A SEAT AT THE TABLE

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MITE CONTROL

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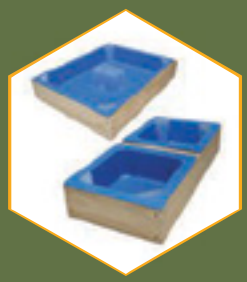

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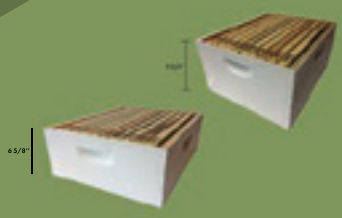

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February Bee Culture...

800.289.7668
Executive Publisher – Brad Root
Associate Publisher, Senior Editor – Jerry Hayes, Jerry@BeeCulture.com, Ext. 3214
Layout and Design – Emma Wadel, Emma@BeeCulture.com, Ext. 3220
Advertising and Customer Service – Jennifer Manis, Jen@BeeCulture.com, Ext. 3216

Contributors
Clarence Collison • James E. Tew • Kim Lehman
Jay Evans • Ross Conrad • Ed Colby

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I enjoy the audio of the magazine. I can multitask while assembling frames. Good idea.

Thank you,
Doug

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Telling the Bees

I have been reading your magazine since I started keeping bees 12 years ago. We have learned so much and enjoyed the sharing of information.

A story I read somewhere, possibly in your very magazine. A story in living color this Summer at my house.

Telling of the bees…

The old tradition of telling the bees of important changes in their keeper's life. Births, marriages, deaths.

I read that it was thought that the bees would fly away if they were not told. There is a connection between nature and man, the bees just aid in translation.

In May, I knelt quietly before my hives and told them of the passing of my beloved horse. Then in September, I told my bees that their mistress had just lain her mother to rest.

Three days after I told them my mother was gone, Queen Elizabeth's beekeeper told the bees of her passing.

Once upon a time, only my beekeeper friends knew of this tradition but then I posted on social media that I had told my bees of the passing of my mother, and the rest of my friends knew as well. With the queen's passing, the world knew.

Regards,
Maria McGee

Big Corps

So, I am a two-year beekeeper driving around listening to my bee podcast from our state's big college while running errands in my suburban setting. Driving four blocks, I take a left-hand turn and am now on a busy state road that goes north, all the way to Georgia, with nothing but businesses.

The podcast's topic is bees in an urban setting without enough food. This struck a chord with me. In the state of Florida, we have a state registration program so the state knows where hives are. With this tool, I have found 12 apiaries within a 20-block radius of my residence. I do not get much honey. So, I feed my bees.

So, I come to realize that my city is a pollen desert. I don't know the last time I saw a pollinator during my day. On this road, I do not recall a single pollinator plant.

Big corporations in Colorado hired a company to place bee hives on their roofs. Isn't that a feel-good moment for the companies? Turns out many corporations including IBM, Google, Sterling Bay, UMB Bank, the University of Denver, Giant Eagle, Walmart, etc. all want that feel good moment. We need to make them aware that it is not solving the problem with urban beekeeping.

In my opinion, sideliners can handle the bee population. These companies could make a real difference by putting pollinator plants on their properties. How far apart do we see Walmart's, banks, gas stations, Whole Foods, etc.? These businesses could make a REAL difference with pollinator plants. Could you imagine all the businesses that we see having pollinator plants year-round for the pollinators? That would by the best option for making a difference.

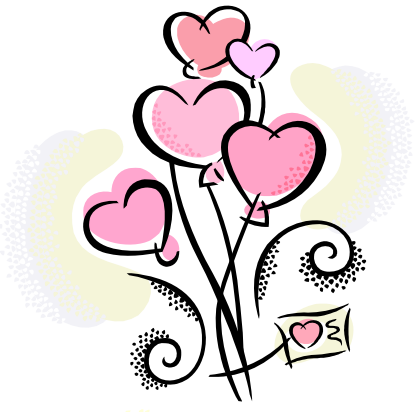
I know, I know. The companies would say that due to liability, they can not put pollinator plants on their properties. Here is the perfect answer.

Companies that REALLY want to make a difference can put on a living roof with pollinator plants year-round on all their locations. Hardest part would be to get them to do it. Perhaps all of the bee scientists and professional bee people could talk to these companies to really save the bees.

It seems everyone talks about all the problems about bees, except food. How can we make this work?

Sincerely,
Jose

Maria, telling her bees.



NEXT MONTH

Region 1
- Watch food reserves
- Consider what colonies to equalize
- Clean out bottom boards
- On a warm day, do an alcohol *Varroa* sample
- Reverse hive bodies
- Get ready for Spring buildup
- Pray for live colonies
- Feed
- Is your equipment repair/painting done?
- Clean dead bees out of the entrance and bottom board

Region 2
- Make sure feed is available
- Sample and treat for *Varroa* in live colonies on warm days
- Check space for queen to lay
- Put out swarm traps
- Rotate brood boxes
- Check brood condition on a warm day
- Feed if needed
- Do hive inspections on warm days
- Prepare for splitting

Region 3
- Alcohol sample for mites. Treat
- Equalize hives
- Make splits
- Set out bait hives
- Feed
- Mite count and safe treatment
- Install SHB traps
- Check for brood diseases

Region 4
- Purchase enough supplies for splits
- Feed to stimulate brood production
- Prepare to equalize brood in late-March
- Be ready for mite sampling and treatment
- Clean deadouts
- Check food stores
- Hive inspection if there is a warm day
- Feed syrup and unwrap

Region 5
- Mite sampling and control
- Check feed stores
- Look at cluster if weather allows
- ID deadouts
- Feed syrup
- Make sure no mice in colonies
- Build hive bodies and supers
- Feed pollen sub

Region 6
- Take a real quick look and add feed if needed
- In Phoenix, mite control 24/7/365
- Watch for pollen coming in
- Add boxes for colony growth
- Splits hives
- Requeen with gentle stock
- Remove the dead ones and clean out

Region 7
- Get deadouts ready for new bees
- Feed as needed
- Clean off bottom board
- Check health coming out of almonds
- Sample, treat, sample again for good mite control
- Split hives when weather appropriate
- Check brood health and queen laying
- Clean out hive entrance
- Check your equipment and supplies

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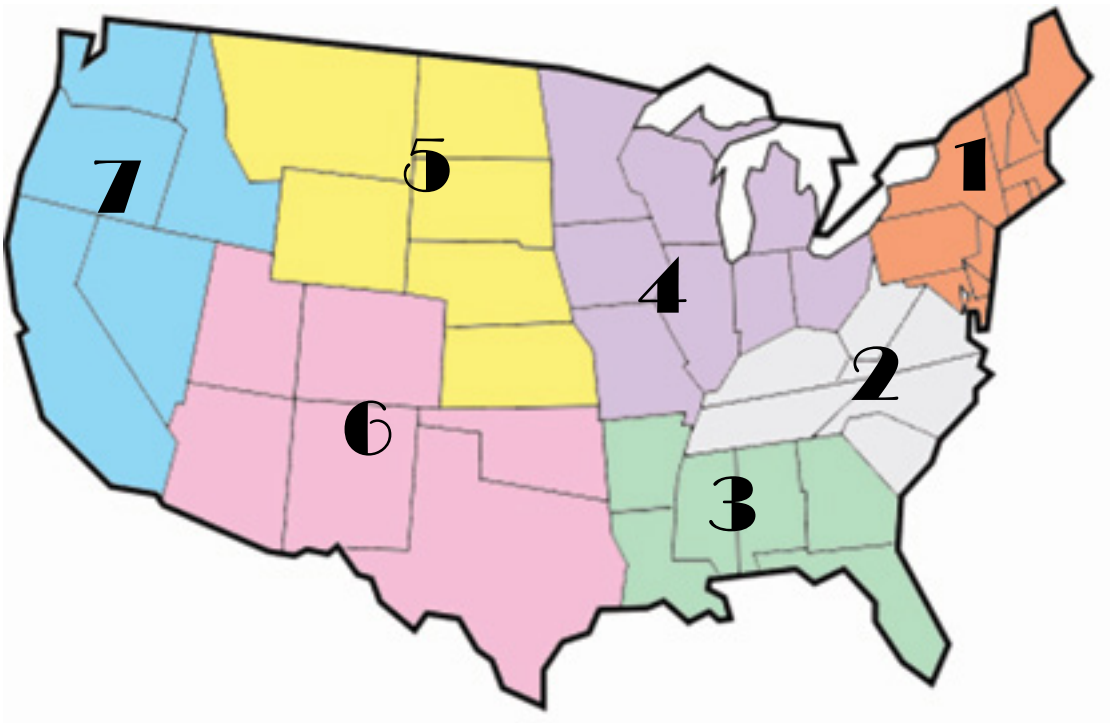
FEBRUARY – REGIONAL HONEY PRICE REPORT

	REPORTING REGIONS							SUMMARY			History	
	1	2	3	4	5	6	7					
EXTRACTED HONEY PRICES SOLD BULK TO PACKERS OR PROCESSORS								**Range**	**Avg.**	**$/lb**	**Last Month**	**Last Year**
55 Gal. Drum, Light	2.66	2.51	3.00	2.98	2.80	2.72	2.95	1.95-3.25	2.81	2.81	2.88	2.44
55 Gal. Drum, Ambr	2.58	2.53	2.65	2.98	2.80	2.65	2.75	1.80-3.25	2.74	2.74	2.76	2.36
60# Light (retail)	237.73	262.50	214.67	217.67	227.50	201.64	286.67	150.00-350.00	232.83	3.88	230.62	210.77
60# Amber (retail)	238.89	257.50	234.00	211.63	260.00	187.74	258.33	160.00-310.00	230.86	3.85	227.21	209.98
WHOLESALE PRICES SOLD TO STORES OR DISTRIBUTORS IN CASE LOTS												
1/2# 24/case	109.28	116.80	94.67	96.06	87.36	90.00	-	67.20-200.00	103.32	8.61	104.95	97.57
1# 24/case	169.15	212.60	161.60	139.97	181.42	114.18	144.00	48.36-360.00	163.87	6.83	157.21	143.77
2# 12/case	164.00	192.00	150.25	126.75	173.76	150.00	156.00	84.00-300.00	152.74	6.36	143.53	137.04
12.oz. Plas. 24/cs	128.93	140.86	139.20	107.14	107.84	133.20	117.60	72.00-240.00	124.26	6.90	117.74	117.37
5# 6/case	171.18	239.40	164.41	128.49	143.19	-	-	96.00-330.00	162.17	5.41	160.17	151.85
Quarts 12/case	230.75	208.25	169.80	188.27	192.45	270.00	205.50	120.00-330.00	200.61	5.57	183.86	167.97
Pints 12/case	101.00	127.20	102.60	107.80	149.50	127.50	125.10	72.00-270.00	119.27	6.63	118.97	101.76
RETAIL SHELF PRICES												
1/2#	6.38	6.55	5.09	5.43	5.89	5.67	8.25	3.00-12.00	6.09	12.18	6.27	5.61
12 oz. Plastic	8.13	7.80	6.97	6.66	6.11	8.25	7.31	3.75-15.00	7.41	9.88	7.38	6.90
1# Glass/Plastic	10.07	10.93	9.39	8.43	11.65	8.80	10.40	5.79-20.00	9.87	9.87	9.98	8.93
2# Glass/Plastic	18.28	19.51	16.30	16.09	19.99	13.99	17.67	7.98-30.00	17.59	8.79	16.78	15.31
Pint	10.59	12.86	10.20	11.36	13.84	14.33	12.60	5.00-30.00	11.89	7.93	12.31	11.35
Quart	21.72	22.45	19.34	20.26	18.00	21.00	21.81	10.00-32.00	20.82	6.94	21.69	20.34
5# Glass/Plastic	37.37	39.95	44.50	35.40	31.33	39.67	-	15.00-75.00	37.50	7.50	36.68	34.17
1# Cream	12.58	11.88	10.49	11.23	11.50	-	14.00	5.79-22.00	11.97	11.97	11.62	11.45
1# Cut Comb	16.37	13.46	12.50	14.42	11.00	-	16.00	6.00-36.20	14.70	14.70	14.04	14.60
Ross Round	14.99	9.65	-	11.20	-	-	15.17	6.95-20.00	12.96	17.29	14.09	12.03
Wholesale Wax (Lt)	10.29	8.85	6.44	7.40	6.67	5.00	8.13	3.20-18.00	8.23	-	8.62	7.47
Wholesale Wax (Dk)	9.29	7.10	6.88	7.47	7.00	3.75	-	2.80-16.00	7.52	-	7.01	6.37
Pollination Fee/Col.	94.55	66.71	97.50	149.17	7.00	-	61.67	7.00-250.00	92.97	-	100.94	91.79

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

MODIFIED DADANT HIVE

Last year about this time I re-discovered the 'Modified Dadant Hive' as I was thinking about Brother Adam at Buckfast Abbey. The amazing carpenter, builder and contributor to *Bee Culture*, Ed Simon shared several months of articles with you, all focused on how to build a Modified Dadant Hive with all its parts and pieces. Ed cut out all the parts and pieces and sent them to me for assembly. I did it and made splits from my colonies, installed them and watched to see what happened.

The following photos and captions will give you an idea of this first year.

Getting ready to make splits into Modified Dadant Hive.

Take from the strong colony to make another colony in the Big Modified Dadant.

Put empty supers on top so I could feed securely and get colony to grow.

From the Editor, Jerry Hayes

New splits done and feeders inside.

New comb drawn and Queen laying well.

Colony growing now but they need to build more population for an Ohio Winter. Took off empty boxes and feeder inside. Drilled a large hole in lid and placed feeder on top now.

In our snowy Winter, it is always fun and stress reducing when after a snow you can look at the top of the outercover and see where the heat from the cluster has melted the snow. BC

FOUND IN TRANSLATION

Missing Their Better Half, More on Drone Genetics

Listen along here!

Jay Evans, USDA Beltsville Bee Lab

Last month I wrote a tragic, and maybe a little droning, article about the shortcomings of male honey bees and their fragility. On a more uplifting note, drone genetics have great potential for use in honey bee breeding. Male bees, like male ants and male wasps, have half a deck of chromosomes, $^{16}/_{32}$nds to use a precise carpenter term. These 16 chromosomes provide all of the information needed to make a bee (obviously) but with no redundancy for the most part. When there is a critical mutation in a critical gene, that bee will not fly. This liability is actually a gift in disguise for breeding and genetics in several ways.

Remember that, despite their limited job duties, not all male bees are equal. Differences among drones impact their ability to contribute genes during mating, and the value of those genes to their unseen offspring should drones win the mating lottery. Bradley Metz and David Tarpy showed that male bees in commercial beekeeping operations differed by two-fold in weight and by an amazing 100-fold in the amount of sperm they have available for mating (Metz, B. N., and D. R. Tarpy. 2021. *Reproductive and morphological quality of commercial honey bee (Hymenoptera:* Apidae*) drones in the United States*. Journal of Insect Science 21, **https://doi.org/10.1093/jisesa/ieab048**). By their estimate, 6.5% of adult drones in commercial operations were of 'low quality'. To produce males matching the subpar guys, these scientists had to raise males in smaller worker cells. As expected, 83% of males raised in worker cells were graded as 'low quality', versus 2% of males raised at the same time in proper drone cells. Since males are unlikely to be raised in worker cells in the field, other colony or genetic factors must lead to the production of low-quality males. The usual suspects are disease, chemical stress and poor nutrition, although this study did not explore those causes. Interestingly, bee genetics can also play a role in variable drone traits, and in drone reproductive traits in particular. Garett Slater and colleagues reviewed substantial data showing that races of bees differed consistently in drone traits such as sperm count and sperm longevity (Slater, G.P.; Smith, N.M.A.; Harpur, B.A. 2021. *Prospects in connecting genetic variation to variation in fertility in male bees*. Genes, 12, 1251. **https://doi.org/10.3390/genes12081251**). While mated queens use only a fraction of the sperm received over the multiple mating events they engage in, there is some evidence that queen egg-laying is negatively impacted by mating with poor-quality males. Overall, these studies indicate the value of exposing your queens to healthy males.

Given all these weaknesses, what do males bring to the queen selection table? Being haploid means that individual males can have a disproportionate effect on offspring traits. In a hypothetical mating between a queen and a single male, the worker bee offspring are "super-sisters" in that they are *identical* on their dad's side. In contrast, sisters share roughly half of their mom's genotype (a term for the combined variants seen in a typical diploid animal). Male-driven breeding, coupled with instrumental insemination (since no one has time to direct males on the wing to precise matings), has huge potential to shift bee populations toward desirable traits. In our group, Laura Decanini led such an attempt for earlier efforts to identify resistance to American foulbrood (Decanini, L. I., A. M. Collins, and J. D. Evans. 2007. *Variation and heritability in immune gene expression by diseased honey bees*. Journal of Heredity 98:195-201, **doi:10.1093/jhered/esm008**) Starting with genetically homogeneous breeder queens, from a singly-mated Italian mom, we were able to produce a 100-fold range of immune traits when crossing those queens to a diverse set of 26 local drones. Heritability for both immune activity and survivorship in the face of *P. larvae* was high, as measured by comparing immune traits of resulting offspring with their 'aunts' from the 26 drone source colonies.

Even more powerful are attempts to screen drones themselves for desired traits, then collect and use sperm only from the drones who aced their fitness test. Ivelina Ivanova and Kaspar Bienefeld in Germany attempted to use drones as a surrogate for worker hygienic behavior, by subjecting drones to the 'Proboscis Extension Reflex' a common assay for learning and behavior in workers. (Ivanova, I. and Bienefeld, K. 2021. *Suitability of drone olfactory sensitivity as a selection trait for* Varroa*-resistance in honey bees*. Scientific Re-

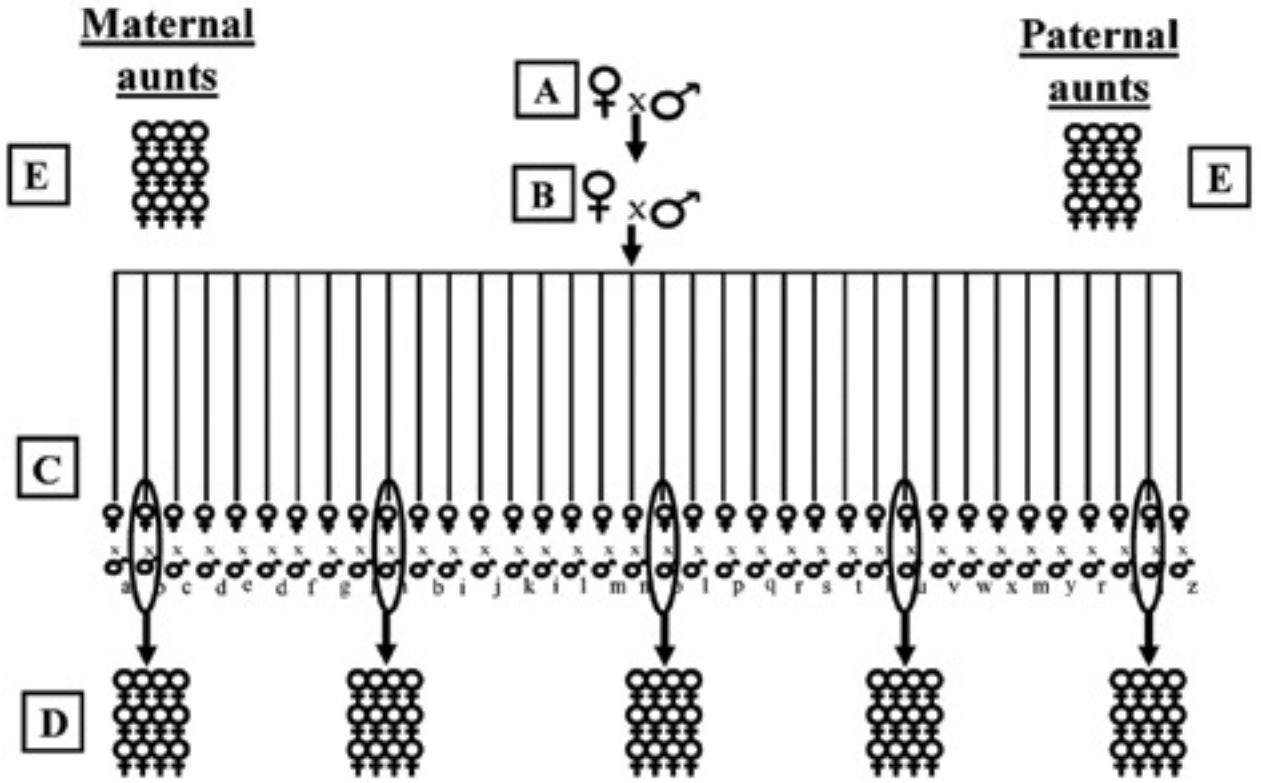


Figure 1. The breeding scheme used to estimate heritability. A single founder queen **(A)** produced a daughter queen **(B)** which was then mated using artificial insemination to a single drone (male). Forty progeny queens from this cross **(C)** were each mated singly to male bees from 26 diverse colonies. Drone sources with the same letter indicate drones from the same colony. Daughters from these crosses **(D)** were then scored for immune gene transcription. Paternal aunts (sisters of the drones for artificial insemination) and maternal aunts (sisters of the queens) were also scored **(E)**.

ports 11, **https://www.nature.com/articles/s41598-021-97191-w**). In worker bees, the PER can be used to assess responsiveness to the chemicals that trigger hygienic behaviors. Bees, which are smarter than most insects, will stick their tongues out for a food reward and can be trained to do so for cues like smells, learning like Pavlov's dog to associate those smells with something good. Males in this study figured out the PER, as do worker bees, although males apparently do so with less vigor and more 'nervousness'. Also, in the current study, "We observed a greater unwillingness of drones to respond to the CS+ and the sugar solution on cold or rainy days, although the temperature in the laboratory was regulated", and "during our preliminary tests, we also observed high drone mortality if drones were treated according to existing bee protocols". To go easy on these fragile males, the PER study was shortened, and the authors were able to generate usable data. Sadly, males that scored well in these standardized tests did not father the most hygienic offspring, so there was a disconnect there somehow. Still, males from high-scoring colonies helped perpetuate that trait, a validation of PER and comb-based hygienic tests for improving this key trait… but only when female bees are asked to take the test for their brothers. This does not rule out using male bees as a direct screen for individual resistance traits, including immunity. Drone-level screens of immunity followed by instrumental insemination give a direct path to stock improvement since drones fend off disease with the same immune response as their sisters. Scientists, including my USDA colleague Michael Simone-Finstrom and bee breeder Daniel Weaver, are using drone screens of disease response to enhance stock resistance (**https://www.ars.usda.gov/research/project/?accnNo=441927**). Drones still have time to show their strengths and it is fascinating to contemplate how being 'haploid' affects male contributions to colony life. Something to buzz about as we edge past the long drone of February toward Spring and colony renewal. BC

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A Closer Look

Russian Honey Bees

Clarence Collison

The staff of the USDA, Honey Bee Breeding, Genetics and Physiology lab visited the Primorsky Territory on the Pacific coast of Russia in an effort to find honey bees resistant to *Varroa destructor*. Initially, work with these bees included preliminary evaluations, detailed study of colonies in Russia, importation of Russian queens through quarantine, a detailed comparison of the response to *varroa* mite infestations of Russian and Italian colonies, studies of selection for resistance to *varroa* mites, resistance to tracheal mites and studies of honey production. The emphasis of the program then shifted from identifying breeder lines to intensifying selection within breeder lines (Rinderer et al., 2005).

