) while a gallon of gasoline was 21¢ in 1929, in my hometown, today, it is $2.86 (1262% increase). So . . . since 1929 milk and gas have risen about 1300%. During the same time, honey bee queen selling prices have risen about 7000%.

Be it known that one cannot live in the past. I suppose I now find myself out on a limb, and I guess I am presently in a clumsy situation, but not as much as one might think. My defense it that – yes – queens are expensive, but production costs are high, and successful production is not easy. We have new pests and high demand to thank for that. Labor is hard to find. Queens cost what they cost. Pay for them or produce your own.

Modern queen advertisements do not offer pricing. Interesting.

What I flounder over is why we are still having to use the classic Doolittle method of queen production as the only method for raising queens? Other than selecting for characteristics like hygienic behavior, docility, and color, not much else has been achieved in queen breeding. Here's the rub. To select for hygienic behavior, docility, and color, we can only use the Doolittle system to produce those queens. It's not just US beekeepers – it's the entire world producing queens this way. Obviously, growing queens is simply not easy.

I like Michaels Strevens' explanation for situations like this that he presented in *"The Knowledge Machine*[2]*."* Scientists and investigators doggedly and persistently work within a paradigm until that model begins to fail or even fails outright. Generally, there is an adjustment period of uncertainty and confusion while new norms are established and agreed upon. You may recall that there was a time when the best minds of the day thought that Earth was the center of the universe. That paradigm had to die in order for the new best minds of the day to show that the sun is the center of our universe. Now we know better. Or do we? How many universes are there? How many paradigms are there? I suggest that beekeeping is presently at a point where the Doolittle paradigm of queen production and our subsequent queen introduction techniques are being sorely stressed and challenged.

Could Doolittle be simplified?

Why have we not been able to simplify backyard queen production and management? I don't know, but we haven't. May I say that it's worse than ever? Queens are pricey. Availability is iffy and we are insecure about the health of the bees' drone population. Something needs to change.

Short-circuit the Doolittle's system! Why not just use ripe queen cells? Don't bother with the mating nucs aspect of queen production. Well, been there. So far, that idea has not been made to work. Just last season, I and a beekeeping friend, John H., tried to ship ripe cells across four U.S. states. In our very first effort, shipping was delayed, and the cells sat for a couple of extra days in transit. We got our money back and our dead cells back, but we kept our bad attitude.

How about introducing unmated queens? Great idea, but very, very old idea. Doolittle wrote in his 1915 book, *"I believe that the day is not far distant when the traffic in virgin queens will assume greater proportions than at the present."* Never happened. Would have been great if it could have. If we could introduce virgin queens, it would just about cut time and effort by about 50 percent.

Where am I?

Am I living in the past or am I simply blind to the future? Maybe just some combination. Maybe beekeeping has changed, and I have not. Maybe all things queen-related is like art work more than management methodology. Whether or not she deserves it, the queen is the representative soul of the colony. In all our colony management years, we have never been happy with our queens. What does that say about, "*bringing about the best results for the beekeeper*?"

I have to quit – for now

Well, I have had yet another rant and I still feel my frustration surrounding this queen subject. Embarrassingly, I did not some address the hypothetical questions that I posed in my piece last month, but I will do that – soon. While I admit that I am still managing queens within the ongoing Doolittle paradigm, I must believe that there are still things that we can do for ourselves.

Like detectives working on an old murder case, *"Go back to the beginning."* In the earliest days of queen production development, procedures, and devices were much

[2]Strevens, Michael. 2020. *The Knowledge Machine*. Liveright Publishing Corporation, 500 Fifth Avenue, New York, NY. 10110. 350pp.

simpler. I'm rummaging through the volumes of some of the old ways. Maybe something lurks there that would now help with this ongoing queen issue. I look forward to talking to you again on this subject. If you have thoughts, please let me know. 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 podcast with Kim and Jim
https://www.honeybeeobscura.com

For a short video on **"Perpetual Queen Management Frustrations"** and more comments on this month's article, hover your smart device QR app over this code....

https://youtu.be/IuzOLtng0OU

Minds are like parachutes –
They only function when open!

