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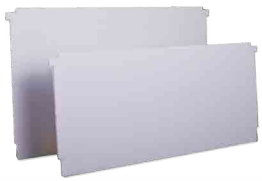

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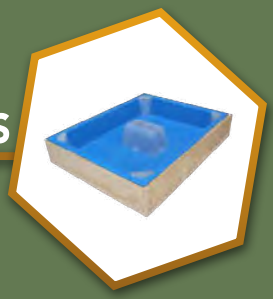

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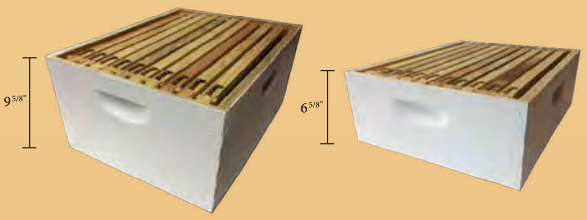

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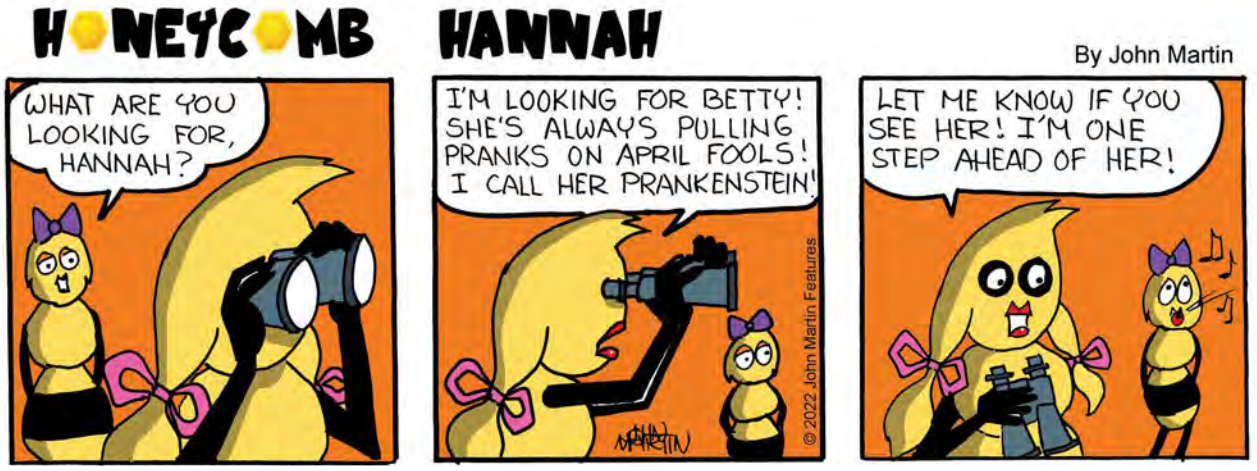

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Epipen

As both a beekeeper who developed an allergy to honey bee venom and also as a recently retired pharmacist, I'm very aware on both a personal and a professional level that the price of epinephrine autoinjectors has skyrocketed in recent years. I read Ross Conrad's "Epipen" article (November 2021) with great interest.

I truly believe that most businesses start out with a mutually beneficial business plan: they will provide goods or services for which they will receive money. Everyone wins. The customers acquire something they want or need and the business gets an income. Starting a business is not for the faint of heart. It's a lot of work.

Sadly, though, some companies seem to get so wrapped up in succeeding, in doing everything that they can to increase their income, that they lose sight of their original mission. It's almost like gaming and getting as many "points" (dollars in their case) as possible, even if they're way ahead.

So, while we might debate their motives–self-interest versus better patient outcomes–for requiring patients to buy two autoinjectors at a time, it's actually the correct thing to do. The effect of an epinephrine autoinjector ranges from five to twenty minutes. If medical care can't get to you or you can't get to medical care in that period of time, that second autoinjector could mean the difference between life and death.

Big Pharma may be right for the wrong reason, but I'd bet my bottom dollar that they've saved lives by packaging autoinjectors in twin-packs. Every beekeeper should have some on hand, too, even if they're not allergic. I wasn't initially, either.

Marguerite Weiner
Upton, MA

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Almonds

As others have pointed out, some of the almond varieties touted as self-pollinating are self-fruitful (will set an almond with their own pollen) but are not self-pollinating (some bees are still needed for optimum pollen movement from anthers to stigmas). Most commercial prune varieties in CA are self-fruitful, but some prune growers rent bees (some don't because they are concerned about setting too many prunes that don't reach optimum marketing size). Prune bloom fills a nice niche between almond bloom and citrus bloom in CA for bees; prune bloom maintains or increases bee populations in colonies after almond bloom, which allows those colonies to maximize orange honey production (almonds bloom in late February, prunes bloom in March, citrus in April: for some CA beekeepers, orange honey is the only honey crop they will make all year). Beekeepers used to charge prune growers for bees (at relatively low rates compared to almonds); now some prune growers don't want free bees (freebies) in or near their orchards; some beekeepers now pay prune growers (sometimes a few cases of honey) for their sites during bloom.

To set a prune (or almond) in self-fertile varieties, pollen must still be transferred from a flower's pollen-laden anthers to the female stigma on the same flower, a distance of a millimeter or two (an infinitely easier chore than transferring pollen from another tree, maybe 20 feet away). For most prune (and almond) varieties, the stigma is located slightly above the anthers (nature's way of making self-pollination, which could give rise to less hardy offspring, more difficult). Self-pollinating almond (and prune) varieties could be bred by breeding for flowers that had their stigmas at the same level (or slightly below) the anthers, which could allow a slight breeze to easily move the pollen to the target (stigma). No bees are needed; There may be current work on developing such varieties.

If one is an optimist or a pessimist, depending on which side you are on (almond grower or beekeeper), one could envision a future California where all almond trees are both self-fertile and self-pollinating. Since almonds bloom in the Winter, a time when vital pollen is in very short supply in CA, one could imagine beekeepers paying almond growers a modest fee for the privilege of placing bees in or near their orchards. And almond growers who believed that bees robbed their trees (by stealing nectar from their flowers) of vital carbohydrates that could be needed by their developing crop, could place signs around their orchards: NO BEE ZONE! (trespassing hives will be removed).

The Almond Board likely has figures of the % of self-fruitful almond varieties currently planted in CA. I saw some recently, I'm guessing 8%; for bearing acreage; slightly more for non-bearing acreage.

To my knowledge, there are no self-pollinating almond trees in California (yet).

Joe Traynor

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Honey Bee Health

Have there been any studies regarding honey bee health and industrial wind projects? I've read that they emit infrasound but not sure about electromagnetic fields and any effect on honey bees. Wind farms are springing up all over rural America much to the detriment to humans and livestock. Don't imagine they're good for pollinators either.

Diane Forristall

Hi Diane,
I am not aware of any studies that have looked at the impacts of industrial wind projects on pollinators. Due to their scale, industrial projects of any kind will tend to have negative impacts. While bees seem to only hear sounds at close range and feel vibrations more than hear sounds, I imagine that the three phase power lines that transport the electricity generated by electrical wind generation projects is probably more of an issue for bees than the wind turbines themselves. But that

is just a guess and a hope. I don't think that anyone really knows the full and complete answer to your question.
Ross Conrad

• • • • • • • • • • • • • • •

Varroa

I have been thinking since our communications about a subject that I believe you are passionate about. The idea many beekeepers have about *Varroa* treatment is that if a particular treatment worked (lowered mite levels below the threshold) then it should work the next time said treatment is applied. Which is of course, not true at all but they wish it to be and therefore believe it is. That said I personally experienced having a treatment that worked well in 2020 but failed miserably last year. After I removed my honey I did an alcohol wash on about 30% of my colonies around the third week of July and high mite numbers required treatment. I treated with Apiguard and after the treatment period I did another wash to confirm that I had controlled the mite population. To my surprise and without exception the mite numbers had risen and as you can see in the image (sample of what I saw in all colonies) in some colonies numbers doubled. I immediately treated with an Amitraz based treatment. After that treatment I checked (see 9-9 date in image above) and numbers were in the low single digits and as low as zero. The take away is, what if I had not sampled after treatment and just assumed that the treatment would work as it did in the past? It's obvious I would have lost a lot of colonies by now if I had not followed up.

In conclusion I don't know why the Apiguard didn't work in 2021 like it did in 2020 but I can only theorize that maybe the extremely hot temperatures we experienced during that time caused the Apiguard to vaporize too quickly. Thought you might be interested.
Charlie

Hello Charlie.
You are 100% correct! There are no consistent Varroa *treatments that I know of because of growing resistance issues, temperature, humidity,* varroa *bombs etc. And then we have the collateral damage to honey bees from treatments in trying to kill a little bug on a big bug. Then add in the increasing growth of even more stress damage that encourages Nosema, SHB, AEB, AFB, PMS and on and on. Never assume (you know what happens when you assume… you make an ass of u and me) that any treatment you use works until you sample again after the labelled treatment period.*
Sample (regularly)… Treat… Sample Again.
Thank you so much for sharing Charlie!
Jerry

- 7-21-21
- Notice the dramatic increase in mite population in this colony.
- What would have happened if I had assumed everything was good because I had treated.

Small Hive Beetles

Small hive beetles are so well established here in Missouri that the days of smashing a few runners with a hive tool are over. I decided to give my portable vacuum a try. I made a ¼" screen cover for the nozzle to keep bees from being sucked in. Beetles are fast so I have the vacuum running before I open the hive. Once open, I vacuum them up. Back at the house I put the vacuum in the deep freeze overnight to kill the beetles.
Robert F. Zack

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NEXT MONTH

Region 1
- Add supers as needed
- Check for queen cells/swarming
- Make splits
- Alcohol wash mite check
- Catch up on reading *Bee Culture*
- Pray for a good May and June
- Add space in brood box to prevent swarming
- Start raising Queens
- Remove dead outs
- Feed new packages

Region 2
- Make splits
- Add supers
- Remove comb older than three years
- Swarm prevention
- Do complete inspection of colonies
- Reverse hive bodies
- Check queen laying
- Alcohol mite wash / treat if over 3 per 100 bees
- Go to bee meeting
- Move hives to pollination

Region 3
- Move bees out of suburb
- Alcohol sample for mites
- Install more supers
- Check colonies for swarming
- Provide water source as it gets hotter
- Sample for SHB population
- Equalize colonies

Region 4
- Get woodenware ready
- Have supers and frames/ foundation ready
- Super, super, super
- Equalize colonies
- Prevent swarming
- Make room, make room
- Powdered sugar mite treatment on packages before installation
- Here we go!!!
- Requeen

Region 5
- Sample for *Varroa* (alcohol wash)
- Hive inspection for queen and healthy brood
- Move colonies to better flower source
- Super as needed
- Mite control if sample indicates
- Reverse hive bodies
- Check for swarm cells
- Split strong hives

Region 6
- Spring has sprung!
- Add supers
- Check queen laying pattern
- Requeen if necessary
- Inspect for swarm cells
- Check brood pattern
- Split strong colonies

Region 7
- Split
- Add supers
- Mite alcohol sample, treat if needed
- Make nucs
- Requeen
- Inspect for swarm cells
- Equalize colonies
- Make it stop raining!

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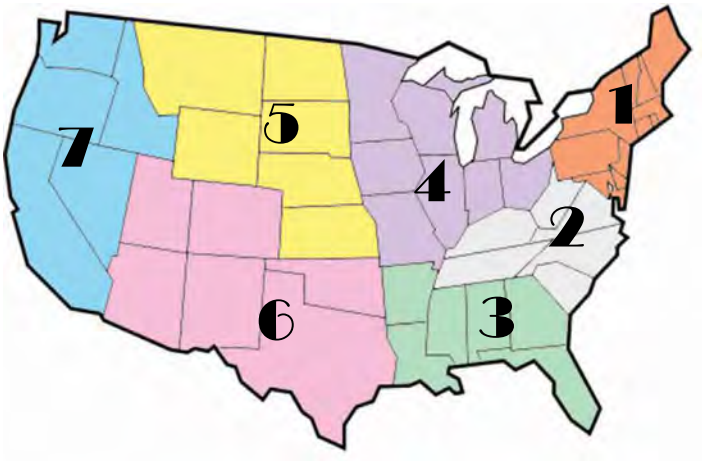


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	REPORTING REGIONS							SUMMARY			History	
	1	2	3	4	5	6	7	Range	Avg.	$/lb	Last Month	Last Year
EXTRACTED HONEY PRICES SOLD BULK TO PACKERS OR PROCESSORS												
55 Gal. Drum, Light	2.67	2.30	2.50	6.91	2.68	3.16	2.55	2.00-29.17	3.75	3.75	3.39	2.10
55 Gal. Drum, Ambr	2.47	2.26	2.25	6.23	2.35	3.14	2.50	1.90-29.17	3.66	3.66	3.10	2.12
60# Light (retail)	230.96	207.55	221.00	195.44	235.00	198.24	225.60	120.00-330.00	215.64	3.59	215.58	206.01
60# Amber (retail)	225.00	214.44	221.00	195.39	230.00	186.69	221.60	120.00-310.00	213.12	3.55	213.34	197.92
WHOLESALE PRICES SOLD TO STORES OR DISTRIBUTORS IN CASE LOTS												
1/2# 24/case	103.56	95.25	96.00	84.96	151.20	96.00	-	67.20-200.00	100.09	8.34	102.75	93.49
1# 24/case	161.17	200.16	100.00	121.47	193.30	96.92	144.00	45.00-325.00	149.32	6.22	145.14	144.57
2# 12/case	152.97	264.00	128.00	110.07	-	108.00	156.00	84.00-300.00	141.80	5.91	147.75	126.64
12.oz. Plas. 24/cs	129.27	159.90	103.50	96.76	126.84	107.88	108.00	72.00-250.00	118.51	6.58	116.61	105.52
5# 6/case	166.30	229.05	-	120.85	-	115.00	-	90.00-330.00	156.92	5.23	154.41	143.54
Quarts 12/case	208.67	207.83	132.00	138.42	196.08	158.34	190.00	70.92-330.00	182.83	5.08	175.19	170.66
Pints 12/case	111.50	128.00	72.00	91.37	122.33	98.00	108.00	60.00-180.00	106.15	5.90	100.71	96.63
RETAIL SHELF PRICES												
1/2#	6.15	5.81	5.00	5.34	5.12	4.00	-	2.99-10.00	5.78	11.56	5.97	5.49
12 oz. Plastic	7.53	7.01	6.99	6.68	5.83	5.44	5.90	4.19-12.00	6.94	9.25	6.88	6.48
1# Glass/Plastic	9.57	9.71	9.61	8.26	8.26	6.99	9.00	5.69-18.00	9.15	9.15	8.89	8.74
2# Glass/Plastic	16.09	16.07	18.00	14.77	14.09	9.97	15.50	7.00-30.00	15.55	7.78	15.78	14.82
Pint	12.86	11.10	9.48	11.23	11.75	9.63	11.80	6.21-22.00	11.54	7.69	10.93	10.88
Quart	24.00	21.08	18.75	19.04	21.00	15.67	19.80	11.00-42.00	20.75	6.92	19.95	19.09
5# Glass/Plastic	34.60	36.20	46.75	28.18	32.16	21.50	-	18.00-60.00	33.53	6.71	31.88	33.62
1# Cream	12.36	10.70	-	10.86	10.42	10.00	14.00	7.95-24.00	11.65	11.65	11.46	9.75
1# Cut Comb	14.55	12.16	15.00	14.14	10.00	-	-	8.00-26.00	14.65	14.65	14.11	12.55
Ross Round	13.06	10.12	-	12.25	-	-	13.75	6.50-20.00	12.26	16.35	12.95	11.91
Wholesale Wax (Lt)	9.46	6.82	8.25	8.27	9.73	4.50	7.70	3.00-18.00	8.32	-	8.36	6.79
Wholesale Wax (Dk)	7.60	6.32	5.75	6.25	6.20	3.50	5.00	3.00-15.00	6.47	-	6.55	5.52
Pollination Fee/Col.	91.25	73.00	-	136.67	90.00	-	109.75	50.00-225.00	99.04	-	101.41	98.42

Please note: anywhere within each region that there is a '-' it is because no information was sent to us for that specific item in that region.

STUDY HALL

QUESTION

#1 One of my hives died out. A pile of dead bees appeared outside of the hive entrance. The bees were mostly in pieces, just pieces of bees. I couldn't see any tracks of animals around the area. Why were the bees in pieces?

#2 I recently saw an article about beekeepers who got rid of 'mites' by feeding sugar syrup with salt and dried chamomile flowers in it. I found an article from *Bee Culture* in 2003 that says it works. Do you have any information on this?
Sam Kanagy

ANSWER

Thank you for the questions Sam.

One of the predators of honey bees is the **PYGMY SHREW (SCIENTIFIC NAME *SOREX MINUTUS*).** The pygmy shrew is a very common problem for overwintering honey bee colonies. Most beekeepers are unaware of the potential hazard their presence may be or mistake them for the much less harmful common yard mouse.

A pygmy shrew is a very small mammal with a markedly pointed snout. They average 1½ inch body length with a 1¼ inch tail. Their average weight is 0.105 ounces. They are able to go through a hole less than 0.393 inches.

Shrews are insectivores feeding on insects, arachnids, woodlice, and in cold climates like Canada, they specialize feeding on honey bees during Winter.

Shrews are as fast as they are small. Their heart rate and respiratory rate of 800 beats per minute is maintained by consuming 125% of their own body weight daily.

The method of feeding on wintering colonies is by grabbing a cold sluggish bee from the outside of the cluster and then taking it to a feeding place either in the back of the hive away from the cluster or in the wrapping material.

Shrews target the thorax by removing the head or entering through the top making a large hole hollowing out the thorax. They may also consume some of the exoskeleton leaving what looks like dirt (wings, legs and bit of the abdomen).

With shrews weighing about 0.105 ounces and requiring 125% of their body weight in food per day, they may consume over one pound of bees in 120 days of Winter.

The article from almost 20 years ago in *Bee Culture* and salt being a possible *Varroa* control has been disproven. Trying to kill a little bug (*Varroa*) on a Big Bug is hard to do without hurting the Big Bug. The best resources for *Varroa* control is the Tools for *Varroa* Mangement Guide from the Honey Bee Health Coalition. Go to; **https://honeybeehealthcoalition.org/wp-content/uploads/2018/06/HBHC-Guide_Varroa_Interactive_7thEdition_June2018.pdf** and get your 'free' copy.

QUESTION

My business partner and I were having a debate about the ethics of queenless hives during pollination. I'm curious if you could lend some expertise to the conversation?

Let's say you have two 5-6 frame colonies. One is queen right and one is queenless (or with a failing Queen). I would argue that the queenless hive is as much of a pollinator unit as the queen right hive for these three reasons:

1. In a queenless hive you have zero brood so almost the entire six frames of bees are available to forage rather than tend to hive housekeeping and brood rearing responsibilities.
2. You generally have a much older population of bees in a queenless hive. As we know the final stage of the bees lifecycle is foraging, so again nearly all six frames of bees would be foragers in the queenless hive. In contrast the queenless hive would likely have one or two frames of young nurse bees who haven't yet reached the foraging stage of their lifecycle.
3. My own observations are that queenless hives are often the most plugged out with honey and pollen. This indicates that indeed they are effective foragers.

Thoughts?
Jason

ANSWER

The ultimate question is if you are a honey bee colony and there is at some point no brood to feed directly by nurse bees and stored bee bread, why put that amount of energy into this activity of collecting pollen? As an example, when we had small children, our grocery list and quantity of food was different than it is now. No developing children to feed now.

Back in the day, I remember a honey producer in the Midwest who, during a significant bloom period for soybeans, would cage the queens. The colony would collect more nectar now, and his crop would be larger and more valuable.

There is a lot of anecdotal evidence that honey bees with little brood to feed don't have a biological need of collecting pollen. But, no researcher has ever done a field trial on this as far as I know.

QUESTION

Hi Jerry,

I am back in beekeeping after a decade away, and quite excited about it. I subscribed to *Bee Culture* again a few months ago, and have been enjoying the magazine a lot.

I feel like I have no window into the management practices of successful operations through either *Bee Culture* or *ABJ*. The science bent is valuable, but I would like to see how that gets translated into practical management applications on successful operations.

As I have gotten back into beekeeping, I have immersed myself deep in research, trying to understand what defines successful beekeeping businesses, and what the common management practices are among them. I soon learned there are two distinct groups of beekeepers. Those who usually have bees to sell every

From The Editor —

year, and those who frequently need to buy bees every year. I want to learn from the former, and I care more about their perspectives than the latter.

I am not observing any journalism where successful operations are being showcased, either in an online format or in the publications. Have I missed it, or is this an area of opportunity?

Thank you!
John Kempf

ANSWER

Not to be a pain but please define 'success.' At what level is success considered success? Can a commercial beekeeper keep losses around 30%...yes. Is that success? Or in an example a business operation taking bees to a warm part of the country, providing lots of nutritionally incomplete food, treating with toxic chemicals every 10 days, re-queening every 90-120 days and then selling what has been forced honey bee production as nucs or packages, that 50% have to be requeened or *varroa* kills them or the *Varroa*/Virus complex takes over. Is that success? I could go on and on.

All that to say in my humble experience it is all about beekeeper consistent informed management for the *Varroa*/Virus Complex, and all the diseases that take advantage of honey bees with compromised immune systems and collateral damage from *varroa* controls.

There is no great checklist other than the information from the Honey Bee Health Coalition, HBHC, **https://honeybeehealthcoalition.org/** Go here and at the top, click on resources.

Thanks for the great question and sorry for my realistic but perhaps pessimistic answer.

QUESTION

I want to point out to you that there is an assertion made in a 'Catch the Buzz' daily email blast titled "Almonds Without Bees" that is simply not true. It states:

"In return the beekeepers tend to get hives back bubbling over with bees and new brood as almonds are said to be a "complete" nutritional resource for managed bee colonies. "

It is a well proven fact that monoculture agriculture does not provide a complete nutritional resource for bees. Bees need a variety of pollen in order to stay healthy, **as has been published by numerous articles in your own magazine**.

I hope you will print a retraction of that because it is patently a false statement, put out at **www.almonds.com**. I expect better of a magazine that is supposed to be for beekeepers and is supposed to publish factual articles. If we can't trust your magazine to proof read articles for accuracy, why should we bother to subscribe?
Elizabeth

ANSWER

You may be right or you may be wrong but remember that I do not write anything in Catch the Buzz. Catch the Buzz is not *Bee Culture* magazine. Catch the Buzz is a daily email blast to share all sorts of different ideas, opinions and direction in our industry from independent sources. The shared information in Catch the Buzz is from other publications that I get permission to re-print to share, right or wrong, and bring info to readers so they can move their thoughts forward.

If you look at the very bottom of that Catch the Buzz you will see this.... To read the whole article go to: **4,000 pounds of almonds without bees? It can be done (farmprogress.com).**

I would encourage you to share your thoughts with them.

Thank you for reading Catch the Buzz. Thank you for contacting me at *Bee Culture*. Now, advance your thought with Farm Progress.

Stay safe and well.

QUESTION

I read a recent article you wrote regarding oxalic acid usage for *varroa* mites.

We run a 2000 colony operation and have used oxalic acid for about 15 years now. We are located in upstate NY and would predominantly use the dribble or "drizzle" method in December or early January, weather permitting.

I always heard as well as observed that the dribble method was hard on the bees...that the OA solution would burn eyes and the exoskeleton. It should only be used one time when broodless.

The last four years or so we have mainly been using OA vapor with the pro vap 110. In my experience, it seems to work as well but be much less harsh on the bees, especially since they don't have to dry off. I know we always had good mite reduction using the dribble method, but it seemed to be too hard on the bees. I thought vaporization could be done repeatedly if necessary with no ill effects on the bees.

I believe your article states that OA vaporization is very hard on the bees as well. Can you give me sources for that information? Any information would be helpful.

Thank you for your time.
Ben

ANSWER

I am glad you are having confidence in OA with *varroa* control. But....nothing is perfect and there is collateral damage with use of anything.

As an example if you watch any TV there will be ads for 'medications' for us humans. At some point in the ad there will be a very fast talking announcer telling us all the bad things that could happen to us because of use, all the while on the screen showing happy smiling people.

You have a great weekend. BG

Sources for Ben's Question

https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5620704/ 'Effects of Oxalic Acid on Apis mellifera'

Terpin, B., Perkins, D., Richter, S. et al. A scientific note on the effect of oxalic acid on honey bee larvae. Apidologie, 50, 363–368 (2019).

https://link.springer.com/article/10.1007%2Fs13592-011-0102-0 Sublethal Effects of oxalic Acid on Apis mellifera: changes in behavior and longevity'

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https://hal.archives-ouvertes.fr/hal-00891844/ Cell death in honey bee larvae treated with oxalic or formic acid'

https://www.researchgate.net/profile/Erik-Tihelka/publication/328200942_Effects_of_synthetic_and_organic_acaricides_on_honey_bee_health_A_review/links/5bc24d02a6fdcc2c91fb762d/Effects-of-synthetic-and-organic-acaricides-on-honey-bee-health-A-review.pdf

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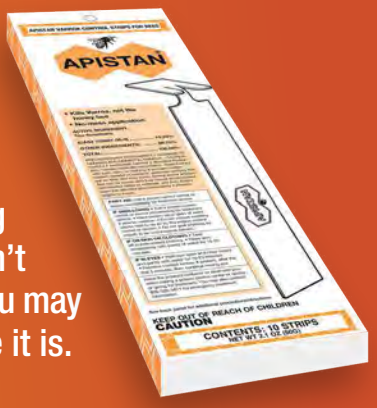

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Obituary

Bruce Bell made a huge impact in the beekeeping community of Southwest Colorado. When word got out that he had passed away on November 18, 2021, the notes of thanks for his life came pouring in. He had a passion for bees that got many, many people started in beekeeping, and was always generous with his time. He spent countless hours helping people with their bees. He was important in the regional bee club as a mentor to its founder and though he always sat in the back row, with his experience, wisdom, and advice he was the mainstay of the club. He loved (and hated) doing bee removals and taught a couple of us everything we know about this challenging job. He loved to joke about those occasional mean colonies that he "needed Teflon underwear" to get through. He was a fantastic storyteller, and his beekeeping stories helped us learn what to do, and what not to do, when we came to the same situation.