Russian honey bee queens were first brought into the United States in 1997 for the purpose of genetic improvement of *varroa* mite resistance in managed honey bee stocks (Rinderer et al., 1997; Rinderer et al., 2005). Yearly importations continued through 2002 to include a total of 362 queens. From tests of individual queens and numerous field trials of groups of siblings, 18 lines in total were established that had resistance to tracheal and *varroa* mites and good honey production (Rinderer et al., 1997). The lines were divided into three groups of six lines each, to form a closed breeding population having a three-block design. Lines within each block were deliberately crossed with lines from the other two blocks under controlled conditions to promote maintenance of genetically diverse lines. Queens were allowed to free-mate in flight in isolated apiaries on coastal islands containing drones from predetermined sources (from the remaining two blocks). Initial breeding efforts resulted in a release of three lines of improved stock to commercial beekeepers in 2000 (Rinderer et al., 2000). Controlled releases of numerous lines to select beekeepers continued through 2008 (Bourgeois and Rinderer, 2009).

Field trials of Russian honey bees (ARS Primorsky stock) propagated as queen lines from queens imported from the far-eastern province of Primorsky were conducted in 1999 and 2000 in Iowa, Louisiana, and Mississippi. *Varroa destructor* populations in Primorsky colonies grew more slowly and hence, had fewer numbers than they did in domestic colonies. Colonies of six Primorsky queen-lines evaluated in 1999 averaged about half the number of mites found in domestic control colonies. In 2000, colonies of 10 Primorsky queen lines in Louisiana supported an average *V. destructor* population growth of 2.5-fold increase across 91 days, far less than the 17.3-fold increase predicted from growth models derived for domestic colonies. Most colonies of the same 10 Primorsky queen-lines in Iowa and Mississippi had no (150 colonies) to very few (48 colonies) detectable *V. destructor* three months after being inoculated with about 100 mites.

Hence, in all trials, ARS Primorsky honey bees showed strong resistance to *V. destructor*. Variance within and between queen lines indicated good potential to further increase this resistance through selective breeding (Rinderer et al., 2001).

The *varroa* resistance of several genetic crosses utilizing ARS Russian honey bees was tested in Alabama during 2001. Bee stocks included pure ARS Russian (Russian queens x Russian drones), commercial (commercial queens x commercial drones), Russian hybrids (commercial queens × Russian drones), and SMR-Russian hybrids [(queens bred for the suppression of mite reproduction trait) × Russian drones]. The *varroa* resistance of Russian hybrids was intermediate to that of pure ARS Russian and commercial stocks. This suggested that Russian hybrids may offer some *varroa* resistance, but pure ARS Russian stock should be used to achieve the maximum *varroa* resistance that is currently available in Russian bees. The lowest growth of mite populations occurred in the SMR-Russian hybrids. This may suggest that resistance genes from the two parental types combined in an additive manner, but they could not be sure because pure SMR bees (SMR queens × SMR drones) were not included in the study (Harris and Rinderer, 2004).

Russian Queen

The commercial management of ARS Russian honey bees is different from the stocks that beekeepers are familiar with. Requeening is more difficult with some Russian stocks and queens usually take longer to start laying. Russian colonies overwinter well but may have a small cluster size in early Spring. They buildup rapidly after pollen is available and require adequate supering, but shut down brood rearing when resources disappear. Russian honey bees are resistant to both *varroa* and tracheal mites (Tubbs et al., 2003).

Earlier studies showed that Russian honey bees support slow growth of *varroa* mite populations. De Guzman et al. (2008) studied whether or not comb type influenced *varroa* reproduction in both Russian and Italian honey bees, and whether Russian bees produced comb which inhibited *varroa* reproduction. However, the major differences found in this study concerned honey bee type. Overall, the Russian honey bees had lower (2.44 ± 0.18%) levels of *varroa* infestation than Italian honey bees (7.20 ± 0.60%). This decreased infestation resulted in part from a reduced number of viable female offspring per foundress in the Russian (0.85 ± 0.04 females) compared to the Italian (1.23 ± 0.04 females) colonies. In addition, there was an effect by the comb built by the Russian honey bee colonies that reduced *varroa* reproduction. When comparing combs having Russian or Italian colony origins, Russian honey bee colonies had more non-reproducing foundress mites and fewer viable female offspring in Russian honey bee comb. This difference did not occur in Italian colonies. The age of comb in this study had mixed effects. Older comb produced similar responses for six of the seven *varroa* infestation parameters measured. In colonies of Italian honey bees, the older comb (2001 dark) had fewer (1.13 ± 0.07 females) viable female offspring per foundress than were found in the 2002 new (1.21 ± 0.06 females) and 1980s new (1.36 ± 0.08 females) combs. This difference did not occur with Russian honey bee colonies where the number of viable female offspring was low in all three types of combs. This study suggests that honey bee type largely influences growth of *varroa* mite population in a colony (De Guzman et al., 2008).

In another study, 32 Russian (RHB) and 14 Italian honey bee colonies were assessed for the *Varroa* Sensitive Hygienic (VSH) trait using two different assays. Firstly, colonies were assessed using the standard VSH behavioral assay of the change in infestation of a highly infested donor comb after a one-week exposure. Secondly, the same colonies were assessed using an "actual brood removal assay" that measured the removal of brood in a section created within the donor combs as a potential alternative measure of hygiene towards *Varroa*-infested brood. All colonies were then analyzed for the recently discovered VSH quantitative trait locus (QTL) to determine whether the genetic mechanisms were similar across different stocks. Based on the two assays, Russian colonies were consistently more hygienic toward *Varroa*-infested brood than Italian honey bee colonies. The actual number of brood cells removed in the defined section was negatively correlated with the *Varroa* infestations of the colonies (r^2 = 0.25). Only two (percentages of brood removed and reproductive foundress *Varroa*) out of nine phenotypic parameters showed significant associations with genotype distributions. However, the allele associated with each parameter was the opposite of that determined by VSH mapping. In this study, RHB colonies showed high levels of hygienic behavior towards *Varroa*-infested brood. The genetic mechanisms are similar to those of the VSH stock, though the opposite allele associates in RHB, indicating a stable recombination event before the selection of the VSH stock. The measurement of brood removal is a simple, reliable alternative method of measuring hygienic behavior towards *Varroa* mites, at least in RHB stock (Kirrane et al., 2015).

The removal of *Varroa destructor* was assessed in Russian honey bee (RHB) colonies with known levels of *Varroa* Sensitive Hygienic (VSH) and brood removal activities. The expression of grooming behavior using individual bees was also measured using three groups of RHB displaying different VSH levels: low hygiene (RHB-LH, < 35% VSH), medium hygiene (RHB-MH, 35–70%) and high hygiene (RHB-HH, > 70%). Italian colonies (5.43–71.62% VSH) served as a control. Their results demonstrated, for the first time, significant relationships between two hygienic responses (VSH activity measured as percent change in infestation and the actual brood removal of *Varroa*-infested donor comb) and two measurements of mite fall (trapped old mites/trapped mites (O/T) and trapped young mites/trapped mites (Y/T)). However, these relationships were only observed in RHB colonies. In addition, the RHB colonies that displayed the highest levels of hygiene (RHB-HH) also groomed longer in response to the presence of a *V. destructor* mite based on individual bee assays. The positive regressions between the two hygienic measurements and O/T and their negative regressions with Y/T suggest that the removal of infested brood prevented successful mite reproduction, ultimately suppressing *V. destructor* infestations in the RHB colonies. In addition, it was demonstrated that RHB resistance to *V. destructor* rests on both an increased hygienic response and the removal of phoretic mites, released by hygienic behavior, through grooming. Both resistance traits are reflected in the O/T and Y/T ratios found in trapped mites from RHB colonies. None of the measurements involving mite injuries were associated with any measurements of hygiene and colony infestations (Kirrane et al., 2018).

Flight activity was compared in colonies of Russian honey bees and Italian bees during commercial pollination of lowbush blueberries (principally *Vaccinium angustifolium* Aiton) in Washington Co., Maine, in late

May and early June in 2003 and 2004. Colonies of the two stocks were managed equally in Louisiana during Autumn through early Spring preceding observations in late Spring each year. Resulting average populations of adult bees and of brood were similar in colonies of the two bee stocks during pollination. Flight during pollination was monitored hourly on six days each year by counting bees exiting each colony per minute; counts were made manually with flight cones on 17 colonies per stock in 2003 and electronically with ApiSCAN Plus counters on 20 colonies per stock in 2004. Analysis of variance showed that temperature, colony size (population of adult bees or brood) and the interaction of these effects were the strongest regulators of flight activity in both years. Russian and Italian bees had similar flight activity at any given colony size, temperature or time of day. Flight increased linearly with rising temperatures and larger colony sizes. Larger colonies, however, were more responsive than smaller colonies across the range of temperatures measured. In 2003, flight responses to varying temperatures were less in the afternoon and evening (1500-1959 hours) than they were earlier in the day. Russian colonies had flight activity that was suitable for late Spring pollination of lowbush blueberries (Danka and Beaman, 2007).

Differences in flight activity and in the percentages of pollen foragers between commercially managed honey bees, of two stocks (USDA-ARS Russian, n=41 colonies; and Italian, n=43 colonies) were evaluated in an almond *Prunus dulcis* (Miller) orchard in Kern Co., CA during February and March 2002. Flight activity was measured by taking one minute counts of bees exiting colonies on each of nine days. Flight activity was best predicted with a model containing the effects of colony size (populations of adult bees and sealed brood), temperature, time of day, the interaction of adult bee population with temperature and the interaction of adult bee population with time of day. Flight increased linearly with adult bee and brood population, had a quadratic relationship with temperature (increasing, but less so at higher temperatures) and had a quadratic relationship with time of day (decreasing, but less so at later times). Larger colonies had more response to changing temperatures and less response to different times of day than small colonies. Bee type had no direct influence on flight activity at any given colony size, temperature or time of observation or when evaluated using a reduced data set retaining 34 Italian colonies and 32 Russian colonies whose mean sizes were equal. Overall, however, Russian colonies were less populous by about one-fourth and so fielded on average 71% of the foragers that Italian colonies did. Pollen collection was measured by capturing returning foragers on four days. The percentages of foragers with pollen were not different for the bee types (Danka et al., 2006).

Honey bee colonies infested by parasitic mites are more prone to suffer from a variety of stresses, including cold temperature. De Guzman et al. (2005) evaluated the overwintering ability of candidate breeder lines of Russian honey bees, most of which are resistant to both *Varroa destructor* Anderson & Trueman and *Acarapis woodi* (Rennie), during 1999-2001. Their results indicated that Russian honey bee colonies (headed by original and supersedure queens) can successfully overwinter in the north, even during adverse weather conditions, owing to their frugal use of food stores and their resistance to

tracheal mite infestations. In contrast, colonies of Italian honey bees consumed more food, had more mites and lost more adult bees than Russian honey bees, even during unusually mild Winter conditions.

To compare resistance to small hive beetles between Russian and commercial Italian honey bees, the numbers of invading beetles, their population levels through time and small hive beetle reproduction inside the colonies were monitored. Frake et al. (2009) found that the genotype of queens introduced into nucleus colonies had no immediate effect on small hive beetle invasion. However, the influence of honey bee stock on small hive beetle invasion was pronounced once test bees populated the hives. In colonies deliberately freed from small hive beetle during each observation period, the average number of invading beetles was higher in the Italian colonies (29 ± 5 beetles) than in the Russian honey bee colonies (16 ± 3 beetles). A similar trend was observed in colonies that were allowed to be freely colonized by beetles throughout the experimental period (Italian, 11.46 ± 1.35; Russian, 5.21 ± 0.66 beetles). A linear regression analysis showed no relationships between the number of beetles in the colonies and adult bee population, brood produced or amount of pollen. There were more Italian colonies that supported small hive beetle reproduction than Russian colonies. Regardless of stock, the use of entrance reducers had a significant effect on the average number of small hive beetles (with reducer, 16 ± 3; without reducer, 27 ± 5 beetles). However, there was no effect on bee population (with reducer, 13.20 ± 0.71; without reducer, 14.60 ± 0.70 frames) or brood production (with reducer, 6.12 ± 0.30; without reducer, 6.44 ± 0.34 frames). Overall, Russian honey bees were more resistant to small hive beetle than Italian honey bees as indicated by fewer invading beetles, lower small hive beetle population through time, and lesser reproduction. BC

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Clarence Collison is an Emeritus Professor of Entomology and Department Head Emeritus of Entomology and Plant Pathology at Mississippi State University, Mississippi State, MS.

Almond Business

John Miller

I often write about the relationship between the almond industry and the beekeeping industry. These two groups are bound together. Beekeepers rely on hard-earned income from pollination services and almond growers rely on honey bees setting the almond blossom. This relationship between honey bees and almond trees is literally, millions of years old.

The almond industry is near the bottom of a cycle. 2023 almond prices paid to growers is in many cases, below costs of production. The roots of the situation are found in the 2022 Almond Almanac, a publication of the Almond Board of California. A copy can be downloaded at **www.almonds.com**. Go to the *Tools and Resources* tab, then scroll down to the Almond Almanac.

One chart in particular (print version on page 33) illustrates why now, in 2023 the almond industry struggles.

In the 2014/2015 crop, almond crop value hit $7,944 per bearing acre. That same year, the amount of the prior year crop carry in, as a percentage of the prior year shipments was 18%, a very manageable amount of carry in. In 2022, the carry in was 32%, almost 700 million pounds.

The carry in, coupled with the prior three years production of 3.3 to 3.5 billion-pound crops is a huge amount of crop to move.

Why are these crops so enormous? The invisible hand motivates farmers to grow more or grow less, depending on the opportunity to profit. Legislators and governors enact or do not enact taxes, limitations, build water-storage, or do not; expands and encourages or discourages improved highways and ports. Resources, always in competition for the supposed highest, best use are consumed. Weather patterns annually bless and curse different regions across the globe. In 2014, an almond grower saw farm price per pound for almonds above $4.00 a pound. Demand for almond ground expanded. Growers expanded acreage in areas with lots of good almond dirt, but not a lot of good almond water.

Enter three years of global chaos beginning in 2020; and the first of three – three billion-pound almond crops. A pandemic paralyzed global commerce. Export ports, especially in California utterly failed freight handling. A needless war in Ukraine heightened tensions. Ill-timed tariffs harmed global trade. Inflation reduced discretionary spending, globally. Buying almonds is discretionary. A hungry human, faced with buying peanut paste for .25/lb. and almond butter for $4.00/lb. will choose the former.

Nine years later, those trees planted in 2014 are now nearing full production. Ten years ago, growers made poor planting choices. For the first time in probably 20 years, the 2022 almond-bearing acreage went down. Bearing almond acreage will decline again in 2023. Prices for almonds will remain soft. Growers who perhaps got too far out over the tips of their skis are having awkward conversations with bankers and accountants.

This too shall pass.

During the Almond Board Research Conference held annually in early December, speakers pointed out that the almond industry is resilient. 2022 marked the 50th anniversary of the ABC Research Conference. Speakers acknowledged the tough times. It is worth noting a few things: Global wealth continues to grow. Global human health has never been better. Some predict that within five years, five billion humans will be middle class consumers. Middle class consumers want to purchase aspirational foods, nutritious food. Almonds, globally, are aspirational. The almond industry will recover. Demand will recover in an industry that exports nearly 70% of its production.

California is openly hostile to Ag. growers navigating how to thrive. Regulatory compliance now accounts for one of the top three costs in s grower's business (the other two tall poppies are water costs and pollination fees). Growers will focus on better planting choices where water is more abundant: Sacramento Valley – not so much San Joaquin Valley. Pollination costs per acre may become more efficient and responsive to tree variety, density and terrain. Stocking rate recommendations should be science driven, not hunch driven. This is not news. Labor inputs will get a hard look. Whether planting pit-fruits, wheat, vines or keeping bees or cattle – all of Ag is engaged in a cost per unit, cost per acre and cost per hive analysis.

At least we should be.

During the ABC Conference, I was chatting with Josette Lewis, Chief Scientific Officer at ABC.

I'm fond of asking, "Where will we be in five years?" I asked Josette that very question. Her reply inspired me: "John, where do you think beekeeping will be in five years?"

I don't know. I'll write about that a little bit in 2023.

Here is a simple one: When the first genetically modified honey bee is engineered – What will be the reception? BC

Denver International Airport on March 25, 2020 at 7:32am. Usually one of the busiest times in one of the busiest airports in the world.

JRM
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Educating Veterinarians on the Diagnosis and Treatment of Foulbrood Diseases in Honey Bee Hives to Assist Beekeepers

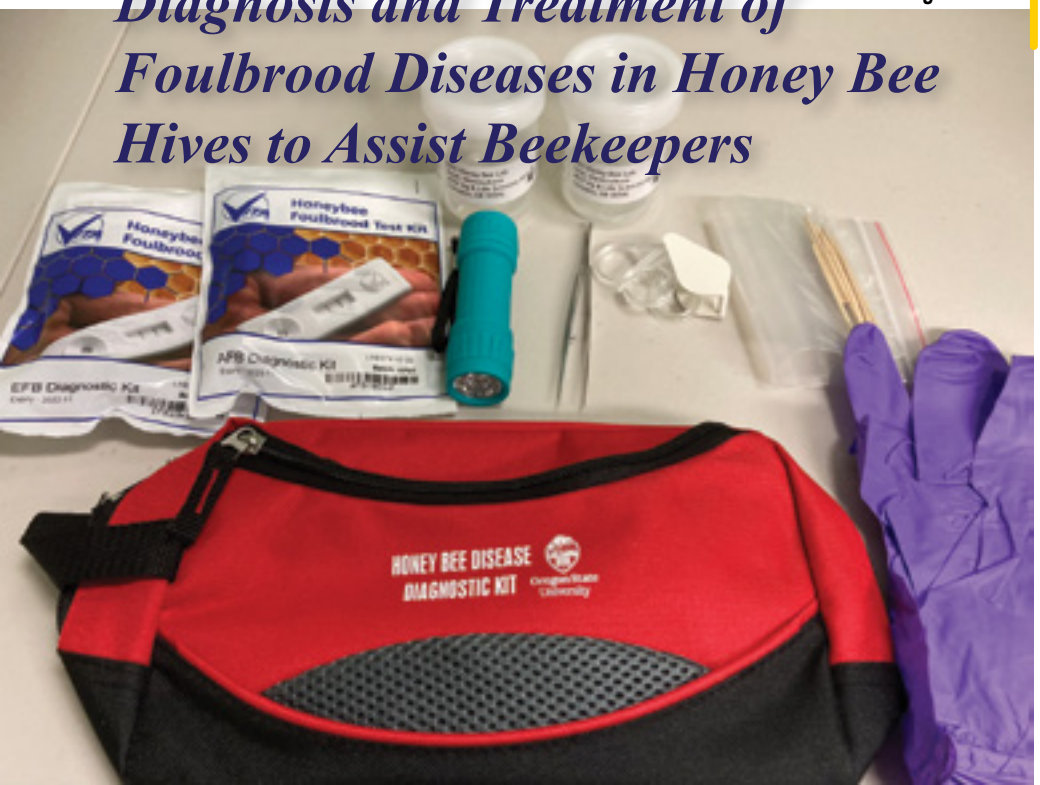
On January 1, 2017, the Food and Drug Administration revised rules to include honey bees in the food-producing animal category under the same oversight as cattle, sheep, goats and pigs. Any animal feed that contains antibiotics requires a veterinary feed directive (VFD), which is a special kind of veterinary prescription. It is only valid for six months and must be submitted in writing. According to this rule, beekeepers must have a current, valid VFD to legally use or retain any antibiotics. This rule change was implemented to promote judicious use of antimicrobials in food-producing animals.