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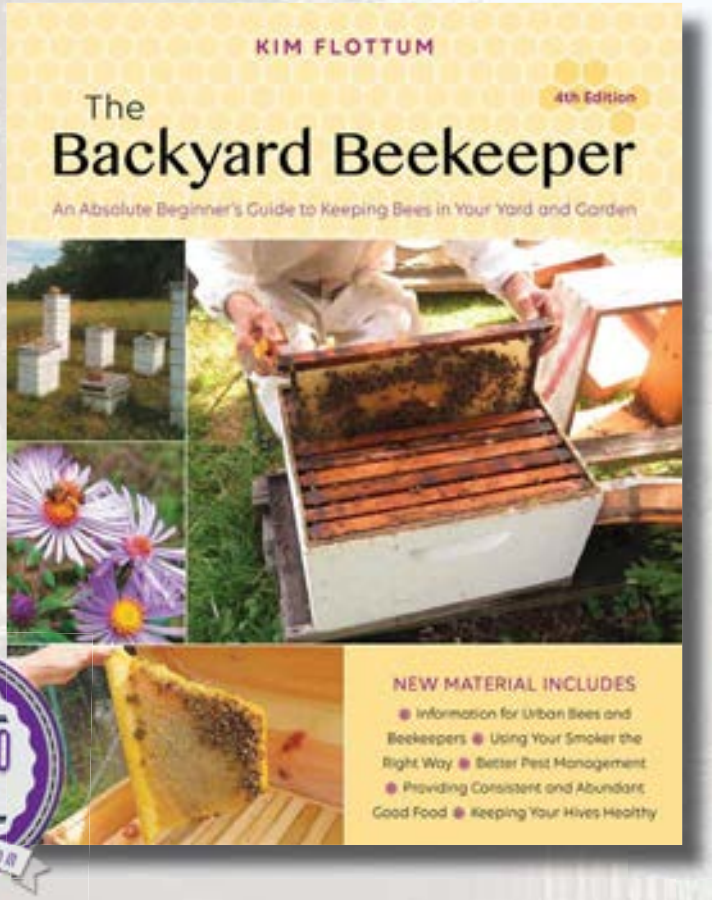

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Pan Seared Salmon –

Shana **Archibald**

Pan Seared Salmon
Skinless salmon fillets
Olive oil
Salt and freshly ground black pepper
Garlic
Cornstarch
Heavy cream
Dijon mustard
Honey
Low-sodium chicken broth
Fresh dill

How to Cook Pan Seared Salmon

First heat a large non-stick skillets over medium-high heat (or use two skillets if you used large fillets like I did so they aren't overcrowded).

Add 1½ tsp olive oil to each skillet or 1 Tbsp to 1 skillet. Dab both sides of salmon dry with paper towels and season both sides with salt and pepper.

Place salmon in skillet (top turned down).

Let sear until golden brown on bottom, about four minutes. Flip and continue to cook to desired doneness, about two to three minutes longer.

Remove from skillet and transfer to plate, leaving oil in one skillet for sauce. Place foil over fish to keep warm.

How to Make the Creamy Dijon Sauce

Meanwhile, in a liquid measuring cup whisk together cornstarch with 1 tbsp cream, then mix in enough cream to measure 1/2 cup. Whisk in dijon mustard and honey.

Set skillet with oil over medium heat, saute garlic until just barely golden brown.

Pour in chicken broth.

Bring to a simmer then reduce heat to medium-low and let simmer until reduced by about 2/3, about three minutes.

Whisk cream mixture once more then pour into skillet. Cook and stir, bringing to a simmer. Let simmer gently, while stirring, for about 30 seconds.

Remove from heat stir in dill, return salmon fillets to pan, spoon sauce over salmon. Serve warm.

We paired the salmon with parmesan couscous and mixed veggies. BC

CALENDAR

♦COLORADO♦

Spring Bee Camps – will be held by Tina Sebestyen near Durango. The beginner's camp will be held June 11-16, geared towards beekeepers with at least one year experience.

May 21-16 – this camp is for beekeepers with at least three years experience.

The cost is $500 ($100 deposit). Camping and outdoor facilities available at the site and hotels available in nearby Durango.

For information please visit **https://beequest.buzz** or contact Tina at **bee.longing@protonmail.com**.

♦GEORGIA♦

The UGA Honey Bee Lab will old the 2021 Virtual UGA/Young Harris Beekeeping Institute May 13-14.

Speakers this year include Robin Crewe, Kirsten Traynor and Jerry Hayes. Regular institute presenters will also be included.

For information please visit **https://bees.caes.uga.edu/yhc-uga-beekeeping-institute.html**.

♦INDIANA♦

Michiana Beekeepers Association Annual Meeting will be held May 15 in Nappanee. .

Clarence Collison will speak in the morning followed in the afternoon by a Beekeeping Equipment Auction. Pre-registration is required

For information visit **Michianabees.org**.

♦MINNESOTA♦

MN Honey Producers Summer Meeting will be held July 8-9 in Mankato.

Jim Gawenis, Sweetwater Science Labs, is the keynote speaker.

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

♦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**.