He told a story about a bee getting inside his veil one day. Normally not a big deal, so he decided he would ignore her and let the girl out when he finished his job. This particular day, though, the bee went up his nose. Not expecting this after 40 years of keeping bees, he didn't have a plan, so he did the first thing that crossed his mind. He crushed the bee inside his nose. She stung him, of course, making his "nose pour snot and eyes run with water." He was laughing at himself for not thinking to put his finger against the other nostril and blow her out. It wasn't but a little while later that this exact thing happened to me, but thanks to Bruce, the bee and I both survived unscathed.

Bruce lived his whole life with the energy and enthusiasm that he poured into his bees. He never hesitated to try new things, and if he loved it, he gave it his all. He lived a very full life in his 74 years. He was born on April 26th, 1947 to LaRue Reck and was then adopted by Charles and Frances Bell. They lived in Iowa where he enjoyed time on the farm with his cousins. When he was 14, they moved to Arizona where he graduated from high school in Prescott in 1965. After school, he joined the army and felt very blessed to be stationed in Alaska instead of Vietnam. He married Rose, and they had four children, the oldest dying at age six.

After getting out of the service, he moved his young family to Arizona where he became the youngest state patrol officer at the age of 21. He had some great stories from this time, one involving a coffin flying off a hearse and causing an accident. Later, he worked as a deputy sheriff and in construction, which is what brought him to Durango, Colorado, where he helped tear down the old Graden Feed Mill where a fancy hotel now stands. He owned BC towing (more great stories) and the trailer park near the local drive-in. He worked as a volunteer firefighter and ran for sheriff in 1986.

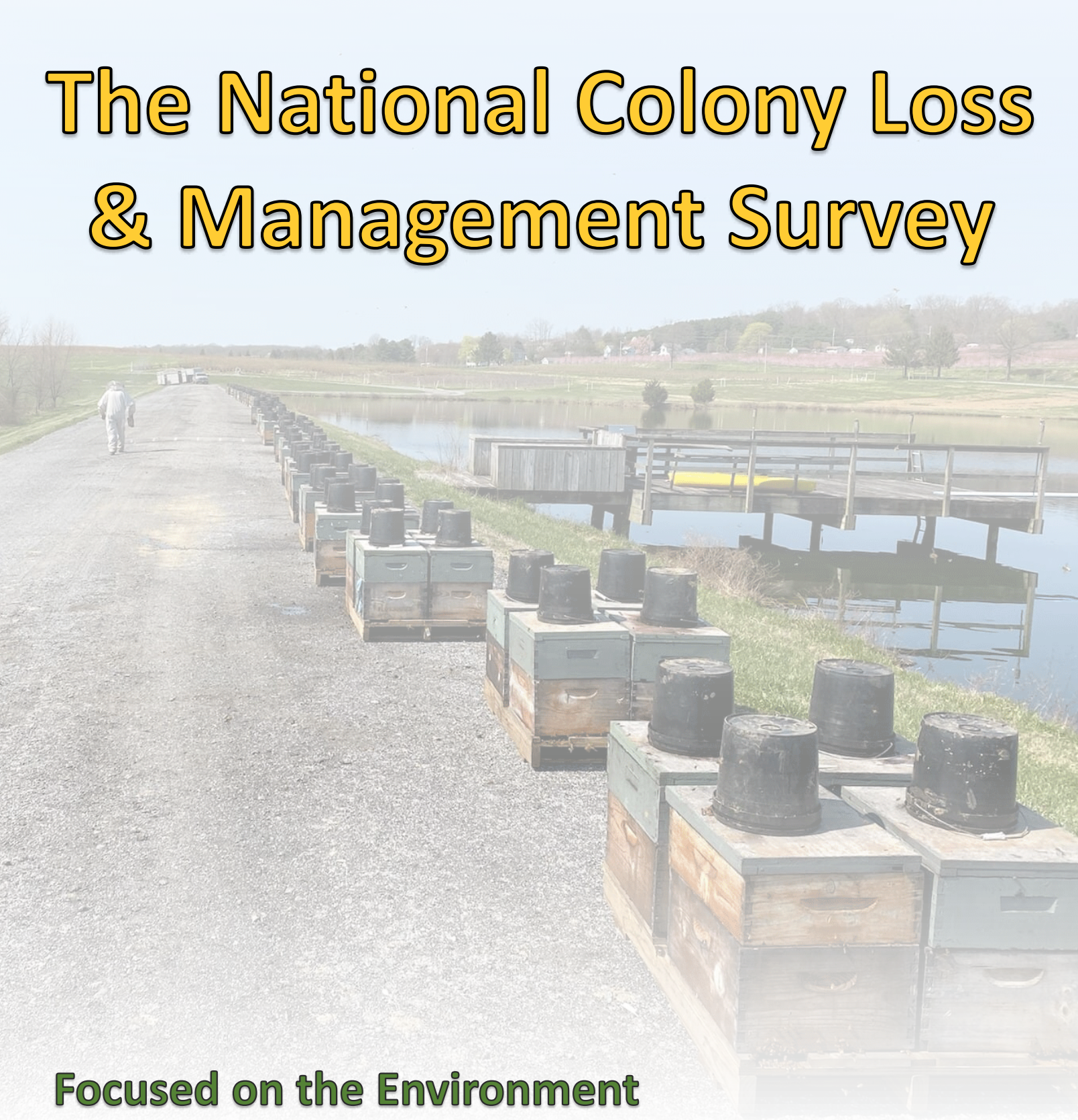
In 1987, he married Rita Robbins and they took over running her dad's cattle ranch until 1993. Bruce and Rita learned to dive and sail, and they sold everything and bought a sailboat that they called home for eleven years. Rita worked as a traveling nurse while Bruce picked up odd jobs. He worked as a taxi driver in the Florida Keys without a driver's license (Bruce was not a conformist), as a DJ, security guard, or whatever came along that interested him, and made many friends along the way.

During shoulder surgery in 1987, Bruce's heart stopped, and this motivated him to find his birth mother, which he eventually did. He really enjoyed getting to know his mother, three half-sisters, and six cousins, though he remained deeply thankful for his adoptive parents. In 2004, when Bruce was diagnosed with cardiomyopathy from damage caused by a virus, they sold the boat and came back to Durango. He was given six months to live and felt so thankful for every extra minute since then. He wasn't able to get a heart transplant, and thereafter was unable to do a lot of the things he had done before. He still lived life with joy, and was always interested in something new. He loved farming, raising a lot of his own food, and his bees, and had a team of draft horses that he enjoyed driving with his wagon down to get ice cream in town.

Bruce was diagnosed with bladder cancer in 2016, and due to his heart condition, treatment options were limited. They didn't give him much hope. He had the tumors scraped out four times, and he did natural treatments. He was cancer-free for the last three years. He never stopped trying to get the most out of life, even during the last six months when he was having so much more trouble with his heart and respiration. He donated his body to science.

Happily for us, he had put his faith in Jesus and was baptized in 1986, so we who are saved will get to see him again. He and Rita realized Bible truth together in the Seventh Day Adventist Church and made many great friends there, where he will be sorely missed. He was a deacon. We look forward to seeing him soon, and in the meantime his legacy lives on in Southwestern Colorado. He is survived by his wife Rita, five children and multiple grandchildren. Those who knew him can come help us celebrate his life on his farm on April 30th. BC

The National Colony Loss & Management Survey



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Jay **Evans**, USDA Beltsville Bee Lab

Having honed my endurance by watching dozens of Winter Olympic events (who knew curling was so TV-friendly and intense?), this month I am ready to tackle not a couple but 17 new works: specifically, a compilation by members of the American Association of Professional Apiculturists (comprised of Apiary Inspectors, researchers and educators who work with honey bees, along with a few passionate beekeepers, **https://aapa.cyberbee.net/**). The AAPA joins one of the two major national bee industry meetings each year via their American Bee Research Conference (the results of which have been presented in *Bee Culture* this month and last) and every few years officers of the AAPA collect and edit a series of peer-reviewed papers from our field. This time, Drs. Michael Simone-Finstrom (USDA-ARS), Hongmei Li-Byarlay (Central State University) and Margarita M. López-Uribe (Penn State University) edited papers for two rounds in the freely available *Journal of Insect Science* (**https://academic.oup.com/jinsectscience/issue/21/6** and **https://academic.oup.com/jinsectscience/issue/22/1**). This Special Collection "Honey Bee Research in the United States: Investigating Fundamental and Applied Aspects of Honey Bee Biology" truly has something for everyone.

For those interested in bee disease, four works tackle *Varroa* mites. *Bee Culture* writer and scientist Jennifer Berry and colleagues from the University of Georgia and Auburn University show the good and the bad of repeated mid-season oxalic acid treatments (in this case by vaporization; **https://doi.org/10.1093/jisesa/ieab089**). Quite ambitiously, they treated colonies every five days, seven times in a row, in the middle of Georgia and Alabama Summers. This held mite levels in check in treated colonies while, in two of three years, untreated colonies showed the predicted seasonal mite increases. Overall, the 'percent mite intensity' (mite counts per 100 bees) differed by five mites in treated versus untreated colonies, almost entirely due to increases in the latter. Colonies themselves survived the aggressive treatment regime fine and in one trial the treated colonies showed a trend toward having more food stores. No word yet on how colonies with diminished mites fared during late-season and Winter challenges.

Cameron Jack and Jamie Ellis (University of Florida) reviewed the available integrated pest management (IPM) strategies for *Varroa* in the U.S. (**https://doi.org/10.1093/jisesa/ieab058**). They started by defining the mite levels that result in unacceptable injury and economic damage to honey bees and beekeepers, respectively. Prior to that are thresholds for management action. In general, the ethic of IPM is to avoid risk altogether by breeding or isolation, monitor often, and then apply gradually more and more aggressive control methods when mite impacts are imminent. The authors covered the latest recommendations on mite counts, available controls, and available bee stock that might help delate or avert escalation.

Kate Ihle and USDA-ARS colleagues tackled a potential form of mite resistance to *Varroa.* They label social apoptosis, namely a tendency for parasitized brood to give up and die when capped, perhaps sealing the fate of their mite parasites (**https://doi.org/10.1093/jisesa/ieab087**). They found some differences in this tendency across different bee lines and also a striking effect of the colony environment. By rearing brood from

egg to sealed brood in common colonies, they showed that bees raised in colonies with high mite loads tended to die at higher rates.

Finally, Taylor Reams and Juliana Rangel review the state of knowledge for mite genetics and behavior (**https://doi.org/10.1093/jisesa/ieab101**). To explore diagnostic tools for European foulbrood, Meghan Milbrath and colleagues at Michigan State University and USDA-ARS (including myself) pitted three diagnostics based on microscopy, genetics, and a commercial antibody test against each other (**https://doi.org/10.1093/jisesa/ieab075**). For 77 cases of true EFB, and nearly 400 larvae, all three methods behaved similarly.

Several authors focused on the stresses faced by bees in managed farmlands. Dylan Ricke and colleagues from the Ohio State University measured the effects of agrochemicals on honey bee queen development (**https://doi.org/10.1093/jisesa/ieab074**). The insect growth regulator diflubenzuron was especially damaging, reducing queen survival to adulthood by more than 80% when presented in pollen at field-relevant levels. This paper also provides critical data for the persistence of chemicals and adjuvants from pollen to royal jelly to developing bees.

Bradley Ohlinger and colleagues at Virginia Tech University looked at the impacts of sugar syrup laced with 26 parts per billion of imidacloprid on foraging and recruiting (**https://doi.org/10.1093/jisesa/ieab095**). Foraging trips decreased by a third, a significant result, while there were trends toward reduced dancing by returning bees to direct their sisters to food.

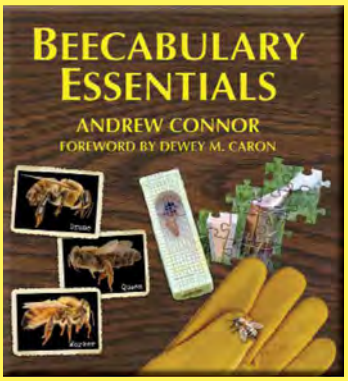
Arathi Sehadri and Elisa Bernklau (USDA-ARS) found that plant chemicals found in nectar and pollen can interact with a common insecticide, thiamethoxam, to either increase or decrease risk to honey bees, depending on conditions (**https://doi.org/10.1093/jisesa/ieab053**). Michael Simone-Finstrom and colleagues described the impacts of local bee colony transport on stress genes and disease agents in bees (**https://doi.org/10.1093/jisesa/ieab096**). These are hard experiments because bees on the move face different foods than those left behind. Here, through a clever use of bee-swapping after

migration they were able to decouple in-move stress versus lasting effects and did see some minor changes in pathogens for both. As someone who has puzzled for years over the web of microbes in bees and their importance, this paper also offers a strong look at how microbes and bee traits like immunity relate to each other. To add layers to that complexity, in a provocative but hard read for many of us, Maggie Shanahan from the University of Minnesota presents the case that we are missing the forest for the trees (**https://doi.org/10.1093/jisesa/ieab090**). With some tough-love for both researchers and the beekeepers we support and respect, she argues for a major upheaval of current practices. She is an excellent writer and this essay provides food for thought and thought for food.

No compendium of bee science is complete without some love for reproduction and this batch has several papers on this topic. Sarah Lange and colleagues from Louisiana State University and USDA-ARS shed light on how treating or 'priming' a queen might lead to better immunity for her thousands of offspring (**https://doi.org/10.1093/jisesa/ieac001**). I described some early evidence for this in *Bee Culture* in 2017 (**https://www.beeculture.com/found-in-translation-3/**) and it remains a hot topic today. By carefully exposing queens to a virus either through oral exposure or through the fluids used in instrumental insemination, Lang and colleagues found evidence in one trial that consequent offspring (from nine queens treated via insemination fluids) were indeed less prone to virus infection. Regrettably, in round two of the same experiment 'primed' queens produced MORE vulnerable offspring. In both cases the results, yeah or nay, were significant, suggesting that bee genetics or underlying infections affect the outcome…not quite ready for prime time but exciting nonetheless.

Also exciting are new ways for bee breeders to improve their selection routines. Kaira Wagoner from the University of North Carolina-Greensboro, with longtime leaders in bee behavior and hygienics, described a brand-new assay for identifying hygienic stock (**https://doi.org/10.1093/jisesa/ieab064**). Using a cocktail of smells released by stressed bee larvae, they vetted colonies for the tendencies of worker bees to identify and clean out parasitized sisters. The assay, based on 'Unhealthy Brood Odor' (UBO), held up well against the freeze-killed brood assay, is safer for humans, and relies on only a tiny circle of brood. Stay tuned as Dr. Wagoner and team develop this into a package breeders can acquire and use. For now, just remember that if UBO, then UBD (you be dead).

Bradley Metz and colleagues from North Carolina State University and Mississippi State University present an analysis showing exactly how nurse bees react to these types of smells (**https://doi.org/10.1093/jisesa/ieab085**). With significantly less stress (being blocked from receiving food for four hours), developing larvae were able to attract a larger



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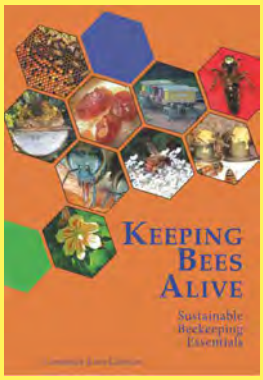

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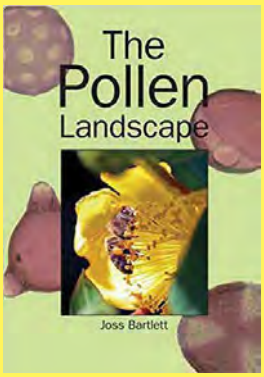

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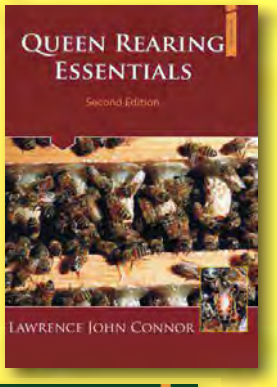

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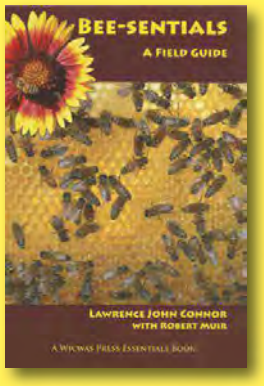

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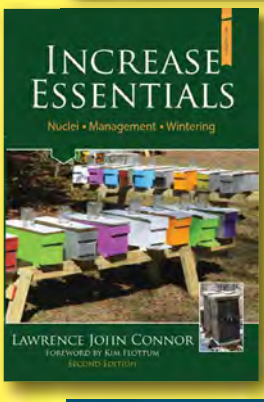

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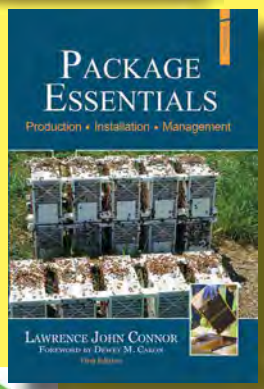

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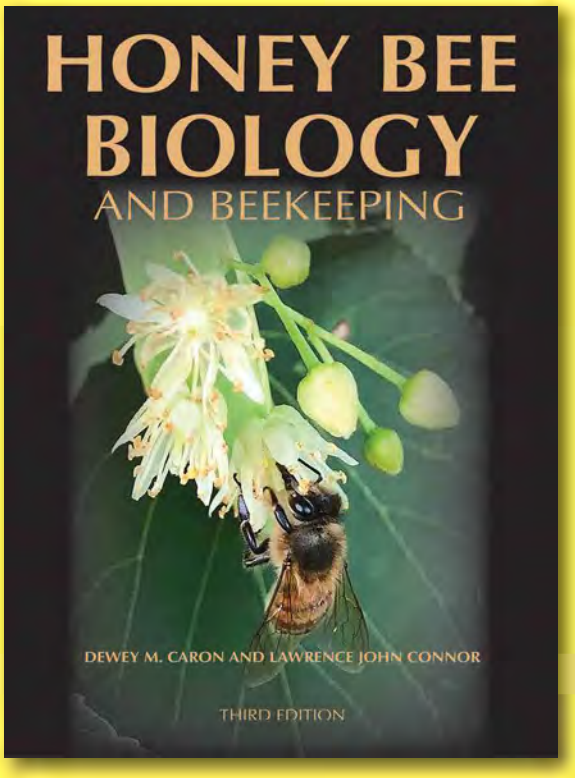

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crowd of attendant workers during the next hour. The researchers did not quite succeed at isolating this 'HBO' ('Hungry Bee Odor') at the chemistry level, but the result alone suggests a volatile or surface mix of chemicals does bring a helpful response. They also found that hunger cues isolated from deprived larvae can lead to greater pollen foraging at the colony level, a result with great practical and biological implications.

Males (drones) were not ignored in these articles, starting with a demonstration of the physiological stages of drone bee sex parts as they mature by Colby Klein and colleagues from the University of Saskatchewan, Canada (**https://doi.org/10.1093/jisesa/ieab064**). Along with confirming that drones take longer to mature in cooler Spring temperatures (a four-day difference between June and July), this paper gives a day-by-day 'expected' state for drone testes. This roadmap can be used in future studies aimed at the many biological, temperature, and chemical stresses that impact fragile males.

Next, Bradley Metz and David Tarpy from North Carolina State University gave an overview of drone quality for U.S. bees (**https://doi.org/10.1093/jisesa/ieab048**). They first generated a useful metric for good males by contrasting many measurements for drones reared in drone cells with those reared, atypically, in worker cells. As expected, drones reared in the right places looked better and performed better. This separation fed into statistics for what a healthy drone SHOULD look like when emerging from a drone cell. 2% of such drones actually fell into the worker-cell category, while 17% orfworker-cell drones came out ready to battle equally with drones reared in drone cells. They also compared drone quality across 19 operations and found substantial variation. As with their excellent work on queen quality, these tests were not designed to shame specific breeders but perhaps to guide them in ways to do better.

In another attempt to understand how genetic and environmental backgrounds favor survival in bees, Kilea Ward and colleagues from Central State University measured longevity of foraging worker bees plucked from traditional and feral colonies (**https://doi.org/10.1093/jisesa/ieac002**). Bees from feral colonies survived significantly longer when held in an incubator, while also showing more signs of oxidative stress. How they were able to tolerate that stress remains an open question.

Finally, for fascinating natural history, you should read Willard Robinson's story of the most bird-like bee, *Apis dorsata*, a species that moves miles and miles as a colony across the seasons, and in search of forage (**https://doi.org/10.1093/jisesa/ieab037**). These colonies move over 100 miles, apparently to the same spots, and he discusses the conundrum of who drives the return when surely most, if not all, workers die between migrations.

These papers reflect the passions of researchers to better understand our favorite insect and to use science to improve their survival. Reading these great works at once felt like doing a 17-stage beeathlon, so it's back to curling on the couch for now. BC

A Closer LOOK

Robbing Behavior

Clarence **Collison**

Honey bee robbing behavior may take two different forms.

Honey bee robbing behavior may take two different forms: stealing honey from hives that are unable to defend themselves during a nectar dearth, and collecting nectar from some flower species without making contact with the reproductive organs after carpenter bees have made slits in the flower petals (corolla). Robbing may also become involved in the transmission of *Varroa* mites and diseases between colonies. "When nectar sources are scarce or unavailable locally, honey bees are attracted by honey in neighboring hives. They make raids on hives that are unable to defend themselves and steal their honey or sugar syrup. Bees will never rob during a nectar flow as long as an abundance of nectar is available in the field. Robbing intensity depends upon the availability of natural sources of food, the more scarce or unavailable nectar becomes, the more the intensity of robbing increases. It is the strong colonies that make onslaughts on the weak ones or those that are poorly guarded (have few guards). The robber bees are the forager bees. They are after honey – they do not steal pollen. The tendency to rob varies with the race and strain. Italian bees are much more prone to rob than the brown or black races. Robbing may occur between colonies in one apiary or colonies of different apiaries. Sometimes it is possible to see several colonies in the apiary robbing one another simultaneously. Robbing behavior is usually more aggressive than normal and can develop into deadly fighting and the destruction of a hive. Robber bees are nervous, noisy, and fly timidly and shiftily. They alight cautiously on the alighting board at the entrance and dodge the guards that catch them. Robbing starts with the robbers forcing their way into a hive, taking their fill of honey/sugar syrup, and flying off. Upon returning to their hive, they alert their hive-mates to the honey source and taste and recruit a large number of bees to take advantage of this honey. The recruited bees are attracted to the scent of honey which is emitted from the entrance of the hive or any open spaces between supers. They frantically hover up and down before the entrance attempting to enter the hive. When robbers are about, the local bees will be actively on guard chasing away intruders who seek entrance. Combats will take place between the robbers and defenders of the hive leading to the death of a large number of bees from both colonies. Should the robbers succeed in overpowering a colony, they will strip it of all its honey; they rip the caps off the honey in the combs and sip the honey, leaving the surface torn and messy" (Hamdan 2010).

At the colony level, robbing is characterized by a conspicuous increase in foraging activity, requiring a concomitant increase in food storing abilities. Nectar foragers do not directly store their nectar load, but instead transfer it to receiver bees. The length of time a forager waits for a receiver affects the speed at which that forager leaves for another trip. During robbing, the rapid increase in foraging trip rate (Grume et al. 2021) likely requires rapid, increased recruitment of receiver bees (Seeley 1989), and possibly a change in the feedback mechanism that regulates foraging activity. The robbing colony's defensive specialists also have been implicated in the syndrome (Grume et al. 2021). Guard bees are specialists who defend against invading robber honey bees. Guards smell odors on incoming foragers and chase away non-nestmates (Breed et al. 1995). Unsurprisingly, experiencing robber intrusion results in increase victim colony guard numbers and higher rates of non-nestmate rejection (Couvillon et al. 2008; Downs and Ratnieks 2000). However, guards from robbing colonies that have not experienced such intrusions can also elevate their defensiveness, even towards their own foragers (Grume et al. 2021), (Rittschof and Nieh 2021).

In honey bee colonies, foraging and nest defense behaviors are performed by similar-aged bees, and so hives must adjust their workforce investment to fulfil both tasks. Grume et al. (2021) investigated this balance in the context of honey robbing, a tactic in which foragers invade a victim hive, kill worker bees and steal honey stores. Robbing is highly beneficial because stored honey is a plentiful, concentrated food resource. However, robbing requires a large workforce to overwhelm the defenses of the victim hive; it is unknown how robbing hives adjust other behaviors to accommodate this demand. A method was developed to provoke a hive to engage in simulated robbing so rapid changes in foraging activity and nest

defense could be measured. Surprisingly, robbing hives increased both behaviors. Guards, the individuals responsible for nest defense, specifically increased defensiveness towards their own nestmates as they returned from a robbing trip. They found that increased foraging activity and changes in forager odor profiles from prolonged exposure to victim hive honeycomb were insufficient to explain robbing-induced changes in guard defensiveness. However, brain gene expression profiles of robbing foragers suggest these bees are unusually aggressive, and thus more likely to provoke aggression from nestmate guards. Increased forager aggression occurred even in the absence of direct competition with victim bees. Thus, although increased guard defensiveness may be costly in terms of increased nestmate mortality because the ecological conditions that promote robbing simultaneously increase the likelihood a hive will become a robbing target, guards may use cues from returning nestmates to determine invasion risk and adjust their defensiveness accordingly. These results suggest that colonies use social information to dynamically optimize both foraging and defensiveness in order to maximize the benefits and minimize the costs of this high-risk tactic (Grume et al. 2021).