Should a beekeeper wish to obtain antibiotics for the treatment of American Foulbrood or European Foulbrood diseases, they must visit a veterinarian with whom they have an established "Veterinary-Client-Patient Relationship". This veterinarian must be trained on the diagnosis and treatment of American and European Foulbrood, and willing to take bees as patients. Many beekeepers in Oregon and other states were facing challenges in finding such veterinarians willing to provide a prescription for antibiotics.

According to the Oregon State Beekeepers Association, there were fewer than 10 veterinarians in Oregon willing to write a VFD for beekeepers in January 2019. To address this problem we secured funding from Agricultural Research Foundation at Oregon State University and developed a training program for veterinarians in Oregon. Our goal was to have a veterinarian trained to write VFDs for beekeepers in each of Oregon's 36 counties.

With sandwiches and beverages for the vets and staff, we visited veterinary clinics during lunch hours for a brief training during the years 2020 and 2021. We presented a 40-minute PowerPoint lecture on the symptoms, diagnosis, treatment and prevention of American Foulbrood (AFB) and European Foulbrood (EFB). The veterinarians were also shown the frames containing classic symptoms of AFB and EFB. We demonstrated proper frame examination technique and carefully explained each symptom and how they compare among different diseases. A frame with classic symptoms of Parasitic Mite Syndrome (PMS) was also presented for comparison, as PMS is a common malady in honey bee colonies and sometimes could be confused with brood diseases.

The veterinarians were able to handle and closely inspect the frames with disease symptoms. They poked, prodded and compared the cell contents. They were encouraged to try the ropy test for AFB, and they smelled the differences in odors between AFB and EFB. The veterinarians were also trained in how to write a VFD for their clients. After the training, each clinic received a "Honey Bee Disease Diagnostic Kit," (see image) a small zippered pouch containing gloves, forceps, toothpicks, a mini flashlight, a magnifying glass, a VITA test kit for each AFB and EFB and some sample jars for sending material to the Oregon State University Honey Bee Lab for further analysis.



Diagnostic Kit

This training effort resulted in a list of 34 veterinarians in 19 Oregon counties willing to write a VFD for beekeepers. We plan to continue this effort in the future for the benefit of beekeepers. Oregon beekeepers may now reference the list of veterinarians on the Oregon State Beekeepers Association website: **https://orsba.org/veterinarians/**.

In the United States the state beekeeping or regional beekeeping associations that are interested in getting veterinarians in their respective states trained on diagnosis of AFB and EFB for the benefit of their members may consider one of the following approaches depending on their specific circumstances.

(a) In states where there is a honey bee research lab and a veterinary college / veterinary faculty in the same university (or a different university in the same state) the beekeeping association can coordinate the training effort with assistance from the respective honey bee lab and veterinary faculty.

(b) In states where a honey bee research lab exists at a university, but don't have a veterinary college or veterinary faculty, the beekeeping association can coordinate the training effort by connecting the honey bee lab with the state veterinarian.

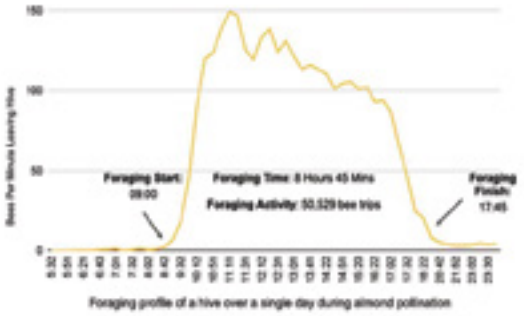
(c) In states where there is no honey bee research lab, the beekeepers association can approach the state veterinarian and explore the possibilities of collaboration to train veterinarians directly by developing appropriate training material.

(d) In states where there is no scope of collaboration with university honey bee labs or veterinary colleges or a state veterinarian, the state beekeeper association could develop an appropriate training program and provide training directly to interested veterinarians in their respective states/region. BC

BEEHERO

Pollination Research Stations

George Cloutson



Foraging profile of a hive over a single day during almond pollination

Successful pollination is critical for a strong almond yield and healthy crop. The amount of bee foraging activity during almond bloom is therefore of considerable interest to growers. Currently, bee pollination activity is inferred from the amount of good bee foraging weather during almond bloom. A Bee Flight Hour is accumulated for each hour that it does not rain, the temperature is above 55°F and wind speeds are less than 15 mph. The Bee Flight Hours calculation starts when the early cultivars first bloom and runs through petal fall, and is sometimes used as a predictor of nut set, and ultimately yield.

While this concept seems logical, in reality, the situation is much more complicated. There are various factors that will impact bee foraging activity as well as the weather. This includes colony size, brood status, and stage of bloom (forage availability). It is the dynamics of all these factors that determine the number of bee visits received by the blossoms.

The application of smart sensor technology and data analytics means it is now possible to directly monitor all these variables to provide accurate, real time tracking of pollination progress. With this aim in mind, California based BeeHero is rolling out a network of strategically placed ***Pollination Research Stations*** statewide, covering all major growing regions and cultivars. Each location will be equipped with specialist sensors to monitor the hives, local weather conditions and bloom progress.

- **Bee Counters** to measure real flying times and the actual number of bee foraging trips.
- **In Hive Sensors** to monitor colony strength and brood status.
- **Hive Scales** to track nectar foraging activity.
- **Cameras** to give visual confirmation of bloom progression.
- **Weather** sensors to monitor local weather conditions.

The initiative was piloted during 2021 almond pollination, and revealed the highly dynamic foraging behavior of the bees. The Bee Counters continuously and precisely record bee traffic thus providing direct measurement of bee flight hours and the impact of changing weather and bloom status. The sensors showed that bees will sometimes fly in weather conditions outside the thresholds used for the Bee Flight Hours model, particularly when high-value pollen is available. Thus in this example the real flight hours exceeded the Bee Flight Hours model.

The sensors also showed how a Bee Flight Hour can differ significantly in terms of the actual number of foraging trips. During full bloom, colonies performed around 5,000 foraging trips per hour, which halved to 2-3,000 trips per hour during petal fall, demonstrating the colonies response to the reduction in forage availability. Furthermore, the Hive Scales identified when the bees were nectar foraging and building up honey stores, also a valuable insight for growers and beekeepers.

The Pollination Research Stations bring together real time data on bee foraging activity, bloom status and weather conditions, to provide an accurate localized assessment of pollination progress for growers and beekeepers. The initiative will also generate an incredibly rich source of data that will contribute to the development of more accurate models and metrics for assessing pollination efficacy. In essence, the bees themselves are the 'sensors' of the environment, and harnessing the wisdom of the hive can help to improve our understanding and management of one of the most important processes for food production.

The data derived from each station will be made available to everyone in the almond industry. To track your pollination this season head to: **https://growers.beehero.io/ExternalsentinelStations** BC

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Baton Rouge Scientist Spotlight

Elizabeth Walsh, USDA Baton Rouge

I'm Liz Walsh, a USDA-ARS (United States Department of Agriculture-Agricultural Research Service) scientist at the Baton Rouge, Louisiana location where I work in the Honey Bee Breeding, Genetics and Physiology Unit. I did my dissertation work with Dr. Juliana Rangel at Texas A&M University where I examined how pesticides impact honey bee queen health. My postdoctoral work was with Dr. Steve Pernal at the Agriculture and Agri-Food Canada in northern Alberta, and there I explored honey bee disease ecology with a particular emphasis on American Foulbrood and chalkbrood. As someone who became a beekeeper in high school, it's very exciting to have my dream job working with honey bees full time as a Research Entomologist at the honey bee lab here in Baton Rouge.

As the newest scientist at the location, I am in the midst of setting up my research program. My ultimate career goal is to make a positive impact on the beekeeping industry. To do that, I need to have a focus on applied scientific research that is done well and then communicated to both beekeepers and scientists. I'm particularly interested in exploring how breeding initiatives can affect things like colony reproductive health, disease progression and behavior.

One of my current projects is particularly fun, and I've jokingly nicknamed it the "'Hangry' bee project." As beekeepers and scientists, we know that genetics and breeding play huge roles in colony temperament—for instance, "killer bees" are hybrids of *Apis mellifera scutellata* and European bees. They are known for being hot tempered, although there have been a few populations that are notable exceptions, and this is explicitly attributed to their genetic background. Similarly, specific honey bee stocks that have come from different breeding efforts also have reputations for gentle or hot temperaments. Genetics clearly play a role in honey bee colony temperament and behavior (Avalos et al., 2020).

However, there is data that suggests the environment that colonies are in also plays a role in their temperament (Rittschof and Robinson, 2013). Anecdotally, it was a memorable realization as a second year beekeeper to realize that the reason my very first split was so mean probably wasn't because of a mean queen, but instead because I had lovingly located them close to the house—directly downwind of the chimney, which meant they were getting smoked constantly. That's probably enough of a disturbance to annoy any colony. There is also more recent empirical data, specifically from Clare Rittschof's lab in Kentucky, that shows chronic disturbances impact the way colonies behave (Harrison et al., 2019).

In the "hangry" bee project, I've taken a yard of honey bee colonies and standardized their populations and colony resources, then I've put pollen traps on them. Half of the colonies have traps that are turned on and collecting pollen from the colonies' foragers, which deprives the colonies of pollen. The other half of the colonies in the yard are the control colonies which have their traps off, so their foragers are able to bring pollen into the colony. We conducted behavioral and molecular assessments of the colonies and their individuals weekly to see if the ones deprived of pollen behave more aggressively than their control counterparts. We've found that, independently of stock, the colonies that were deprived of pollen became more aggressive (e.g. showed more aggressive behaviors like racing around the frame, stinging, etc.) than the non-pollen deprived colonies. This can help us shed some light on why different stocks of bees behave differently than their breeding or reputation suggests they would, and it is important when we consider breeding criteria.

Another set of experiments that I am working on centers around chalkbrood, an opportunistic fungal parasite that infects and kills older larvae in a colony. I'm curious about a potential treatment substance that we may use to control chalkbrood outbreaks, as the traditional advice to simply "keep strong colonies" is inadequate for dealing with chalkbrood outbreaks.

Hangry bee experiment colony with pollen trap

Hangry pollen

Paidon Gravois

The chalkbrood experiments have three parts: two in the lab and one in the field. The first laboratory experiment is currently ongoing. We are seeing if chalkbrood (or *Ascosphaera apis*) can grow on growth media containing control media/no dose, low dose, medium dose and high dose of our anti-fungal compound of interest. This work is being done with an undergraduate student from LSU, Paidon Gravois, who is pictured here with one of the plates we grow chalkbrood on. The next step will be to graft larvae into plates we keep in the lab, and subject the larvae to different conditions: control conditions, chalkbrood, anti-fungal compound and chalkbrood+the anti-fungal compound. This is known as an *in vitro* experiment, as the bees are being reared inside incubators in the laboratory rather than in colonies in the field. If the *in vitro* experiment results look promising, then we will graduate to field experiments next Summer.

As someone whose been keeping bees for 15 years, the beekeeping industry and community are both very important to me, and I hope you've enjoyed the news from the newly formed Walsh Lab. I encourage you to email me with questions: **Elizabeth.m.walsh@usda.gov**. BC

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From the University of Florida Honey

January: Overview of the HBREL at UF

February: Honey Bee/ Beekeeping Teaching Programs

March: Research on Honey Bees
April: Apiculture Extension (Part 1)
May: Apiculture Extension (Part 2)
June: Roles in a Typical Honey Bee Lab
July: How Labs are Funded
August: The Lab's Physical Infrastructure
September: What it Take to Run a Laboratory Effectively
October: Professional Development in the Lab
November: Members of the HBREL Team and What They Do
December: The HBREL's Most Notable Successes/Contributions to the Beekeeping Industry

Hi everyone! As this is the first time I have written an article for *Bee Culture*, allow me to briefly introduce myself. My name is Cameron Jack (Figure 1) and I work as an Assistant Professor at the University of Florida Honey Bee Research and Extension Laboratory (UF HBREL) (Figure 2). I grew up in a rural farming town called Logandale, NV, just outside of the glitz and glam of fabulous Las Vegas. My Grandpa, with whom I am very close, was a high school principal, but he was also a sideliner, supplementing his income through bees. When I was young, he managed 150-200 hives, occasionally recruiting help from his grandchildren for assistance with honey extraction and a bit of manual labor. I grew up around honey bees and beekeeping, so I like to tell people that "I liked beekeeping before it was cool." I obtained my bachelor's degree in biology from Southern Utah University in 2012 and then pursued my master's degree at Oregon State University under the mentorship of Dr. Ramesh Sagili in 2013. My master's was my first experience with honey bee research and within the first two weeks the hook was set, and I knew I wanted to pursue a career that revolved around honey bees. After completing my master's research in 2015, I traveled across the country to work on a Ph.D. at the University of Florida under the mentorship of Dr. Jamie Ellis (who we heard from last month as he introduced our lab's series of articles). There, I began investigating integrated methods to control the devastating pest *Varroa destructor* and I have continued this line of research. I have worked as a faculty member in the Entomology and Nematology Department at UF since May 2018.

Okay, now that you know me a little better, indulge me just a moment longer to set the stage regarding the history of formal instructional efforts in agriculture and beekeeping in the United States. Thousands of students each year across the country enter college/university programs related to agriculture. You can go to any Land Grant University (LGU) in the country and select a major related to some agricultural area and become fully immersed in coursework, internships and projects related to that topic. For instance, if you were interested in cattle or dairy production and considered pursuing this as a career, you could choose from dozens of LGUs around the country. Likely you will find an Animal Science department that would provide courses such as: Principles of Agribusiness Management, Careers in the Livestock Industry, Principles of Animal Nutrition, Food Animal Nutrition and Feeding, Genetics of Domestic Animals, Growth and Development of Farm Animals, and

Figure 1. The author (Cameron), his wife (Kelsey) and their four daughters.

Figure 2. The University of Florida Honey Bee Research and Extension Laboratory. Photo: Chris Oster, University of Florida

Bee Research and Extension Laboratory

The University of Florida Honey Bee/ Beekeeping Teaching Programs

Cameron Jack

finally, you would be expected to have full-time practical work experience at a university ranch or dairy farm. Upon graduation, you would likely seek and obtain employment similar to your school training. It is likely that you would have some professional contacts made through your department faculty, internships and academic advisors to help guide you to employment opportunities. Similarly, if you were interested in growing food, you would join the Agronomy department, take a similar series of courses, do an internship and go into that industry. Then, why do we not see a similar education track for those interested in pollination, honey production or the management of beekeeping operations?

You and I already know that our beloved honey bees play an essential role in agriculture. According to a recent economic value study conducted at UF in partnership with the Florida State Beekeepers Association, the total revenues for Florida beekeeping operations were estimated at $93 million in 2020[1]. This total revenue includes $60 million for sales of honey bee products and $33 million for crop pollination services. The total value for pollination services in specialty crops in Florida was estimated at $8 million and out-of-state pollination services were estimated at $25 million in 2020. Keep in mind that this is only one state, and Florida is not the biggest beekeeping state in the country. If honey bees play such a large role in agriculture, and thousands of students each year are participating in agriculture education programs, why do you never hear of anyone going to school to study beekeeping? Well, I suspect the reason may be shockingly simple. No one has ever demanded it.

The case for beekeeping education

Most LGUs that are fortunate enough to have a honey bee researcher typically want that faculty member to spend the majority of their time on research and extension. Most of these faculty have little to no teaching responsibility. If they do teach a course related to beekeeping, it is meant to give students a thousand-foot view of the subject. Students who complete these courses are often left in amazement about the fascinating world of honey bee colonies and have the warm and fuzzies, dreaming about how fun it would be to start their own hive someday. While these courses serve an important role in informing students about the importance of honey bees, they do not prepare students to go forth in a career in the beekeeping industry. How can we cram all the information necessary to comprehend honey bee biology and beekeeping into a single semester? I would like to echo Vizzini, my favorite character in The Princess Bride, who frequently exclaimed, “Inconceivable!” Therefore, more courses are needed to adequately prepare students for all the challenges associated with the beekeeping industry.

Here at UF HBREL, we offer many courses related to beekeeping and I am excited to tell you more about these in a minute. When I tell others about all the courses I teach, I am often asked if they can come to UF and major in beekeeping. The answer is technically… no. A degree major typically bears the name of the department in which the work was completed. If you were to take our beekeeping courses at UF, your degree would be in Entomology and Nematology, as that is the name of our department. Similarly, you do not minor in beekeeping, as minors, like majors, bear the name of a department. We have a very long road ahead of us before there would ever be a honey bee or beekeeping department at a U.S. university.

Now, as I have spoken to different audiences about the future of beekeeping education, not everyone is excited about it. Some commercial beekeepers ask, “do we even want more beekeepers?” I can certainly understand this point of view. More beekeepers mean more competition for contracts, holding yards and customers. However, consider this thought. Not everyone who receives an education about a specific area starts their own business. How valuable could it be to a commercial beekeeper to hire someone who has beekeeping experience, business management training and scientific know-how? They not only would be valuable in their skill-set, but they may be able to help train other employees and seasonal crews. In many other businesses, employers pay for their employees to go to school or get online training to bring back skills and knowledge to the company. Could this model not also work for commercial beekeepers who routinely hire crews of employees that have little, if any, education related to insect behavior, biology or physiology? I believe that beekeeping education can play a role in improving the current industry climate and I will share with you about our efforts at UF HBREL to create such a program.

Beekeeping education at the University of Florida

Since 2011, Dr. Jamie Ellis, like most other honey bee research/extension faculty with little to no instruction appointment, taught a single online course at UF on beekeeping simply called *Beekeeping*. For the first few years, enrollment was around 20 students, but students thoroughly enjoyed the course, and its popularity grew. It grew so much that to meet the demand of student interest, he started teaching the course every semester. By 2017, enrollment was nearing 100 students each semester it was offered. Now Jamie, being the apicultural visionary man he is, saw this desire from students to learn beekeeping topics and knowing the plight of the commercial

beekeeping industry thought that perhaps a traditional education program could exist for beekeeping at UF. Soon, Jamie began advocating for the College of Agriculture and Life Sciences and the Entomology and Nematology Department at UF to create a unique position, a 100% teaching faculty focused solely on creating a beekeeping education program. To my knowledge, a university faculty position focused entirely on the teaching of college students the ins and outs of beekeeping has never existed before in the U.S.

In 2017, Jamie's request for a new position was granted by the university and the one-of-a-kind teaching position was announced. At the time, I was two years into my Ph.D. program, but I recognized the uniqueness of this position and decided to throw my name in the ring. After an intense interview process, I was fortunate enough to be offered the job. Immediately upon my hire the next year, I set to work with Jamie and Mary Bammer (HBREL's Extension Coordinator at the time) to strategically plan a honey bee/beekeeping curriculum. We started by examining the *Beekeeping* course Jamie had already developed and broke up the individual topics, deciding which topics could be fleshed out with sufficient detail to warrant a separate course. Fortunately, there are so many wonderful books related to beekeeping that choosing what to teach was not so difficult. We drew ideas for beekeeping curriculum from such books as *Honey Bee Biology and Beekeeping* by Dewey Caron and Lawrence Connor, *Storey's Guide to Keeping Honey Bees* by Malcolm Sanford and Richard Bonney, and *In Business with Bees* by Kim Flottum. The real challenge was to consider how each course would complement one another to sufficiently prepare a student moving through the curricula to be prepared for a career in the beekeeping industry. After five years of course development, I am excited to share with you the ***ten*** honey bee/beekeeping courses that we now offer at UF.