Different Types of Honey

H E N P V M E S Q U I T E C A L O N A C
E L P A M S U T P Y L A C U E E K N C L
A V O C A D O N H L I F A C A C I A K M
R E V O L C T K N A P W E E D N J Q M E
M S O L E P U T E H E A T H E R M J T L
N O T T O C L S V K R E D N E V A L H I
E L P P A S R E W O L F W O D A E M I L
H G F S U H A W T H O R N Y P C G N S O
U B U C O C O N U T P A L M I V Y L T T
D L C B V D A N D E L I O N A S P W L H
E A H A T S W E E T C H E S T N U T E E
E C S S U N F L O W E R B O R A G E Y F
W K I S M A N U K A B U C K W H E A T E
E B A W P H U U X T U L I P T R E E H F
R E Q O A Y R R E B E U L B X V H Z Y N
I R H O L L Y V G O L D E N R O D S M A
F R D D D O O W R E H T A E L Y A G E P
S Y T D H G H C Y Z V E A W E R A W E R
P Y X C K S A I N F O I N L I N D E N G
H E Y R A M E S O R T E A L F A L F A H

Display Advertisers

I ripped the stitches out of my elbow less than a week after the doc put them in, doing some exercises with a five-pound weight. I was just trying to stay in shape for beekeeping. My sidekick Marilyn has to keep reminding me to take life in moderation. This is not my natural inclination.

When my charming dermatologist re-stitched me, she as much as acknowledged that I was a problem patient, since this time she played it safe, using heavier stitching thread and a different knot, and taking a bigger bite of my flesh with her curved stitching needle. I watched my doctor's every move. She has very nimble fingers. When I told her she should tie flies, she seemed pleased. "I tie flies for my husband!" she chirped.

I like to watch when doctors slice me open or sew me up. When I was 12, I looked away as I received a yellow fever inoculation on the top floor of the American Embassy in Rio de Janeiro. I promptly got on an elevator that filled up on the way down.I remember we were stuffed in there like sardines. I must have passed out standing up but didn't fall down, because of the press of flesh around me. Apparently no one noticed I was out cold – until we got to the lobby. The next thing I remember is lying face-down on the floor, with a bunch of concerned grownups gathered around.

Now, 60 years after falling out of that elevator, I'm still working on my queasiness around needles. That's why I always watch.

I call my doctor charming, because she is! She takes a genuine interest in my well-being. When I told her I'd been using a 50/50 mixture of manuka honey and Aquaphor as a wound ointment, instead of the pure Aquaphor that her nurse had recommended, she told me you can buy a commercial manuka wound ointment. But she seemed impressed with my home remedy. She listens patiently when I tell her stories, even when they go on and on, and she always inquires about my honeybees. I'd like to tell her, "If I had a daughter, I'd want her to be just like you!" But of course I never will.

It's been a month since I've visited my billionaire's bees. The last time, on January 28, I fed one of four colonies. Now it's time to go back, stitches on no, because I wouldn't want to have to replace a colony that starved on my account. Megan considers me her mentor, and she likes to come along. She lives down the street from my billionaire, so when I swing by she can just hop in.

Normally I do the heavy lifting and let Megan do the rest of the work. Why not? She's become very proficient at counting Varroa mites, and in December she did an oxalic acid dribble on those four colonies. Great! That's how you learn. But this time I'll really need her, so I don't do something dumb and tear out those stitches again.

Megan's own bees got wiped out by mites last year. By the time she grasped the severity of the situation, it was too late. I told her I could part with a couple of nucs this spring, to get her going again. Her neighborhood is a hotbed of "no-treatment" beekeepers who each year lose their bees and then wonder why. I'm confident that this time Megan will be both vigilant and pro-active.

Of course I have the same mite problem with my billionaire's bees, since they're in that same mite-pandemic bee community. Last year I had to hit them with repeated treatments, as they got Varroa-bombed time and again. But they made a lot of honey, so maybe it was a tradeoff.

I explained to Megan that I'm basically out of the nuc-selling business. She understands my concerns. – I sell bees to folks who don't take care of them, and in so doing, I contribute to the Varroa pandemic – and murder my bees. Her take is a little different. She argues that I need to "meet people where they are." I get this. I was as green as grass once, too, and I got devastated by mites not once but twice. I got up and jumped into the ring again, wiser each time, and more devoted. So maybe Megan has a point.

If you own bees, and you like to keep them alive, you might check out Tina's three-year Journeyman Master Beekeeper program, at **Coloradobeekeepers.org/education-information-and-applications/**. You don't have to live in Colorado to enroll and learn a lot. You can sign up anytime. You do have to convince Tina you're a sufficiently experienced beekeeper. If you pass muster, she'll send you the secret password. You might be able to fudge a little on your application, but not a lot. You'll discover your classmates are pretty sharp! Once you're in, you can take online classes, learn from stimulating speakers like Dewey Caron, Katie Lee, and Dave Tarpy; go to bee camps; do self-directed studies; make new beekeeping friends, and hang out with Tina. You can aim for your degree and the gold-anodized hive tool, or you could go the no-credit route and simply use this as an opportunity and an inspiration to learn more about your little darlings.

And if complete Tina's course, I'll tell you one thing for sure. I'd sell you some bees.

Ed **Colby**

All About Women