Guard bees are primarily responsible for preventing robbing. Previous research has shown that the probability of both nest-mate and non-nest mate workers being accepted by guards at the nest entrance increases as nectar availability increases. The mechanism responsible for this change in guard acceptance may be explained by two competing hypotheses: Odor Convergence and Adaptive Threshold Shift. In this study the Odor Convergence hypothesis was tested. The acceptance by guards at the nest entrance of workers transferred between four colonies that had been fed either odorless sucrose syrup (two colonies) or diluted heather honey (*Calluna vulgaris*) (two colonies) was measured for three days before feeding and during two weeks of feeding. Despite the large sample sizes, the probability of guards accepting non-nest mates was not affected by the similarities or dissimilarities in food odor between guards' and non-nest mates' colonies. This finding contrasts with the accepted wisdom that food odors are important in nest mate recognition and the data, therefore, strongly reject the Odor Convergence hypothesis (Downs et al. 2001).

In the colony, entrance guards distinguish between nestmates and intruders. Those below a threshold of dissimilarity are accepted. However, the threshold is dependent on ecological conditions and may shift to become either restrictive or permissive, depending on the frequency of intrusion and cost of admitting an intruder. Previous research has shown that both the number of guards and their acceptance threshold to conspecific non-nestmates can change dramatically over weeks owing to changing nectar availability and robbing intensity. Couvillon et al. (2008) investigated whether these changes could also occur rapidly, over minutes, in response to sudden increases in conspecific intruders (robber bees). They induced high levels of intrusion at nest entrances and determined changes in the number of guards, the number of fights per guard, and the acceptance thresholds of guards. Their results showed a rapid response within 15 minutes. At the level of individual guards, acceptance declined from 83 to 55% for nestmates and 67 to 43% for conspecific non-nestmates. Also, per individual guard, mean fights increased from 0.005 to 0.06 fights/guard. At the colony level, the mean number of guards at the entrance rose from 1.9 to 2.3, and overall acceptance in a three minute trial declined from 74 to 52% for nestmates and 59 to 30% for conspecific non-nestmates. These results show that honeybees can make rapid behavioral shifts at both the colony and the individual levels.

When honey bee colonies collapse from high infestations of *Varroa* mites, neighboring colonies often experience surges in their mite populations. Collapsing colonies, often called "mite bombs," seem to pass their mites to neighboring colonies. This can happen by mite-infested workers from the collapsing colonies drifting into the neighboring colonies, or by mite-free workers from the neighboring colonies robbing out the collapsing colonies, or both. To study inter-colony mite transmission, six nearly mite-free colonies of black-colored bees were positioned around a cluster of three mite-laden colonies of yellow-colored bees. The movement of bees between the black-bee and yellow-bee colonies before, during, and after mite-induced collapse of the yellow-bee colonies was monitored. Throughout the experiment, they monitored each colony's mite level. They found that large numbers of mites spread to the black-bee colonies (in both nearby and distant hives) when the yellow-bee colonies collapsed from the high mite infestations and became targets of robbing by the black-bee colonies. They concluded that "robber lures" is a better term than "mite bombs" for describing colonies that are succumbing to high mite loads and are exuding mites to neighboring colonies (Peck and Seeley 2019).

Robbing is a route of disease transmission that probably occurs at significant levels both under managed and natural conditions. However, bees generally rob only when there is little available foraging opportunities in the field, and they are only able to invade weak colonies. When outside food sources become scarce, guard bees in strong colonies usually detect and repel intruding bees from other colonies. On the other hand, when colonies become diseased and weakened, guarding becomes ineffective and robbing bees easily enter a sick colony where they may encounter pathogens. A robber bee brings pathogens back to its own nest on the surface of its body, or in robbed honey stored in its crop. An infected robber could also infect the visited colony with pathogens on its body, although this route of infection seems less likely (Fries and Camazine 2001)."

Surprisingly little is known about transmission rates between honey bee colonies of *Paenibacillus larvae*, the causative agent of American foulbrood. Lindström et al. (2008) studied the rate of horizontal transmission of *P.*

larvae spores between colonies as a function of physical distance between colonies by culturing for the spores from sequential samples of adult bees. The results demonstrate a direct effect of distance to clinically diseased colonies on the probability of contracting high spore levels, as well as on the probability of developing clinically visible disease symptoms. The results also demonstrate that colonies may develop considerable spore densities on adult bees without exhibiting visible symptoms of disease. Furthermore, the data suggest that transmission of AFB between apiaries occur within a one km distance from clinically diseased colonies but is significantly lower at two km distance or longer when colonies dead from AFB are allowed to be robbed out (Lindström et al. 2008).

Nectar robbing is also a problem in the pollination of some plant species. "In Hawaii, a carpenter bee (*Xylocopa sonorina*) and the honey bee use floral perforations to obtain nectar. With its maxillae, *X. sonorina* perforates corollas and calyces of introduced plant species; in corollas of different lengths and diameters, the perforations made are significantly different in length. Through these perforations, *X. sonorina* imbibes nectar without pollinating the flowers. Old and New World *Xylocopa* spp. perforate the flowers of at least 22 families. Honey bees obtain nectar through these perforations made by *X. sonorina*. Elsewhere in the world, honey bees use previously made perforations in flowers to obtain nectar from at least 10 plant families. These bees are "robbers" of some plants in that they take floral provisions in ways that are unlikely to effect pollination" (Barrows 1980).

Honey bees probe for nectar from robbery slits previously made by male carpenter bees, *Xylocopa virginica* (L), at the flowers of rabbiteye blueberry, *Vaccinium ashei* Reade. This relationship between primary nectar robbers (carpenter bees) and secondary nectar thieves (honey bees) is poorly understood but seemingly unfavorable for *V. ashei* pollination. Two studies were designed to measure the impact of nectar robbers on *V. ashei* pollination. First, counting the amount of pollen on stigmas (stigmatic pollen loading) showed that nectar robbers delivered fewer blueberry tetrads per stigma after single floral visits than did the benchmark pollinator, the southeastern blueberry bee, *Habropoda laboriosa* (F.), a recognized effective pollinator of blueberries. Increasing numbers of floral visits by carpenter bee and honey bee robbers yielded larger stigmatic loads. As few as three robbery visits were equivalent to one legitimate visit by a pollen-collecting *H. laboriosa* female. More than three robbery visits per flower slightly depressed stigmatic pollen loads. In a second study, a survey of 10 commercial blueberry farms demonstrated that corolla slitting by carpenter bees (i.e., robbery) has no appreciable affect on overall *V. ashei* fruit set. Their observations demonstrate male carpenter bees are benign or even potentially beneficial floral visitors of *V. ashei*. Their robbery of blueberry flowers in the southeast may attract more honey bee pollinators to the crop (Sampson et al. 2004).

Carpenter bees (*Xylocopa* spp.) act as primary nectar thieves in rabbiteye blueberry (*Vaccinium ashei* Reade), piercing corollas laterally to imbibe nectar at basal nectaries. Honey bees learn to visit these perforations and thus become secondary nectar thieves. Dedej and Delaplane (2005) tested the hypothesis that honey bees make this behavioral switch in response to an energetic advantage realized by nectar-robbing flower visits. Nectar volume and sugar quantity were higher in intact than perforated flowers, but bees (robbers) visiting perforated flowers were able to extract a higher percentage of available nectar and sugar so that absolute amount of sugar (mg) removed by one bee visit is the same for each flower type. However, because perforated flowers facilitate higher rates of bee flower visitation and the same or higher rates of nectar ingestion, they are rendered more profitable than intact flowers in temporal terms. Accordingly, net energy (J) gain per second flower handling time was higher for robbers on most days sampled. They concluded that the majority evidence indicates an energetic advantage for honey bees that engage in secondary nectar thievery in *V. ashei*.

A two year study was conducted to assess how nectar robbing in honey bees affects fruit production in rabbiteye blueberry. Various harvest parameters were measured from fruit collected from plants tented with honey bees and carpenter bees (AX), carpenter bees (X), honey bees (A), no bees (0), or in open plots (open). In open plots, rates of illegitimate honey bee flower visitation increased from initial lows to fixation at $\geq$ 95%. Fruit set is higher in open, A, and AX plots than in X and 0 plots. Even though fruit set is similar in A and AX plots, seed numbers are significantly reduced in AX plots in which *X. virginica*-induced illegitimate honey bee flower visitation approaches 40%. Open-pollinated berries were larger than berries from all other treatments in 2001, whereas in 2002 berry weight followed the pattern A > open > AX > (X≈0). Sucrose content of juice and speed of ripening were unaffected by treatments (Dedej and Delaplane 2004).

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ABRC 2022 Proceedings - Conference Abstracts

Part 2 - Short Talks

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Lighting Talks - Session I

Favorable interactions between genetic selection and polyandry

Delaplane KS, Given JK, Menz J, Delaney DA
University of Georgia

A queen's mating frequency is positively associated with her workers' genetic diversity and colony's fitness. Over 90% of a colony's diversity potential is achieved by its mother's tenth effective mating (m_e); however, many females mate at levels of $m_e > 10$, a zone we here call hyperpolyandry. We show experimentally that average brood survival was higher in colonies whose queens were instrumentally inseminated with m_o (observed mating number = 54 males) compared to colonies whose queens were inseminated with $m_o = 9$ males. We also show that colony levels of *Varroa destructor* were lower in colonies whose queens were inseminated with drones carrying resistance alleles (*Varroa*-sensitive hygiene), but only at the highest polyandry level tested (m_o=54 vs. 9). These results are consistent with two hypotheses for the evolution of mating levels in excess of the genetic diversity asymptote: hyperpolyandry improves colony fitness by (1) optimizing genotype compositions for common tasks and (2) by capturing rare specialist allele combinations, resisting cliff-edge ecological catastrophes. Our work implies that increasing queen mating number should be an intentional input alongside targeted genetic selection in our efforts to improve queen performance. This work is published in Behavioral Ecology and Sociobiology (2021) 75(126), **https://doi.org/10.1007/s00265-021-03065-6**

Reducing Winter mortality of honey bee colonies (*Apis mellifera*) by applying treatments against *Varroa destructor* parasite during Summer

Plamondon L, Giovenazzo P, Dubreuil P, Paillard M
Université Laval

Uncontrolled *varroa* mite (*Varroa destructor*) infestation has been identified as one of the major causes of Winter colony loss and in Canada. Many beekeepers try to follow a *varroa* integrated pest management strategy that will keep infestation rates below the recommended threshold of 2% during Summer and 3% in Fall. Below these thresholds, colony health is usually sustainable until the following Spring. There are many recommended *varroa* treatment options in Fall, but unfortunately, there are few treatment options when infestation rates are above the Summer threshold. The goal of this project was to measure the efficacy of a novel Summer *varroa* treatment by applying oxalic acid/glycerine impregnated shop towels in colonies. We compared one control group and two experimental groups: Group 1: control, no treatment, Group 2: formic acid (MAQS), Group 3: oxalic acid/glycerine impregnated shop towel. Treatments were tested simultaneously in three regions of Quebec Province Canada, during Summer 2021 using a total of 135 colonies. Dependant variables measured were efficacy of treatment, colony performance (brood and bee population, cluster size and weight), Winter mortality, Spring brood and population buildup, *varroa* infestation level and six virus infection levels linked to *Varroa destructor*.

Resilin Distribution and Abundance in *Apis mellifera* Wing Joints across Biological Age Classes

Anderson, A, Keime, N, Fong, C, Fassbinder-Orth C
University of Nebraska-Lincoln

The presence of resilin, an elastomeric protein, in insect vein joints provides the flexible, passive deformations that are crucial to honey bee flapping flight, especially in forager worker bees. Resilin is a potential novel and age-dependent indicator of health. In this study, resilin was quantified in different age classes by gene expression and autofluorescence. Gene expression was determined via ddPCR on whole bees. Resilin autofluorescence was measured in 1m-cu, 2m-cu, Cu-V, and Cu2-V joints on the forewing and the Cu-V joint of the hindwing. These joints were analyzed using a fluorescence microscope equipped with an aniline blue filter. Quantitative fluorescence imaging analysis was performed to yield Corrected Total Cell Fluorescence (CTCF). Resilin gene expression varied significantly with age, with resilin activity highest in the pupae, lowest in the nurse bees, and intermediate in the hatchling and forager bees. Autofluorescence of the 1m-cu and the Cu-V joints on the ventral forewing, and the Cu-V joint on the ventral hindwing varied significantly between age classes on the left and right sides of the wing. The results of this study suggest that the resilin expression is age-dependent and may inform us more about the physiology of aging in honey bees.

Honey bee aging: Exploration of molecular markers of age in the European Honey Bee (*Apis mellifera*)

Fong, C, Keime, N, Anderson, A, Fassbinder-Orth, C
Creighton University

Populations of bees and other pollinators are in decline worldwide, which has major implications for ecosystem health as well as global agriculture. When colonies decline, they often experience dysfunction in their social structure and a decline in the number of older bees, such as foragers. As the foragers die, they often leave the queen and her brood behind with sufficient food stores. There is little research exploring the physiological markers of this shifting age demographic in colonies undergoing rapid decline. In this project we investigated the gene expression of several key aging markers in bees using ddPCR. We investigated the expression of DNA-methyltransferase (DNMT), octopamine (OAR), and juvenile hormone (JH) in pupae, hatchling, nurse, forager, and drone bees. Clear patterns of expression were obtained for each age class. Establishment of standard patterns of aging and social structure markers can provide us with comparative markers for decline and may aid in early diagnoses of colony decline.

Show me the honey (and soybean, too!)

Lin C-H, Passifiume W, Johnson RM
The Ohio State University

As one of the most important commodity crops in the U.S., the expansive acreage of soybeans can potentially produce a substantial honey flow during bloom for beekeepers while pollination by honey bees could improve soybean production. However, evidence for the mutual benefits between soybeans and honey bees has been inconsistent due to the self-fertilizing nature of soybeans, varietal differences in floral attractiveness, and various environmental conditions affecting the growth of soybeans and foraging behaviors of honey bees. To evaluate the benefits to both honey bees and soybeans, we installed honey bee colonies in ten soybean fields in Ohio during soybean bloom. Colonies that were surrounded by more soybeans gained more weight during soybean bloom. Abundant soybean pollen was detected in honey collected from the experimental colonies post-bloom, suggesting soybeans as an important source of nectar. Improved pod development was observed in soybean plants near the honey bee colonies compared to plants that were far away from the bees, although the difference was less prominent in smaller fields. Data on honey origins and soybean production in response to bee pollination could help guide management decisions to maximize benefits to both farmers and beekeepers in regions where soybeans are grown.

Impacts of indoor mass storage of two densities of honey bee queens during Winter on queen survival, reproductive quality and colony performance

Levesque M, Giovenazzo P, Rousseau A
Laval University

Winter honey bee (*Apis mellifera* L.) colony losses represent a major barrier to the Canadian beekeeping industry and force beekeepers to import queens in early Spring. However, these imports carry several risks, such as the dissemination of pathogens or undesirable genetic strains. A potential way to reduce these imports is the mass storage of queens in bank colonies during the Winter period. In our study, we first assessed the impact of the density of queens in bank colonies on their Winter survival. We also tested the effect of mass Winter storage of queens on their reproductive quality and colony performance. Our results show that storing a higher number of queens negatively impacted their Winter survival. Banking queens also significantly reduced their weight and size, but their sperm viability in their spermatheca remained intact. Stored queens were readily accepted into a colony the following Spring, but egg laying is delayed during the first weeks after introduction compared to queens overwintered individually in their colony. After 12 days in a nucleus colony, the stored queens regained their normal size and weight. This study highlights the potential of mass storage of queens for the Canadian and global beekeeping industry.

Creative Communication in Apiculture Education

Kirby M
Institute of American Indian Arts/Zia Queenbees/Adaptive Bee Breeders Alliance

Information transfer between academics, beekeepers, and the general public requires different communication languages. For scientific communication, we've been trained to use language that is concise, clinical, and "cold" - without relaying emotion as if we are outside of our research like detached observers. For artistic expression, we've been encouraged to tap into our creativity and to blend our realities into multidimensional interpretations. The past paradigms for these communication approaches are evolving, and so should we as our arena learns to integrate interdisciplinary approaches for better understanding our bees' needs, their existence and behavior, and how we interact with them in this shared space we call Earth. Science and Art encompass each other - for what are each without the abilities to share experiences that explore relationships? It is time to metamorphosize BEEyond how we've been conditioned to communicate as "strict scientists" and explore how multi-sensory communication of our research can benefit diverse audiences and support the next generation of science communication storytellers. Our bees don't live on stats and graphs alone, and neither should we - especially if we strive for our efforts to not only add to the growing body of work, but to also building better relationships through aesthetic information transfer.

Bee-based environmental biomonitoring of pesticides, pollutants, and pathogens

Cunningham MM, Tran L, McKee CG, Ortega-Polo R, Newman T, Lansing L, Griffiths JS, Bilodeau GJ, Rott M, Guarna MM
University of Victoria/Agriculture and Agri-Food Canada

Monitoring the environment for pollution, pesticides, and pathogens is crucial for protecting human, agriculture, and overall ecosystem health. The European honey bee, *Apis mellifera*, is a globally managed pollinator that can serve as a continuous biomonitoring species. During foraging, honey bees are exposed to pesticides and pathogens and carry them to their hives where they can be detected and quantified. Although individual bees are vulnerable to many contaminants, the honey bee colony is more resilient and accumulates stressors without collapsing. This allows for long term monitoring and the potential to create spatio-temporal gradients of environmental contamination. We will discuss demonstrated and proposed uses of honey bees and their hive materials (honey, bee wax, and stored pollen) for environmental biomonitoring of pesticides and plant pathogens. We will also present the use of gene expression, microbiome profiling, and other high-throughput methodologies to increase detection sensitivity. Bee-based monitoring could also be expanded to study emerging threats such as antimicrobial resistance. This presentation highlights the versatility and potential utility of honey bees as biomonitors of ecosystem health.

Mating success of queens fed different pollen source during development

Mahmutoglu E
Nigde Omer Halisdemir University

We know how important nutrition is for honey bee queen development and how important queen quality is for a healthy hive. In this study, we investigated if diet during development affected honey bee queen development success and eventual mating success. We reared queens under identical conditions in the laboratory with two different diets. Queen development was followed until day 10, and then queen cells were introduced into mating nucleus colonies in the field. Furthermore we continued with the healthy queen cells by introducing new queenless colonies to measure the acceptance in the colony. We measured the acceptance rate and then returned to record mating success 16 days after introduction. While our results were not significant, the natural pollen fed group had a higher success rate over the pollen-sub group.

The impacts of smoke and heat during the Oregon wildfires on honey bees

Chakrabarti P, Metz BN, Yang L, Tarpy DR, Sagili RR
Mississippi State University

Recent wildfires and the resulting smoke in the west coast including Oregon have impacted thousands of managed honey bee colonies and potentially hundreds of feral honey bee colonies in the wild. The effects of smoke and fire on honey bees are not well understood. During the period of smoke, beekeepers noticed significantly reduced foraging in their colonies. The ash (particulate matter) resulting from wildfires/forest fires may impact olfaction, respiration and physiology of honey bees. Further, the colonies that were in close proximity to these fires may have encountered significantly higher temperatures. Past studies have shown that stressors like heat-shock can reduce stored sperm viability and result in queen failure in honey bee colonies. The present study investigates both the impacts of smoke and the wildfire heat on workers and queens across impacted honey bee colonies.

Working with Project *Apis m.*: Funding Research and Practical Solutions for Beekeepers

Shreve P, Downey D, Kunkel G
Project *Apis m.*

Project *Apis m.* (PAm) is a nonprofit organization linked closely to commercial beekeepers, growers, and research scientists in the USA and Canada. PAm funded studies encompass the range of honey bee health issues, and this year we expect to pass nine million dollars in funded research. We are always on the lookout for projects that focus on practical solutions, resulting in better yields and lower losses for beekeepers and growers, looking to translate the science into practices, tools and resources for healthier bees. Learn more about what research PAm funds, the process, and how to apply for this funding opportunity.

The Ontario *Varroa* Dashboard: from regulatory inspections to citizen science and healthy apiaries

Sobkowich K, Berke O, Bernardo TM, Pearl DL, Kozak P

Beekeeping agencies are routinely collecting data with more potential than being realized. Dashboards have become a commonly used communication tool that brings data to life, offering users the ability to explore patterns and trends. In Ontario, we have developed an online interactive dashboard centered around regular *varroa* mite inspection data. Producing dashboards such as these allows for data otherwise limited to static figures and spreadsheets to be liberated into interactive visuals, able to be accessed by all members of the beekeeping community at any time. Maps, time trend plots, and summary tables, are all able to be filtered, and sorted by region and/or time, permitting intuitive data exploration and giving beekeepers the tools to recognize the status of *varroa* mite prevalence in their area. The current dashboard serves as a proof-of-concept, with the goal to utilize citizen science data collection methods to help detect outbreaks earlier and improve the success of targeted intervention strategies. In addition to *varroa* mite data, general information regarding how and when to sample and treat for *varroa* makes this dashboard a comprehensive tool for Ontario apiarists, ministry officials and researchers and could become the central hub for monitoring the *varroa* status in the province and beyond.

Lighting Talks - Session II

Manipulating ventilation during indoor Winter storage to suppress *varroa* and improve honey bee health

Currie, RW, Rempel, Z
Dept. of Entomology, Univ. of Manitoba

Indoor wintering or storage of honey bees is commonly practiced in Canada and becoming more common in the U.S. Indoor-wintered colonies have better survival or lower population loss than outdoor wintered colonies when under stress from pathogens or parasites using standard ventilation requirements. Restricting ventilation, increases ambient CO_2, and Humidity and decreases O_2 in the cluster resulting in greater mortality of *varroa* mites in both cage studies (Kozak and Currie, J.Econ.Ent. 2011) and full size colonies (Bahreini and Currie J.Econ.Ent. 2015). In this study we compared colonies under standard ventilation (n=21) to those held under restricted ventilation (n=21) during indoor Winter storage in Canada. Colonies were monitored daily to assess C02, O2, temperature, humidity, *varroa* mite drop and colony size, weight, mite level, viruses were assessed before and after Winter storage. The results showed that restricting ventilation significantly increased colony CO2 levels, increased daily mite mortality rates and marginally suppressed some viruses relative to standard ventilation. Colony survival was not improved by restricting ventilation however, when under high mite loads, colonies that did survive were larger and the proportion of colonies that survived that were considered economically viable was significantly greater than those held under standard ventilation.

Honey bee swimming behavior: ecological significance and effect of pesticides

Huang ZY, Zhang J, Yin L, Saleem SM
Entomology, Michigan State University

Honey bees have recently been shown to have a unique swimming behavior (PNAS, **https://doi.org/10.1073**) upon dropped onto a water surface. What is not known is whether this swimming behavior is simply a "panic response" or is it adaptive behavior. We dropped honey bee workers to the center of a water bowl (diameter: 21.6 cm) and let the bees swim toward the edge. One piece of paper with a black area was presented to one direction of the bowl. We found a much higher percentage of bees swam toward the black area than expected if they swam randomly (Rayleigh test, $P<0.01$). We also found that bees that were fed a sublethal level of pesticide failed to show a preference to the dark area (Rayleigh test, $P=0.36$). We therefore conclude that honey bees, when dropped to a water surface, are behaving in an adaptive fashion: that they swim to a darker area, which presumably represents the closest bank of a small pool of water. Further, this adaptive behavior is changed when bees were pre-fed with a pesticide.

The remarkable size variability in U.S. *Varroa destructor* population

Christmon K, vanEngelsdorp D
University of Maryland, Department of Entomology

Varroa destructor, an ectoparasitic mite of the European honey bee (*Apis mellifera*), and the viruses they transmit, are the most important factors driving high rates of honey bee losses in the United States. In response to concern over the discovery of mites whose size (but not genetics), suggested they were *V. jacobsoni*, we conducted a survey of the *varroa* mite populations across the U.S. a total sample size of 9,065 collected in 2012-2013 and 2016-2018. We found that only 33% in 2012-13 and 79% in 2016-17 of mites collected in the surveyed years fell within the 95% confidence interval (CI) bounds of published *V. destructor* size. We also found a shift in mite size over time from the years of 2012-13 to 2016-18. We explore several hypotheses to explain this shift, including shrinkage from long term storage, season of collection, colony disease state, and miticidal resistance. Understanding the reason for size change may hold important clues for mite management in managed honey bee populations.

Incidence of European foulbrood in honey bee (*Apis mellifera*) colonies following blueberry pollination in Michigan and the effect of protein supplementation on disease occurrence

Kyle B[1], Fowler P[2], Graham K[3], Milbrath M[3]
[1]Department of Population Medicine, Ontario Veterinary College, University of Guelph; [2]Comparative Medicine and Integrative Biology, Michigan State University; [3]Department of Entomology, Michigan State University

European foulbrood (EFB) is a serious bacterial disease of honey bee (*Apis mellifera*) colonies with significant economic consequences for beekeepers. Beekeepers report a high prevalence of EFB within colonies contracted for blueberry pollination. It has been previously proposed that the elevated incidence of EFB seen immediately following blueberry bloom is due to poor nutritional quality of blueberry pollen. One possible mitigation strategy is to supplement colonies with commercially-available protein patties. During this prospective cohort study, 14 blueberry fields in Michigan were selected in 2018 and 2019 with nine colonies from each site enrolled in the study. Colonies were randomly assigned to one of three treatment groups – protein supplementation, pollen trapping with protein supplementation, and control. Colonies were evaluated for EFB and colony strength parameters at the start of the study period (beginning of bloom), at the end-of-bloom, and two weeks post-bloom. Incidence of EFB was calculated and compared between treatment groups. Regression modeling was used to determine if protein supplementation was protective against the development of EFB. Trapped pollen from each field will be analyzed for species data and for macro- and micro-nutritional quality to evaluate the role that poor nutrition may play in the incidence of EFB.