Honey bee/beekeeping courses offered at the University of Florida

Before listing all the courses I teach at UF, I want to emphasize first that the herculean task of developing so much teaching material has absolutely been a lab effort and not mine alone. As I previously mentioned, Jamie, Mary and I collectively strategized for days on which courses would be important to create. Mary was instrumental in the editing of the lecture recordings and videos, as well as applying her knack for graphic design to make the courses interesting and beautiful. Additionally, I relied on at least half a dozen other lab members that deserve credit for helping me outline content, assemble presentations, create diagrams and figures, design learning activities and importing class materials in our online classroom system. I sincerely would like to thank all the lab members, students and volunteers who helped in this effort. OK, now, on to the courses that I teach as part of the honey bee/beekeeping curricula as of 2023.

Beekeeping I/Apiculture I:

This course is offered to both undergraduate and graduate students and is taught online every semester (Spring, Summer and Fall) with an average enrollment of ~140 students. This course introduces students to the biology of honey bees and the craft of apiculture by exploring the life cycle of honey bees and evolution of beekeeping. Equipment, techniques, management practices, pollination ecology, economic practices and current issues within beekeeping are also discussed.

Beekeeping II/Apiculture II:

This course is offered to both undergraduate and graduate students and is taught online every Spring semester with an average enrollment of ~40 students. In this course, we provide more depth on topics introduced in

Figure 3. Cameron teaching a group of undergraduate students in his Practical Beekeeping course. Photo: Tyler Jones, University of Florida

Beekeeping I/Apiculture I including beekeeping styles, colony stressors and yearly management. This course also explores issues affecting the beekeeping industry including integrated pest management, pests/diseases, African bees, commercial pollination, queen production, bee removals and pesticides.

Honey Bee Biology:

This course is offered to both undergraduate and graduate students and is taught online every Fall semester with an average enrollment of ~50 students. In this course, we provide an in-depth look into the fascinating world of honey bee biology. We explore topics including honey bee sociality, taxonomy, biogeography, behavior, anatomy, physiology, reproduction, nutrition and genetics. Additionally, these topics are discussed via the paradigms of individual bees and the honey bee superorganism.

The Business of Beekeeping:

This course is offered to both undergraduate and graduate students and is taught online every Spring semester with an average enrollment of ~10 students. This course provides an overview related to the management of a commercial beekeeping operation. In this course, we review the ways to generate revenue in beekeeping, the steps of creating an effective business plan and many of the rules and regulations of which beekeepers need to be aware.

Practical Beekeeping:

This course is offered to undergraduate students only and is taught in-person in Gainesville, FL every Summer semester with an average enrollment of 30 students. The overall course goal is to train students to establish honey bee colonies and manage them to be healthy and productive. To achieve this goal, this class is organized as a combined, hybrid course with online lectures and in-person field experiences. Some of the class experiences include assembling hive equipment, installing packages, queen care, making splits, pest and pathogen diagnosis and treatment, honey production and extraction and the creation of other hive products (Figure 3).

Honey Bees of Asia:

This course is part one of the Beekeeping in Thailand study abroad program (the first two weeks in Thailand) which was taught for the first time to 12 students during the Summer of 2022. It is available to undergraduate and graduate level students, along with a handful of interested beekeepers, should there be enough space. The western hemisphere is home to only one honey bee species, but all other honey bee species can be found in southeast Asia. This course allows students the opportunity to discover the amazing diversity of honey bee species and explore the different environments in which these bees may be found. Students participate in laboratory and field experiences in Thailand to study both the biology and threats to these species. Students are housed at Burapha University in the city of Chonburi and work in the lab of professor Dr. Guntima Suwannapong, who co-teaches this course. This course is taught in conjunction with the *Beekeeping in Asia* course. (Figure 4)

Figure 4. Students in the Beekeeping in Thailand study abroad program standing in front of a large tree filled with* Apis dorsata *nests. Photo: Sanchai Naree, Burapha University

Beekeeping in Asia:

This course is part two of the Beekeeping in Thailand study abroad program (the last two weeks in Thailand) which was taught for the first time to 10 students during the Summer of 2022. It is offered to the same group of students who participated in the *Honey Bees of Asia* course. This course allows students to discover the amazing diversity of honey bee species and the different ways in which people manage them. Students in this course are exposed to different styles of beekeeping as they explore different beekeeping operations throughout Thailand. In this course, we visited multiple beekeeping operations and cultural sites in Khao Yai National Park, Chiang Mai, Samui Island, Phattalung and Bangkok. The Beekeeping in Thailand study abroad program will continue every other Summer, with the next courses being taught in 2024. (Figure 5)

Figure 5. Students in the Beekeeping in Thailand study abroad program visiting Supah Bee Farm in Chiang Mai, Thailand. Photo: Cameron Jack, University of Florida

Insect Research – Issues in Honey Bee Health:

This course is offered to undergraduate students only and is taught in-person in Gainesville, FL every other Fall semester with an average enrollment of 30 students. This course is designated as a Classroom Undergraduate Research Experience (CURE), meaning that students conduct novel research as part of the course. During this course, students are introduced to important topics in science and provided with an opportunity to conduct publishable research in the field of honey bee health. The goal is to prepare students to join other research teams at UF and feel confident in their abilities to contribute to their desired scientific fields. To achieve this goal, this class is organized as a flipped classroom, offering both online and in-classroom learning experiences.

Insect Toxicology:

This course is offered to graduate students only and is taught online every other Fall semester with an average enrollment of 30 students. While this class is not specifically about honey bees or beekeeping, I included it in this list of courses because 1) I teach it, and 2) I believe that many students will find the content interesting and relevant to beekeeping. This course introduces students to concepts associated with the toxicology, chemistry, formulation, modes of action and metabolism of insecticides. Additionally, this course explores issues affecting the environmental impacts associated with pesticide use and the management of insecticide resistance in the field.

Commercial Beekeeping Internship:

This course will soon be offered to both undergraduate and graduate students every semester. Unlike all the other courses that are lecture-based and include set learning materials accessed by students in a classroom or online environment, this course is an internship. The purpose of this internship is to provide students with on-the-job training from commercial beekeepers located in their area. Interns will spend at least one day/week over the course of the semester completing the beekeeping tasks required by the commercial beekeeper host. Student performance will be evaluated and critiqued by the beekeeper.

If you would like to view the syllabi of any of the courses listed here, please visit our website at **www.ufhoneybee.com**.

I was once again blessed professionally to move into a more permanent position at UF and I am no longer in a 100% teaching role. I now have a 70% teaching/30% research appointment as an assistant professor. I continue to teach all ten courses listed above, even though my department only asks that I teach five courses with my current appointment, but I truly want these courses to remain in existence to maintain a beekeeping educational program. While I cannot possibly add any more courses to my teaching plate, there are several other courses that I would love to see added to the UF honey bee/beekeeping teaching curricula in the future. Dr. Ellis and I have frequently discussed additional study abroad courses in other locations such as in South Africa studying honey bee biology and evolution or in Brazil studying stingless bee biology and management. Additionally, I would love to see courses related to specific skills like queen rearing or on topics of extreme importance like honey bee nutrition and controlling honey bee pests. Though all these ideas for future courses would be beneficial to students in a beekeeping education program, it would require more faculty to teach these courses. Before we can really advocate more honey bee/beekeeping education faculty at UF, we would likely need to demonstrate the demand of students first.

The case for online beekeeping courses

As you read the descriptions of the honey bee/beekeeping courses offered at UF, you probably noticed that most of these courses are taught online. While traveling across the country and talking about my different courses, I am met with a mixture of reactions upon learning that the majority of courses are taught online. One of the most common objections I hear goes something like "You can't learn beekeeping at a desk or on a computer. You have to learn it in the field with a mentor and the bees as your teachers." While I will certainly concede that one cannot simply take a lot of courses and then immediately become a successful beekeeper, there is, in fact, much that can be learned in a classroom, both on campus and virtually. For instance, you do not need to be in a hive to learn the basics of honey bee anatomy and physiology. You can read about beekeeping theory and history. You can listen to lectures about the biochemistry and social behaviors taking place in the colony. I am certainly not discounting the importance of in-hive experiences, only suggesting that you can, in fact, learn much about honey bees and beekeeping in a classroom.

You may be thinking, "Well, what is the use of taking a beekeeping course online since you're never going to see a real life honey bee?" To address this point, may I say that all the online beekeeping courses require some kind of hands-on experience outside of the classroom. In *Beekeeping I*, students are required to find a beekeeper near them to shadow or attend some kind of educational beekeeping event. In *Beekeeping II*, students have to document that they have attended at least three honey bee club meetings somewhere in their area. In the *Business of Beekeeping* course, students will interview a commercial beekeeper of their choosing to learn more about their business models and strategies.

The main benefit of online courses is accessibility. The demand for a honey bee/beekeeping education program here in Gainesville, FL is too low to justify teaching so many courses and exerting so much effort. Thus, teaching many of the beekeeping courses online allows me to cast a wide net and attract students from around the world to my courses. Online courses are also extremely convenient. There may be some who are interested in pursuing a beekeeping education but are place bound or working full-time. Online courses make it possible for these students to learn at their own pace and access course materials during the time of day most convenient to them. These courses are becoming increasingly popular with commercial beekeepers who have very busy schedules and often work difficult hours. I can provide these students a higher-level of flexibility on assignment submissions because I understand their outside demands better than most other professors. An online training program could significantly benefit commercial beekeepers who might be interested in providing a few of their employees with additional training in a flexible and affordable online program.

I have also heard many people say, "You just can't get as much out of an online course as a face-to-face course." In many cases and situations, this is possibly a true statement. However, I have been interested in comparing if this is true for beekeeping courses. I recently made my first attempt at conducting a social science experiment with the help of some professors who regularly do this type of research. Using surveys and quizzes, I compared the understanding of many key beekeeping topics of students in my online *Beekeeping I* course vs. students in my in-person *Practical Beekeeping* course. The results were interesting to me and fortunately support the idea that an online beekeeping program can lead to similar outcomes of knowledge gained. After comparing more than one hundred students in these courses, we did not

observe any significant differences in knowledge to any of the questions we asked. Furthermore, students in the online course reported just as much eagerness to pursue beekeeping later in life as those that registered for and participated in a face-to-face course. I will be working on writing and publishing this research over the next year. With the addition of this research, there is strong support for the tremendous accessibility and knowledge gained from an online beekeeping education program.

Why pursue a honey bee/ beekeeping education at the University of Florida?

Please believe me when I say that I do not want the University of Florida to be the only formalized university beekeeping education program out there. Nothing thrills me more than to witness the rise of beekeeping education programs around the globe, with students becoming trained to handle the challenges facing the industry. It will take demand from students and the industry before this could ever become a reality. Now, let me briefly explain the options we currently offer or will soon offer at UF.

Undergraduate and Graduate level certificate in Beekeeping

A certificate program is like a mini degree. It is specific training in a single subject area, typically involving ~15 credits of required coursework. The Beekeeping certificate at UF will require *Beekeeping I, Beekeeping II, Honey Bee Biology* and about a dozen other options as electives to choose from to make a total of 15 credits. Many students at other universities that need elective credits take our certificate and then transfer these credits to their home university to complete their degree. In 2022, we were able to create a graduate level beekeeping certificate and sometime in early 2023 the undergraduate certificate should be fully approved and open for enrollments.

Undergraduate degree in Entomology and Nematology

This option represents the "traditional" route of agriculture education. Students living in Gainesville, FL can pursue an undergraduate degree in Entomology and Nematology. In addition to the common core requisites (chemistry, biology, algebra, etc.), students would take honey bee/beekeeping courses along with a few general entomology courses like Principles of Entomology and Insect Classification. In 2023, our department is planning to go live with a 100% online undergraduate degree in Entomology and Nematology.

Non-thesis online master's degree in Entomology and Nematology

For those students that have previously completed an undergraduate degree within the sciences or have a non-science undergraduate degree, but some relevant science coursework, there is a non-thesis online master's degree in Entomology and Nematology available. In this program, students can choose to specialize in *Beekeeping* and take coursework similar to that of the *Beekeeping Certificate* program, with the addition of other foundational courses, such as statistics, insect ecology, insect physiology, etc.

Traditional M.S. or Ph.D. in Entomology and Nematology

Like all honey bee research laboratories at universities with graduate programs, we also offer graduate assistantships for those interested in pursuing a research-focused degree. This route is not necessarily intended for those who wish to pursue beekeeping as a career, rather it is for students interested in improving the beekeeping industry through research. Funding for these assistantships is competitive, with only one or two new students joining the lab each year.

If you are reading this article, you share, along with thousands of others, a passion for learning about honey bees. Even if you are not interested in pursuing a formal university education in beekeeping, please consider the benefits that beekeeping education could have on the industry. Additionally, consider suggesting the idea of pursuing a formal education in beekeeping to someone interested in bees and starting their university education. I sincerely believe that formal university education on the subject of honey bees and beekeeping will enhance the beekeeping industry in many ways.

We have already witnessed several students go on to important positions in the world of apiculture after taking our courses. Some of these students have moved into state regulatory positions, some have gone on to work for commercial beekeepers, and others have gone on to work in honey bee research laboratories across the world. I am thoroughly convinced that those who participate in honey bee/beekeeping courses can become more competent beekeepers that benefit the industry. Therefore, I encourage more beekeepers within the industry to seek out those graduating from university beekeeping programs for hire. Lastly, I encourage more people to demand that their regional LGU provide a beekeeping education program.

Here at HBREL, we sincerely believe that we are currently in the best situation to teach students, both in person and virtually, about beekeeping. Of course, we are incredibly biased, but after you learn more about our world-class facilities, faculty, students and staff through the coming articles this year, I think you may agree. I sincerely hope that you have enjoyed learning about the efforts being made at UF to teach others about the most fascinating and important insects on planet Earth. I hope that you will join us next month as we hear again from Dr. Jamie Ellis about our research programs at HBREL. (Figure 6) BC

Figure 6. Current members of the Honey Bee Research and Extension Laboratory. Photo: University of Florida.

[1]Economic contributions of the Florida beekeeping industry in 2020. Court, C. et al. UF IFAS Economic Impact Analysis Program, October 10, 2022

BEE VET

A Seat at the Table

Dr. Tracy Farone

This month, I have exciting news to share with the honey bee industry!

The American Veterinary Medical Association (AVMA), which has over 100,000 member veterinarians, have a variety of Committees that report to the AVMA Board of Directors, including the Animal Agriculture Liaison Committee (AALC). After years of advocacy from members of the Honey Bee Veterinary Consortium (HBVC) and AVMA staff (shout out to Dr. Michael Costin, Dr. Terry Kane and Dr. Kristin Clark), the AALC will have a delegate veterinarian representing honey bees for the first time starting this year. The AALC consists of seats of representatives of other animal species like cattle, swine, chickens, etc. that veterinarians typically serve. Honey bees and their industry now have a delegate sitting on this committee to represent them. Dr. Terry Kane, DVM has been appointed to be the first primary HBVC delegate on the AALC, and I have been appointed as the alternate delegate.

The AALC activities include reviewing AVMA policy, reviewing and drafting positions on proposed state and federal legislation, developing new AVMA resources and reports, as well as participating in and developing presentations for various stakeholders. The AALC acts as a liaison between the AVMA Board and the producers and other stakeholders, to identify mutual concerns and working to strengthen relationships, while providing veterinary expertise[1]. The charge of the Committee is stated as follows:

1. "Identify present and future issues of mutual concern to the veterinary profession and the producers of food products derived from animals.
2. Strengthen relationships between AVMA and organizations related to animal agriculture.
3. Improve communications and the flow of information among animal agriculture organizations inside and outside AVMA to support AVMA's decision-making process.
4. Provide expertise and content in the area of animal agriculture for the AVMA and serve as a primary resource for matters associated with animal agriculture.
5. Advise on and develop animal agriculture policy and recommendations for submission to the AVMA Board of Directors."[1]

Honey bees are a big part of agriculture

Representatives from the following organizations are often involved in AALC meetings to provide their organization's perspective on animal health and welfare issues. These organizations include: U.S. Department of Homeland Security (DHS); U.S. Food and Drug Administration Center for Veterinary Medicine (FDA-CVM); U.S. Department of Agriculture Food Safety and Inspection Service (USDA-FSIS); USDA Animal and Plant Health Inspection Service (USDA-APHIS); USDA-Cooperative State Research, Education and Extension Service (USDA-CSREES).[1]

I have often talked with beekeepers lamenting about lack of recognition of their industry given the importance of honey bees, often with the bulk of the attention, concern and funding focused on other agricultural animal industries. I believe giving honey bees a seat at this table is an important step to leveling some attention to the industry to look at disease, public health and environmental health issues affecting the industry. I look forward to learning more about how this process works over the next three years of my term and I will do my best to give you updates on any progress that is made.

[1]AVMA Animal Agricultural Liaison Committee. **https://www.avma.org/membership/volunteering-avma/councils-committees-task-forces-and-trusts/animal-agriculture-liaison-committee**. Accessed December 19th, 2022.

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A new seat at the table

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Board by Board, Hive by Hive

Stephen Bishop

In a moment of inspiration, I once grabbed a crowbar and decided on a whim to start a small home improvement project—that is, re-siding my old farmhouse with Hardie board and installing insulation in the walls in the process. Now, two and a half years later, I'm finally on the last wall of my house and I no longer feel inspired. And I can firmly say I'm now anti-inspiration. I've come to the conclusion that if I need to be inspired to do something, that something probably doesn't need to be done.

Don't get me wrong, I'm sure I saved money by doing the work myself, but I likely also lost several years off my life-expectancy due to lead poisoning. People always talk about how well-built old homes are, but I think old homes are just well armored. The old wood boards I pried off my house were likely covered in so much lead that I could have pawned them off as metal at the scrap yard. They had at least a dozen layers of paint, dating back to the original paint used way back in 1893.

On a more positive note, in the two and a half years it has taken me to re-side our house, I've had a lot of time to think about life priorities and core values while climbing up and down a ladder toting Hardie board. After one day of much introspection and ladder climbing, I decided upon the following maxim as my new personal life slogan, "Never start a project you can't finish in two hours."

In beekeeping, I've had similar moments of overzealous inspiration that reinforced the wisdom of this maxim. To save money, I once thought I'd build a hundred bee boxes myself using my table saw. My first five homemade boxes were so revolutionary in design they resembled something you might see in a Picasso painting; they were that out of square. That said, if you ever want to increase your comb production, give your bees a good cattywampus homemade box. You'll have all the burr comb you could ever desire.

"Why did I need 100 bee boxes?" Because on some preceding day, as if struck by another bolt of inspiration, I decided I would become a sideline beekeeper and use my future sideline beekeeping earnings for the noble cause of paying off my mortgage early. Yes, I know that may be the funniest thing I've ever written, but stop your belly laughing. I wasn't too far off. If only I'd have used the money I *invested* in sideline beekeeping then I would have certainly paid off my mortgage early.

Alas, some people have eyes bigger than their stomach and overeat. I have inspiration bigger than my ability and over-aim. The problem with inspiration is that it's great at getting people to start and commit, but terrible at getting people to follow through and finish. Once the inspiration is gone, what you're left with is not so much a dream, but a project. And projects are time-consuming things that can only be finished board by board if you're re-siding your house—or hive by hive if you're building your apiary. The important thing I've learned about long-term projects is to just keep plugging away at them and don't stop. Momentum, however minimal, is still momentum, and it's a lot easier to keep going than to restart.

Ten years after my sideline beekeeping inspiration, I no longer feel so much inspired by beekeeping as addicted to it, but I'm now halfway to one hundred hives and haven't stopped. Believe it or not, my bees are actually turning a profit and maybe, just maybe they'll contribute a dividend back to their owner's mortgage this year (stop your snickering).

That said, now that I'm finally finished writing this, I'm seriously considering updating my personal life slogan yet again, to something more fitting for a parent of a toddler, something like: "Never start a project you can't finish in twenty minutes." BC

Stephen Bishop keeps bees while perpetually repairing his old farmhouse in Shelby, NC. You can receive his weekly farm blog updates at ***misfitfarmer.com*** *or follow him on Twitter @ themisfitfarmer*

All The Buzzz in...

Bug Camp at the University of Tennessee

Science U at Penn State

Bug Camps

Summer may seem like ages away but when it comes to cool summer camps, now is the time to look around in your community for these interesting learning opportunities. Either start searching on the internet yourself or ask an adult to help you find a science camp that would interest you.

Where to Look

Here are some places that may offer science based camps.