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The screening of new active ingredients against *Varroa destructor*

Padé R, Marsky U
Véto-pharma

Véto-pharma is a French company dedicated to honey bee health, and mainly focused on *varroa* mite control. Here, we would like to give you a quick overview on an R&D project that we have been working on for several years now: the screening of new molecules as active ingredients against *varroa* mites. We're looking for both synthetic and organic compounds to enable beekeepers to develop a solid strategy of integrated pest management. We called this project "*Varroa* 2.0". So far, we have been screening more than 40 molecules. We would like to present you some preliminary results for three of them.

Secret Sounds of Bees: Analysis of Honey Bee Vibroacoustics using Hidden Markov Models

Orth A, Fassbinder-Orth, C

Vibroacoustics are sounds and vibrations that are emitted by bees in response to stimuli and may be essential to understand more about honey bee behavior and health. In this study, I developed a Hidden Markov Model within Matlab using a Hidden Markov Model Toolkit for Matlab (MatlabHTK). Nine health states were included in the model, and five minute vibroacoustic signals were recorded at least weekly from 25 hives in Iowa from August-November, 2021. The signals were analyzed using this Hidden Markov Model to predict their colony health. The model was 100% accurate in identifying the signals from the training repository and 92% accurate when the entire collection of 258 audio files from 25 hives was assessed. This model will provide beekeepers with a non-invasive analysis of their colonies' health that identifies vital situations like exposure to volatile chemicals, robbing of a dwindling hive, active honey flows, etc. This model can be used to reduce colony loss rates when combined with mitigation strategies from beekeepers.

Developing tools to study the honey bee (*Apis mellifera*) gut microbiome response to environmental stressors

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The honey bee (*Apis mellifera*) gut microbiome has a relative low taxonomic complexity, with a core microbial composition of five to eight members: (*Bifidobacterium asteroides, Gilliamella apicola, Snodgrassella alvi, Lactobacillus Firm-4* and *Firm-5, Frischella perrara, Bartonella apis*). These species and phylotypes are the most abundant and are reportedly constant across different honey bee living conditions. However, recent studies have shown that there can be changes to microbiota species diversity and relative abundance when the honey bee gut microbiome is subjected to stressors. As part of a large multidisciplinary project, BeeCSI (**https://beecsi.ca/about/**), we are exploring how proximity to different crops and exposure to pesticides and pathogens affects the honey bee gut microbiome. We will report our efforts to develop a bioinformatics workflow for analysis of microbiome metagenomics sequencing data, which includes data quality assessment, taxonomic profiling and downstream statistical analyses, as well as our initial results comparing the gut microbiome of bees exposed to different treatments. The nutrition, health, immunity, and productivity of honey bee colonies are greatly impacted by the composition of their gut microbiome. Therefore, our ultimate goal is to identify microbiome profile signatures in order to be able to diagnose factors affecting bee health.

BeeBiome.info: a portal for increasing the accessibility of bee microbiome data

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The bee gut microbiome is the community of microorganisms living within the bee digestive system, and it directly impacts bee health and immunity. Recent advances in sequencing technologies has enabled the generation of rich bee microbiome datasets from diverse regions and research areas. There is an urgent need to increase the accessibility of these bee microbiome datasets so that information can be applied in scientific research and can be translated for stakeholder use. Our team is advancing the development of the BeeBiome Data Portal, which was initiated by the international Bee Microbiome Consortium. The portal will maximize the value of the complex and diverse bee microbiome datasets by enabling analysis and dissemination of information on the microorganisms and viruses associated with bees. Our main goal is to provide a comprehensive catalog of all currently available sequence datasets of bee-associated microbes and viruses, enrich it with literature data, and serve as an entry point to facilitate access to information on the diversity of bee-associated microbes and viruses and their impact on bee health. Our aim is to help catalyze bee microbiome research by promoting metadata standardization, sharing and analyses through the increased accessibility to bee microbiome data.

Off the Wahl Beekeeping
ADDING BEES TO YOUR HIVE

Richard **Wahl**

A Bit about *Varroa* Mites

According to the dictionary, the archaic definition of "bane" is: "something, typically poison, that causes death." Although *Varroa* mites are not poisonous, if left untreated they can cause the death of an infested hive. A more current definition of the word bane is "a cause of great distress or annoyance." I do not think there is a better way to sum up our mite infestation pandemic. The word "pandemic" refers to a disease, and research has shown that mites do pass a variety of viruses which can cause diseases in bees. For a long time it was believed that mites were living off the hemolymph (bee blood) of the bee. More recently, entomology scientists found that the mites are actually living off the body fats of bees and/or of the pupae inside capped cells.

Two mites on a bee abdomen

Mites on a drone bee pupa

When attaching to bees or pupae, the mites are much like leeches on a fish, each living off the host's body resources. Mites can pass a number of viruses to the bees, including one of the more obvious ones called deformed wing virus (DWV). If severe, the bee hatches from a cell and wings are so shriveled that the bee cannot contribute to the hive. DWV is often confused with K-wing virus, which is another disease passed on by tracheal mites. Tracheal mites are microscopic and live inside the bee's tracheal tubes, as opposed to the *varroa* mites which attach to the outside of bees or pupae.

Therefore from the late 80's, when the *varroa* mite first appeared in the U.S., it became necessary for the beekeeper to pay close attention to mite loads in a hive and to seek out treatments for any significant infestations.

When I first began my bee management experience thirteen years ago, I knew nothing about mites, or for that matter much of anything about honey bee husbandry. At that time there was still a lot of publicity about the honey bee decline and the phenomena of Colony Collapse Disorder (CCD) that had recently hit honey bee populations. Some individuals speculated that the *varroa* mite played a major role in CCD. Although I am not aware that particular supposition became proven fact, it certainly was a probable contributor. So erring on the side of caution, I used a few Check-Mite strips on my first year hive, not yet knowing how to test for mites, but noticing some deformed wings on one or two bees, a sure sign of the presence of mites. Check-Mite was effective against both hive beetles and *varroa* mites at the time, but seems to have lost its effectiveness against mites possibly due to over use. It took seven or eight years before I saw any hive beetles, probably due to the fact that my hives sit on a cement pad and hive beetle larva mature in soil around or near hives.

As mites in general increased their tolerance for these treatments, better treatments evolved and through the years I have used Mite-Away Quick Strips, Mite-Away II, Formic-Pro, oxalic acid dribbles as well as green drone comb and brood breaks to try to keep mites at low levels. I have found the best technique is to rotate through different types of treatments so the mites do not build up a tolerance to any one particular type of application. The goal is to keep mite infestations low. Even with treatments to minimize the mites, viruses and diseases the mites have passed to the bees can linger for months, much like a bad cold that does not go away in a human that if left untreated could turn into pneumonia. With each of these types of treatments the specific manufacturer's instructions should be followed very carefully. Handled or applied in an inappropriate manner they could be toxic to your bees or to the beekeeper that is using them. So let's look at some of the pluses and minuses of mite control treatments that I am familiar with, and have worked for my beekeeping efforts, starting with brood breaks.

Brood Breaks

A brood break occurs when a queen is not laying eggs for a period of three weeks. This can be the result of removing or caging the queen for three weeks, or a new virgin queen that is waiting to hatch out (16 days), along with the time it takes her to go on mating flights, usually estimated to be eight to 12 days. During this time mites have no capped cells to reproduce in and resort to attaching to adult bees. Worker bees tend to do more grooming during a brood break and therefore will knock more mites off their sisters. A chemical treatment during a brood break will also enhance the destruction or slowdown of the mite population. The downside is that the queen is not producing more bees and the bees are not able to raise more bees to support gathering of pollen or nectar for the

hive, which in turn slows any honey production.

Drone Comb Foundation

Most bee supply companies sell one piece green plastic drone foundation frames. Since drones are slightly larger than worker bees, the drone starter cells are slightly larger than standard worker bee foundation. Where a standard sheet of worker bee foundation contains just over 3,600 cells on a side, a drone frame contains just fewer than 2,400 starter cells. Once the bees are filling standard foundation with comb cells, a green drone frame can be added next to a brood frame to encourage the bees to draw out drone comb. The trick here is to remove any capped drone cells before they hatch out prior to their 24 day maturity date. Mites seem to favor drone cells since they stay capped until day 24, as opposed to worker cells that will hatch out in 21 days. The extra three days give mites a bit longer to reproduce and mature in the cell prior to hatch out. The suggested norm is to remove the drone frames at 21 days, scrape off the drone cells and replace with a new drone frame.

A drone brood frame

Another way is to simply freeze the drone frame for 24 hours, killing the mites in the cells, and then replace the frame and let the bees clean out the dead drone pupae and mites, making room for the queen to lay new drone eggs. This method preserves most of the wax cell structure which would require much energy for the bees to reconstruct. The caution here is to not let the drone frame remain past the hatch out time or you will be adding to the mite population. Another technique is to place a medium frame between two deep brood frames. The added space below the medium frame will usually be drawn out as drone comb by the bees much as the bees often do along the bottoms of regular brood chamber frames. Prior to the 24 day drone hatch out, the capped drone cells can be scraped off the bottom of the medium frame, destroyed or fed to the birds or chickens if you have them. This is the least expensive method of mite control but requires a continual calendar watch and three week cycle of frame removal if eggs are being laid in the drone frame cells or on the bottoms of shorter frames placed between brood frames in supers.

Apivar Treatment

Another treatment that has worked well for me just after the first Spring full hive inspection is the use of Apivar strips. This treatment requires the strips to remain in the hive for 42 days for best efficacy. This is to be followed by 14 more days after strip removal before honey supers are placed on the hive. This total of 56 days with no honey supers will most likely only occur in the early Spring or late Fall unless the intent is to not collect honey for a season. Do not use Apivar while honey supers are on the hive. The recommended practice is to only use Apivar once during the year for adequate mite mitigation. Additionally, temperature has no effect on this treatment although bees are less active in cooler temps and therefore less likely to spread the molecules of amitraz (the active ingredient) around the hive. Even though this is a more recently developed treatment, I have already read one Canadian article that stated some mites are beginning to build a tolerance for this treatment due to extended or overuse as conditional approval of the Apivar treatment came to Canada in 2012, whereas common availability and use in the U.S. has only appeared in the past few years. Another good time to apply Apivar is after a swarm catch since it will possibly take a swarm several months to build comb and expand brood before honey supers are considered for addition to a hived swarm.

Formic Pro Treatment

Formic acid is a naturally occurring substance in nature found in the stings of ants and many small stinging insects. Mites have a lower tolerance for formic acid than the bees and as such the use of formic acid products have been developed to control mite populations. Several different treatments have evolved over time that have formic acid as their active ingredient. Mite-Away Quick Strips, Mite-Away II and Formic Pro all fall in this category. I have used each of these during different years of my beekeeping experience. Each have their specific manufacturer instructions which should be followed very carefully. I will concentrate on the Formic Pro treatment parameters. This treatment is stated in sales catalogs as being "safe to use during the honey flow," while other research shows it to be safe with honey supers on the hive. But just as a note of caution, I like to wait a week or two after removing Formic pads before removing and processing my honey supers. However, Formic Pro has daytime temperature restrictions of between 50°F to 84°F (10°C to 29°C). Two strips are placed over the brood

*Apivar packet**

*Formic Pro packs**

frames for 14 days or one strip for 10 days, followed by a second single strip for an additional 10 days. Another plus for Formic Pro is that it has a 24 month shelf life as opposed to the Mite-Aways which have a one year shelf life in storage. I once used two year old Mite-Away strips just to get rid of them and they did not seem to have much effect on the mites in that hive, which validated the shelf life claims. The formic acid vapors are stated to be able to penetrate and kill mites in capped cells.

Oxalic Acid Dribble

The use of oxalic acid as a vapor or dribble is another natural substance that has been developed for use in the treatment of mites. Very low quantities of oxalic acid are found in many plants, including leafy greens, vegetables, fruits, cocoa, nuts and seeds. I have not used the vapor method since I have had good luck with the dribble method. The dribble method requires less expensive equipment and I believe works well for the hobby beekeeper, although a bit more time consuming per hive. Larger commercial operations would more likely prefer the vapor method. The dribble method amounts to dissolving oxalic crystals in water and dispersing five ml per frame seam directly onto bees between the frames using 50 ml max per a 10 frame deep. Although temperature is not a factor, application is not recommended if the following nighttime temperatures will fall below 45°F (7.2°C) in order to give bees time to clean each other off. This cleaning action is where the bees remove mites from each other. Since the dribble does not penetrate capped cells, it is best to do this when there is very little capped brood in the hive. This has been my favored late Fall treatment and seems to be very effective just prior to the Winter slowdown when there are very few pupae in capped cells. My last treatment of 2021 occurred on Nov 8. The risk here is that if waiting too long there might not be another day/night above 40°F (4.5°C) and the opportunity is missed. It is not recommended to do more than one dribble in very early Spring or late Fall as the dribble is very hard on any newly hatched brood. If using the vapor method, it is recommended that three treatments be given at five day intervals in order to catch all the mites leaving newly hatched brood cells, since drones stay in capped cells for 14 days. Oxalic acid treatments should not be used with honey supers on. Much more detail on set up and execution of the oxalic dribble method will be a more appropriate topic for a Fall edition.

Summary

There are many different mite applications, each with their own time, temperature, brood condition and honey super directions. Manufacturer's directions should be followed carefully so as to not damage your bees or contaminate your honey or injure yourself. A very good site that lists comparison information on when to use, length of treatment, temperature restrictions, whether or not it can be used during honey flows and other general info in an easy to read format can be found at: **https://www.beekeepingfornewbies.com/comparing-varroa-mite-treatments/.** The comparison listing is near the bottom of the internet entry along with other mite related data percentages of non-chemical methods that are often employed by beekeepers. Although this site does not claim to be scientific, it compiles a lot of data from surveys that seem to convey the reality of the beekeeping industries' fight against the mite pandemic. There are many more sites available at present than were available when I started my management of bees thirteen years ago. As with anything taken from the internet, use your own critical judgement as to its accuracy and use multiple resources to verify the realities you seek. Any of the aforementioned treatments are what I found worked for me. Your results may vary based on your conditions, experience or state of your hives. The best advice I feel I can give is to vary your treatment types so mites do not build up a tolerance to any one method. And if you can develop a strain of bees that do not require treatment of any type, as was the case many years ago, please let me in on the secret.

Richard Wahl

*(some product pictures taken from the internet)

Oxalic dribble in progress

Small dark dots are mites 24 hours after dribble application, notice dead hive beetles to the right.

Beekeeping Critical Thoughts – *Weather and Honey Bees*

Earl **Hoffman**

- Please let us consider thoughts on how wind, rain, floods, ice/snow, and drought affect honey bee colonies.
- Think of why feral colonies choose trees in the woods to find shelter.
- Honey bees can not fly fast; wings beating 230 times per second provide on average a speed of only 15 mph with bursts of 20 mph. If the bees are not carrying pollen, nectar or propolis they could fly as fast as 40 mph.
- Let me suggest that wind and wind chill are both environmental dangers to honey bees and their colony.
- It is advisable to always place colonies behind a wind break and not at the crest of a hill. You can use the side of a hill if the land provides a wind buffer.
- I prefer using the south wall of buildings to cut the cold north wind and to provide access to solar gain on those rare sunny Winter days.
- At our farm, we place our hives on the east side of a deep woods that cuts the wind to almost zero at ground level; its a nice wind break.
- Rain can loosen the soil and cause hives to tilt, or worse, to fall over.
- Place the hives at a slight tilt forward to keep rain water from collecting at the bottom board.
- Priority one, two and three is to keep the hive cover from blowing off the hive.
- Many use the abundant large rocks in the apiary to place weight on the hive.
- We use two small cement blocks that can be placed to mark the hive status.
- Others have found it necessary to use ropes or straps to secure the hive covers.
- If the wind blows over a hive, it will soon perish if the hive cover is lost.
- But if the hive is laying on the ground with the cover on, most times it will live.
- Excessive rain is not of concern, unless this will cause flooding of the apiary.
- Placing hives along river banks or flood prone land is ill advised.
- Gullies and valleys harbor both cold damp air and rapid flooding.
- The axiom that I suggest you ponder is “wet bees die.” Keep the girls dry!
- Ice and snow can both block the hive entrance at the bottom board, that is why you must provide an upper entrance for your honey bees.
- Deep snow can provide a nice wind break from blizzard conditions if it is deep.
- Winter and Spring cleansing flights are critical for the health of the hive.
- Drought is a huge challenge for the honey bees; house bees will reject nectar from the foragers if the hive needs water. Bees need water to live.
- I suggest you monitor your hives during inclement weather and take action as needed.
- Provide afternoon shade in high heat, drought conditions.
- Have hive(s) painted in reflective white paint which can reduce heat/solar gain.
- Provide water in entrance feeders if natural sources are not available (not your neighbors bird bath).

The New World Carniolan Closed Program Celebrates Its 40th Generation

Sue **Cobey**

Carniolan pollen forager dancing. Dance language dialects vary between suspecies.

Carniolan Honey Bees

Carniolan bees, highly favored by beekeepers worldwide, are known for their calm temperament, Winter hardiness, rapid Spring buildup and productivity. The subspecies, *Apis mellifera carnica*, is indigenous to the European Alps, the highest and most extensive mountain range of Europe. Well adapted to the cold Winters, short Springs, and hot Summers, their home range includes the Danube Basin, Northern Balkans and into the Alpine region.

Behavioral and physiological traits distinguish Carniolan bees. Well adapted to a harsh cold climate, they tend to winter in smaller clusters and are frugal in consumption of Winter stores. Spring population growth is rapid in response to increasing day length and early pollen sources. Brother Adam called these the "ideal bee for early Spring flow." If not given space and properly managed, they tend to swarm. Colonies are well-organized with a tight broodnest, surrounded by rainbows of pollen and honey packed above. Highly responsive to the environment, in late season they cease brood production in response to limited resources and shortening days.

Cold climate adapted, Carniolan bees forage in cool, marginal weather and start at first light. A memorable demonstration of this was delivering NWC breeders to queen producers at a meeting. By lunchtime NWC foragers were returning with pollen to their five frames nuclei on my truck. Italian bees in two-story colonies in the nearby almond orchard were still confined by the spring drizzle.

Honey bee subspecies vary in communicating forging distances. The dance language dialect of Carniolan bees indicates a larger foraging range. Foragers transition between the round dance signaling nearby resources, the sickle dance signaling further distances and the waggle dance signaling more distant resources. Carniolan foragers perform the round dance at distances beyond 30m (98ft), do not display a definite sickle dance, and transition to waggle dances at distances beyond 60m (197ft) In contrast, Italian foragers transition from round to sickle dances at 20m and sickle to waggle dances at 40m (131ft).

Sue collects semen with Aleš Gregorc watching and Stane Plut delivers a cage of drones.

These transition changes to different dance types indicate adaptations to the foraging range of the different subspecies. The waggle dance communicates complex information, the dialects vary in the dance tempo and duration of the waggle runs, The farther the resource, the longer the waggle phase. Carniolan bees have a longer dialect, performing the waggle dance after foraging a longer distance.

There is indication of assortative mating among subspecies. Carniolan mating flights tend to occur at higher elevations. A study in Austria reported differences in the vertical distribution of drones: Carniolan drones flew at 20m (66ft) and Italian drones flew at 4m (13ft). Progeny testing showed the tendency of queens to mate with drones of their own subspecies.

Carniolan bees are dark in color, the various ecotypes (geographical variants) vary in browns and grays, from uniformly dark to markings with brown rings and dark dots on the dorsal abdomen. Never yellow, as this is an indication hybridizing and mis-mating. Carniolan bees are large, slender in body shape and have a long proboscis, an advantage in foraging for diverse floral sources.

A three year old NWC breeder. Photo by Kathy Garvey

Dr. Nick Naeger, molecular biologist at WSU, pictured as a student at OSU with a beard of NWC bees.

These traits and the genetic versatility of this subspecies afford high adaptability, and favorable response to selection. Breeding programs have resulted in larger winter clusters and negligible swarming. Widely distributed, Carniolan bees now exist on all continents except Antarctica. In Germany Carniolan breeding programs have largely replaced their native Dark bee, *A.m.mellifera.*

The New World Carniolan

The choice to work with Carniolans was to address the challenge of maintaining these bees among predominate Italian stocks. Italian drones flooded mating areas and isolated locations were difficult to find. Consequently, the Carniolan traits were diluted and often unrecognizable in U.S. stocks. The use of instrumental insemination provided a method of controlled mating to establish and maintain a Carniolan line.

Having the benefit of the best teachers and mentors, Dr. Harry Laidlaw introduced me to the technique of instrumental insemination, (II), at U.C., Davis and Dr. John Harbo refined my skills at the USDA Bee Lab in Baton Rouge. While at UCD, Dr. Harry Laidlaw and Dr. Rob Page developed their theory of the Closed Population Breeding Program (CPBP). This became the basis to establish and maintain the New World Carniolan (NWC).

The CPBP concept appeared practical and doable given the challenges of honey bee breeding: the random in flight, multiple mating of queens, the social and behavioral complexity of the hive and their sensitivity to inbreeding. Prior to the concept of the CPBP, the major breeding system used was the Four Way Hybrid Program of the Starline and Midnight lines. This system requires the cumbersome maintenance of inbred lines and crossing these to create hybrids, which are the final product. The CPBP supports the continuous selection of desirable traits within a large population, providing flexibility and longevity to a bee breeding program.

The CPBP concept is intuitive and based upon what beekeepers have traditionally been doing - selecting and propagating the best colonies from large populations. Strengthening this process included working with a known breeding population, using scientific methods of selection,

Three tubes of semen collected for importation.

record keeping, and controlled mating, thus increasing the effectiveness and progress. The uniformity and consistency of desired traits in the breeding population increased and could be maintained over time.

In 1981, Susan Cobey and Timothy Lawrence established a beekeeping business, Vaca Valley Apiaries, in northern California and developed a Carniolan foundation population. Queens of mixed genetic backgrounds from across the U.S. and Canada were collected. Using instrumental insemination (II) and a system of selection and back-crossing, the breeding population increasingly expressed Carniolan traits within a few generations. The operation maintained 500 colonies for honey production and pollination services and 1000 mating nucleus to produce several thousand queens annually. Over half of the production colonies were headed by II queens to support the breeding program. It was essential to run II queens in full size colonies to provide income and evaluate these for field performance.

Five years into the NWC program, Dr. Harry Laidlaw brought his friend, visiting scientist Dr. Friedrich Ruttner, to see our project. A privilege, the renowned bee geneticist from Austria, who headed the Austrian Carnica Association at the time, offered his evaluation and advice. Samples were collected and tested using morphometrics (before molecular techniques were available). In his analysis, Dr. Ruttner described the NWC line as "the most Carniolan like bees" he had seen in the United States and Canada, although they did not meet the subspecies criteria for "pure" *A.m.carnica*. By appearance and behavior, the NWC expressed traditional Carniolan characteristics at this early stage of the program. Although, the mixed background of stock collected to establish the foundation population was evident in morphometric testing.

The NWC program was young and the dream to work with European *A.m.carnica* was not an option at the time. The Honey Bee Act of 1922 restricted importations to avoid the introduction of tracheal mites, *Acarapis woodi*. Subsequent amendments further restricted the importation of "undesirable germplasm" with concern of Africanized bees. We applied to obtain a permit for the importation of semen with the support of Dr. Laidlaw, Dr. Ruttner and Strachan Apiaries. Politics and concern over potential risks created unfavorable circumstances for importation. The award of a permit to import bee semen would take an additional 20 years.

Industry needs changed with the impact of parasitic mites, "Colony Collapse Disorder" and Africanized bees. The almond industry's concern, if colony numbers would be sufficient for pollination needs, eased regulations. An estimated 105,000 package bees from Australia were imported between 2005 and 2010. However, increasing concern of risk management and the incursion of the Asian bee, *Apis cerana*, in Australia shut this down. These events opened the door to our request to import bee semen from Europe.

The NWC program moved from Vaca Valley Apiaries to several universities. The closure of the Canadian border eliminated a major queen market for these cold climate adapted bees. Commercial queen sales had supported the breeding program. This event pushed the focus of NWC program to concentrate on breeding

stock, within a university setting. The program was housed at the Ohio State University from 1990-2007, then moved to back to California to UC, Davis in 2007 and to Washington State University in 2012. The goal remained, to produce highly productive bees with traditional Carniolan characteristics.

NWC program continues to provide breeding stock; instrumentally inseminated breeder queens and bee semen, to queen producers. This resource supplies most of the Carniolan production queens used by pollinators and honey producers in the U.S. Drs. Page and Laidlaw state in their 1997 book, *Queen Rearing and Bee Breeding*, the New World Carniolan program is "perhaps the most successful" such breeding endeavor.

Page-Laidlaw Closed Population Breeding Program

A modified CPBP, as applied the NWC, is briefly described. The program is designed to allow progressive selection within a large breeding population, over time. An essential component is maintaining genetic diversity within the breeding population A key criterion is selection for solid brood patterns. This is especially important considering a mass selection system is used (see the Page-Laidlaw CPBP description).

The theoretical model of the Page-Laidlaw CPBP is based on a foundation population of 50 queen mothers with a predicted life of 20 generations. Over time, the process of selection narrows the gene pool and can result in inbreeding depression. The NWC program has passed this benchmark. To increase the longevity of the program, additional Carniolan sources have been added to enhancing genetic diversity and increase vigor. The addition of *A.m. carnica* from European sources has proven a major benefit.

The goal is to maintain selection pressure on the breeding population to increase the consistency and uniformity of desirable traits. To evaluate numerous colonies efficiently, the selection process must be simple yet effective. Selection is based upon evaluating several general traits quickly and simultaneously among numerous colonies. New traits can be added to the selection criteria as new challenges and methodologies are developed, as well as testing for tolerance/resistance to pests and disease. These specific tests are labor intensive, so as a result, they are performed on fewer colonies after some culling.