- The entomology department of a local or state university
- Ag extension office in your county/ 4-H
- Nature centers
- Science museums

Check Out These Camps

Pennsylvania –State College
Science-U at Penn State University offers a wide variety of science camps for grades 2 - 8 and grades 9 – 12. The Nature Explorers Camp include activities about insects. Some other camp topics: Design, Robotics, Astrobiology, DNA, Ecology, Sustainability, and the Human Body.

https://science.psu.edu/outreach/scienceu/2023

Texas – San Antonio
Texas A&M AgriLife Extension organizes a Summer Entomology Camp for ages 7 – 12.
https://bexar-tx.tamu.edu/summer-entomology-camps/

Mississippi – Mississippi State
Beekeeping Camp and Bug and Plant Camp is open to people from 10 years of age and up.
https://www.biochemistry.msstate.edu/bugcamp/beekeeping.php
https://www.entomology.msstate.edu/bugcamp/

Maryland – College Park
Bug Camp is supported by the University of Maryland.
https://entomology.umd.edu/insect-camp.html

Tennessee - Knoxville
University of Tennessee presents Bug Camp in June for 2nd – 4th graders.
https://utarboretum.tennessee.edu/bug-camp/

Bee kid's corner

Produced by Kim Lehman
www.kimlehman.com
www.beeculture.com
February 2023

Camille Liu, 13, TX

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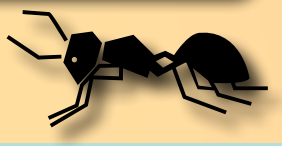
Emily, TX

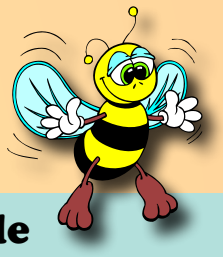
Bee Mine Oreos

You will need:

- Oreo cookies
- yellow icing in a tube
- almond slices
- candy eyes (optional)
- pistachio (optional)

1. Arrange the cookies on a plate.
2. Squeeze the yellow icing to make stripes on the top of the cookie.
3. Stick two almond slices on the icing to make wings.
4. Make little icing dots for the eyes or squeeze a bit of the icing on the cookies to place the candy eyes.
5. Make a mouth using anything you can find like a pistachio, a peanut, or a raisin.





Insect Word Scramble

Unscramble the letters in each word to make the name of an insect. Fill in the letters with the corresponding numbers to discover the mystery message.

NTA ☐☐☐ (2 17)

LFY ☐☐☐ (22)

BEELTE ☐☐☐☐☐☐ (1 26)

DBUGLYA ☐☐☐☐☐☐☐ (7 19 10 18)

LUTYFRBTE ☐☐☐☐☐☐☐☐☐ (3)

TOQSOMUI ☐☐☐☐☐☐☐☐ (5 6 12 11 13 4)

GYARLFNOD ☐☐☐☐☐☐☐☐☐ (8)

EYBENOEH ☐☐☐☐☐☐☐☐ (14 21 23 15 20 25)

RHGPPSRAESO ☐☐☐☐☐☐☐☐☐☐☐ (9 16 24)

☐☐☐☐☐☐☐☐☐☐ ☐☐ ☐☐☐

(1 2 3 4 5 6 7 8 9 10 11 12 13 14 15)

☐☐☐☐☐ ☐☐ ☐☐☐☐☐ C ☐☐☐ .

(16 17 18 19 20 21 22 11 23 24 25 26 12)

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INNOVATIVE TECHNOLOGIES

Minding Your Bees And Cues

Beeyard Gratitude

Becky Masterman & Bridget Mendel

Besides the witches in Marlon James' *Black Leopard, Red Wolf* who move through the novel haloed by bees, we're hard pressed to find examples of beekeepers who don't need a place to keep their hives. Could be a rooftop, a backyard, a farmer's field, a hollow log, a garden. No matter where, a beeyard is a place requiring negotiation. Neighbors, landowners or rooftop sunbathers must be consulted, wooed and rewarded for tolerating your admirable yet stinging insects.

Generational beekeepers often have long-standing relationships with landowners, who allow them to keep their bees on farms or in fields in exchange for "yard rent," a yearly gift of honey. This is an often-informal agreement based on tradition and mutual respect, not money, though land access is crucial for the beekeeper's business. The landowner goes out of his way to support bees and beekeepers, planting habitat or leaving wild spaces, sometimes against their own economic interests.

In turn, as Minnesota/Texas beekeeper Dan Whitney explains, the beekeeper also goes out of their way for the farmer:

"I've helped old men [landowners] cut trees, fix fences, [help] cows give birth…

I am an asset to the land as well as the bees. I have keys to numerous gates that no one else has. Most of my landowners are old. They can't bushhog anymore. Their children appreciate what we have done for mom and dad over the years, and when they pass, the kids say our bees are always welcome on their land. Makes the beekeeper proud to hear that.

Landowners plant stuff for us or leave sections wild. Isn't it amazing that in this litigious society we live in, people will give you permission to place stinging insects on their land in exchange for honey? Landowners are people that 'get it'. They understand the importance of bees to mankind and nature."

Dan Whitney is a first generation beekeeper. He took over about 30-40 beeyard relationships when he bought his business. He now maintains about 125 relationships with landowners between Minnesota and Texas. He says the rule of thumb is to give the landowner about one pound of honey per colony on the land.* Some landowners just appreciate the pollination services and don't want the honey, but he encourages them to take some for themselves and donate the rest to their church or other people in their communities.

Some generational beekeeping operations trace their beeyard relationships back to the early 1900s or before. When we asked Mark Sundberg, current president of the Minnesota Honey Producers Organization and owner of Sundberg Apiaries, Inc., about the history of his beeyards, he shared that he has seen records of his earliest yard relationship going back to his grandfather's time in 1920; his home yard was established in 1907.

As implied by their name, "backyard" beekeepers, keep their bees in their own backyards. The concept of "yard rent" may not apply. But gifting honey to neighbors is still a means to show gratitude to those who plant flowers for pollinators and tolerate the occasional pooped-on car. A jar of honey and the story of your hives is also a smart way to start a conversation with the pesticide-happy guy down the road or the person who just doesn't like bees (yet).

One of our favorite beekeepers has mastered yard rent gratitude and includes an educational component. We remember years ago when John Miller of Miller Honey Farms asked to buy hundreds of copies of **Plants for Minnesota Bees (https://beelab.umn.edu/plants-mn-bees)** to include with his yard rent and to pass out at his landowner BBQ. Having a talent to scale solutions that improve bee health, Miller was a significant supporter and part of the conversations in the founding of **Project Apis m**. (officially founded by Christi Heintz and Dan Cummings) and the **Bee and Butterfly Habitat Fund** (founded by habitat evangelist Pete Berthelson) which support projects that help landowners (with and without bees) place effective bee

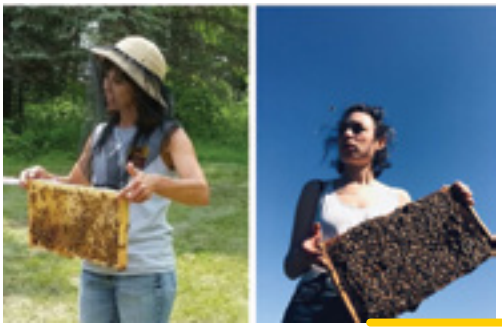
Yard rent prep for commercial beekeepers is a serious operation done with pride. This photo shows part of the yard rent production process for Dan's Honey Company and Whitney's Lonestar Queen Company. Photo Credit: Dan Whitney

forage projects at low or no cost. Miller understands the importance of bee yard relationships as a pathway to improving colony health through nutrition. Combining big picture habitat options with an open house and BBQ on his farm, Miller celebrates the relationship between landowners and beekeepers while giving them sophisticated opportunities to improve habitat for the bees on their land.

Honey bees will continue collecting and storing honey long after they have enough to get through Winter – if flowers are in bloom in the environment. This hoarding trait can be explained biologically, but, assuming the lens of poetry, we also can call it generosity. We thank the farmer for allowing the bees on his land; he in turn thanks us for the bucket of honey, for the bees and their excesses.

*This rule of thumb likely varies by location and beekeepers. Our suggestion is to check with your local beekeeping clubs for their guidelines.

This Miller Honey Farms appreciation event (held in their overwintering facility) demonstrates their gratitude for landowner relationships and an enormous capacity to connect with people who can increase bee habitat. Photo credit: John Miller



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 own yard rent stories, please send an email to mindingyourbeesandcues@gmail.com.

Acknowledgments

The authors would like to thank Dr. Marla Spivak for helpful edits and suggestions and John Miller for his insightful responses.

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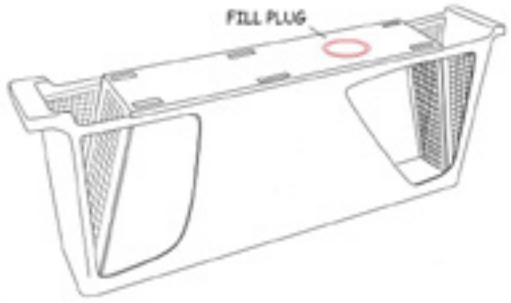

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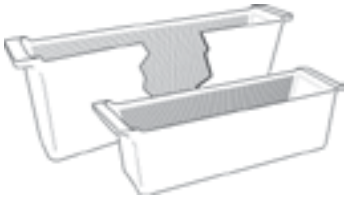

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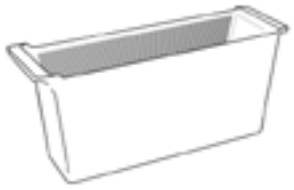

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The Electrical World of the Honey Bee

Listen along here!

It has been said that honey bees have been studied and written about more than any other subject second only to ourselves. Certainly our deep understanding of bees is part of what makes them so fascinating. Yet for all we know about bees, there's much we still do not understand. One area of inquiry in which we have only scratched the surface of our knowledge is the role electricity plays in the life of the colony.

It is well established that insects become electrostatically charged when walking, or when their body parts are rubbed together (Colin and Chauzy, 1991) and insect cuticles in general display the tendency to become positively charged (Edwards, 1962). This phenomenon is similar to the static electricity generated when we walk across a wool carpet or rub an inflated balloon against our hair.

It is also clear that bees become charged with a weak electric charge when flying through the air. How this occurs is not clear however. There are two main theories why this happens. One is that it is a result of friction. The other is that the flying bee picks up positively charged ion particles (cations) from the air. Which one is true? Do both potential charging methods play a role? We do not know. What we do know is that since bees are quite small, they experience weak electrical fields much more profoundly than we do.

Flowers are electrically connected to the earth and pick up a negative charge through electrostatic induction. Bees pick up a positive charge as they fly through the air. The bee's body surface charge appears to facilitate pollination since flowers are negatively charged and bees are positively charged (Greggers et. al., 2013b). The attraction of pollen to bees due to their opposite polarity allows pollen to defy gravity, moving against the earth's gravitational forces in order to stick to the surface of the bee and become lodged in its body hairs (Clarke et al., 2017).

The acquisition and maintenance of charge on a bee appears key to their ability to detect electric fields such as that on a flower (Sutton et al., 2016). While it seems clear that the static electric charge aids in pollen collection by foragers, do these electrical forces (between bee and flower) allow the forager to also assess floral rewards and perhaps allow them to tell which flowers have been recently visited by another pollinator and which have not and therefore which blossoms are worth taking the time to investigate and which are a waste of time?

Some research indicates that the change in electrical charge created by pollinator visits to blossoms stimulate some flowers to release more of their scent thus increasing their chances of being pollinated (Montgomery, 2021). Since flowers have a limited supply of scent, some appear to prefer to release it when pollinators are around – after all, it makes sense that the best time to advertise is when you know you have an audience.

Meanwhile, agrichemicals such as synthetic fertilizers and the neonicotinoid imidacloprid have been shown to effect bumblebee foraging behavior by changing the magnitude and dynamic of electrical cues given off by the treated blossoms. Researchers found that the biophysical responses in the plants modified floral electrical fields appeared to disturb the ability of the bees to sense the electrical fields causing them to approach the electrically manipulated flowers less often, land on the flowers they did approach less and this reduced bumblebee foraging efficiency (Hunting et al., 2022). The bioelectrical potential of the chemically treated flowers were impacted for a longer duration than the changes observed by natural phenomena like the wind or a bee landing on the flower. This raises questions about what other pesticides might influence the electrical fields of flowers.

Honey bees appear to perceive weak electrical fields through the two joints of the antennae johnston's organ (Greggers et al. 2013a). Bumblebees can also detect electrical fields with their antennae but appear to do so more effectively using their body hairs (Sutton et al., 2016). Like a sapling bending in the wind, the bee hairs and antennae alert the bee to oppositely charged electric fields. Do honey bee hairs or other rigid cantilevered body parts, carrying an electric charge and subject to external electrical force, also bend toward (or away) from electrically charged objects?

Bees appear to detect and use aerial electric fields not only in the context of foraging but also during in-hive communications over short distances. Research suggests that part of the waggle dance includes low-frequency oscillating electrical stimuli from electrically charged vibrating foragers to yet to be recruited foragers while doing the dance (Greggers et al., 2013b). Does the honey bee use its antennae for other forms of electroreception communication as well? Exactly how bees respond, learn from or exploit electrical fields in their natural habitat and within social contexts is not entirely clear. For example, how does rain, high humidity or winds impact floral electrical fields?

Since each bee carries with it a small electrical charge, what happens when a large group of them swarm? A recent study suggests that honey bees contribute to atmospheric electricity in proportion to the size and density of the swarm that issues from a colony. Researchers calculated that the swarm had enough charge to affect the atmospheric electric field known as the potential gradient, which is the voltage difference between the earth's surface and a point (often one meter) above it. The effect was proportional to the swarm density. Similar impacts can be observed in swarms of locusts, although their

The static electric charge that builds up on the bee's body while it flies greatly increases its pollen collecting efficiency.

impact is much greater since locust swarms can cover hundreds of square miles and pack between 40-80 million locusts in less than half a square mile. The study authors hypothesize that insects can have similar effects on atmospheric electricity as weather events since at the ground level where they made their measurements; the strength of the honey bee swarm's electric field was comparable to the kinds of changes in electric fields that we see during a thunderstorm (Hunting, 2022).

Does this mean we need to include the role of insects in geological modeling of atmospheric changes? Scientists have long wondered about what forces can carry sand particles from the Sahara desert across oceans. Could atmospheric changes brought on by the electric fields given off by insects help to explain the long distance dust transportation that has been documented in nature that cannot be explained by physical processes such as wind and updrafts alone (Toth et al., 2020; Does Van der et al., 2018)? Perhaps the charged up bee's electrical fields add to the electrifying effect the sight of a swarm has on us beekeepers?

So many questions; so few answers, and this is just one small area of inquiry into the amazing and mysterious world of the honey bee. BC

Electrostatic dusting is used to reveal areas of the greatest negative charge density on each flower. Flowers are shown before (left) and after (right) dusting with positively charged colored powder of blue or yellow (bottom image). Photo credit: Concept and Pictures by D. Clarke & D. Robert

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New(ish) Beekeeper Column

Off the Wahl Beekeeping

BEGINNER BEEKEEPING BASICS

Richard Wahl

Before I delve into the basics, let me share a bit of background as to how I chose the topic for this issue. In the November issue of *Bee Culture Magazine* I wrote about the advantages of taking a class, joining a club or doing extensive reading before acquiring your first beehive (That article on *Resources for the New Beekeeper* can also be found on the *Bee Culture* website: **https://www.beeculture.com/off-the-wahl-beekeeping-2/**). I understand that the costs involved or the time commitment required for these activities may be an inhibiting factor for some individuals with young families or competing work schedules. But there is another possibility which requires only a day or two and a minimal cost. That is to attend an annual or semi-annual beekeeping conference, convention or meeting. Most state or country beekeeping associations hold annual or semi-annual get-togethers of this type lasting for one or two days. Simply type your state or country name into an internet search engine followed by "beekeepers" and more than likely several organization or association events related to beekeeping will show up. Searching Michigan Beekeeper's Association (MBA) will take you directly to the 2022 Fall Conference Review. This coming year's MBA Spring conference is scheduled for March 11, 2023.

Stephanie Slater and Chris Beck judging honey at the 2022 Fall MBA Conference (photo by Joan Mandell)

Loren Tate and his top bar hive at the 2022 Fall MBA Conference (photo by Joan Mandell)

Shortly after I began writing for this column a year ago, I was asked to be a speaker at the MBA Spring conference. Although I had heard about such events, I had yet to attend such a conference and was uninitiated on what such an experience would entail. Given the latitude to determine my presentation topic made acceptance of the invitation a bit easier as I could use my previously prepared topic from two years earlier where I taught a small beginner class just before the COVID lock downs. That coupled with the fact that I had taught high school college prep mathematics for sixteen years made the option of public speaking a bit less daunting. With some trepidation I accepted the invitation. My topic was aimed at the new beekeeper or the individual thinking about starting out as a beekeeper, summarized and re-tailored a bit farther on for this article. Most beekeeping association conferences will have at least one track of speakers throughout the day and may have as many as three or four. Often these tracks are split toward the level of the beekeeper audience experience, be those just getting started, those with a few years of experience, or possibly directed topics such as queen rearing or commercial beekeeping challenges. In addition to the lecture tracks there is often a room set up where vendors can bring in their beekeeping wooden ware, bee related or other hive products for sale. At Fall conferences, it is not unusual to find a honey and/or wax judging contest.

I found all levels of experience and expertise to be present at last Spring's MBA conference. I was expecting maybe thirty to forty participants for my "Getting Started and Sustaining Your Hives" topic and was surprised as a first time speaker to draw an audience of near one hundred interested newer beekeepers, representing about one-quarter of those in attendance.

Back to Basics to Consider

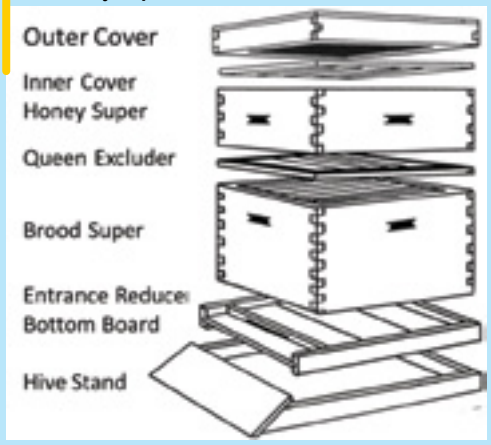
Before jumping into the art of beekeeping one needs to consider the time commitment and costs involved. When asked by the casual honey purchaser or interested party, "What does it take to be a beekeeper?", my short answer is that it is animal husbandry, only with an insect. Just as your pet cat, dog, pony or aquarium fish have food, water and shelter needs along with watching out for pests and diseases, so do the bees. Far too many first time beekeepers think a box can be set out, the bees fend for themselves and a little honey can be collected in the late Summer or Fall. The concept that feral bees

survived in the wild for thousands of years without human intervention is no longer the norm. Due to invasive pests such as *varroa* mites and hive beetles along with the myriad of agricultural chemical use that continues to challenge survival of any insects, the existence of feral colonies is becoming more and more non-existent in many parts of our chemically dependent world. Although a beehive does not require daily attention for water and food needs as other pets would, there are still periods in the Spring and Fall where more concentrated efforts are required for inspections or honey collection. It is highly recommended that the new beekeeper make a good inspection every two to three weeks through the late Spring, Summer and Fall to assess the state of their hives and catch any abnormalities before they become lethal to the hive. As experience is gained, fewer deep inspections, moving frames about, are required. During mid-Summer months, one can get a good idea how well the hive is doing by watching the bees coming and going at the entrance. Weather conditions will often dictate optimal hive inspection times. Time of day, frontal passage, temperature, rainfall, wind and humidity should all be taken into consideration when opening a hive. The bees work very hard to keep their micro-climate inside the hive at an optimal state and when the hive is opened and frames moved about these optimal conditions are upset. It may take days after a long or thorough hive inspection for the bees to return things to their optimal condition. If the only available inspection times are weekends due to a beekeeper's work or travel schedule and those weekends are coincidentally rainy, windy or consistently have a frontal system moving through, optimal inspection times may be difficult to achieve. Several years ago, I assisted a new beekeeper whose work schedule only allowed for hive inspections on weekends. Unfortunately, a number of less than ideal weather conditions precluded thorough hive inspections on a number of subsequent weekends resulting in an unnoticed queen loss that could have been corrected sooner if it had been caught in earlier midweek better weather conditions. (I see a potential future article here on the effects of weather in beekeeping.)

Research Potential Costs

Startup costs are another factor to be considered. A basic hive kit that includes a bottom board, entrance reducer, ten frame deep box (called a super) with ten frames and foundation, an inner cover and a telescoping outer cover would be the minimal hive requirement. Toss in a few more essentials such as a smoker, good hive tool, bee brush and bee suit and you may be set to order your first bee package or nucleus hive. Prices on all items can vary dependent on mail order from a bee catalogue or if there is a local supplier where a pickup can be made to avoid shipping fees. But then as the eternal optimist you need to consider that your hive will continue to expand and your bees will soon need more room, which will demand a second deep with the associated frames and foundations. As Summer progresses and your bees bring in more pollen and nectar, a honey super or two with even more frames will need to be added.

Hive components with a single deep and honey super.



If you are placing hives where cattle or large predators co-exist, there may be a need for fencing, possibly electrified. The point is to do some research on expected costs before jumping into the beekeeping hobby. Early Spring and Summer feeding can aid greatly in getting that first hive off to a good start. Once the bees become active after that first Spring pollen collection, a pollen patty is a good idea for a boost and good early brood development. Adding a one to one sugar syrup mix will serve as a nectar substitute if your nectar flow lags after that first Spring pollen burst, as it does in my area, minimally adding to additional start-up costs. My maples pop in early March for a day or two with a month lag before the dandelions provide any sort of nectar flow. In the Southeast Michigan Beekeeper Association (SEMBA) class that my partner and I taught this past year, we recommended the purchase of two nucs (nucleus hives which usually come with a mated, laying queen and five frames, at least three with that queen's brood) to start two hives. The purpose of nucs is that they provide about a month head start over a package purchase and two hives allow for a comparison.

A ten frame deep split in two sections with two story, four frame nucs above that. Successfully came through Winter with both entrances facing forward.

This past Summer, I was asked to assist two different first year beekeepers who had some concerns about their hives. Each new beekeeper had two hives and one beekeeper's set was doing well. We even started a third nuc hive from his strongest hive during my visit. The other beekeeper had a legitimate concern as one hive did not have the same activity as the other. Come to find out the weaker hive had lost its queen and we were able to set an egg/larva/brood frame from the stronger hive in it. A later report indicated the weaker hive had produced a new queen and that both hives were doing well. Had there only been the one weaker hive, this discrepancy may not have been discovered in time to take remedial action, and no available second hive would have meant ordering and purchasing a new queen.

Location, Location, Location

As the saying goes, location can be a great determining factor as to the success of the beginning beekeeper. There are numerous considerations to make when siting a hive. Ideally, a spot for hives should be chosen that is

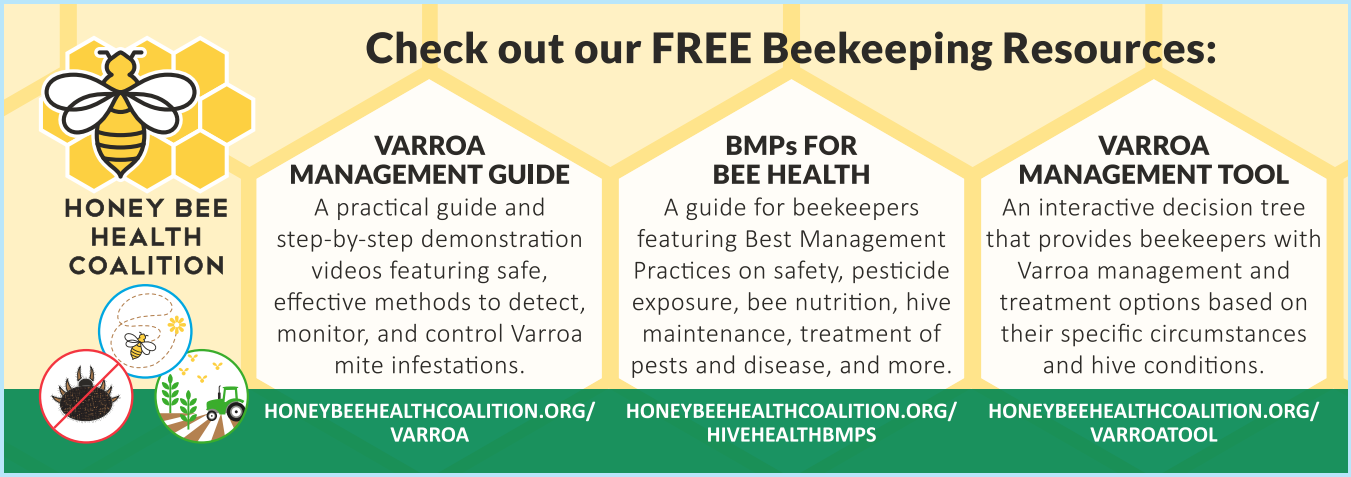
a bit elevated off the ground and gets early morning sun with the bottom entrance facing east or south. Leave three or four feet behind the hives to make working in them easier as working in the front entrance bee path is more irritating to the bees. Any natural or constructed protection from north and west Winter winds is certainly a plus, particularly in unpredictable northern climates. Looking into any local ordinance requirements may preclude confrontation with governing officials. Letting neighbors in on your new beekeeping endeavor and offering to share a jar or two of your future honey crop can go a long way to appease neighbor's concerns. Just a quick explanation to neighbors as to what to do if they encounter a bee can create better peace of mind. I find that honey bees are not prone to sting unless they feel threatened as you deep inspect a hive or pinch them in some way. Their normal action when out in the open, or even as you get closer to the hive, is to buzz around your head and even do a head bump or two before they sting. If you walk quickly away from the hive location they may follow you for a bit, but I find they will often abandon the chase as you get farther away from the hive. This seems to work particularly well if you walk under low tree branches. I have succeeded with this quick walk away action many times, but naturally there is always the exception. Once, several hundred feet away from my hives, days past any inspection activity, I encountered a bee that was obviously on a direct path back to the hive. Without provocation or preemptive notice the bee made a direct hit and sting on my forehead. Accepting the fact that you may get stung is another consideration when determining if beekeeping is for you. Of course the Africanized bees, now more prevalent in the southern U.S. states, require much less stimulation to get agitated and reach the attacking, stinging state.

Hives with a birdbath water source.

An additional consideration for hive placement is to have a nearby water source. Bees seem to love the chemical content of a neighbor's swimming pool if nearby. My bees avoid my very hard well water or even distilled water if provided and prefer my neighbor's pond or a nearby drainage ditch. Another consideration is the ease of access to the location of your hives. Hauling a thirty to forty pound honey super any short distance can easily put a strain on one's back. After getting my truck stuck in a relative's farm lane that had several drainage ditches, I gave up on the placement of several hives on that end of the lane property that had a natural overgrown, brushy protected spot otherwise ideal for a hive.

Mentors, Classes, Clubs and Books

My November article, as noted in the opening paragraph, covered classes, clubs and books. An equally optimal option is to find a person willing to be your mentor. An experienced beekeeper even with only a few more year's experience can go a long way to get a new beekeeper off to a good start. The perfect place to meet these experienced beekeepers is to attend a convention or conference, join a club or take a class which brings us full circle back to the opening of this article. This year's MBA conference will be held in Lansing on March 11, 2023. Find more information as it develops at: **www.canr.msu.edu/events/michigan-beekeepers-association-conference**. The new beekeeper's success will only be enhanced by seeking out answers and having a willingness to learn. I find nearly all persons in this intriguing insect management endeavor to be pleasant, conversant people willing to share their experiences. If you have been hesitant to jump into the hobby of beekeeping, give the aforementioned ideas some thought and if your situation is amenable to the conditions stated above give beekeeping management a try. I do not think you will be disappointed. BC



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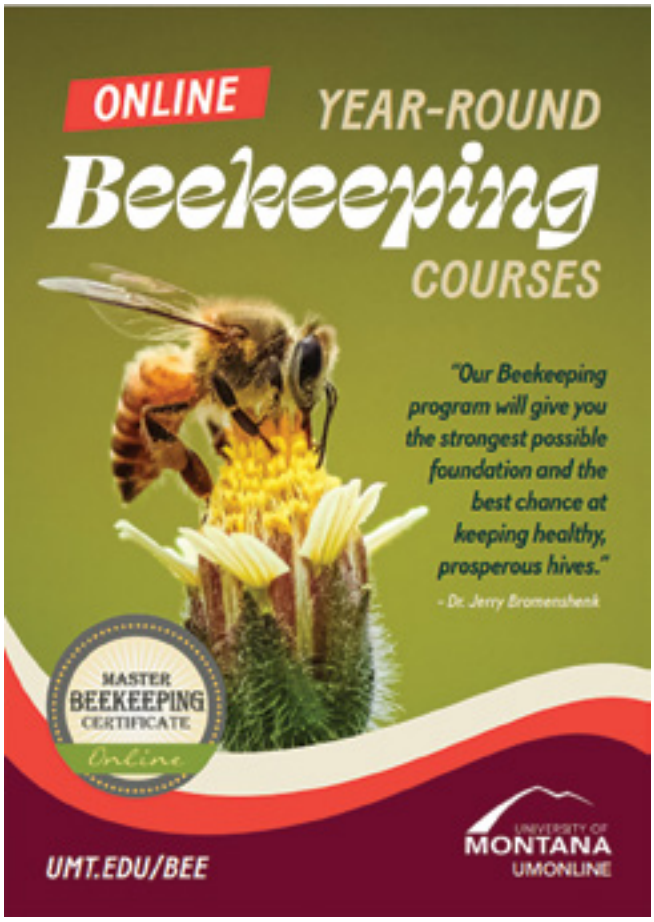
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THE PACKAGE INSTALL

Greg Carey

Let's do this!

Your package may come in a wire sided wooden box or in a plastic molded box. The process I use is pretty much the same for either.

The dump and run method frequently taught in classes is very macho. You have bees flying everywhere, the kids and neighbors are impressed, the bees not so much. I think you will notice in the photos that the bees prefer this method.

Figure 1. This package is in very good shape. There are few dead bees on the box bottom. It is not unusual to see the bottom completely covered with dead bees.

Figure 2. I recommend doing a fit check as you see here before going out with them. I remove four frames and place an Imirie shim to allow for the box lugs and to give space for the queen cage.

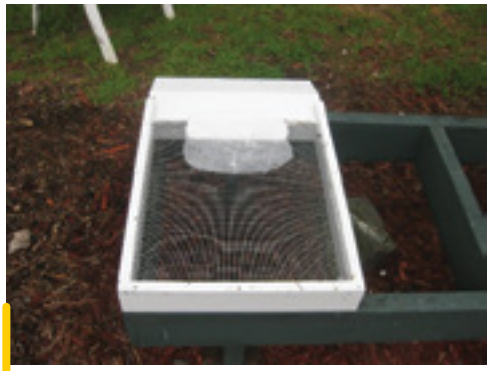

Figure 3. Outside I have the bottom board ready. I use a Crisco patty for tracheal mite control.

Figure 4. The hive body is in place with the four frames removed.

Figure 5. Now I mist the bees well with thin sugar syrup. This helps to calm them and keep them from flying so much.

Figure 6. Use your hive tool to pry the stapled cover off.
If you do not have strong fingers and fingernails, I recommend having a pair of pliers nearby to remove the can. It can be quite snug and sometimes nailed down with wax by the bees.

Figure 7. With the can removed, the queen cage, which always has wax holding it in place, is much easier to access and lift out.

Figure 8. Inspect the queen to ensure she is actively moving around in the cage. Note that wax I mentioned.

Figure 9. The plug is removed from the candy end of the queen cage, and the cage can be laid on top of the frames near the open package.

Figure 10. Since I have drawn frames with stores in them, I then place a second hive body above the queen and package. When I come back in about three days, the queen is usually out and on the frames in this hive body. If you are installing on foundation, you will put a feeder on instead of the second hive body.

Figure 11. This is not what you do with the syrup can. Go ahead and open the can and pour the syrup remnants into your feeder.

Figure 12. Finally, install an entrance reducer to help protect the new colony while it develops its defenses.
Now, enjoy beekeeping! BC

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BUILD A SWARM TRAP

Ed Simon

You have just caught a swarm, and now it seems as though there are more bees flying around and crawling out of your container than there is inside. How can you get them into the container without releasing the bees already in it? All you can normally do is wait until dark when the swarm finally moves into the container.

In the future, the easy solution is to start with a five-gallon pail that employs a funnel or cone lid to trap the bees and not allow them to exit. The funnel acts as a one-way opening. It makes use of the bee's inability to recognize a small opening that is not on a flat surface as an exit. The same concept (cone entrances) is used in many bee related devices such as pollen traps and escape boards. Here is a cheap and easy way to make such a device.

Parts

1. Plastic bucket with a lid – 5-gallon size
2. 8 mesh hardware cloth – ⅛" holes
3. Pop rivets and silicone sealant

Construction

We will build a bucket that has a screened top with a funnel in the middle. The top is modified by removing the sealing gasket and half the top locking tabs. Then a large hole is cut in the top and a screen with a funnel is attached.

Step 1: Remove the seal/gasket.

A gasket is almost always located under the locking rim of the bucket lid. Remove this gasket. There is no need to keep the bucket hermetically sealed when you are going to put a big, screened hole in the top.

Step 2: Cut the hole for the screen/funnel.

Drill a starting hole in the lid, and then use your scroll saw to cut a bigger hole in the top. Make this hole as large as possible while still having room to attach the screen.

Hint: Use the outside rim of the lid to guide the saw. It makes for a nice, neat hole.

Step 3: Remove some of the locking tabs.

The locking tabs make it very difficult to remove the lid. What you *don't* need is to be fumbling around with the lid while the bees inside are getting madder and madder. The best way to make the lid removal easier is to cut most of the tabs off, at the same time, leaving the sealing ridge to keep the bees in. The buckets I've been using have eight distinct locking tabs. I completely remove every other tab. This leaves four locking tabs. One at each corner. (Did you know that circles have corners?) Continue by cutting all but 1½" off each of the remaining tabs. This makes for a very easily removable lid that will still remain locked in place.

Note: Remove the locking tabs a few at a time. You want the lid to be easy to remove and at the same keep the lid rigidly attached to the bucket.

Step 4: Cut the top screen.

Use the lid as a pattern and cut the hardware cloth (part 2) to fit inside the top ridge.

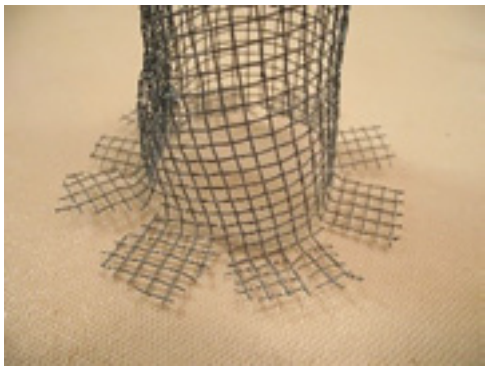
Step 5: Add the screen to the top side of the lid.

Use long staples to allow you to crimp the staple on the underside of the lid.

Hint: Us a scrap piece of polystyrene insulation under the lid to stop the staples from attaching the lid to your workbench.

Step 6: Protect your fingers.

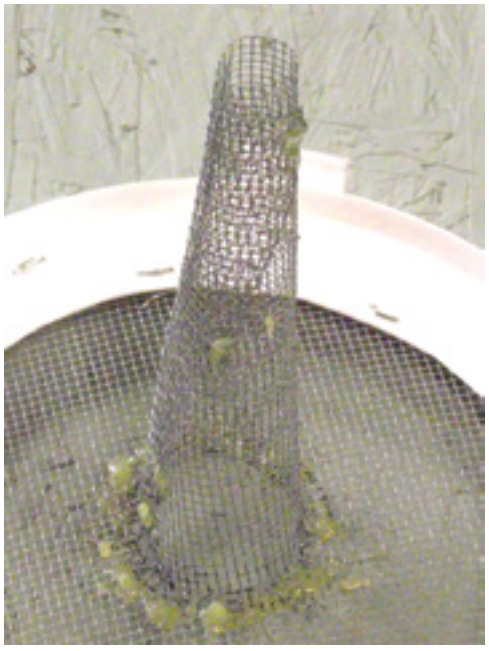
Turn the lid over and crimp the staples so they will hold the screen in place.



Step 7: Create a funnel from the hardware cloth (part 2).

Make the funnel about seven or eight inches long and taper it from a 1½" opening to a ½" opening on the other end. Pop rivet the hardware cloth into the funnel shape.

Step 8: Add a mounting flange to the funnel.



After the funnel is complete, use a pair of tin snips to put a flange on the large end of the funnel. Then, using the inside edge of the flange as a guide, cut a hole in the center of the top screen. Slip the funnel into the hole from the top and use pop rivets to hold it in place.

Step 9: Protect your fingers.

Smooth silicone sealant over the sharp edges of the flange to protect your fingers.

Step 10: Allow the silicone sealant to dry and you have an especially useful piece of equipment.

Easy, wasn't it!

This easy to build inexpensive device will get a lot of use during the swarming season.

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Thoughts

Have more than one swarm bucket handy. In the past three years, I have come to rely on this device for most of the swarms I have caught. Twice during the peak swarming season, I have been called out on a second swarm retrieval before I was able to hive the first swarm. One time the swarm was so big and difficult to get that I missed the queen on the first try. The bees outside the bucket immediately started to return to the original swarm location. I put the lid on this first bucket and used a second bucket to get the queen and the remainder of the swarm. BC

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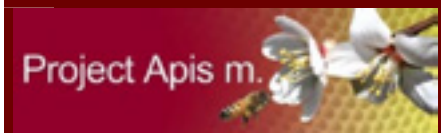

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Making Equipment Choices in Beekeeping

Ettamarie Peterson

Surely you have heard the saying about asking ten beekeepers and getting eleven different answers. Well, it is true because beekeepers are constantly having to choose what methods and what equipment they want to use. We are, for the most part, rather flexible and willing to try various things. There are some old timers who will give you firm advice, but I bet if you questioned them, they would admit that isn't what they did when they first started beekeeping. For one reason or another they changed techniques and/or equipment. Many read articles in *Bee Culture Magazine* (and/or other journals) that inspired them. Some read books that encouraged them to try something new. Others found their equipment wearing out and looked for replacements.

My first example of choices we beekeepers very often make is what to put in deep and medium frames. It can be overwhelming, especially for a beginner. Very often, the beginning beekeeper will buy a complete "starter hive" that comes with the plastic foundations in plastic frames because they are the easiest of all. You don't have to figure out how to use them. They are what could be called "no brainers".

The all-plastic frames with the foundation do have their drawbacks the beekeepers will discover. One major problem with these plastic foundations is sometimes the bees do not properly adhere the comb to the plastic. The comb can be hung like a curtain, just a little bit away from the plastic. Sometimes, just to be creative maybe, the bees will put some on the plastic and ignore it in other places. When this happens on brood frames you cannot see all the brood because some is hidden. Of course, the queen also likes to hide behind these "curtains" too making it difficult to tell which frame she is on. When they make these "curtains" on honey frames all you can do to harvest the honey is carefully remove them and either crush the comb or try to make cut comb honey. Often the bees will draw the comb correctly if you take time to coat the plastic foundation with wax, but that defeats the idea that they are time saving. You can pay extra and order extra heavily waxed plastic foundations. Other times, the manufacturers suggest spraying them with sugar water before using them. This is fine if you want to mess around with spraying sugar water on foundation and hope it helps.

The next drawback with plastic frames is sometimes the plastic can become brittle and your hive tool breaks them while you are attempting to lift them out. You can pay more for extra sturdy frames. The plastic foundation cannot be put into a solar wax melter even if it is in a wooden frame. It will be warped and useless from the heat. There's really no way to sterilize these plastic frames and/or foundations. If you have foul brood, you cannot burn them either!

You can choose to use plastic foundation in wood frames if the frames have both top and bottom grooves. They are easily popped in. There are little triangle pieces in the lower corners you break off before inserting them. These are so the bees move more easily from one frame to another. The advantage to having wood frames is that the plastic foundation can be popped out to clean the frame completely. I use a propane torch to clean and sanitize the wood parts of my bee equipment. The torch should not be used on anything plastic! I have used a steam cleaner on plastic, but it is time-consuming work.

Your next choice might be another easy foundation. It would be real beeswax but pre-wired with vertical wires. These require a bit more knowledge of wooden frame choices. The frames should have top and bottom grooves for the foundation to sit in. Many bottom bars do not have that groove so be sure to order the correct ones. Your side bars do not have to have the pre-drilled holes either. As a matter of fact, it is best that they do not. The holes are for threading wires and the wax moths love to use them for their brood. There are different choices in pre-wired frames. Some have longer wires with hooks you place under a thin piece of wood on the top bar. Not all top bars have that thin strip, so you must be sure you have that when you buy the top bars. The top bars with the strip are referred to in the catalogs as "wedge top bars". You cannot change the size of these foundations, so be sure you order the correct size. Also, you cannot use

Frame with a partial piece of beeswax foundation and wires.

them for cut comb honey. If for some reason the bees get creative in drawing them out, you might have some problem when uncapping the "wonky" combs. This usually happens if you do not space your frames properly in the boxes. That space is important for getting the bees to draw out combs neatly.

The advantages to the all-in-one foundation that are a plastic frame with a permanent plastic foundation, is that wax moths might feast on the old brood comb, but do not injure the plastic. If you use wood frames with plastic foundation, the wax moths can damage the wood but not the plastic. The other thing that destroys wood is rodents. They will chew the wax and the wood but not plastic parts.

Plastic foundation that the bees did not use correctly.

Another choice is just sheets of stamped beeswax that you put in wired frames. You will need to buy side bars that have the holes pre-drilled, unless you don't mind drilling little holes in the side bars. The holes work better if you have the brass gromets to put in them for strength. These gromets are sold in little bags. A gromet tool helps to put them securely into the holes on the outer side of the side bars. The first time you wire your frames it would be wise to either watch a video or have a mentor work with you. There are frame wiring boards you can buy or make yourself. The frames sit in the board. Your spool of wire can be attached to the board or on its own holder. You also need an embedding tool. I find pre-warming the foundation with a cheap hair dryer is important if the wax is cool because it breaks easily. Getting just the right pressure when embedding the wax into the wire takes practice. One thing I like about the un-wired foundation is that you can use half or even a third in the wired frames and the bees draw out the rest. If you have purchased a box of deep sized foundation, they can be cut in half and used in the medium frames. One disadvantage to using just partial size wax foundation in honey frames is that they can easily "blow out" in the electric honey extractor.