Annually, a foundation population of about 30-60 breeders are selected. From these, virgin queens and drones are reared. Drones are collected from all breeder colonies and the pool of semen is inseminated to the virgins. A test population of 200 to 250 colonies, headed by II queens, is established. These test colonies are evaluated in the field and the top third selected. Of the selected colonies, these are tested for more specific traits and the top scoring breeders selected and propagated. This cycle is repeated annually.

Frame of Carniolan drone brood. A critical aspect of the breeding program is rearing a plentiful supply of healthy drones from known sources.

The selection process consists of scanning and comparing colonies, using a two-step process. Step one, the pre-selection process evaluates established young queens. Several general traits are observed simultaneously in each colony. These traits include brood viability, temperament, colony buildup, the incidence of pests and diseases and color. Each trait is given a point value and performance of each colony ranked. Of these, less than average colonies are culled.

Selected colonies are allowed to build up over the season. In step two, colonies are evaluated for honey production, based on a weight gain during the flow, and for overwintering ability, based on early Spring frame counts. Of these, colonies scoring above average are selected and tested for tolerance/resistance to pests and diseases. Monitoring *Varroa* levels and testing hygienic behavior are performed on fewer, select colonies. Of these, the top tier colonies are chosen as breeders to propagate the next generation and the cycle is repeated. Culled colonies are split and requeened.

Importations *A.m. carnica* from European Sources

Genetic diversity, the raw tools of selection, is known to improve colony health, fitness, productivity and reduce the incidence of pests and disease. The historical introduction of honey bees into North America, before the 1922 restrictive importation law, was limited to small samplings of European sources. Over time, the U.S. honey bee gene pool has been reduced by several "bottleneck" events. These include natural genetic drift and the practice of consolidating and reducing breeding populations for commercial queen production. In addition, the syngenetic effects of parasites, pathogens, pesticides, and malnutrition contribute to loss of colonies.

The need to strengthen selection programs of commercial breeding stocks is increasingly recognized. Ensuring importations are safe and effective is essential. Limiting importations to semen only, and to proven, established breeding programs reduces risks and ensures future benefits.

In 2006, a USDA-APHIS, United States Department of Agriculture - Animal Plant Health Inspection

Above
NWC Drones ready for flight. Typical coloration, black abdomen, Thorax hairs brownish to grayish.

Left
Ralph Büchler, Director Bee Institute in Kirchhain, Germany, working a Carniolan in his sliding (no lift) colony.

Left
Sue Cobey, Steve Sheppard & Brandon Hopkins, in front of a Bee House at the Slovenia Center in Lukovica. Illustrated beehive panels display historical and folkloric art.

Right
Erik Lunzar's historical horse drawn carriage which transported starter colonies in 18th century Slovenia. Beehive panels are traditionally painted with historical and folkloric art.

Service, permit was issued to Ohio State University to import *A.m. carnica* semen from the Austrian Carnica Association to augment the NWC program. In partnership with Dr. Steve Sheppard, additional permits were awarded to Washington State University. *A.m. carnica* semen was imported from Germany and from Slovenia. With the incorporation of these European sources into the NWC program, beekeeping customers anecdotally reported increased vigor.

To minimize risk and in compliance with the APHIS permit, samples of the imported semen are tested for viruses by the USDA Beltsville Lab. The colonies resulting from queens inseminated to the imported semen are placed in an isolated quarantine station in eastern Washington. Colony inspections and progeny testing are conducted, and USDA-APHIS approval is required for release.

The imported semen of *A.m. carnica* stocks were sourced from Europe breeding programs with a long tradition of maintaining, preserving, and improving this subspecies. Beekeepers, with the support of government institutions and beekeeping associations, coordinate selection programs based upon performance tests, statistical data analysis, and controlled mating. Today, these programs utilize a modified BLUP (Best Linear Unbiased Prediction) animal model program, adapted for honey bees to estimate breeding values. More recently a European-wide project initiated as part of the COLOSS project (**http://coloss.org**) estimates *Varroa* resistance and vitality of various European bee strains.

We sourced *A.m. carnica* stocks from the Austrian and German Carnica Associations, breeding programs initiated by Dr. Ruttner dating back to the 1950s. Bee semen was obtained in 2006 from the Lunz Bee Institute in Austria headed by Dr. Hermann Pechhacker. In 2008 and 2009 stock was sourced from the Bee Institute in Kirchhain, Germany with the support of the Director, Dr. Ralph Büchler.

Aleš Gregorc, Sue Cobey & Brandon Hopkins at the Apicuture Museum in Slovenia. Horse drawn carriages transported started colonies in the 18th century.

Bane Kozinc with Aleš Gregorc, and Steve Sheppard collecting drones at this isolated mating station in Kesce, Slovenia.

Additionally, *A.m. carnica* stocks were sourced from Slovenia in 2011 and 2017. With a long history and tradition of beekeeping dating back over 300 years, Carniolan bees are highly valued and important to the national identity and heritage of Slovenia. Every village has traditional bee houses, beekeeping shops offering local honeys and bee products, and often a museum displaying the local beekeeping history.

A small country of diverse climates, landscapes, and flora, Slovenia supports several ecotypes of Carniolan bees adapted to the different geographical areas. Preserving these ecotypes and their individual characteristics is highly valued. The Slovenian Beekeepers' Association ensures the status and protection of their native bees through the Pure-Line Carniolan Bee Breeding Register.

The calmness and elegance of these bees is impressive; when working the local bees our bee veils remained unused. Dr. Aleš Gregorc from the Agricultural Institute of Slovenia hosted our collection trips. The Agricultural Institute, Slovenian Beekeepers' Association and Ministry of Agriculture work together to protect and conserve the purity, improve the quality of *A.m. carnica* throughout Slovenia.

During our collection trips, fresh imported semen is inseminated to virgin queens supplied by cooperating NWC producers. The resulting queens are established in nucleus colonies and placed in quarantine, until release. Bee semen can be held at room temperature with good viability for over two weeks, time enough for collection and transport. We also cryopreserved some of the collected bee semen in liquid nitrogen for future use. Several lines of Slovenian *A.m. carnica* are maintained in the WSU germplasm repository and will be utilized to support the future of the NWC program.

Erik Luznar lighting a smoke strip inside his bee house, commonly used instead of a smoker.

Stane Plut at his mating station in Semič, Slovenia, checking mating nucs, placed in large cages for bear protection. Sue holding a smoke strip, commonly used instead of a smoker.

Stane Plut, at his mating station in Semič, Slovenia, opening a large bear protection cage of mating nucs.

Certified NWC Producer Partnership Established

The NWC is the major Carniolan stock used in the U.S. and serves as an industry standard. Now in its 40th generation, the goal is to transition the program into the future. A Certified NWC Producer Partnership has been established with the expertise of two, well respected, multi-generational queen producing operations, Strachan Apiaries and Buzz's Bees.

Based in northern California, Buzz's Bees and Strachan Apiaries will maintain the NWC breeding population and provide instrumentally inseminated breeder queens, in addition to production queens to the industry. Washington State University will continue to provide technical support. Part 2 of this article will feature Strachan Apiaries and Buzz's Bees.

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BIP Bits:

'Tis the Season for Surveys Again!

Nathalie **Steinhauer**[1] & Mikayla **Wislon**[1] & Jeri L. **Parrent**[1] & Dan **Aurell**[2] & Selina **Bruckner**[2] & Geoff **Williams**[2] —— Bee Informed Partnership

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Hi beekeepers! The Bee Informed Partnership's Annual Colony Loss and Management Survey team is looking forward to another season with you.

The Loss and Management Survey is a national effort that tracks long-term trends of U.S. honey bee colony health. The survey's main objective is to monitor colony loss rates that beekeepers experience each year, the management actions that beekeepers take, and to compare these losses and practices among all types of beekeeping operations – from backyard hobbyists managing fewer than 50 colonies to large, multistate commercial operations with more than 500 colonies. This not only allows us to identify what groups or management practices are associated with higher colony loss rates, but also enables us to track how beekeepers adapt over time to respond to the changing circumstances of beekeeping. You can think of the survey as a barometer for U.S. honey bee health. In previous years, about one in 10 U.S. beekeepers – and 14% of the nation's estimated 2.6 million colonies – were represented in the survey. We hope that this year we will have even greater participation from the beekeeping community!

Do you live in an area bringing good pollen flow? Nutrition and Environment is the theme of the year for the 2022 BIP Survey! PC: Dan Aurell

The survey data has yielded important insights into U.S. colony health trends. First, it has dispelled the notion that honey bee colonies only die in Winter. Though colony losses are higher in Winter, Summer losses are not trivial. In some rare cases, they can exceed Winter losses. Survey results have also confirmed that professional beekeepers experience lower mortality rates than small scale beekeepers, despite often being criticized for putting their colonies under stress by frequent moves and intense management. Finally, it has become clear that U.S. colony loss rates have not steadily increased since the beginning of the survey in 2007. Losses have followed a cyclical pattern, where one year of higher losses is followed by a year of (somewhat) lower losses. However, these loss rates remain consistently higher than what beekeepers identify as an acceptable level of loss. To read more about these cycles, visit **https://beeinformed.org/citizen-science/loss-and-management-survey/**, where you can find a list of the peer-reviewed publications resulting from the Loss and Management Survey.

With this year's Survey, we are building on our past work in monitoring colony losses and exploring the relationship between them and management. While the Loss Survey has been running since 2007 (and a Management section was added in 2010), we continually want to make it better! Therefore, we made some changes to the Management section of the Survey last year to improve the experience for our respondents. Now, each year's Survey will focus on a specific theme which will reoccur based on a regular rotation schedule. Last year, the Survey focused on "Queens and New Colonies" (particularly nucs and splits). This year, the focus will be "Nutrition and Environment." By focusing on one topic each year, the survey is shorter and more focused!

How to prepare for the survey

To make it easier to answer this year's survey, we will walk you through the different sections, step by step.

1 – Colony Loss Questions

You might want to have a couple of numbers in mind before you begin. The survey questions will ask you to report how many bee colonies you managed at specific times of the year – specifically, April 1st 2021, October 1st 2021, and April 1st 2022. If you're a commercial beekeeper, those key times of the year are not set in stone, but rather determined by your "beekeeping year". For example, your first colony count will be right before you made your first splits in the Spring. We will also ask you what date this was on. Perhaps it was February 25th, or maybe it was March 15th? To understand the number of colonies lost, we will ask you about other activities that make your colony numbers fluctuate: Making splits, combining colonies, buying/receiving or selling/giving away colonies, and the number of colonies involved in each of those activities. For beekeepers who move colonies across state lines at any time during the year, we also ask you to tell us when and for what purpose you moved colonies between states (e.g. pollination, honey production, wintering).

2 - Core Management Questions

There is a set of important core management questions that we will ask every year. Examples include: How did you obtain new colonies and queens? When did you monitor your colonies for pests and disease? When did you treat for *Varroa* and other diseases? What feed did you apply and when? We keep it high level to get an overall picture of what beekeepers do.

3 – Year-specific (rotating) Management Questions

This year, we are focusing on questions related to nutrition and the environment your bees experience. For example, we will ask you to tell us about the seasonality of nectar and pollen flows, details about how you provided feed to your colonies, what your honey harvest was, if you actively participated in the pollination of agricultural crops and whether your colonies experienced issues associated with pesticide exposure.

4 – Demographic Questions

We conclude the survey with an array of demographic questions sociologists like to ask, and the resources you are using to enhance your knowledge about beekeeping.

Don't fret! Before the survey launch on April 1st, we will have the full preview of the survey on our website. We made enormous efforts to update the look of our online survey to make it easier and faster to answer the questionnaire. We hope you'll like it, and take this survey as a chance to look back on your last beekeeping year and all the efforts you put into your bees!

We take your data seriously

Your participation in this research is confidential. All your answers will be stored in a secure, password protected database application that uses SSL encryption. No personally identifiable information will be disclosed in any publication or presentation resulting from this research. Completion of all or part of this survey is voluntary. If you are not comfortable answering a question, please leave it blank – we still use and benefit from the information that you do provide, even if you don't answer every question.

What type of environment were your bees in last year? PC: Eric Malcolm

Who are we?

The current survey team is composed of Dr. Geoff Williams (Auburn), Dr. Nathalie Steinhauer (UMD), Dr. Selina Bruckner (Auburn), Mikayla Wilson (UMD), and Dan Aurell (Auburn).

How to take the survey

The survey will be live on April 1st, and will stay open until April 30th.

Sign up to **beeinformed.org** (**https://beeinformed.org/citizen-science/loss-and-management-survey/**) to be added to our mailing list, and you will receive email survey reminders and updates.

We cannot overstate ***how important*** your responses are for documenting the state of the country's managed honey bee colonies.

Above:
Pollination services of agricultural crops, such as almonds, are going to be covered in the survey. PC: Dan Aurell

We hope you will incorporate taking the U.S. Annual Loss and Management Survey as a part of your Spring traditions!

Crack your hives and tell us how they did last year. PC: Eric Malcolm

BEE VET

Immunity, Vaccines & Honey Bees: Part 2

Dr. Tracy **Farone**

Immunity in Honey Bees

If you missed last month's part one of this series, I am about to give you some homework! Please go back and read part 1 in the previous BC issue, it will really help with your understanding of this article. Much of what I discussed previously applies to vertebrates, and perhaps has best been understood in mammals. Because honey bees do not produce antibodies, we used to think complex individual immunity, particularly humoral immunity did not exist in honey bees, but the more research we do, the more complex we find honey bee immunity to be. We now know that individual immunity exists in honey bees and includes a mix of complex innate, humoral, and cellular responses.

Social immunity is also a characteristic of the honey bee colony. Hygienic behavior, propolis use, and thermal elevations are examples of social immunity in action. We know that individual sick bees will fly off and die in hopes of not infecting the rest of their siblings. Nestmates share and transfer just about everything, so feeding worker bees a medicine easily distributes it throughout the colony.

Interview with Dr. Annette Kleiser

I had the opportunity to listen to a lecture on the current honey bee vaccine research being done by DALAN Animal Health, and later had the privilege to sit down (over ZOOM) with the lecturer, Dr. Annette Kleiser, PhD, CEO, and founder of DALAN AH. Dr. Kleiser's team consists of a mix of PhD scientists, vaccine experts, entrepreneurs, veterinarians and beekeepers. During the interview, Dr. Kleiser was able to share some information with me about the honey bee vaccination research they are doing, although some of the information is still privileged and unable to be shared at this time.

I asked Dr. Kleiser what she and her colleagues would like beekeepers to know.

She followed by saying, "Know that the vaccine/s we are developing are not "chemicals", they are non-GMO, and unlike antibiotics would have no withdrawal time. We are using nature to help (bees) themselves through a vaccine. We are using a killed pathogen fed to the animal. This will be a sustainable action; we **must** get away from antibiotics. DALAN's first vaccine is being developed for American Foulbrood. While antibiotics in some instances can be effective to keep the bacteria burden in hives at bay, prophylactic use of antibiotics is only permitted in high-risk hives surrounding an outbreak of AFB largely due to the concern of antibiotic resistance and residue of antibiotics in honey."

Dr. Kleiser also stressed, "Bees are animals that need the same level of medical care we give our other animals. (Honey) bee health seems to be a blind spot to the traditional animal health companies."

Dr. Kleiser has reason to be proud of the ground breaking progress they are making for the honey bee industry. She continued, "On an academic level, vaccination in honey bees has been described before using injection of pathogens into the queen for example and against diseases such as Chalkbrood, using oral application of the vaccine, though DALAN is the first Company to start the regulatory approval process for marketing a new product against AFB, which is a tricky infectious agent to work with in the field, and acceptable clinical trial protocols also had to be developed from the ground up."

"There are rigorous testing and regulatory steps that are required to test the product." she explained, "Clinical trials are now being defined for bee health and the industry. (We're) pursuing USDA-CVB conditional licensure, and there are issued and pending patents. We are currently conducting field pilot trials to prepare for large scale field studies to test the approach in real-world settings over the next few years once a conditional license is granted."

A specific vaccine for AFB is the first product being investigated but Dr. Kleiser says the technology can be applied to develop vaccines for EFB, an AFB/EFB combo vaccine, Chalkbrood, plus any infectious diseases, like honey bee viruses and other fungal diseases, as well.

Dr. Kleiser also pointed out that "Increased immunity will likely help bees deal with other stressors." As we know, healthier colonies have a better chance at dealing with all types of environmental stressors.

The Vaccination Process in Honey Bees

The vaccine/s under development will be an oral vaccine, fed directly to workers and then ultimately to the queen through royal jelly. Over years of research, DALAN's researchers together with other academic researchers have uncovered the importance of **trans-generational immune priming** in honey bees. This is a process, often seen in insects, where the mother can pass immunity to previously encountered pathogens to her offspring. The process involves innate and acquired immune activity in the queen that results in something analogous to passive transfer in mammals. Through various immunological techniques, researchers are able to tag, often using a fluorescent signature, the vaccine (killed pathogen particles) to see how they move through the queens' bodies to their offspring.

Dr. Kleiser further explained, "Our researchers together with other academic groups followed the passage of killed pathogen particles (the vaccine) in the queen from the royal jelly to the gut, through the hemocoel, to fat body to vitellogenin, to the ovary to the egg and it ultimately triggers immunity in the larvae." Through this research, the researchers have revealed the important role of the pro-

tein vitellogenin in bees, the ability to bind to pathogen particles and pass these immune elicitors on to the egg and larvae.

To test the vaccine effectiveness in transferring immunity, experimental colonies and procedures, control colonies and sham procedures were set up. Per Dr. Kleiser, "We fed or not fed queens with the vaccine, allowed her to establish the new colonies and then took one-day-old larvae into the lab, (and we) challenged the larvae by blasting them with thousands of highly lethal AFB spores and measured +/- survival."

Results of these studies showed that larvae from vaccinated colonies showed a significantly higher survival rate than larvae from unvaccinated colonies. Over the years, DALAN researchers with their academic colleagues also conducted comparison tests for negative effects on colony strength, honey quality, honey quantity, and queen fitness. So far, these studies revealed no negative effects associated with vaccine use which supports safe vaccine use within a hive.

What's on the Horizon?

There are a few questions I am sure beekeepers will be asking about AFB and other honey bee vaccines. When can we expect them on the market? How much will they cost? What about practicality of use?

At this time, the DALAN research team cannot give a time the vaccine/s will be available or cost. Remember safe and effective vaccine work takes years and lots of approvals. As far as practicality, according to Dr. Kleiser, her team believes the vaccine will likely last a season and will need to be applied each beekeeping season.

If the benefits of these vaccines are to increase honey bee immune resistance to AFB, EFB, honey bee viruses and fungal diseases, and they eliminate antibiotic over use/misuse/resistance, it will be priceless to our honey bees, the beekeeping industry, and public health in general.

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Minding Your Bees And Cues

Easter for Beekeepers

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

For beekeepers checking the queen status of their hives, it's one giant egg hunt from early Spring until the queen stops laying in early Fall. Unlike Easter eggs, honey bee eggs are absurdly small and white. But unlike the Easter bunny, the queen bee hides the eggs in plain sight: a healthy queen will lay eggs in the brood nest, in a uniform pattern, one after another. Finding eggs is the easiest way to confirm that the queen is alive and well.

Once your eyes get used to recognizing eggs in the brood nest, and once you become familiar with where the brood nest is found in the colony, then you can leave your inspections with queen status confidence. Lots of people are daunted by finding eggs. It's hard at first! Things that can help you include: using black plastic foundation as opposed to yellow (the white eggs stick out more) wearing glasses, wearing just one contact lens (a strategy employed by Randy Oliver of Scientific Beekeeping), carrying a magnifying glass or cell phone (why not?), enlisting a sharp-sighted child, and making sure the sun is behind you to avoid a glare. For experienced beekeepers, finding eggs is second nature, like a musician picking up the patterns of a song.

Once you join the category of casually-confident egg-finder, you can while away the hours pondering the meaning of the egg, as we like to do. Below, we bring you some of our favorite egg facts, discovered just for you by scientists who like to study small things:

1. **Honey bee eggs are small, but how small?** Researchers at the University of North Carolina demonstrated both genetically based and environmental influences on the size of eggs laid by honey bee queens (Amiri et al. 2020). Not only did egg sizes vary based on the genetic lines of queens, but queens in different sized colonies laid different sized eggs, with the smaller eggs in the larger colonies. The authors hypothesized that investing in larger eggs occurred in smaller colonies to increase chances of brood survival in situations where brood care resources were limited.
2. **And how long does the egg remain an egg?** While the standard answer is that it takes three days for an egg to hatch, a laboratory experiment demonstrated considerable variation in hatch time based on queen source (Collins 2004). Eggs hatch as soon as 66 hours (2.75 days) from the time they were laid all the way up to 95 hours (almost four days).
3. **And how does the egg hatch at whatever time it hatches?** A research team from the American Natural Museum of History and the USDA explained the mechanical help larvae get from hatching spines and a proposed source of enzymes that break down the chorion (the fancy word for insect eggshell). These researchers used electron micrographs to examine egg hatching in numerous bee species (Rozen Jr. *et al.* 2017).
4. Laying fertilized (diploid) eggs is crucial for a queen to maintain a colony's worker population. A study done down under investigated how much control a queen has over sperm release when fertilizing eggs. The results show that honey bee queens release a median of two sperm per egg for fertilization and this number decreases as queens age (Baer *et al.* 2016). According to this research, honey bee queens aren't able to manipulate the use of the finite sperm supply stored in their spermatheca. Instead, the authors hypothesize that when the queen's egg fertilization rate decreases (increased number of haploid or drone destined eggs in worker cells), it might be a signal to workers to rear her replacement (the process is known as queen supersedure). While this information might not directly impact your management decisions, it does provide an explanation for how workers might know when it is time to replace a queen.
5. The term "brood pattern" describes how the brood is arranged in the colony and its quality is measured by the absence of empty cells. A queen with a good brood pattern is laying eggs closely together in the frames. A research

Why can egg spotting be so difficult? Recently laid eggs are upright and harder to visualize. You can spot a few eggs in this photo along with the egg layer (queen).
Photo credit: Rebecca Masterman

Eggs are easiest to visualize when black foundation is used. Another clue to queen health is spotting recently emerged larvae. White eggs that look like tiny grains of rice can be seen just above the pollen and below the larvae and sealed brood in this photo. Close to these eggs you can see small deposits of brood food deposited into cells with young larvae. Photo credit: Rebecca Masterman

study done by Lee et al. (2019) elegantly asks the question of whether brood pattern quality is attributed to the queen or the colony. Their data will make you think twice about replacing a queen because of a poor brood pattern. These researchers revealed that brood patterns can improve when you move poor brood pattern queens to colonies headed by queens with good patterns. Brood patterns decreased in quality for the good brood pattern queens that were moved to poor brood pattern colonies. This study suggests colony level control of rearing the eggs to adult bees, thus releasing some of the blame from queens and thus confusing beekeepers.

6. Understanding brood diseases is critical to the success of your beekeeping operation. Just because–or especially because–diseases are often asymptomatic until it's too late, we all need to do our homework and be proactive with our management. The USDA has an easy to understand overview of brood diseases and apiary management. Vertical transmission of viruses can occur from a queen to an egg. Using tools that can detect virus mediated gene expression, research reported by Amiri et al. (2020) demonstrated that queen transmitted virus infections of deformed wing virus and sacbrood virus could be detected at the embryonic level. More research is needed to understand how this impacts the colony and ultimately management decisions.

Tune in next month for more egg-based information. Although they are small, there is much to cover when it comes to honey bee eggs.

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Authors

Becky Masterman led the UMN Bee Squad from 2013-2019. Bridget Mendel joined the Bee Squad in 2013 and has led the program since 2020. Photos of Becky (left) and Bridget (right) looking for their respective hives. If you would like to contact the authors with your egg hunting success stories or other thoughts, please send an email to **mindingyourbeesandcues@gmail.com**

Is It Analytics Time?

John **Miller**

Readers: My editor, Jerry Hayes grants me extraordinary subject selection freedom on my monthly *Bee Culture Magazine* piece. As previously stated, this freedom is fabulous; and terrifying. I can write 'The World According to John' a semi-fictional varnished truth or two about beekeeping. Commercial beekeeping is my background.

But I've also seen bee clubs large and small, state and local beekeeping clubs that thrive, barely survive – and struggle in the new wilderness of meeting attendance and participation. In North Dakota, if a beekeeper in Williston decides to attend the North Dakota Beekeepers Assn. annual meeting, in early October – it's an investment; not a small investment of time and money and fuel. It is 220 miles from Williston to Bismarck [depending on how hard & which direction the wind is blowing]. Once in Bismarck, an overnight stay on Friday, October 7, 2022. Membership dues, meals; and an expensive side trip to the Sporting Goods store, Scheels adds up.

Thinking about the meeting itself. The beekeeper makes a decision to invest the time necessary to attend the meeting. What information should the Association provide the Membership attending the meeting? Is there an expectation of a Return on Investment [ROI]?

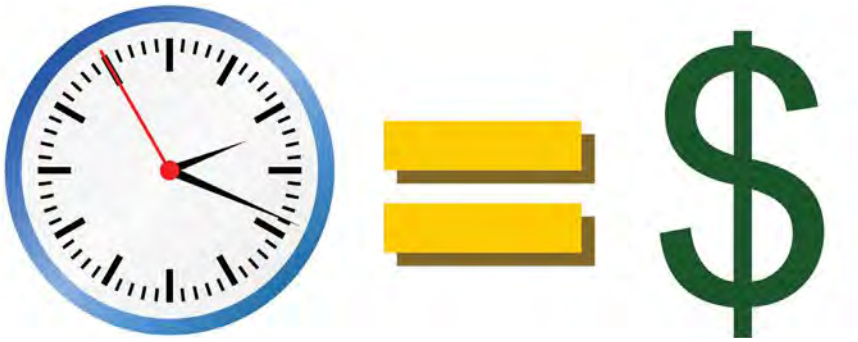
The beekeeper invested, say, $1,000 in the weekend. If she returns with a Chinese grafting tool, snagged as a door prize – is that a return on investment? If she returns with the correct ingredients, say glycerin & oxalic acid, the correct ingredient mixing equipment, a contact for the correct size and absorbent sponge capacity – and application instructions to control *Varroa destructor* in her outfit – and how to safely transport 5,000 doses from shop to bee-yard -is THAT a good time investment?

When her winter losses drop from 30% to 15%, that is a measurable return on investment.

In 1999, Apimondia was held in Vancouver, British Columbia. I have the commemorative hive tool. I'm not sure it was funds well invested. I can't tell you a single thing about the products or machinery displayed. Can't remember a single talk by a single speaker; apologies to readers who presented. What I do recall was a big brute of a guy seated in a lounge chair in the hallway. He was old, and bent like a beekeeper. It was Jim Powers. Jim, his brother Carl, and his father Irvin Francis Powers were beekeeping innovators. Jim had retired. Jim Powers was instrumental in the Miller family beekeeping success.

Jim Powers did not attend Apimondia to glean a return on investment – he had no ROI expectation. His decision to spend time attending Apimondia was to enjoy refreshing and renewing friendships made across the globe. Jim may be the only Harvard Business School – Small Business Management School graduate beekeeping ever produced. His was a life full of experiences and for me, spending time with Jim Powers produced a large ROI.

In 2017, my son, Jason was selected for Class #47 of the California Ag Leadership Program. Twenty-four emerging agricultural leaders are annually chosen from across California to participate. The commitment, for participants was 40 days of 2017 attending Ag Leadership events: International travel; presentations from financial, agricultural, scientific, governmental, mechanical, chemical, genetics and supply-chain experts. Leadership at Miller Honey knew the time invested would equal a big ROI on Jason's career arc – and Miller Honey's fifth generation of ownership is better prepared for emerging opportunities and challenges.



Everyone gets the same 24 hours, every day. The top ten outfits, the top ten operators, the top ten clubs, the top ten Bee Associations – all those leaders and members get the same 24 hours every day. The challenges and the solutions to a big change now underway in beekeeping involves how we spend our time and how we invest our hours.

Analytics. I'm not wandering here – the above examples I hope illustrate how the past informs the future. We don't keep data the way we used to. Big, wonky bee boards give way to bi-lingual Cloud data storage retrievable in the field. Advantage: Analytics. Ten years ago, analytics upended professional sports. In 2022, with analytics, beekeepers can access real time data from distant beehives; anticipating needs without sending a crew to see when bees need supering/requeening/control materials/moving – imagine the possibilities of a device communicating from the bee yard to the operator – say hundreds of bee yards – or hundreds of paid pollination sites – in multiple crops – in multiple states – sampling tens of thousands of beehives.

This will be a messy process – several devices are now in development. The competition to optimize analytics is fierce. Actual money is being invested. The software to run these devices will rapidly improve. A beekeeper, a club, an Association; the vendors will all invest time, a precious commodity in development and refinement.

Beekeeping Analytics have arrived. Spend some time on a good investment.

JRM

Thymol

Considerations for a Successful *Varroa* Treatment

Dr. Claudia **Garrido**

There are several highly efficient treatments against *varroa* mites which are based on substances from natural origin. They are less prone for resistance issues or residues in bee products than synthetic miticides. On the downside, they need a little bit more attention and knowledge to achieve best results. Thymol is one of the natural substances that are successfully used against the parasitic mite. There are two main products with thymol as main ingredient registered in Canada: Thymovar and ApiLife Var. The latter is the latest registration in Canada, dating only from October 2020. In the U.S., two main products with thymol are registered: Apiguard and ApiLife Var.

However, these products are not the same: Apiguard is a gel with thymol, while the other two products are strips, saturated with this substance. ApiLife Var is a blend of thymol with eucalyptol, mentol and camphor, while Apiguard and Thymovar rely on pure thymol. These differences are important for understanding which product to choose in different conditions. Thymol acts by its vapours; it must evaporate to kill the *varroa* mite. The bees distribute the substance in the hive by their activities, like ventilation or removal of the product, thus supporting the evaporation. For this process, the external temperature is important: the highest efficacy is achieved when the temperature ranges between 15-30°C and never falls under 12°C. The ideal range for thymol treatments is 20-25°C. This makes it clear why products based on thymol are Summer treatments: They need temperatures seldomly reached in the colder months.

Comparison of the three products under different environmental conditions

Not many studies are available comparing the three products by means of their efficacy under different environmental conditions. The bee institute in Liebefeld (Switzerland) compared Thymovar and ApiLife Var, finding high and similar efficacy for both products (around 90%). A first extensive comparison of all three products was made in Italy: the scientists performed a study at three different locations in Northern, Central and Southern Italy. In the Centre and the South, all three products showed high efficacy, killing more than 90% of the *varroa* mites in the colonies. In the North, however, Apiguard was less reliable. The efficacy dropped to 66.9%, which is insufficient for protecting bee colonies until the Winter treatment. The researchers attributed this low efficacy to the lower temperatures and low activity of the bees: under these circumstances, the workers did not "work" on the gel to remove it. By this, the gel surface dried, impeding the evaporation. The other two products did not have this problem. In Germany, the same occurred: all three products were tested in Hesse (with cooler climate) and in the Rhine region (with milder climate). Apiguard in this trial had the lowest efficacy on both sites, with 43.1% in Hesse and 71.5% in the Rhine region. Thymovar worked better, though this product was also less efficient at the cooler site in Hesse. In the Italian study, Thymovar in addition demonstrated some problems in tolerability: the bees removed brood and honey from beneath the strips. In Northern Italy, the colonies decreased significantly in strength. At one of the two apiaries in this region, the study had to be interrupted because of the severity of the effects. This may have been due to a higher dose of thymol in Thymovar than in the other products and may have been released too fast. No such adverse effects occurred in Germany, however. ApiLife Var finally, was equally efficient at all sites and no problem with the safety for the bees occurred. In Table 1, you can find a summary of the results of these studies.

	APIGUARD	THYMOVAR	APILIFE VAR
NORTHERN ITALY	66.9%	93.6&	93.7%
CENTRAL ITALY	94.3%	99.5%	94.5%
SOUTHERN ITALY	96.5%	97.5%	96.7%
HESSE, GERMANY	43.1%	86.5%	95.0%
RHINE VALLEY, GERMANY	71.5%	92.6%	95.9%

Table 1
Mean efficacy of registered thymol products for varroa *treatment in Italy and Germany.*

Product characteristics influence efficacy

In addition to the final efficacy, both studies measured the kinetics of the efficacy during the treatment period, i.e. how fast the products kill most of the mites. Again, under the warm conditions in Central and Southern Italy, all three products reached many mites already in the first week. Under the cooler conditions in Northern Italy and Germany though, Apiguard started only very slowly and killed only about 10% of the *varroa* mites within the first week of the treatment. Thymovar and ApiLife Var, in this short period, already killed 30-35% of the mites in Italy and 30-40% in Germany.

In this context, it is important to understand the conditions for treatment success with thymol. As already mentioned, this substance acts by its vapours. The concentration in the hive air must be high enough to kill the *varroa* mites, but low enough

not to harm the bees. This concentration ranges between 5-15 µg/l hive air. Tests in Switzerland showed that Apiguard, under cooler conditions, did not reach this therapeutic concentration. It remained under 4µg/l hive air, which explains the low efficacy on cooler sites. Thymovar and ApiLife Var on the other hand reached the therapeutic concentration already in the first week of the treatment. Interestingly, the hive air concentration decreased during this week in treatments with Thymovar, while it slightly increased using ApiLife Var.

Of all three products, ApiLife Var was the most independent of environmental conditions. The efficacy remained over 90% at all sites. This may be due to the different composition of this product: unlike the other two, it is a blend of thymol with menthol, eucalyptol and camphor. An interesting property of this blend is that it remains liquid at colder temperatures. Pure thymol is solid until a temperature of 49-51°C, therefore also under hive conditions of 35°C. Mixing thymol with other aromatic substances decreases its melting point (i.e. when it becomes liquid). Both solid and liquid thymol can pass to the gaseous stage, which is necessary to reach the *varroa* mites on the bees. However, the step from liquid to gaseous (evaporation) is much more constant and reliable than the step from solid to gaseous (sublimation), especially under cooler temperatures. This may be the explanation for the more consistently high efficacy of ApiLife Var under cooler climatic conditions.

Risks and side-effects of the treatment

Every medicinal product – like *varroa* treatments – has risks and side effects. Despite being a "natural" substance, thymol can be toxic for bees when the concentrations in the hive air are too high. This could happen, for instance, using DIY preparations with thymol crystals. The formulation of registered products helps to avoid this risk, if the label instructions are respected. On the other hand, underdosing the treatments for cost reasons may result in insufficient efficacy and subsequent colony losses.

Thymol is a fatty substance. Therefore, it may form residues in wax and enter honey by small wax particles. A recent study in Spain showed that the thymol concentrations increase significantly during the treatment, mainly in wax and honey. This is not a risk for the consumer: Thymol has a FAO GRAS status, meaning that it is "generally recognized as safe". However, higher concentrations may change the taste of the honey. During the treatments, the concentration in honey could surpass the sensory threshold. Sensitive test participants noticed the taste even three months after treatment. These results confirm the recommendation to never treat with honey supers present. In addition, it is advisable to not mix the combs from the brood nest with those from the honey super.

It is important to note that these risks are mainly a consequence of wrong applications or of using DIY applications like pure thymol crystals or in presence of the honey super. If registered products are used according to the label instructions, the benefit of reducing the mite load clearly prevails.

Dr. Claudia Garrido
BeeSafe – Solutions for Bee Health and Pollination
www.bee-safe.eu

Originally printed in the Canadian Honey Council magazine Hive Lights.

All The Buzzz in...

Bee B. Queen Challenge

Hello Friends,
April is national poetry month. To celebrate , send us your bee poem.

Bee B.Queen

Learn more about bee biology.

Color Me

Walter Kanagy, PA, 9

Josiah, TX

10

Can you read this?

Antennaes Up

Photo: Giles San Martin

Take a good look at a honey bee or any insect for that matter. The antennae are constantly moving. This is how insects sense their surroundings. The bee is using the antennae to touch, smell, taste, and pick up sound vibrations. All these signals give the bee's brain a workout.

Parts of the Antenna

The antenna has 3 major areas.

The ***scape*** attaches the antenna to the head. It is the longest single segment of the antenna.

The ***pedicel*** is the second section.

The ***flagellum*** is divided into "segments". Drones have more segments than the workers and the queen.

When someone says, "keep your antennae up" it means pay attention or be aware.

The Amazing Antennae

Fill in the blanks using words from the list below.

- cell
- communicate
- drone
- measure
- sensors
- temperature
- tongue
- worker and queen

Bees use their antennae to help _____ the size and depth of each _____ while building comb.

They _____ by touching their antennae during the bee dances.

In honey bees, the taste _____ on the very tip of the antennae are more sensitive than those actually on the _____.

A _____ bee has 12 antenna segments.

The _____ have 11 antenna segments.

Bees use their antennae to tell the _____.

ooo Bee kid's corner

Produced by Kim Lehman -www.kimlehman.com
www.beeculture.com
April 2022

Antenna Cleaner

How does a bee clean their antenna? The antenna is placed in a notch on the front leg that has stiff comb like hairs . When the bee bends its leg, the antenna is held in place. It is pulled through that notch so pollen can be removed. Not only do the worker bees have an antenna cleaner but the queen and the drones have one too.

English Lesson

Antennae are both of the antennas.

Beecome a Bee Buddy

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

Name
Address
Age
Birthday Month
E-mail (optional)

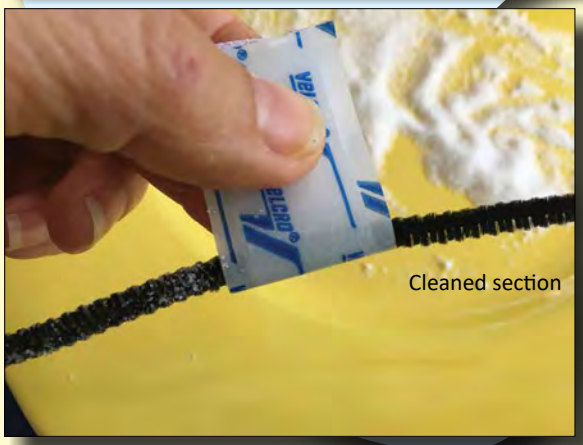
We will send you a membership card, a prize, and a birthday surprise!

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

Clean Your Antenna Activity

Illustrate bee antenna cleaning using a chenille stick, sugar and Velcro.

1. Pour a little sugar on a plate.
2. Cover the chenille stick by rolling around in the sugar.
3. Fold a piece of Velcro in half loop side in to create the notch on the front leg.
4. Place the chenille stick in the fold and pull through the "hairs" to remove the "pollen".
5. Well, that was easier than taking a bath!

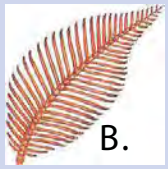


Front Leg of a Honey Bee

Antenna cleaning notch

Antennae Are Not Created Equal

Insect antennae are adapted to specific needs. A male moth has feathery antennae. A butterfly has long antennae with a knob at the top. A mosquito is bristle like. Can you match the antennae to the insect?



Bee ____
Moth ____
Butterfly ____
Mosquito ____

Greater Honey.

Jeff **Kennedy**

I am a beekeeper, albeit unintentionally. My introduction to *Apis mellifera* is likely similar to that of others born before 1990. During what seemed like endless, Summer days of my youth, it was commonplace to step on a honey bee while running barefoot through your yard. As the helpless, forager bee cast her tiny sting into the underside of my foot, I never would have imagined that roughly thirty years later, I would *choose* to get stung on a routine basis. Not just stung, I mean STUNG! Right between the eyes kind of stung!

I recall honey bees engorging on the small, white flowers that grew in everyone's yard. Back then, the Midwest, and a lot of the U.S. was covered in white clover and with the clover, came the bees. But alas, this was a period considered by many to be the "hay day" of commercial beekeeping. Modern-day beekeeping has evolved into a constant toggle between strategy and defense when combating the multitude of evils that await every altruistic forager whom dares to leave the hive.

Climate change, broadscale pesticide applications in agriculture, a booming lawn care industry, and rapid declines in natural habitat and forage, currently present severe challenges for the hive organism, and anyone that dares to don a bee suit in 2022. Lest we forget our nemesis, *V. destructor*!

The long and (the) short of it is this. Pollinators are declining rapidly and forgive me for the overused analogy, but it certainly *will* take a village of like-minded, unrelenting, forward-thinking individuals to get us out of the red so to speak for the countless checks that we have written at the earth's expense.

Backgrounds & Beginning with Honey Bees

My entry into beekeeping came after we purchased our farm in February 2017. The farm, located roughly 40 minutes from our primary residence in the suburbs, had been abandoned for the better part of 18 years and contained an heirloom pear orchard. At that time, our primary focus, and still part of our core ethos today was in land restoration and wildlife conservation. Our goals early on were to remove the unsightly, overgrowth of invasives that were choking out the native plants and propagate perennial, food producing shrubs and trees. Ultimately, we hoped to not only re-establish the natives, and develop a functioning, perennial food system, but also provide a welcoming sanctuary for ourselves and the diverse fauna that call this farm home.

Already having an orchard that was producing on site, it seemed fitting to find a local beekeeper and offer up some acreage for them to place hives on in exchange for their mentorship and helping us manage our hives. The local beekeeper and I soon discovered that his definition of beekeeping and mine differed drastically. Ella and I both have backgrounds in biology, and in another life, were quite successful in our work with reptiles and amphibians. Our specific area(s) of focus were with the true, Giant African Bullfrog (*P. adspersus*) or Pyxie frog as they are commonly referred to and the ever popular, Bearded Dragon lizard (*P. vitticeps*) to which we played an instrumental role in developing a genetically sound example of a newfound, dominant trait. But I digress.

Through his "mentoring" I learned quickly that his method of keeping bees involved letting them collect as much honey as they could collect throughout the beekeeping season, harvest the entire crop at Summer's end, and then leave the bees to their own avail in the Fall. The following Spring, he would head down south, buy more package bees, and repeat the process. Needless to say, nothing felt good about that, not to mention that he was also putting high fructose corn syrup (HFCS) feed on his colonies all season long, thus the bulk of his "honey" crop that he was selling to local retail shops was mostly evaporated and capped HFCS. I would learn that this is an all-too-common practice in the honey industry and one that we vowed to shy away from at all costs with our operation.

What I haven't touched on yet is that during this time, I completely absorbed myself in everything that is the European honey bee. Honey bee biology, breeding honey bees, queen rearing techniques, making colony increases, honey production, wax rendering, EVERYTHING!! I scoured literature from the 1800's, sourced publications from overseas, listened to beekeeping podcasts, watched YouTube videos, etc. After taking in so much information from so many different sources, I quickly realized the relevance of the common beekeeping quote, "Ask 10 beekeepers the same question, get 12 different answers."

So, now with several thousands of dollars in empty bee equipment and the knowledge that we should have possessed prior to ever purchasing our first bottom board, we started over. We spent the first couple of years amassing queen bees from some of the nation's top queen producers hailing from climates colder than ours. We knew that in order to have a sustainable apiary, we were going to have to start with exemplary genetics and then slowly impart the traits that were of the utmost importance to us. There is a lot of credence in Aesop's tortoise. Slow and steady DOES win the race!

So, tortoise we did! Slowly but surely, year after year, we were seeing higher success rates of over wintering colonies and stronger queens coming into each Spring. I find myself every year telling Ella, "These are the healthiest bees we've ever had!" I know that as beekeepers, we are getting better at our craft as our management techniques, and knowledge base evolves, but I can't assume *all* of the credit for having better bees season after season. The bees do the bulk of the heavy lifting in our operation and we are merely there to maintain the beeyards, address problems that arise, and apply treatments as needed.

Those Fluttering Embers of Orange & Black

Shortly after we began clearing out the invasive species that riddled the acreage, something magical happened. Tall, fragrant, rose-colored flowers began to pop up in several of the patches that had been cleared. Not having the taller brush and various sized tree saplings to compete with, the flowers were now able to reach up in to the sky, and grab the precious solar rays that they so desperately needed. As Spring waned to Summer, the patches began to hum with life from within.

We worked the sultry days of Summer away and soon were greeted by a frequent visitor to the farm. Around mid-July, we started to see in excess these fluttering embers of orange and black, dancing about the sky. The embers were Monarch butterflies (*Danaus plexippus*) and like the honey bees of my youth, I too recalled seeing them regularly growing up, but not as much today. A connection perhaps?

The days in the Farmer's Almanac stacked and by the end of August, there were so many monarchs on the farm, that we were dodging them as we mowed. They frequented the patches of flowers that now broadcasted a constant waft of floral sweetness throughout the sun-beaten fields. One day, as I was cutting along the edge of one of the patches, I saw the most intricately striped, yellow and black caterpillar crawling along the edge of one of the flowers large, waxy leaves. A closer inspection revealed that the caterpillar was munching on the leaf like a diligent farmer harvesting his crop. Left to right, right to left, I watched in disbelief as the cat (butterfly talk for caterpillar) consumed almost the entire leaf in just a few minutes time! Reveling in what I had just witnessed, I decided that it was time to research this flower and see what kind of ecosystem I had unfolding in front of my eyes.

My research quickly yielded that the "flowers" in question, that now grew prolifically in several patches on our farm, was the Common milkweed (*Asclepias syriaca L.*) plant, the primary host plant to the monarch butterfly here in the Midwest. The tiger striped caterpillar was the monarch's larval form, and due to a consistent decline in Common milkweed nationwide, the monarch is in serious trouble.

Fate & Honey

We never envisioned ourselves being beekeepers and were as equally blindsided by the impact that monarchs have had on our lives. Fate certainly has a peculiar way of showing itself and when it does, I tend to lean in to the momentum. Countless Google searches kept bringing us back to Dr. Orley "Chip" Taylor and the revolutionary work that he and his team were doing at Monarch Watch.

Prior to founding Monarch Watch in 1992, Chip ran several colonies of bees himself, and spent twenty-two years working for the Department of Agriculture with "killer bees" in Central and South America.

Monarch Watch is a nonprofit education, conservation, and research program based at the University of Kansas, that focuses on the monarch butterfly, its habitat, and the spectacular fall migration. Their popular, tagging program was launched during their first year, and has turned in to the cornerstone of their operation.

The Monarch Watch Tagging Program is a large-scale, community science project that was initiated to help understand the dynamics of the monarch's spectacular, Fall migration through mark and recapture. The tagging process helps to answer questions about the origins of monarchs that reach Mexico, the timing and pace of the migration, mortality during the migration, and changes in their geographic distribution. The tagging process involves applying a pressure-sensitive, adhesive tag with a unique code, to the underside of the monarch's wing. These lightweight, all-weather tags were designed by Monarch Watch specifically for tagging purposes and do not harm them nor interfere with their flight.

Each Fall, more than a quarter of a million tags are distributed by Monarch Watch to thousands of volunteers across North America

whom tag monarchs as they migrate through their area. These "community scientists" capture monarchs throughout the migration season, record the tag code and date, butterfly's gender, and geographic location, then apply the tag and release them. At the end of the tagging season, this data is submitted to Monarch Watch and added to their extensive database to be used in further research.

When it came time to harvest our first crops of honey, we decided to piggy back on the nation-wide platform that honey bees were receiving, to try and spread some additional awareness about the not-so-known decline in monarch populations and the milkweed plants that are needed to support them. Being a smaller operation, we can afford to do some of the more labor-intensive things that the larger producers don't do.

So, we set out to do smaller, seasonal harvests that would mimic the monarch's life cycle here in the Midwest. Sure, it was an unorthodox approach to traditional honey design and packaging, but any concerns that we had were quickly quelled. The seasonal, three part series has been an absolute scream with our audience and the packaging won a Graphic Design USA title in 2019, the first year that it was put into production.

Part of our mission is giving back to and supporting organizations whom we believe strongly in. A portion of all proceeds from the sale of our monarch themed, raw honey is donated annually to Monarch Watch. In addition, we also partnered with them to help spread awareness about the importance of planting milkweed within our local communities. Our "Plant Milkweed Support Monarchs" statement tees have been equally successful and has helped generate some additional revenue for Monarch Watch that we otherwise wouldn't have been able to contribute because of our limited honey production. BC

Originally settled by Chief Ouiska of the Shawnee Indian Tribe, Ouiska Run Farm is located along the banks of Whiskey Run Creek in Marengo, Indiana. Once part of a much larger settlement dating back to the 1800's, the existing acreage served as a pastured cattle operation until the 1950's, before being abandoned completely in the early 2000's.

Ella & Jeff Kennedy committed themselves to the farm's restoration in August 2016. Their stewardship over the past five years has resulted in the planting of over 500 fruit and nut producing trees, re-establishing hedgerows for wildlife, and converting multiple areas of fallow pasture into native, prairie grasses supplanted with wildflowers. Being a pollinator-friendly farm, the Kennedys' have implemented practices that work ***with*** *native pollinators to aid in their recovery and influence ongoing vitality.*

The summer of 2020 brought with it new challenges as Ella and Jeff committed to restoring an additional 12 acres that connects to the couple's farm. Their ongoing efforts, still heavily focused on pollinators, will also include components that are beneficial to grassland nesting birds.

For more information, or to contact Ella or Jeff directly, please visit **www.ouiskarunfarm.com**

PROPOLIS

From Nuisance to Medicine

James **Fearnley**

I remember meeting up with some beekeepers in Vancouver 25 years ago and talking about the amazing medicinal properties of propolis. They were not impressed. One beekeeper told me they had been trying to breed out the tendency of their black bees to produce large amounts of the stuff. Propolis for them was a nuisance which caused them no end of irritation and trouble in connection with the main purpose of beekeeping, i.e. the production of honey!

In the 25 years that have elapsed since that meeting, research into the medicinal properties of propolis has increased exponentially with hundreds of papers now being published every year from research institutions all over the world. My own work includes publishing two books about propolis and contributing to around 30 peer reviewed research papers including papers illustrating how propolis is effective against MRSA.

11 years ago, I started ARC (Apiceutical Research Centre, **www.apiceutical-researchcentre.org)** to research and develop Apiceuticals (medicines from bee products) and Sustainable Beekeeping. ARC organised the first conference ever in the UK on medicines from the beehive with the ambitious title – **Apiceuticals: Future Medicine?**

Six years ago, I started the IPRG (International Propolis Research Group, **www.iprg.info)** which every two years has brought academics together from around the world for a conference: **Propolis: In Human and Bee Health**. Our last physical conference in Sofia, Bulgaria attracted over 125 researchers with over 40 papers presented. Our next physical conference planned for Istanbul in 2020 had to be postponed because of COVID, but the stream of research including clinical research into the use of propolis did not stop. Clinical trials research began to appear about the use of propolis in treating COVID, upper respiratory tract infection and metabolic syndrome i.e. diseases connected with COVID, like Diabetes and Obesity. Rather than waiting for COVID to abate and for travel to be allowed again, the IPRG decided to explore an online conference. Would contributors come? Would there be any participants? It was stressful but highly successful. Over 3000 people viewed the conference **Propolis: Medicine for the Future?** with 400 fulltime participants from 90 countries and 40 papers presented.

At ARC we presented a paper showing how propolis combined with antibiotics can radically improve their efficiency and reduce the side effects.

Suddenly propolis is being talked of as a new medicine rather than a nuisance. It has become a bridge between traditional natural medicines/herbal medicines and pharmaceutical medicines and is proving to be a real contender in the fight against antibiotic resistance, now defined by WHO as a global health challenge.