The last choice is the cheapest of all. Don't put any foundation in! Use just a starter strip, wax foundation or tongue depressors, aka craft sticks, firmly placed in the top bar. When you do not use foundation, you really should wire your frames or use barbecue skewers either vertically or horizontally. These keep the drawn comb from falling out when you lift the frames during a hive inspection. I discovered this one day when helping a friend do a hive inspection. It was a warm day. I lifted a frame out of his hive and tipped it slightly. The drawn comb almost fell out of the frame because the bees had not attached it securely to the frame. Luckily, we saw what was happening and prevented a mess! These foundationless combs do blow out easily in the honey extractor, so they are best used for brood rearing or crushed honey comb.

Short frame with plastic foundation put into a deep box. You can see all the capped drone brood!

It is possible to mix foundations in the bee boxes. I have often mixed no foundation frames with every other frame with foundation. On occasion, you can put a short frame in a deep box, too. The bees generally draw drone comb attached to the bottom board. That drone brood can be cut off to get rid of mites. I accidentally discovered this one time and my 4-H beekeepers had fun digging out drone pupae and seeing all the mites! Don't be afraid to try different techniques. I tell people when they ask advice to find what they are most comfortable doing. If you find something that makes you and your bees happy, tell your fellow beekeepers what you did.

Here in California, we have had prolonged droughts so beekeepers are finding they must feed their bees. There are several choices of feeders available. Each one has pluses and minuses, so you have more decisions to make. The prices will vary.

The most simple and cheapest feeder is the Boardman entrance feeder. It is a little holder that slides under the entrance and has an opening on the inside of the hive. They come in plastic, wood, metal or a combination of wood and metal. They are designed to hold a canning jar with a narrow opening and a lid with small holes punched in it. They are easily filled without disturbing the bees. One advantage is that you can easily see how much sugar water is in them and how quickly the bees are using the feed. They are not recommended for Winter use as the bees must break cluster and go down to the entrance to drink. They also seem to attract ants very quickly, so the beekeeper needs to make sure there is an ant barrier before using them. Another disadvantage is that if the jar is too big, it won't fit on the landing board, so you do have to fill these more often.

There are several in-hive feeders that go in place of a frame. The main advantage to these is that they do not attract ants or yellow jackets. If you must get into them in "robbing season", that is a problem. You should cover the other frames while filling the feeder. The disadvantages are you cannot tell how much food is in them; you must disturb the colony to get to them and some designs need floats such as corks or they drown the bees. Some are better designed and do not drown the bees. It appears there are more deep box sized feeders available, but some bee supply stores do have 6¼" sized ones that hold a gallon and fit in medium boxes. The largest sized ones can hold almost two gallons.

Top feeders have the advantage of being very easy to get to without disturbing the bees. Some are even designed so the bees cannot fly out of them when you take the cover off. That design is the one I prefer because the bees cannot get into the holding trays. The ones the bees can get into need to have floats or the bees drown. Also, I have seen bees build comb in them when beekeepers feed the bees a lot and don't monitor the space when it is empty. The top feeders that are plastic inserts designed to put in empty medium boxes have a problem. The undersides of these inserts have a lot of space that bees seem to like to fill with honey comb. They should have a screen over this space. I have tried this with some I was given. The manufacturers could easily redesign them.

There are other hive top feeders that are containers that fit into an inner cover with a hole cut out. You put an empty box over them and then put the outer cover on top. They can be designed to hold jars or there are some that look something like an angel food cake pan with a cover. I bought one in Ireland that I really like but have not found one like it in the USA.

Smokers come in a variety of styles and prices. Some are small and others are quite large. If you are a hobby beekeeper and have just one or two hives, you really don't need a huge one. A smoker should be kept in a metal bucket, so the smaller ones are often a better choice. You have choices of what kind of protection you have around the smoker. The guards around the smoker are important to protect you from burning yourself and anything you might set near it. The price difference is not much so do spring for the extra cost to get the guard. The bellows are made of wood and leather or of plastic. There are replacement bellows for most smokers. Check before buying. You can buy various fuels for your smoker. I prefer to use dried horse manure as it is freely given to me by my two ponies. Believe it or not, the dried manure does not smell bad! You will need a stopper to put into the smoker. I find the corks from wine bottles need to be trimmed a bit to fit in the smoker. The corks from many brands of olive oil are even nicer because they have a little holder on the top and fit well with no trimming. If you don't drink wine nor use olive oil, check with friends who do. People love to help beekeepers!

Before buying new equipment, visit other beekeepers' apiaries and ask to see what they are using. It is best if you can see into other hives to see how the bees are using the equipment. If this is not possible, go to bee conferences, bee supply stores or peruse catalogs and/or bee supply companies to look at what's available. If you are at a vendor's stand, chat with the vendor and other beekeepers around. There are lots of beekeeping videos on the internet these days. Look at more than one to compare techniques. When you are buying equipment ask yourself how I will keep these sanitary, how can I dispose of them if they get infected with foulbrood, how long do these things last and any other things you think are important to your time, budget and beekeeping practices. BC

About Ettamarie Peterson:

Ettamarie Peterson has been keeping a few bee colonies on her small farm in Northern California for almost thirty years. She is the editor of the Sonoma County Beekeepers Association monthly newsletter and the Liberty 4-H Bee Project leader. She is the mother of three, grandmother of eight and great grandmother of nine children. Her favorite thing to do is catch swarms to share with her 4-H beekeepers and keep a few for herself.

This frame had only wires. You can see how the wires are supporting the comb. The beekeeper is a young 4-H girl getting help from her two sisters, one using a smoker (bottom left you can see the smoker) and the other helping her lift the frame.

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Bees and Women
Alwilda Jane Colwell

Nina Bagley

When I started my beekeeping journey years ago, I began researching women and beekeeping during the 1800's not knowing it would consume me over the years. In doing so, I realized how important these women were. These women cared for the family, home, gardens, the farm and raised bees. Beekeeping allowed women to be independent during the Civil War by selling honey. The honey made money, which provided an income for the family. Life in the 1800's wasn't easy. They didn't keep family records like we do today.

Sometimes the women's names are misspelled on the censuses, so it takes time to research newspapers and historical records. Some women have a documented trail, and some are harder to find. Like in the case of Jennie Culp, who wrote for *Gleanings in Bee Culture* in late 1800's. My facts and research about Jennie were going well until 1887. I couldn't find her anywhere in the census. I called my beekeeping friend Linda Miller, who, like myself, is interested in researching the history of beekeeping. We brainstormed, and we wondered if she was living with her son. Or did she get remarried? It could almost be anything. We finally found her. Not to give anything away, with much research and curiosity, I give you Jennie Culp's story.

Miss Alwilda Jane Colwell (Jennie Caldwell) was born in Norwich, Franklin County, Ohio in 1837; her father (John), mother (Grace) and sister (Elizabeth) were born in England. They arrived in Ohio in 1834 in what is Hilliard today. Her father was a farmer. In 1855, realizing the need for a place to worship, John Colwell offered the land for a church to be built. The First Methodist Church in Norwich, Franklin County, Ohio, was named after Jennie's father. The church was dedicated in December 1876, and Jennie's then husband, Henry Culp, gave the first sermon.

Growing up in Ohio, Jennie had three sisters and a brother. On November 15, 1857, at the age of 21, she married Rev. Henry Culp, who also was born in Ohio in 1833. They had four children: Gracie, Charles, John and Carrie. Gracie was born in 1860. Unfortunately, she passed away in 1881 from typhoid fever. Jennie had another daughter in 1871. Carrie was born and died a few months after she was born. Jennie had described in her writings how hard farm life can be and how poor they were.

Rev. Henry Culp was the beekeeper of the family. He had fifty hives on their farm. Henry would sit and watch the bees collect the pollen from the most beautiful willow trees Henry had ever seen, describing the white flowers with their long anthers. He liked how the bees would pack the pollen in their little pockets to carry to their hives. A.I. Root writes about Rev. Henry: "Although a gospel minister, he was one of those, like many of us, who had his ups and downs, and sometimes his "downs" were grievous to bear." *Gleanings in Bee Culture* Nov. 16, 1884 pg. 785.

Rev. Henry Culp died from chronic pneumonia on April 2, 1882. A. I. Root wrote this about his friend Henry: "Mrs. Culp's husband before his decease was a grower of small fruits. Friend Culp, before his death, was a warm friend of *Gleanings* and my acquaintance with him, which extended over many years, was very pleasant. It is a little sad to think that his Apiary never, during his life, gave the results of honey that it has since he was taken away." *Gleanings in Bee Culture* November 1, 1884 pgs. 733-734.

Jennie Culp's husband had planned the work for her and was preparing his wife to take over his bees after his death. Her husband repeatedly told her what to do and what to expect. He made her frames so that she would be ready when it came time to work bees. Working hours before his death, Henry provided his wife with everything she would need to keep bees herself without her lifelong companion to teach her. Jennie was so appreciative that she had a husband of 24 years who gave her the tools and equipment to succeed. Henry advised his wife to write A. I. Root for guidance in caring for the bees. Jennie wasn't ready to take on beekeeping. She was a housekeeper. Bees were her husband's occupation, but after his death, she changed her heart and felt the need to care for her husband's bees. Henry put the bees first above all, and she felt it was the right thing to do. Jennie loved her husband and believed all good things would come to those who worked hard and persevered. Taking her husband's advice, she wrote to Mr. Root, who advised her to feed the bees maple cakes in the Spring if needed. At the close of one of her letters to A. I. Root, she writes: "I think you will pardon me, as I have no father, husband, brother to talk to, and at times I feel alone as far as human sympathy concerned, but my heavenly father has been wonderfully good to me; he blesses me both temporarily and spiritually." *Gleanings in Bee Culture* Nov. 1, 1884 pg. 734. She was religious and put the good Lord above all, including her family. You can feel the sadness in her letter to Mr. Root. Over the years, she continued to update Mr. Root on what was happening in her apiary. She studied the *ABC of Bee Culture* book by A. I. Root. She would read Langstroth, Professor Cook's and Quinby's books on bee culture. Jennie wrote her bee reports, advice and updates for *Gleanings* using the name Jennie Culp. Why did she use the name Jennie instead of her given name? She used her birth name only on her legal documents. (Alwilda Jane Culp.)

"I commenced the season's operations with a stock of 28 colonies, and as my chief object was honey instead of increase, I prevented early swarming by pinching out queen cells wanted but little increase, as I felt that, for an ABC scholar, I had already an "elephant" on my hands. I carried my bees successfully through Winter 1882 on maple sugar in the cakes. Meanwhile, I built up weak colonies by giving them frames of brood from strong colonies, thus equalizing and keeping in vigorous action in the whole Apiary. As a result of such treatment, I had every hive booming with bees when the honey flow set in from white clover. My first swarm was issued June 15, and the last one July 23, having an increase of 20 colonies, which was more than I desired. Still, multifarious duties, and a light supply of help, led to my neglect of them, for I find successful management of bees as my husband termed the price of liberty. On June 18th and 19th, I extracted 1200 lbs. of honey from the upper story of hives. I did not take any from the brood chamber during the season. The 28 furnished 500 lbs. extracted honey and furnished the increased colonies with two to four frames of brood and honey to commence housekeeping. The new colonies were immediately provided with honey boxes to give them working room. They filled their brood chamber and made 300 lbs. of comb honey in sections." *Gleanings in Bee Culture* Nov. 1, 1884, pg. 733.

Jennie attributed her success to having everything organized and ready and the bees in healthy, vigorous condition on the opening day of the honey season and having surplus frames ready. Her friends would inquire about the type of hive she used, and Jennie would describe the beehive. It's from the "Langstroth" design, which her husband tried to improve, that backfired. After a fair trial, her husband finally acknowledged it was not an improvement!

In the Fall of 1884, packed in chaff hives, Jennie had forty-seven hives, all well supplied with first-class white clover honey going into Winter. In the Spring of 1885, as she put it, "all booming with bees," she lost one colony; she considered that quite a success since bees were dying that

Jennie Culp's Apiary

Winter. Jennie took beekeeping seriously for someone who didn't want to take up beekeeping. She gave it her all, even if only for a few years! She was well read and understood the process of keeping bees. Jennie clipped all of her queen's wings. This way, the queen couldn't fly. So when they did swarm, which they would, she could easily find the queen on the ground in front of the hive. Jennie would not have a queen in her apiary whose wings were not clipped! Reading her bee culture books, writing her updates for *Gleanings* over the years, and following what her husband had advised her to do, Jennie reports in *Gleanings* that on April 16, 1885, her bees were out and going strong, but for the first time being in the business of bees, she's dreading the outcome for next Spring. It has been five years since her daughter and husband passed away. Taking care of the farm and bees is getting harder.

Jennie's boys are married and have families of their own. She has little or no help. She is older and slowing down. Her last Ohio State Convention was in Columbus at the Ohio State Fair in 1886. Before leaving the convention, she informed Mr. Root she would probably not be attending another Ohio State Convention and that she was considering selling her farm, apiary and fixtures and was deciding to go west with her boys. She stated after selling, she would probably not do much with bees as the work in the apiary has gone beyond her strength. She didn't need to work because she owned her own land. With some regret, she wanted her friend, A. I. Root, to let the friends know she was going west. Mr. Root wrote; "I hoped that when she is located in her new home, we may again hear from her through the columns of *Gleanings*." *Gleanings* 1887 pg. 75. The 1887 research records show she didn't go live with her boys and didn't write to *Gleanings*, but what the records show she did get remarried. Jennie's marriage certificate shows she married her second husband in 1887. Jennie Culp, on August 29, 1887, in Franklin County, Ohio, married Theodore Williamson (Theo), a widower born in Ohio in 1823. Why didn't she tell anyone that she was remarried? I wish I knew! Maybe she was a private woman and didn't want people to know about her affairs? For the next twelve years she lived in a house, not a farm. She was not keeping bees. Her second husband, Theo, died in 1909. She's alone again, able to care for herself for some time until the years have finally caught up with her. Jennie's oldest son, Charles, passed away in 1917. How much can a woman bear? Her son John moved to Columbus, Ohio, in 1910. This is where Jennie would remain until her death in 1919 from a stroke at the age of 84. For a petite woman weighing a hundred pounds trying to survive all her hardships, the woman had grit. To keep over fifty beehives and be profitable takes work. Outliving two husbands and the loss of three children was crushing. Jennie's family and relatives are buried in the Wesley Chapel Cemetery in Hilliard, Ohio. Her headstone has her name, Jennie Culp, Wife of Rev. Henry Culp. On the other side, is her daughter Carrie. There are no dates on the tombstone; the dates and years have faded, just like Jennie Culp did in 1887. BC

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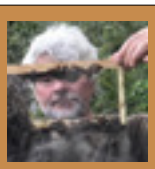
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The Mark of *Life*

John Redkoles

I truly love the early days of Spring! The telltale signs of new life begin to emerge from the soil, fresh buds pop from the trees, warm air greets us and the gift of light goes well into the evening. All of this marks the beginning of a new season and a reminder that it is time for me to inspect the hives of my beloved honey bees. This first inspection of the season comes with much anticipation and anxiety. As I begin the inspection, I open the hive and methodically work my way through each frame. During this time, I am searching for what I call "The mark of life."

Figure 1

So… what is the mark of life? I took this photograph (Figure 1) from my a hive inspection to give an "up close and personal" view of this mark. The larger honey bee, with the white dot on its back is the queen and that dot represents the true mark of life inside the hive. I take time to put this mark on the queen because it helps me find and identify her among the other forty-thousand bees within a typical hive. The queen is special and rightfully bears the mark of life! Without the queen, life inside the hive would cease to exist.

In reality, the long cold days of Winter challenge the very survival of each and every honey bee colony. This challenge can be magnified depending on where you live, especially in the more northern climates when wrapping and insulating the exterior of the hive is a normal go-to strategy. For me, in Southern New Jersey, it's always a roll of the dice… From year to year we experience a mixed bag of weather, from extreme periods of bone-chilling cold with a fair amount of snow, to rather mild days with only

Figure 2

a few short cold snaps in between.

Overall, I've never wrapped my hives and I've done well in over-wintering my colonies. Our more recent Winters have been great for my bees; however, if you're a snow lover, you might think the opposite. The rather mild temperatures we've experienced over the last few seasons have given my hives some much needed relief. Having said that, a lot can still go wrong as honey bees Winter inside the hive.

A few years ago, I took this photograph (Figure 2) of my hives in the midst of a snowstorm. They were sealed by ice and snow and not a sign of life was to be found or imagined. Although hidden from the eye, much is happening on the inside, and the honey bees are very much alive and active. As a beekeeper, I'm often asked what the bees do in the Winter and how they survive the harsh and cold months that are sure to come.

I enjoy stepping into this teaching moment. I quickly reply that honey bees depend on each other and that many of life's lessons could be learned from the way they work together for the common good. As I'm met with puzzled looks, I describe how the honey bees huddle tightly together centered around the queen while feeding on their honey and pollen sources for energy. It is fascinating to think that they use this energy to generate heat by vibrating their bodies, and with thousands of bees vibrating, the cluster can heat up to a balmy 90 degrees and beyond. To my mind's eye, this image never ceases to amaze me.

To help increase my odds of opening a healthy and active hive at the beginning of the season that bears the mark of life, I've employed a few over-wintering techniques that have served me well. For instance, I always top my hives with a Winter quilt box that I've made with 2x3 lumber and a screen bottom filled with pine chips (Figures 3 and 4). Quilt boxes are vented in many ways; however, I've used a "chimney" method for years with great success. The short piece of PVC piping set over the center hole of the inverted inner cover allows the excess heat to vent directly out of the hive.

Figure 3

Figure 4

Figure 5

Then, any condensation that builds on the inside of the top cover drips down onto the wood chips. This leaves the honey bees perfectly dry and free from getting wet and freezing. Most importantly, I install a small screw on the top corners of the quilt box so that the top cover is slightly raised. This is what actually allows the rising heat to escape from the hive. I also place the notch of the inverted inner cover toward the front of the hive. This also helps vent the hive and doubles as a pathway to give the bees an easy exit and entrance back to the hive when Winter weather permits.

Although I'm very conscious about leaving 50 to 60 pounds of honey on the hive for their Winter food, I still give them a small life line of emergency food. I add two winter patties to each hive directly on top of the frames before returning the inner cover (Figure 5). This has really come in handy and I'm confident that this little extra boost has helped sustain my bees as the cupboards start getting bare. In the end, there are never any guarantees in beekeeping, and we learn by trial and error, but proper preparation and over-wintering techniques can pay big dividends when the dark and cold days of Winter have left us.

There is no bigger prize than witnessing your honey bees emerging from the hive full of life as they forage the landscape for pollen and nectar. I captured this image as one of my honey bees visited the bounty of fresh catnip in my yard (Figure 6). BC

John Redkoles

In addition to being an accomplished wildlife photographer, John is a United Methodist pastor, a retired New Jersey State Trooper and a beekeeper. He lives in New Jersey with his wife, an artist, and has two grown daughters. Visit John on Instagram @john.redkoles to see more of his unique work. The two images that are not captioned with a figure number are more examples of his work.

Figure 6

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A Personal Essay on Venom Allergy

Brad Metz

Since a warm Spring Day in 2006, I can tell you the exact number of stings I've taken: eight. But I have utterly lost count of the number of times I've been voluntarily injected with purified honey bee venom, taken epinephrine, or popped a couple of pills and sat quietly in the dark, hoping I don't have to call an ambulance, losing a day's worth of work, and a shocking amount of money. If you haven't guessed, I have developed an extreme allergic response to being stung by honey bees, and yet I remain a honey bee researcher.

I'm writing this because I have a big mouth; whenever I talk long enough about my work with bees, my allergy comes out. Inevitably, then, I get questions about this difficulty of mine. Refreshingly, in an audience of fellow beekeepers and researchers, the "whys" are rare. If you know, you know, and beekeepers know. Increasingly though, I've bumped into people who have suffered like I have, and either stay on the sidelines or have regretfully left the game behind. But after years doing the latter, I was finally convinced by my colleagues, friends, spouse and future boss to get treatment. Many of the questions I get are about that. So, in the hopes of helping anyone going through what I did, understand the honey bee allergy from the patient perspective, here's my story.