Global interest in the medicinal properties of propolis is now a reality. Propolis though is a new medicine which works by stimulating our immune system, by disabling bacteria and viruses rather than destroying them. Propolis, more than any other natural substance, is leading the way towards a more holistic, gentler, and ultimately more humane and effective medicine of the future. BC

About the Author

James Fearnley has been researching the amazing properties of propolis for over 30 years working with universities around the world, publishing two books: *Propolis: Natural Healing from the Hive Souvenir Press* and *Propolis and Oral Health – Dispensary Press.*

James has travelled the world too collecting propolis samples to analyse back home in Whitby North Yorkshire, contributing to over 30 peer review journals exploring the many ways that propolis can help with human health.

BeeVital produces the largest range of high quality propolis products in the UK backed up by decades of research managed by their own trained chemists and researchers in their own laboratories. **www.beevitalpropolis.com**

Apiceutical Research Centre **www.apiceuticalresearchcentre.org** was founded by James in 2010 and has built an international community of researchers looking at how propolis works for both the honey bee itself and for man.

The IPRG (International Propolis Research Group, **www.iprg.info**) which James founded in 2016 runs international conferences of this now global research community and provides a platform for information, research collaboration and online conferences via its own unique platform **www.hivechat.co.uk**

James' BeeArc Project **www.beearc.com,** planned to open in 2025, will create a threefold exploration of ways in which the honey bee can inspire our social, economic and cultural life through a combined Discovery Centre , Research Centre and Sustainable Village.

Worldwide **Propolis Survey**

Wherever you find propolis, its chemical and biological properties vary depending on the local flora and climate.

1 In Tropical Zones propolis contains more phenols and has stronger "antibiotic" properties.

2 In Temperate Zones propolis contains more of flavonoids and has greater anti-inflammatory properties.

3 In Meditteranean Zones propolis has a mix of these characteristics.

Why Propolis is so Important?

The ARC **Global BeePharma Project** has looked at propolis from around the world. We found that:

- Propolis can stop bacteria from joining together in dangerous biofilm.
- Propolis from the South Sea Islands was effective against MRSA - Multiple Resistant Staphylococcus Aureus.
- Propolis from an area where there was sleeping sickness contained an anti-trypanasome chemical, i.e. a chemical used in treating sleeping sickness.

James Fearnley founded the Apiceutical Research Centre in 2011. ARC is a not-for-profit organisation, devoted to researching the medicinal properties of bee products and to their sustainable production. ARC is run be an international board of scientists.

In 2016 James founded the IPRG (International Propolis Research Group) which runs bi-annual conferences on propolis in human and bee health.

Find out more:

IPRG International Propolis Research Group — iprg.info

ARC Apiceutical Research Centre — apiceuticalresearchcentre.org

Calling All Beekeepers **Wherever You Are In The World**

Send us a 300g sample of your propolis and we will pay you $100!

Contact us for further details about how to send your sample and claim your $100

james.fearnley@beearc.com

+44(0)7980624988

Information including the precise location of the sample, a description of local flora, the date and time when the sample was collected will be required.

Oh, The Joys of Swarm Season

Ettamarie **Peterson**

Fellow beekeeper Christine Kurtz getting ready to hoist the "swarm bucket" up to help catch a very high swarm.

It's just a few days past the Winter solstice and I am already getting geared up for swarm season. That is because it is my very favorite part of beekeeping. I am an absolute nut about catching swarms! To me it is like fishing; once you have caught your first fish, you are hooked! Catching my first swarm was what did it with me! I remember being superstitious about wearing a certain shirt because it seemed when I wore it, I would get a call for a swarm. I convinced myself that was a bit ridiculous as I did get calls on days the shirt was in the laundry, so I stopped trying to wear it so much.

Now I rely on getting the word out to anyone and everyone that might possibly spot a swarm. I use social media a lot to do this. My name is also on our local beekeepers' association website swarm list which helps a lot. I am well known in our nearby town as a person to call when there is a swarm. The local police department has my contact information and calls me often. Once when I was headed home from a swarm call downtown during the annual street antique fair, I crossed a congested intersection despite the sign that clearly said, "Right Turn Only." A policeman spotted me and pulled me over. I showed him my license and he called it in. As I was busy trying to find my proof of insurance he talked to the office. He came back and told me I was free to go as I was "the bee lady!" Was I ever happy that day!

When I get called for a swarm, I quiz the caller. I ask the size of the swarm, so I know what size box to take. Often the answer is something like there are at least a million bees so then I ask what size the swarm is in relation to a baseball, football, or basketball. If the caller says they have not landed yet so they can't answer that, I say call back when they land as I cannot catch them while they are still flying.

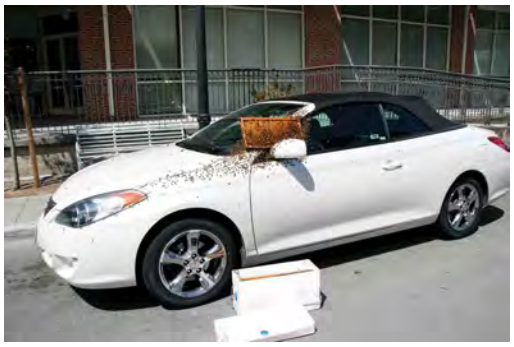
The other questions I ask are when did the swarm arrive and how high up is it? These are important things to know because if they just landed, I know I probably have more time to get there. I need to know how high up, because if they are too high to reach with a ladder or my bucket on a pole. I must explain that they are not possible for me to retrieve. Often, I will hang a swarm trap in a nearby tree and explain that with luck the swarm will move into it.

My favorite swarms are chest high or lower. I have started asking people to take cell phone photos and send them to me. This is a big help letting me know what I am getting into.

Sometimes swarms are on fences near roads where parking is a problem. If the swarm is on private property, I make sure I have permission to go on there. Last Spring as I was taking a swarm off a fence, the farmer on the other side of the fence challenged me. I politely asked him if being on the roadside was trespassing and he had to admit it was not. I assured him I was not trying to steal the bees which had come out of a commercial beekeeper's stand of hives on his property. I told him I was really doing him a favor because the bees might leave the fence and go into one of his neighbor's buildings. I also assured him I had called the number that was stenciled on the beehives and got a recording and had left my name and number. He rode off on his four-wheeler satisfied that I was doing the right thing.

Before I leave for a swarm call, I pack up all the gear I think may be useful. I have a bucket with a list of essential items taped to the side, so I won't forget something. The list reminds me to take my bee brush, large turkey feathers, clippers, Fischer's Bee Quick, lemongrass oil and/or Swarm Commander, a spray bottle with sugar water, duct tape, caution tape, rope, an old sheet, a queen catcher and my business cards. I generally use the feathers rather than the bee brush, but the bee brush has a longer handle to reach farther. The feathers are good for painting Bee Quick above the swarm if I don't want them to move up out of reach. The lemongrass oil works as an excellent attractant, and I lightly drop it on the top of the frames in my catcher box. Last season was the first time I

Another beekeeper, Paul LeMay, using the swarm catching "bucket" for a high swarm.



Having an old frame really helped lure the bees off the car in Petaluma. Funny thing that happened while I was doing this was the owner of the car saw me doing this and turned to her companion and casually said, "I guess we will take your car!"

Close up of how a water jug can be turned into a swarm catcher. The pole slips in and out of the PVC adapter to make it easier for the beekeeper to dump the bees in the box. Advantage of this gadget is various lengths of poles can be used and the beekeeper can see from below the bees are in the jug.

bought Swarm Commander. I think it and the lemongrass oil are about equal as an attractant. Old drawn comb is one of the best attractants. I always take some along in my catcher box. When the bees are up in a tree or on a fence post I put the old comb by the swarm, and they generally climb onto it. If I see the queen is on the old comb, I put it in the box and then hold the box up next to the rest of the swarm. If she isn't on the old comb, I shake the bees into the box and put the comb back next to the swarm gathering more bees. If the swarm has landed on the ground, I can put the box with the old comb down next to it and almost always they will walk right in. This is one reason I prefer swarm catching boxes that have bottom entrances. The old sheet is useful to cover the ground under the swarm box. You can see the bees better and the bees have an easier time walking into the box. Duct tape is used to make sure the lid stays on the box. I have accidently flipped the lids off in my car!

I have designed some boxes using the ends of old bee boxes and campaign poster boards. I really like these homemade boxes because the fronts and backs are solid and have the shelf to hold frames. I drilled air vents in the fronts and backs. I also screwed holders for ropes so I could hang these boxes in trees and hold them easily while climbing ladders.

The business cards are essential for several reasons. Very often a second swarm will come to the same spot within a day or so of the first one. The contact person knows your name and phone number. Sometimes the call will come a year later because there is a nearby bee tree that swarms annually or even a neighbor that has beehives that swarm annually. There is one lady that has called every year because the bees love her house. I told her it was because she lived at the top of B street! You want your contact information to be shared as much as possible. You also need to advise the contact person you will be returning at sundown when all the bees are in the box. Ask them to call you if they see the bees have all rejected the box and taken off. Sometimes the bees leave for unknown destinations and sometimes they just go back to their original spot. Put

This swarm had bees that could read!

Caution tape was very necessary to alert cars and people to this swarm catching in progress. The box in the photo is one of my homemade swarm boxes made from campaign posters and old bee boxes.

your name and phone number on the side of your swarm boxes. This gets your name out as a responsible beekeeper.

The caution tape is very often needed to warn people to go around the swarm catching box. I have caught many swarms near sidewalks. People appreciate the warning. Remember, when you are in public catching swarms, you are an ambassador for bees and beekeeping. Take time to talk to the public and explain about why bees swarm. Watching a swarm being caught is great entertainment! Sometimes the local newspaper will take your picture and write an article about the catch. I also carry an extra bee suit that can be offered to a person who volunteers to help me by holding the ladder or handing me things while I am up on a ladder. People love being part of the swarm catching! Some might even decide beekeeping could be the next hobby worth looking into. Come to think of it, a swarm catcher was the person that encouraged me to be a beekeeper 28 years ago. Maybe that's another reason why I love swarm catching so much!

Left
I had to call my beekeeper friend Darlene McGinnis and ask her to bring the big double-deep hive her husband John builds because there was another huge swarm in the same location. You can see in this photo how using an old sheet under the box helps the bees enter the box.

Right
When a swarm is too high to reach, the alternative way to capture it is to hang a swarm trap made of two pressed pulp flower pots and hope they go into it. I explain to people that it does not always work because sometimes the bees have already decided where their next home is and will go there instead.

Darlene McGinnis took this photo of me that day we were chasing multiple swarms!

Author Bio

During the year when Ettamarie Peterson is not capturing swarms, she is the beekeeping project leader for Liberty 4-H, so many of the swarms are given to the young beekeepers. She is the editor of the Sonoma County Beekeepers Association monthly newsletter. She and her husband have a bee friendly farm just outside Petaluma, California where they raise a small herd of cattle, a flock of egg laying chickens, a small orchard, lots of bee friendly flowers and a huge vegetable garden.

BUILD A SWARM BOX

Starter Colony

Ed **Simon**

I've tried both a Cloake Board and the Horizontal Frame Support to raise queens. Now it's time to try a Swarm Box. The swarm box is an artificial, extremely highly populated nucleus size box with large areas of screen that provides massive ventilation. The ventilation is required to dissipate the heat that an extremely large volume of bees produce.

This is the better way to produce quality queens, as recommended by The University of Minnesota in their bee raising class, and Dr. Larry Conner in his book "Queen Rearing Essentials." The premise behind this method is that a massive number of nurse bees feeding a relatively small number of grafted queen cells will produce a large quantity of royal jelly to feed the larvae which then gives the larvae an excellent start on their life as a queen.

Basically the swarm box is a five frame nuc with extensions to the bottom that allow for ventilation and a place to put a water supply. There is also a sliding top that can be easily shut and secured so it won't be opened by mistake. The need for the secure top is because the swarm box is usually placed in a cool dark area for eighteen to twenty-four hours. In my situation this means a basement room and I don't need five to ten thousand bees loose in the house.

Parts

(Thickness x Width x Length) – for a five frame swarm box

1. ¾" x 9¼" x 19⅞" – Sides (2) (1" x 10" board)
2. ¾" x 7¾" x 15" – Ends (2) (1" x 10" board) – vertical orientation
3. ¾" x 9¼" x 20¼" – Box bottom sides (2)
4. ¾" x 9¼" x 20¼" – Box bottom ends (2)
5. ¾" x 9¼" x 20¼" – Box sides (2)
6. ¾" x 9¼" x 20¼" – Box ends (2)
7. ¾" x 2½" x 19⅞" – Sliding top side (2)
8. ¾" x 2½" x 10¼" – Sliding top closed end (1)
9. ¾" x ¾" x 19⅞" – Sliding top side guide (2)
10. ¾" x ⅜" x 7⅛" – Sliding top closed end guide (1)
11. ¾" x 1½" x 10¼" – Sliding top open end (1)
12. ¼" x 9½" x 21" – Sliding top (1)
13. ¾" x 7¼" x ??" – Frame stabilizer (2) (Deep on medium)
14. ⅛" hardware cloth or aluminum window screen

Construction

This swarm box is designed for use with deep frames. If it is used with medium frames there is a little more room for the bees and the ventilation should improve.

The building of a swarm box is more complicated than the usual devices I build. This is because of the number of parts needed. Be sure you study and understand the drawing before you cut any wood. Remember it's impossible to cut a board longer or wider that it's current dimensions.

Step 1: Trim a ⅛" slice from one end of the board to square the end of the board.

Step 2: Cut the sides (parts 1) from your board.

Step 3: Cut the ends (parts 2) from your board.

Note: The ends are used with the wood grain running vertically. This provides strength to the wood that holds the screen on the bottom ends and sides. They look like legs in the pictures.

Step 4: Cut a ⅜" x ⅝" frame rest in one end of each of the end boards.

Step 5: Cut the ventilation windows in the ends. Leave a 1" wide leg on each side of the ventilation cutout. See the diagram marked "Front View" for the positioning and dimensions of this cutout.

Step 6: Using the ends and sides (parts 1 & 2), construct the body of the box.

Note: The box must be square so the top/lid will operate correctly and smoothly and not allow any bees to escape.

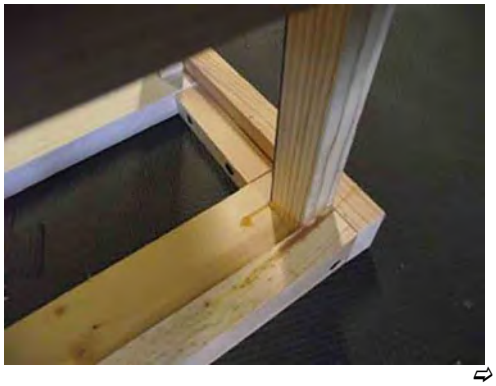
Step 7: After cutting the parts for the framing of the bottom of the box (parts 3, 4, 5 and 6), assemble the bottom of the swarm box as follows:

A. Attach the box bottom sides (parts 3) to the bottom of the legs.

B. Add the box sides (parts 5) to the sides of the pieces attached in step "A".

C. Add the box ends (parts 6) to the end of the swarm box.

D. Finish the bottom by installing the box bottom ends (parts 4) inside the box ends and between the box bottom sides (parts 3).



Note: What you are accomplishing in this step is providing a frame on the bottom of the swarm box to which you will attach the hardware cloth.

Step 8: Cut the sliding top parts 7, 8, 9, 10 and 11 from available wood. Glue and screw the sliding top pieces 7, 8, 9 and 10 into an open ended assembly. This assembly should just slip over the top of the

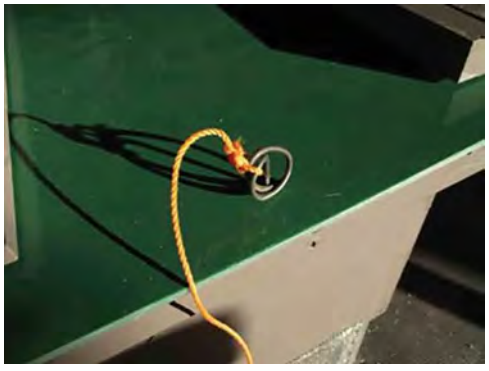
swarm box with the slide guides resting on the top of the box. The sliding top open end piece (part 11) will be used after this assembly is attached to the swarm box.

Step 9: Select a ¼" piece of hardboard or plastic and cut it for the sliding top (part 12).

Note: I like to use plastic because it doesn't swell and bind up when used in a groove.

Step 10: Place the sliding top (part 13) on top of the swarm box and then put the sliding top assembly built in step 8 on top of the sliding top. Add a set of shims under the sliding top guides to provide the spacing so the sliding top (part 13) will be able to move in and out with ease. Then screw the sliding top assembly into the sides of the box.

Note: The top must be able to be closed very easily. You will have four to seven thousand bees milling around and you need them confined in the swarm box.



Note: Do not glue the sliding top assembly to the box. You may want to remove it at some time in the future.

Step 11: Finish the top by adding the sliding top open end (part 11) to the open end of the top assembly. It needs to allow the top (part 12) to glide in and out of the grooves with minimal resistance.

Step 12: Drill a hole through the sliding top (part 12) into the sliding top open end (part 11). This hole should be big enough to allow a nail or a piece of wire to be inserted to hold the sliding top closed.

Note: You don't want the swarm box to lose its lid when you are moving it around. Five thousand bees loose in the house would mean the end of your beekeeping career and possibly a divorce.

Note: If the wire or nail is loose then give it a slight bend to make it stick in the hole. Then add a tether to the wire so you won't lose it.

Step 13: Cut the frame stabilizers (parts 13) and drill the holes in them. These are used to provide a path for the bees to get to the water on the bottom of the swarm box and to keep the frames from moving.

Note: The length of this part is entirely dependent on whether you are using deep or medium frames in your swarm box.

Screw the frame stabilizers in place. Do not glue these in. You may want to use different size frames in the future.

Step 14: Paint your swarm box.

Note: Free paint is usually available at your local recycling centers.

Step 15: Staple the hardware cloth (part 14) to the swarm box. Use plenty of staples. A hole or leak for bees to escape through is not a good situation.

Note: Because the staples are in tight corners use a staple hammer and a hammer to apply the staples.

Conclusion

This swarm box is solidly built and a little complicated to build, but if constructed carefully, it will give your queens a good start for many years.

Thoughts

A queenless swarm box with an over population of nurse bees and no larvae to attend to, is the recipe for queen cell building. Adding the grafted cells with a vertical orientation kicks the nurse bees into a nursing frenzy and the grafted cells will be well filled with royal jelly. In less than twenty four hours, a batch of queens will have an excellent start.

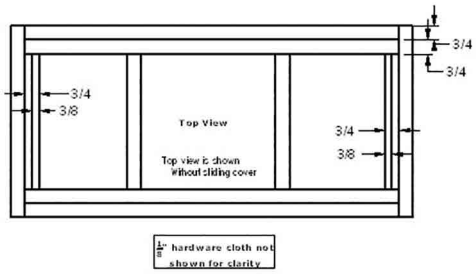
Usage

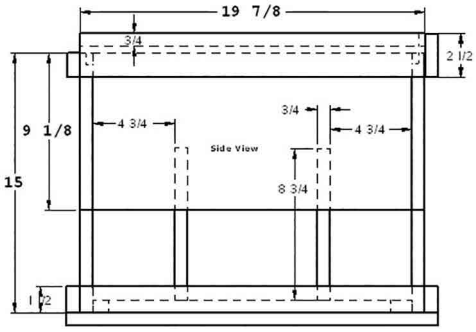
It is just like baking a cake (take two cups of flour and add…)

1) Place a shallow container of water with a wet wash cloth or a wet sponge, on the bottom.
2) Add two frames of honey & pollen (uncapped honey works just fine, pollen should be fresh).
3) Add two frames of drawn comb for cluster space.
4) Add a frame of young larvae in the center position in the box.

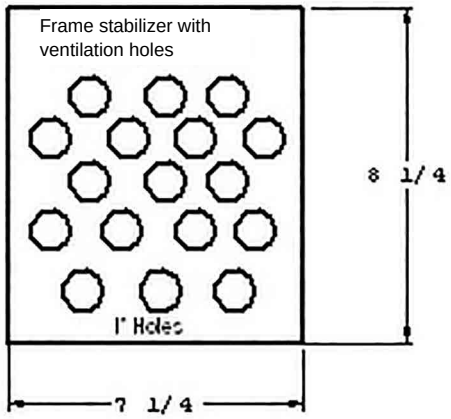
Note: This will start the nurse bees producing royal jelly and at the same time provide a second check for a queen that you missed when you shake the nurse bees into the swarm box.

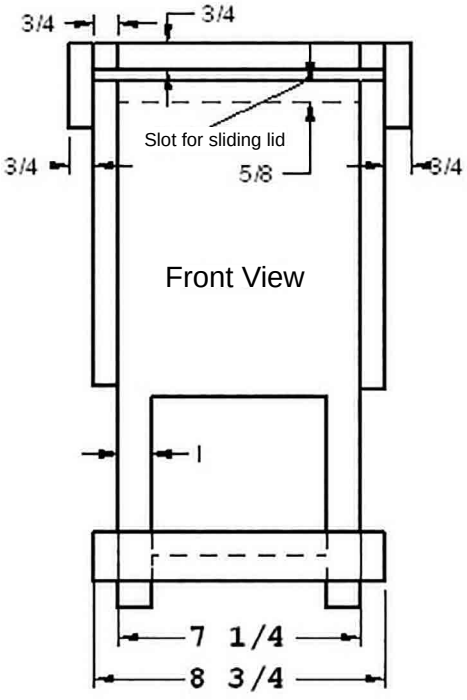
5) Shake five to 10 frames of nurse bees into the box (no queen).
6) Let it sit in a cool, dark place for 24 hours.
7) Check for the start of queen cells to make sure that there is no queen in the swarm box.
8) Fill your grafting frame with young larvae.
9) Replace the young larvae frame with your newly grafted frame in the center position in the swarm box.
10) Return the swarm box to the cool ,dark place.
11) Wait 18-24 hours.
12) Place the newly started queen cells into your finishing hives.
13) Return the nurse bees to their original hives.





Measure to fit - dimensions are approximate for medium frames





South Carolina Statewide Honey Pollen Analysis

David **MacFawn**

In early 2021, South Carolina Beekeepers Association (SCBA) began thinking about conducting a South Carolina statewide honey pollen analysis. Work on the Congaree River basin honey pollen analysis (Melissopalynology) was completed in 2021 and an article was submitted to *Palynology*.

For the Congaree River basin, we collected fresh honey during 2020 and analyzed the pollen in the honey to determine what nectar sources were contributing to the honey. The Congaree study was extremely successful, and we decided to replicate the Congaree study on a South Carolina statewide basis. South Carolina is the first state to do a honey pollen analysis on a statewide basis to determine what comprises our honey. The analysis will also help determine what to plant in the various parts of the state when bees forage. We will also observe what plants are blooming when we collect the weekly nectar. This will help the universities quickly identify the pollen sources.

Brett Kahley, a district manager for FedEx, was instrumental in setting up affordable shipping to Global Geolab Limited (see next page for full address), for slide preparations before sending the slides to the three U.S. universities for analysis. June Ponder, a long-time beekeeper in the SC upstate, was contacted and agreed to help co-manage the grant. A budget was generated for the SC statewide honey pollen analysis that included pollen analysis at three universities in the United States, labor, and travel. The budget came to approximately $400,000. USDA did not have that much money in their budget for this type of research, so the South Carolina Department of Agriculture was contacted. They had a grant available for $50,000. This meant all the labor and travel needed to come out of the budget, leaving the university the cost of the honey pollen analysis. Rosalind Severt (another Eastern Apicultural Society Master beekeeper and SC Master beekeeper) was consulted, and we decided the study was certainly worth doing. The participants decided to proceed without anyone taking a salary. SCDA was gracious enough to increase the budget to $70,000 to use mainly for university analysis. So, we had our funding, and the budget was approved at the end of September 2021. Travel expenses were covered by David MacFawn. The sales of his three published books defrayed the costs (Outskirts Press in Parker, CO, Amazon, Barnes & Noble, and Books a Million).

We had a chart of blooming plants in SC that was between 50 and 75 years old. This chart was defined using anecdotal information. Pollen analysis of the honey would be much more accurate, and the Congaree study identified multiple additional nectar sources contributing to the Congaree honey. To date, 19 out of 20 honey collectors have been lined up and we are in discussions for the remaining honey collector.

Project Goal

The South Carolina Beekeepers Association will select 15 local bee associations, resulting in 20 collection locations throughout the state of South Carolina (15 rural and five urban). These are based on the six SC ECO Regions collecting honey samples weekly during the nectar flow and check/collect nectar as available during the nectar dearth's for honey pollen analysis to determine:

- when and which plants typically bloom
- what the nectar sources are for honey in particular areas of the state
- if maples that bloom at the end of January/early February are both a pollen source and honey/nectar source

The honey samples will be analyzed for pollen at universities throughout the United States and one or more articles will be published with the results. Replicating this study in the future will help determine changes to the SC ecosystem.

Project Workplan

07/2021 – 12/31/2021 Define primary and backup beekeepers who will collect honey from 15 local SC associations for 20 sites. Determine to which university each honey collection site will send its honey samples.

01/2022 – 12/2022 Collect honey from colonies during the nectar flows and check/collect nectar as available during the nectar dearths.

06/2022 – 01/2023 Process the honey samples.

01/2023 – 05/2023 Generate data reports.

05/2023 – 12/2023 Generate articles for journals.

12/2023 – 9/2024 Publish results online and in a book available to the public.

We have organized and identified the names, USPS mailing addresses, email addresses, and latitude/longitude of the honey collectors' bee yards. Starting in mid-January 2022, each of the honey collectors were contacted weekly to discuss what is blooming and their honey collection. Hive scales (BroodMinder purchased through Betterbee), specimen containers, and hive tools were purchased for all the sites. The material was mailed to the beekeepers in December 2021 to ensure they could start their work in January 2022.

During a nectar flow, the bees will stop taking sugar syrup if you are feeding it in favor of fresh nectar. If you believe you are in a dearth (between when the maples bloom and the Spring nectar flow starting in March/April in South Carolina, or the Summer dearth starting end of May into June in most parts of the state) and are feeding sugar syrup, you can tell if it is fresh nectar by doing the following:

- turn the comb upside down and if "nectar" shakes out, it is fresh and has not been cured by the bees
- if you are feeding sugar syrup and the bees are still taking the syrup, this is syrup, and you should not take a sample
- if you are feeding sugar syrup and the bees are not taking the syrup this is fresh nectar and you should take a sample

Several things will contribute to the success of our honey grant project:

- Collect honey samples weekly during the nectar flows. Collect honey samples for two weeks when the maples bloom and collect honey samples during the Spring nectar flow. There usually is a dearth in most areas in South Carolina between the maple bloom and the Spring flow during which we will not collect samples.
- Collect samples around the brood nest during the maple bloom and in the upper part of the super stack during the Spring flow.
- Check for fresh nectar when we believe there is a Summer dearth in most parts of the state. The upstate/mountains may be the exception with the Sourwood flow. If there is not any fresh nectar, do not collect samples. Be careful if you need to feed sugar syrup; it may appear to be fresh nectar, but it is syrup. If the bees are taking the syrup, do not take samples. If there is fresh nectar coming in, the bees will not take the syrup. Given the cost ($115 to chemically process to see the wall structure of pollen grains and analyze a sample, and we are on a budget), even though there are 25 samples available per site, we will only take 18 to 20 samples for the entire year. We need to have extra funds left to publish a very thorough book.
- It is very important to write the date the sample was taken on the label provided before placing the label on the specimen jar. This date is how we are going to track when during the flow the sample was taken.
- I will email/call the honey collectors weekly starting toward the end of January/first of February 2022.

The purpose of the contact is to discuss any questions and for me to collect information for our SCDA quarterly report.

There is usually a dearth after maples bloom until the main flow starts. So, in your area start going into the hive two weeks before you expect your normal flow. Look for bees flying with intent, fresh nectar in the comb, whitening of comb edges due to fresh wax, and increase in hive weight. Sample weekly during the flow until the Spring flow ends. The hive scale should help determine when the flow is over.

Check the hives during the Summer dearth for fresh nectar and sample accordingly. Do NOT take all supers off in Summer and start feeding during the dearth.

Sample during any Fall flow up to the first frost. We are trying to save work and expenses, so only take samples when there is fresh honey in the hive. It costs $115/sample to process the honey.

Bees store surplus honey above the brood nest. They typically store surplus nectar beginning in the center of the super and store outward as the nectar flow proceeds. When the super is full except around the outermost frames, the beekeeper adds another super. ***It is critical that the beekeepers sample honey from the outermost frames of the top honey super.*** How quickly the superframes are filled is a function of the number of bees in the hive and how strong the flow is. Also, I used supers with all drawn comb, not supers with foundation or foundation frames interspersed with drawn comb. The rule of thumb is it takes 8.4 pounds of honey to produce a pound of beeswax if the wax cells need to be drawn out from the foundation. Hence, honey may be impacted if drawn comb or just foundation is used. For plastic foundation, the plastic should be coated heavily with beeswax to get the bees to draw out the plastic foundation. The bees use the beeswax on the plastic foundation to assist them in drawing out the cells.

Hive Scale: The goal of the hive scale is to detect when nectar flows are occurring, and the hive is gaining weight. The nectar collector can move the scale to another hive in the same bee yard if the current colony swarms, dies, etc., so they can detect nectar flows.

We have three universities doing the analysis (University analysis subcontracts: Morehead State University, Dr. Jen O'Keefe; Louisiana State University, Dr. Sophie Warny; C & S Science Consulting, Dr. Carol Wymer). Mail samples approximately every other month starting the middle of May. **Each specimen must be labeled with the hive's latitude/longitude, date sample taken and your name so we can keep track of the samples during lab processing.**

Send your sample to:
Global Geolab Limited
729B 15 Street S.W.
Medicine Hat, AB
Canada T1A 4W7

Printed shipping labels will be provided.

Log Layout

2022 WEEK	DATE Sample Taken	Plants Blooming
Jan Wk1	_____	_____
Jan Wk2	_____	_____

Log of Honey Sample Dates and Blooming Plants

You may log blooming plants even when samples are not taken as indicators that hives are not producing honey. Try to take samples the same day of the week if possible. For example, avoid collecting on Saturday and then the Monday right afterward. That said, it is better to do it that way than to skip a week in a honey flow. The weather may alter the schedule.

We will write another article in about a year to update you on our preliminary results. A book with the findings will be compiled and published by Clemson University Press and be made available to both the South Carolina beekeepers and the public. BC

David MacFawn (**dmacfawn@aol.com**) is an Eastern Apiculture Society Master Beekeeper and a North Carolina Master Craftsman beekeeper living in the Columbia, South Carolina area. He is the author of three books:

Applied Beekeeping in the U.S.
https://outskirtspress.com/appliedbeekeepingintheus/
Beekeeping Tips and Techniques
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A Chronicle of Some Common Beekeeping Terms

I gave you a "heads-up"

In the February 2022 edition of *Bee Culture* magazine, I wrote that I had found some of obvious artifacts in bee supply catalogs and in the bee world that are historically interesting. At the end of that piece, I wrote that I would return to this subject. Well, I'm back. As it were, you were warned.

Your local bank teller

Think about it. Why are banks the only places today that have *"tellers*?" Apparently, the word is a derivation of a Middle English word, *tellen*, which meant *"to count."* As early as 1480, the word, *teller*, was used to describe anyone who counted anything – merchandise, animals, votes, or money – anything that needed to be inventoried. While in times past, *teller* seems to have been a common word used for multiple purposes, we now use it nearly exclusively to describe employees at banks who count our money. So, when you visit an ATM (Automatic *Teller* Machine), that modern contrivance is named after an ancient procedure. It's interesting that we are using a very old word for a very modern procedure.

Language litter

Our English language is littered with words having interesting histories. *Clue, quarantine, malaria* (from Africa meaning *bad air*), and *ketchup* are but a precious few of the many, many words we use every day that have colorful, if not ancient derivations.

But my interest is in all-things-beekeeping and not so much bank tellers. Humans have apparently had a relationship with honey bees for about nine-thousand years[1]. We've been beekeeping about as long as we have been farming. I don't think modern beekeepers realize just how old our craft is.

Naturally, beekeeping has evolved some words (terms) that have either been changed or have adapted to modern apicultural use. They go back a long way. But these words can require outright study when reading an older bee book or perusing a supply catalog. These words frequently make no linguistic sense in beekeeping context – or any other context for that matter. They have become unique to the beekeeping lexicon[2].

Super and supering

Only beekeepers worry about their *supers and supering*. Who of you reading this have not had to explain to your friends who know nothing of beekeeping why you are *supering* your colony? Indeed, do ***you*** know why you are ***supering***?

Readers, at this point, I am on thin ice. I am not a historian, grammarian, nor am I a linguist. I am only a beekeeper trying to determine why our industry uses bee boxes called *"supers."* What follows is my effort. Patience please.

From the *Wiktionary* I post directly: From *super-* (prefix), from Middle English *super-*, from Latin *super-*, from *super* ("above"), from Pre-Italic or Proto-Indo-European **eks-uper*, from **eḱs* ("out of") (English *ex-*), from **$h_1$eg^{h}s* + **uperi* (English *over*). Cognate to *hyper*, from Ancient Greek[3]. Merriam-Webster defines "*super*" as: super- Prefix. Latin, *over, above, in addition*, from super *over, above, on top of* — more at *over*.

Beekeepers, it seems that we are using a very old definition of the word *super* when we use it as a name for a bee box. Super. Nearly everyone today, uses *super* as a prefix, while beekeepers use the word uniquely as a noun that names a bee box.

During the development of supering, glass domes or small wicker baskets were considered superior to simple wooden boxes. In our earliest years, wooden boxes were not our first choice for use as a super. It took the passing of time for the development of the wooden box that are now called supers to come into common use.

Does this information *super* excite you? So, go to your bee yard next Spring and *super* up. Put those empty boxes on top of your hive. You'll be doing the right thing. But you can pretty much forget *nadiring, eking*, or *collateralling*. We don't do that much now.

Nadiring and eking

In general, when adding space to a colony, beekeepers no longer employ *nadiring, eking*, or *collateral* positioning any more. Interestingly, beekeepers who use the Warré hive design will sometimes nadir their colonies, but that use is pretty much the limited range of beehive nadiring today. Nadiring is the process of adding empty boxes at the very bottom of the hive just as supering is the process adding additional space on the very top of the hive.

In *The Handy Book of Bees*[4], A. Pettigrew explains that when nadiring, the empty added space below was separated by a crown board – what we now call an inner cover in the U.S. The crown board had a "large" hole

[1] Roffet-Salque, M., Regert, M., Evershed, R. et al. *Widespread exploitation of the honeybee by early Neolithic farmers*. Nature 527, 226–230 (2015). **https://doi.org/10.1038/nature15757** (Summarized in: **http://go.osu.edu/oldbeekeeping**)

[2] From Latin: *Apis* (Bee), *Apiarium* is beehouse or beehive. (Apiary) (Apiculture – the rearing of bees)

[3] **https://en.wiktionary.org/wiki/super**

[4] Pettigrew, A. 1870. *The Handy Book of Bees – Being a Practical Treatise on Their Profitable Management*. William Blackwood and Sons, Edinburgh and London. 193pp.

in the center from which the crowded brood nest would move through and into the lower empty box, *"hanging there to build new combs."* Essentially, the new comb would be used for brood and the original space that was previously used for brood would become filled with honey.

The now-full original brood nest that has been filled with honey could be removed as surplus honey. In a way, the original brood nest had become what you and I call a super. Pettigrew, with only anecdotal support, wrote that both nadiring and eking suppressed swarming. Maybe it does. Maybe it doesn't. I don't nadir my bee hives, so I can't say one way or the other.

"Eking" was the procedure of adding an additional rim, commonly below a skep but sometimes a wooden rim beneath a hive much like nadiring. Eking seems to have been done primarily to forestall swarming by adding brood space to a crowded colony. There was no mention of using a crown board with the eking process.

Co-lateral hive management

During the 1750s, *"Bee-Masters"* of the day explored supplying additional space to the central colony on both sides rather than only on top or bottom. An important consideration of the time was that keeping bees in skeps required that a specified number of these colonies had to be killed with sulfur to harvest the honey. The collateral system was noted to be humane and that the bees would not leave the colony *"in disgust"* after having their honey taken from them.

The side compartments were primarily additional space to help dissuade swarming. By my and your standards, these were small colonies producing small crops. In many instances, there was a glass dome atop Thomas Nutt's[5] hive that was a kind of super. In general, the few surviving examples of Nutt's Collateral Hive were superbly constructed and were referred to as parlor hives for gentlemen. If a Nutt Hive was put outside, it was generally kept beneath a shelter.

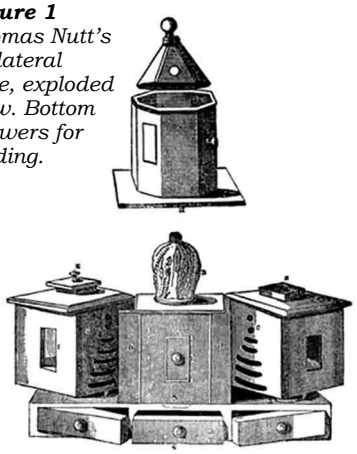

Figure 1
Thomas Nutt's Collateral Hive, exploded view. Bottom drawers for feeding.

Along with Thomas Nutt, Stephen White and John Jones survive in the old beekeeping literature as beekeepers who supported collateral hive concepts, but there are no existing hives that they touted. Few procedural instances remain for today's beekeepers to add additional space from the sides of the colony. Maybe stretching a point, but some management procedures of top bar hives, on occasion, may employ a kind of side space additions.

Supers and supering are paramount beekeeping terms

At the historical outset, placing additional space on top of the colony was called *"Storying."* Later (I don't know how long), the word *super* replaced the word *"story."*

Beekeepers, I apologize for this discussion taking so much of your reading time, but I feel that it is necessary to understand that super and supering – as used by beekeepers - is essentially an archaic use of the word that has now evolved other meanings in the English language. As is so often the case in beekeeping, other techniques were in use, and each procedure had its loud and strident proponents and opponents. *Storying*, renamed *supering*, survives to this day, but *nadiring* (and it's similar *eking*) and *collateralling*, have passed into beekeeping disuse.

So that's why beekeepers *super* their hives. *(There! I discussed that to death.*)

Medium brood foundation – the story as it fades into history

For many years, and still today for some producers, medium brood foundation was offered for sale. In fact, medium brood was the primary wax foundation for multiple decades and is still available today. It may have been crimp-wired and either hooked or hookless. It was always *Medium Brood Foundation* – never MBF or any other shortened designation.

New beekeepers could logically think that this foundation was for medium supers. No, it wasn't. One would need the correct sized medium brood foundation so it would fit in a medium super. These are two different bee equipment items. In a radical diversion, I suppose one could feel that this was the foundation to use if one wanted to use foundation that would produce medium-sized bees. That would be wrong, too. The cell size and not the foundation weight – apparently - determined the size range of the developing bee.

As early as 1900, several weights of foundation were offered for sale. *Heavy, Medium, Thin* and *Thin Surplus* weights of foundation were manufactured. *Heavy* was discontinued very soon after it became apparent that *Medium Brood* was all that was needed (Before 1910). Later, *Thin Brood* was also dropped. That left *Medium Brood* for typical use and *Thin Surplus* for comb honey production. Both of these old designations can still be found in some of today's bee supply catalogs. But know this beekeepers, these designations are rapidly fading into history as plastic foundation inserts continue to replace pure beeswax sheets. Modern foundation inserts have proprietary names that are unique to the supplier.

Coating plastic comb inserts makes them more appealing to bees. While referencing this discussion for you, I found that one company advertises "*Heavy Wax Foundation*" inserts. This does not refer to the heavy designation of the early 1900s, but rather to the quantity of wax coating the plastic sheet. *(I feel that it's okay if you're confused. This foundation subject is an industry morass and always has been.)*

Division Board Feeders

If you keep bees more than a few years, no doubt you will acquire a *Division Board Feeder*. You all know what it is. Instructors presenting at field days will readily tell you – correctly – that *Division Board Feeders* go next to one of the outer walls to aid in filling them. Just shift the upper boxes a bit or slip the inner cover to one side and pour in about a half-gallon of feed into the feed-

5 Nutt, Thomas. 1834. *Humanity to Honey Bees*. Printed by H. and J. Leach, for the author, of whom it may be had at Moulton-Chapel or at 131 High Holborn, London. 270pp. **https://www.gutenberg.org/files/58229/58229-h/58229-h.htm** (Shortened to: **go.osu.edu/thomasnutt**).

er. Good. Good. That's solid basic beekeeping. But why is it named a *Division Board Feeder*? Because at one time, there was an actual device named a *Division Board*.

During the 1800s, beekeepers were concerned that a small cluster could not control the temperature in a large, mostly empty box. A hive divider, the size and thickness of a frame, was used to partition internal space – a bit like a temporary wall. So, for instance, a ten-framed deep colony could be subdivided into a space for only three frames with the remaining space left open for future colony use. But for the moment, this ten-frame box was being used as a three frame nucleus colony.

These early division boards were padded on the ends and bottoms to make those areas bee tight. If needed, a quilt was frequently used to provide insulation and restriction across the hive top. The bees would propolize all of the canvas surfaces, cracks, and edges.

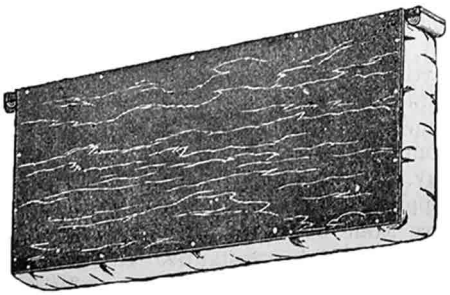

Figure 2
A beekeeper-made Division Board (circa 1888).

The padding shown in the drawing shows the duck canvas that was used on the ends and bottom. Note the small rolls that filled the frame rest lugs with a duck padding obstruction. This partition was intended to be bee tight. Internally, the divider was filled with chaff. During Winter months, two were used per colony and were positioned at the outer edges of the cluster or one against each of the outer walls.

The construction of the *Division Boards* was described in the 1888 edition of *ABC of Bee Culture*. I don't know how much earlier it was designed. By the 1930's, later editions of ABC dropped the listing for the *Division Board* but gave instructions for a simple improvisation of a *Division Board* by wrapping paper around a frame of honey in a wintering colony. Know this – as usual and is so often the case, prominent apiculturists of the day disagreed on the value of *Division Board* use. C.C. Miller (Illinois) saw no value while A.J. Cook (Michigan) used them year-round.

In my self-assigned role as *Reckless Historian*, I am unable to determine who first modified a *Division Board* from a divider into a feeder. That's a pity. They should be acknowledged (again). As I have time, I will continue to search.

I'm out of space, but this won't quit

A *Division Board* was intended to be bee tight. A *Follower Board* – a similar but different contraption – was not bee tight. It was usually much thinner – maybe even down to one-quarter inch. Another name for a *Follower Board* was *Dummy Board*. Rather than dividing colonies, *Follower Boards* were used primarily as a spacer. These spacers were usually along the box sides where they would also help some with insulation issues. Upon their removal, subsequent frames could be removed more easily. *Follower boards* are still available from some suppliers while *Division Boards* have faded from use.

Figure 3
Modern Follower Board (BetterBee)

Are you tired of this?

What about *Hoffman Self-Spacing* frames or section scraping knives or maybe foulbrood? But I need to stop. If I leave you with one thought, I hope it is that we, as beekeepers, are participating in an old craft with an incredibly long, complex history – the world over. I enjoyed preparing this piece and I thank you for reading it. BC

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www.go.osu.edu/april2022

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Lemon Poppyseed Bread

Shana **Archibald**

Ingredients

- ☐ 2 cups all purpose flour
- ☐ 1 teaspoon baking soda
- ☐ 1 teaspoon baking powder
- ☐ ½ teaspoon salt
- ☐ ½ cup honey
- ☐ ½ cup oil
- ☐ ½ cup Greek yogurt
- ☐ 1 teaspoon vanilla extract
- ☐ 2 eggs
- ☐ 2 lemons (juice from 1 + zest from 2)
- ☐ 3 tablespoons poppy seeds

Directions

Step 1
Preheat your oven to 360°F

Step 2
Zest two lemons using a microplane, and squeeze the juice out of one lemon. Measure and prepare the other ingredients.

Step 3
Combine all the wet ingredients in a bowl: eggs, Greek yogurt, oil, vanilla extract, honey, lemon juice.

Step 4
Then, add the dry ingredients; baking powder, baking soda, salt, flour and lemon zest. Mix the ingredients together until just combined.

Step 5
Pour into a bread pan (or cupcake liners)

Step 6
Place them in the oven, and bake for about 17 min, (if making muffins) or until a skewer or toothpick inserted comes out clean. *bake for 40-45 mins if making a bread*

CALENDAR

♦INDIANA♦

The Heartland Apicultural Society (HAS) has made plans to host its 2022 conference in June in Evansville, Indiana.

Watch **www.heartlandbees.org** for details.

♦TEXAS♦

Texas Beekeepers Association will be holding a Summer Clinic on June 25, 2022 at the Lone Star Convention Center.

The keynote speaker is Keith Delaplane. The clinic includes Beginner Tract, Advanced Topics, Sideline to Commercial Tract, Panel discussions and hands-on demonstrations.

To register visit: **https://texasbeekeepers.org/** or for more information contact Dodie Stillman at **vp@texasbeekeepers.org**

Texas Beekeepers Association will be holding their Annual Convention on November 3-5, 2022 at the Mayborn Convention Center.

Their conference includes renowned keynote speakers, interactive classes, industry updates, legislative updates, and annual membership meetings.

Registration opens in August.

To register visit: **https://texasbeekeepers.org/** or for more information contact Dodie Stillman at **vp@texasbeekeepers.org**

♦WEST VIRGINIA♦

The Monongalia County Beekeepers Association is proud to annouce the 2022 Spring Beekeepers Course.

The classes will be held April 2 and 9 from 10am-3pm. Lunch is provided courtesy of Beehive Café. The classes will take place at the Monongalia County Extension Office.

Register at **https://www.moncountybeekeepers.org** and for more information call Debbie Martin at **304-367-9488**.

CLASSIFIEDS

FOR SALE

- For Sale: Clean, empty 55GAL steel, open head barrels, with lids & rings. $8 each. Call 330-231-0613
- Larry's Backyard Bees Beekeeping Equipment: USA Made Hive Boxes, Package Bees, Beekeeping Tools, Smokers, Bee Suits and more. Order online at **www.larrysbackyardbees.com** or Call Toll Free (844)561-BEES. Newburgh, NY

New Contest - Bee Swarm Images

We're starting an image gallery! This month, we want to see any and all pictures you have of Bee Swarms. Please make sure that your image is nice and big! We may pick your image for the gallery, or you have the chance to get on the cover! So get creative.

How To Submit:

Email your images to **Emma@BeeCulture.com**

Use the subject "Image Gallery"

Please include in your email:

- The image as an attachment (we will not consider it if it is embedded)
- Your First and Last name
- Your mailing address
- Your renewal code (if you know it)

If your image is chosen:

For the Gallery:

You will get three months added to your current subscription.

For the Cover:

You will get twelve months added to your current subscription.

Display Advertisers

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

When my enthusiastic and very Catholic beekeeping mentee Megan announced that she would stop by the farm to drop off Christmas goodies, I cited my doctor's warning to cut back on the sweets. (Tough medicine for a beekeeper!) I regretted this afterwards, because the wise Marilyn taught me long ago to accept all gifts with grace and appreciation.

It's early February as I write, and yesterday Megan stopped by with a belated Christmas gift – a shallow honey super, complete with frames and foundation, along with a comb cutter, for cut comb honey.

But what intrigued me more was the playing card-sized artist's rendition of St. Abigail, sixth century Irish patron saint of beekeepers, that fell out of Megan's holiday card. The hauntingly lovely, haloed Abigail looks back at you through the palest of pale blue eyes. She holds up a tiny fragment of honeycomb in her delicate hands, like an offering. Bees circle overhead.

The days fly by, then weeks and months and years. Time speeds up as we age. Did you know that? When I was a boy, Summer lasted an eternity. Now it slips away in the winking of an eye. So the less time we have remaining, the faster it goes. I try to make sense of this. We're not here for a long time. Nothing we can do about that. Maybe the important question is, what have we learned?

The Colorado State Beekeepers Association held their Winter meeting in Longmont on December 3, 2005. Former *Bee Culture* editor Kim Flottum was the featured speaker. I planned to attend, but a blizzard moved in. With 200 miles and the Continental Divide between me and Longmont, I reconsidered and went back to work on Aspen Mountain. This decision had profound implications, as December 3, 2005 turned out to be the worst – and the best – day of my life.

By noon I was buried in an avalanche. When it broke, I lunged for an aspen tree, hanging on briefly, until a river of snow ripped me away and down the mountain again.

I didn't go that far, very quickly coming to rest in a ditch that cuts across the ski slope. I could feel the snow silently piling on top of me. I found myself stuck in the skydiver freefall position – face down, with my knees bent and feet elevated. My initial reaction was surprise. It struck me as unfair and even illogical that someone as claustrophobic as I should be buried alive. Why not somebody else?

I could move my left foot. I thought my ski boot might be sticking up out of the snow (it wasn't), so I tried moving it in hopes of attracting attention. Then I thought, "Ed, you don't have to wiggle your foot. If anybody sees a boot sticking up out of a pile of avalanche debris, they'll guess there's somebody on the end of it!"

On the bright side, I got caught in a closed area almost right under the chairlift, and I heard lift riders scream when the slide started. I was pretty sure I'd seen Isabel on the chair. She had her ski patrol radio. Reassuringly, my own patrol radio began squawking nonstop, but muffled under the snow.

I wondered if my avalanche beacon was on. I knew it was in my patrol coat pocket. Then I recalled turning it on that morning. I remembered Curtis checking all of our beacons as we headed out the door.

So I knew they'd find me, but I wondered how long it would take. I could raise my face maybe a fraction of an inch. My mouth and nose were clear of snow. I could breathe OK, for now.

But I only got partway through the Lord's Prayer before panic strangled me, and I forgot the words. (Later, when I told this to Father Bob, he chuckled and told me about the time he fell into a well.)

I screamed – twice that I recall. I remember thinking afterward, "Don't be a fool, Ed. Who could hear you down here?"

As I began to run out of air, I gasped uncontrollably.

The next thing I remember is awakening as if from a dream to footsteps on top of the snow directly above me. "Oh, good," I thought.

Then I heard furious digging that got frantic and close. I heard Ricky yelling. A great peace descended on me, as I slipped back into dreamland.

Then I was in the world again. My face was blue (some say purple) when they dug me out. I was barely breathing. The first person I saw was Ali. "Ed, we love you," she said, over and over, like a mantra. She looked and sounded so desperately sincere. I confess I melted. I smiled. Ask anybody who was there.

By now half the patrol was at my side. Their voices sounded musical. I said, "I'm pretty sure I'm OK," but they ignored me. They tied me down onto a backboard. When I started to shiver, they stuffed hot packs inside my jacket.

Somebody asked me if I wanted my face covered up with blankets for my toboggan ride down. Were they kidding? "No, thanks," I said. "I was buried long enough."

I heard, "Who's running this rig?" It pleased me when Gorp said, "I am," because he can drive a sled.

On my ride down I took stock of my situation. As we shot through Spar Gulch, I suddenly understood. From flat on my back I looked up at the wide world. The sky opened. Maybe I caught a glimpse of Heaven. BC

Ed **Colby**

A Glimpse of Heaven