I came up working bees in Texas, where highly defensive bees are the norm. We took stings regularly; zippered veils and long sleeves underneath our suits couldn't entirely prevent the pugnacious little buggers getting through a tight fold, a seam edge, or sweat spot. We even had annual sting parties, taking turns to tag each other so we would get that first higher reaction out of the way after the dearth months of Winter gave our immune responses time to build up. For the first years of my graduate studies, my stings were familiar to any of you. There'd be some pain, a little redness, and some swelling. Nothing that a swift scrape of a card, bee tool or handy scalpel (and swearing) wouldn't fix. Over time, though the swelling increased, and the redness intensified. I counted knuckles, if the swelling passed a knuckle, I'd take a Benadryl, if the swelling didn't go down after a few hours, I'd take another. If the swelling ever crossed two knuckles, I was supposed to take an epinephrine shot and call a doctor. Finger knuckles are short, so that didn't count – so I told myself. If the swelling ever passed my wrist, I'd go for help. There'd be days when my whole hand swelled so badly, I couldn't get into a glove. But being stung in other places, the swelling wasn't debilitating, and didn't cross two knuckles, so I took Benadryl and kept at it. I proceeded this way for years. I loved my work. Like most graduate students, I had an obsessive drive fed by the similar obsessions of those around me. We wore our stings like badges of pride. In a bar full of net-wielding geeks and white-coated pipette jockeys, we smelled like smoke and had war wounds. But nevertheless, the annoyance of being stung gave way to "concern" over the next one. That made me a worse beekeeper, which exacerbated the stings. I kept on, but the shine was wearing off and I started running from my hives after working them to take deep breaths, hiding in bushes to get away from the engine drone of angry workers. Towards the end of my PhD, the bee work lightened up and my interactions with bees came fewer and farther between. That seemed good for someone who was increasingly a liability in the field, but that was the final straw for my immune system.

I was working a colony at our lovely lakeside apiary. I was being quick about it because I had a bunch of cages to take care of in the trailers, and I was nervous. Two stings hit right to the inside of my elbow where the elastic from the glove pinches the sleeve. I only had a T-shirt on underneath – it was so hot, and I didn't have it in me to layer. Immediately, I knew something was wrong. I tasted blood and my head started ringing, by the time I got back to the trailers and got to my phone, I couldn't see anymore. I remember the woman on the 911 call yelling at me to stay conscious, but it wasn't happening. Next thing I know there's two paramedics slapping me awake and asking questions I didn't understand. When I could talk, I asked them to carry me to the restroom. By the time I took the ambulance ride to the ER, I felt fine, exhausted, but fine. I was annoyed because I'd left an experiment running and the timing, while not ruined, wouldn't be as clean as I wanted. The doctor told me I couldn't possibly have had an allergic reaction because I wasn't still dying. He recommended I see an allergist and sent me on my way.

A few weeks later, the allergist – I remember he had huge hands, so I trusted that he worked hard – told me that he couldn't provoke an allergic reaction with his skin tests. Whatever this was, wasn't an allergy, so I went back to work. When the inevitable happened, my academic big brother drove me to the ER while I vomited out the side of our lab truck. Once again, the fact that I was returning to a normal state of being by the time doctors saw me was cited as fact that I wasn't having an anaphylactic reaction. Further consults with my allergist led to discussions of a vasovagal syncope, which was described to me as what brides do at weddings. I was offered an anti-anxiety drug as a potential remedy. My own foolhardy relationship with psychiatry, along with the "good ole' boy" doctor's disdainful discussion of my "reaction" meant that we ultimately did nothing. Insofar as I understood, no medical remedy existed.

For the next two years, my life went thusly: I'd work bees, get stung, pass out in the field, wake up, vomit, and go back to work. Sometimes people were around; sometimes they weren't. I learned that after taking a sting, I had forty seconds to get somewhere safe before losing consciousness. Once I miscalculated and landed on a fire ant nest. My main innovation during this period was that if I could elevate my legs, I could keep the blood pressure to my brain high enough to retain consciousness. This left me helpless, but at least vocally so. Needless to say, I planned my exit from bee research, and it was a short hop to phasing out of research altogether. My story was set to end there, I began a teaching career, and figured I was terminally separated from bees. I returned my lab-issued suit and veil. I put my mead-making supplies into storage. I stopped going to bee meetings.

It was seven years later that I moved to North Carolina. I'd raised my children through their infant years, and they were ready for school; they didn't need a stay-at-home dad anymore. It was a lark that I found that Dr. David Tarpy at NC State was hiring a research position. I was shocked by how much I missed the work. My wife and I argued; she didn't like the idea, but ultimately agreed that I'd been missing some "spark" that she'd known for so long. I figured as long as I was honest with him, Dr. Tarpy could make the choice about whether I'd still have any utility in a bee lab, given that I couldn't touch bees much. Luckily, he had a project on drones. We figured the one honey bee that couldn't sting, shouldn't do much damage. I became the drone guy; but Dr. Tarpy also hired me with a qualification: go see an allergist again. It seemed a reasonable enough request; maybe I could get some cheap epipens and peace of mind.

Meeting Dr. McWilliams was the first time I'd seen a physician visibly angry during an appointment. While describing my experiences, she kept coming back to a single point: my lack of local reaction. Once I started fainting, I no longer swelled up, there was no need to count knuckles, and there was little local pain. To Dr. McWilliams, this was a sign that despite the oddities, what I was experiencing was an anaphylactic reaction, and one that she'd expect any physician to recognize. The next step was to prove it through allergy tests. I sat in a room hooked up to monitors for several hours as I was injected with miniscule doses of honey bee venom, and then waited, nurses at the ready with injections of epinephrine and their "crash cart," just in case. The ascending doses left me nonplussed, nurses at attention, but starting to wonder if anything would happen. I didn't swell, no redness, barely any reaction. We reached the maximum standard testing dose without any reaction, and so we went further. At nearly a full sting, I went horizontal mid-sentence. When I came to, we had our diagnoses and could start doing something about it. Crucially, getting my life back was the goal. Dr. McWilliams never once told me to quit working with bees; instead, she said: "since avoiding bees isn't an option for you, let's get you to where you're safe." This meant everything to me. At the time, I was told the process could take around six months before I could take a full sting, with the completion of the immunotherapy in around three years. Little did I know that it would take me seven to life.

Venom immunotherapy is a fairly straightforward process, although it takes a great deal of care and monitoring. Essentially, we went about training my immune system to ignore honey bee venom as much as possible. This goes a little against what both the venom and the immune system is designed to do. Honey bee venom has proteins to invoke a massive immune response, tear cells and membranes open to spread itself, and deploy histamines – the very communication molecule our cells use – to provoke a reaction. All of this to make sure that any mammal that gets stung is properly repulsed. Our immune system, on the other hand, responds aggressively to anything that isn't supposed to be there, and there are a wide variety of cells involved in the recognition of such things and coordinating the appropriate response. In an allergic reaction, the recognition molecule is IgE – a class of antibody and the major coordinator cell is the mast cell. These mast cells are packed with signal amplifiers, histamines among them, and release these to recruit an ever-wider array of responsive cells and protein pathways. This can result in a cascading response that, like a nuclear meltdown, builds upon itself in extreme and unpredictable ways. In my case, it drops my blood pressure to the point where I no longer can maintain oxygen to my brain, losing consciousness. That's why laying down with my legs up worked, using gravity when my circulatory system couldn't do the job.

To complicate matters, I have a condition called mastocytosis – which means I produce an overabundance of mast cells. Like most people with this disorder, I have a fairly benign version that manifests in a higher propensity towards allergies and the need to take bone marrow stimulants to maintain bone density: I use my marrow extensively to make all those mast cells. But the real kicker is that one of the most common symptoms of mastocytosis is *an extreme allergic reaction to venom!* Because of this, I was prone to sudden and extreme reactions, and the only response was to scale up my venom dose very slowly. A normal progression would involve a weekly shot of diluted venom in an ascending concentration of about 30% each iteration until a maintenance dose of about two stings worth of venom is reached, at which point the shot frequency is slowly increased to once a month. At this point, most people can conclude treatment with no further ill effects. In my case, we had to increase the frequency of the shots at first and increment the dosing at much lower rates, going so far as to repeatedly inject the same dose for a few weeks before attempting the next. Even with this, I occasionally lost consciousness in the office and once, terrifyingly, on the drive home. Every time I fainted, we had to start back over again at a lower dose and work back up. Happily, more quickly than the last time. My immune system was a slow learner, but it *was* learning. In 2019, I reached maintenance dose for the first time, with a great deal of pride. The next step was to stretch out the doses, which I had to do a single day at a time, because any more than that knocked me out. So now I was operating on a strange rotating schedule that had to work carefully around weekends and other commitments, but we got through it to monthly shots: maintenance. It wasn't until 2020 that I got my first test of the efficacy of the treatment.

A young researcher primarily focused on interactions among

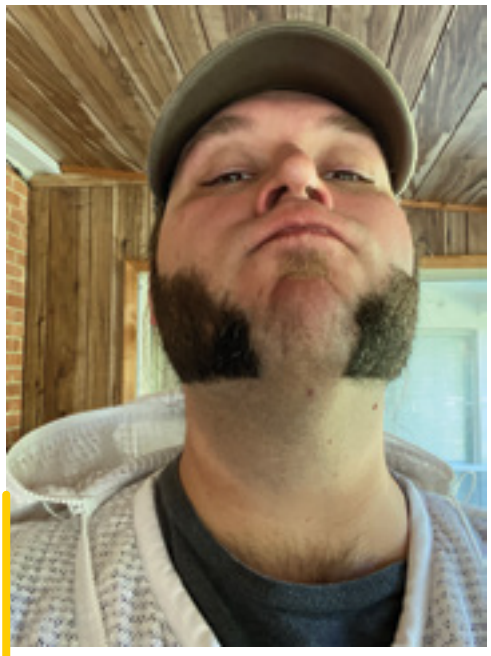


Figure 1. The author, thirteen minutes after being stung, demonstrating both the efficacy of venom immunotherapy and the foolishness of pressing one's face up against their veil to get a real good look. Some things, doctors can't fix.

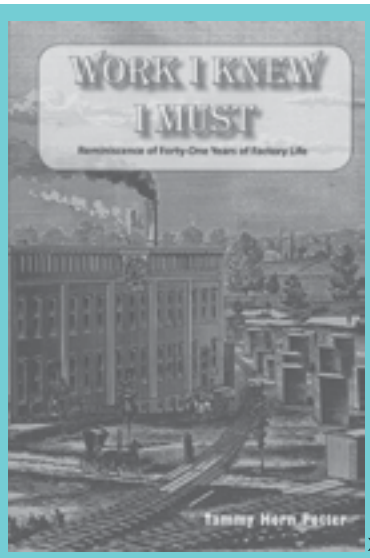
pollinators at flowers often used our facility as an observation site. Not being a beekeeper, they rarely considered defensiveness in their dress or approach, relying on the gentleness of most insects at flowers as protection. But in June (robbing season here in NC) their long hair managed to capture a half-dozen bees while walking between patches, right through a flyway between colony groups. When they ran (barefoot) into the house where I was paint-marking my drones, I could do nothing other than help. Despite my care, I took two stings to the back. They were minor, through cloth, the stinger didn't stick, but immediately I was alert. I felt my pulse quicken, a familiar light-headedness set in, the taste of iron on my tongue. I grabbed my epinephrine, quickly ate two Benadryl and sat down, legs propped up on the table, bracing until the last possible second to use the epinephrine, because of course THEN I would have to go to the hospital, and abandon my experiment. The years have taught me a lot, but not a lot of sense. But the reaction stopped there, and I felt better in about an hour. I called Dr. McWilliams, and she recommended an extra dose of antihistamines, some monitoring, and otherwise it looked like the immunotherapy was working.

I've been stung three times since then. I'm never so cavalier as I once was. Every sting is accompanied by a cessation of work, a cup of water, and the slow count to forty. But each time, I've stayed afloat, and slowly, I'm back to enjoying working bees. As long as I live, monthly venom shots will be part of my routine, and my purse always has a pair of epinephrine shots in it just in case. My days of carefree independence are over; but I can work bees with a partner, I can go out in the field, and most importantly, I can feed that undying obsession with the whys and the hows of honey bees that put me into the apiary over twenty years ago and kept me coming back despite everything.

Venom allergy presents in about 30% of beekeepers. This can turn that joy of working with our smallest "domesticated" animal into fear or regret. But for the vast majority, there are treatment options that are relatively easy, and effective. Something like 80% of people that suffer anaphylactic reactions can recover with immunotherapy. Those with a less intensive reaction can get by with antihistamines. Anyone who notices changes to their reactions to bee stings should contact an allergist sooner rather than later, since they can provide peace of mind where therapy isn't warranted. In my case, the journey was more fraught, but the lesson here is that sometimes, persistence and a competent second opinion, can get you where you need to be in the end. BC

Author Bio

Brad Metz is a researcher under Dr. David Tarpy of the NC State Apiculture Program. He is the lead scientist in charge of the Honey Bee Queen & Disease Clinic and runs a small research program concerning honey bee male reproduction and quality. He earned his PhD from Texas A&M in 2009 where he studied honey bee chemical communication. Brad is married with two children, both of whom think working with stinging insects is crazy, despite his best efforts to convince his own larvae otherwise.



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Oxalic Acid Vaporization End-point Monitoring

Oxalic Acid Vaporization (OAV) is an ideal Fall/Winter treatment for honey bee (*Apis mellifera*) colonies infested with the *Varroa destructor* (*VD*) mite. *Varroa destructor* decimates apiaries and threatens the food supply worldwide. OAV is most effective in a broodless colony when phoretic mites otherwise shelter in the capped cells of developing worker bees (Van der Steen & Vejsnæs, 2021). Beekeepers employ different homespun regimens to resolve a VD infestation and treat their colonies a few times for a few weeks and hope for the best. OAV is proven to kill mites with minimal impact to a colony's bee population, but many beekeepers have no systematic application schedule or definitive treatment endpoint.

My technique consists of counting dead mites that drop onto a sticky board 48 hours after an oxalic acid vaporization treatment and recording the results in Excel. Line graphs from the data show the number of dead mites over time. The graphs show how long beekeepers should continue to treat and monitor until the curve(s) approach zero – the treatment endpoint.

The timing for the Fall/Winter treatment is determined by seasonal temperatures, amount of brood remaining in each hive and the perceived urgency to treat based on a bell-weather alcohol wash in September after the last Summer mite treatment, such as Apivar. Each bee colony has a unique character which adds another variable in the hive's population dynamics and varroal footprint. There is a risk-reward trade off with the timing of the Fall/Winter treatment versus the increasing viral load as you are waiting for the ideal broodless state.

The efficacy of treatment is dependent on the presence of sealed brood. Bee brood is the reservoir for *varroa* and when there is brood present in the hive, the mite drop remains elevated and treatments are prolonged. Brood levels taper off in Northern Virginia by mid-November. The amount of brood in different regions in the world varies from year to year based on colony dynamics and temperatures affected by climate change. Our mid-December is as broodless as one can expect and is typically when the queen stops laying eggs. It is a certainty that a portion of the mite population can escape treatment because they are protected from OAV in the sealed brood cells. The unknown amount of sealed brood not affected during treatment reduces the overall effectiveness of the OAV by just a small percentage (Toufailia & Ratnieks, 2018).

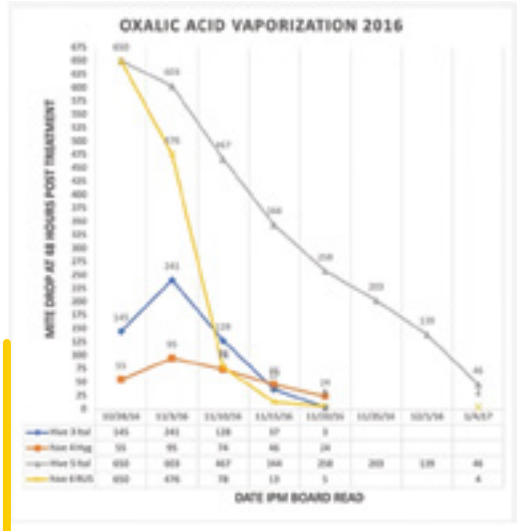


Figure 1. 2016 Mite drop at 48 hours post-OAV Treatment vs. Time
The first in this series of beehives treated in 2016 with oxalic acid vapor kill* Varroa destructor. *Treatments are spaced five days apart and show a decrease in mite drop over time to a stopping point. Hive #5 required multiple treatments to approach zero.

The Fall/Winter OAV treatment catches mites in the open before they can shelter in brood cells. Once those brood cells are capped with *varroa* inside, they parasitize the larval hosts through all remaining stages of brood development and affect the health of emergent bees. When oxalic acid was first approved in 2015, the seven day, three-week treatment interval was based on the life cycle of the drone because the *varroa* mite prefers drone brood, but drones are not present in the Fall.

A more practical treatment method addresses the kairomone phenomena, where the female *varroa* mite senses the kairomone chemical cues, a pheromone-like compound, and targets brood frames for feeding and reproducing. The pheromone-like cues attract gravid mites into worker cells 15 to 20 hours before they are sealed, around the fifth day. The ability of *varroa* to sense brood kairomone from open brood, allow them to hitch a ride on a nurse bee to get close to the brood nest. The gravid female *varroa* detaches herself near an open cell and enters before it is sealed to later begin laying eggs (Nazzi & Le Conte, 2016). A popular treatment parameter is treating every five days, but without endpoint monitoring, this method is still arbitrary.

The OAV is more effective towards the end of the day when the bees return to the hive. Seasonally, it is hard to gauge decreasing brood levels to begin treatment(s). Temperatures in the 50-60 degree range with the bees not in cluster are the best conditions. Personal protective equipment is required and staying upwind of the OA application is advisable. Gloves, eye protection and a nuisance level organic vapor cartridge like the 3M 2297 or equivalent are strongly recommended.

To prepare the apiary for treatment, seal the hive openings, install a sticky board and remove any feed. The Provap110 vaporizer is an improvement over the conventional pan-style heating element that keeps high temperatures outside the hive. This vaporizer is quick and easy to use, and more importantly, it does not

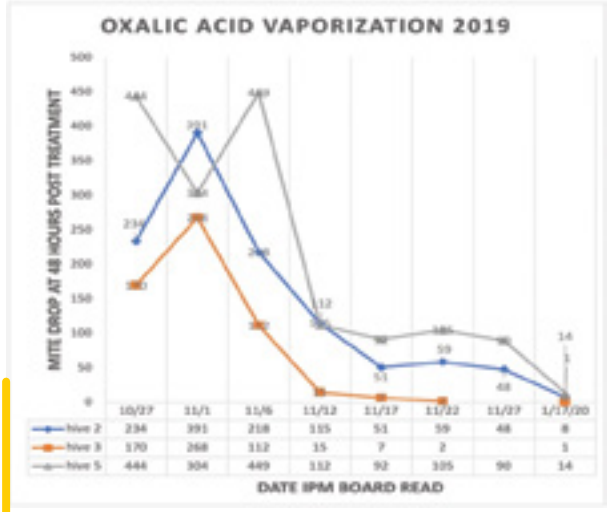


Figure 4. 2019 Mite drop at 48 hours post-OAV Treatment vs. Time *Mite treatment started in late October 2019 and were spaced five days apart over seven treatments. A treatment in January confirmed the effectiveness of end-point monitoring.*

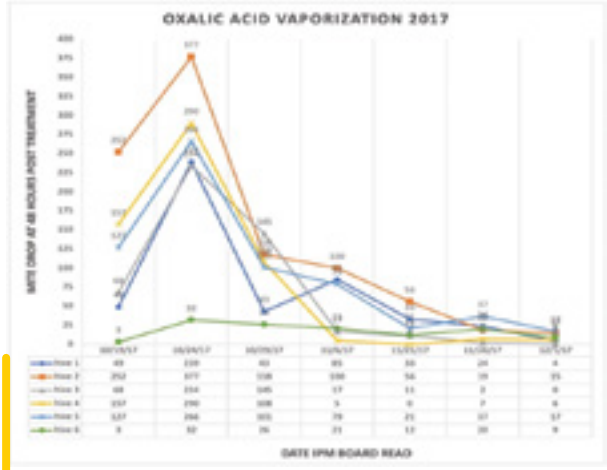
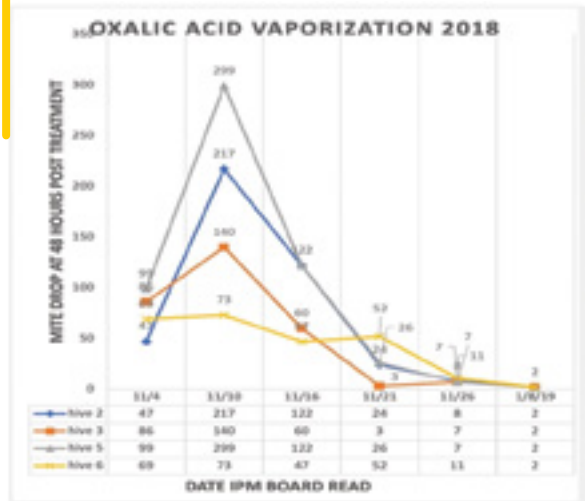


Figure 2. 2017 Mite drop at 48 hours post-OAV Treatment vs. Time *OAV treatments were spaced five days apart over the course of seven treatments in 2017. All six colonies responded well to the OAV and confirmed the effectiveness of end-point monitoring.*

Figure 3. 2018 Mite drop at 48 hours post-OAV Treatment vs. Time Varroa *mite treatments started in early November of 2018. They were spaced six days apart over six treatments until the drop approached zero. A treatment in January confirmed the effectiveness of end-point monitoring.*



kill some bees or scorch the frames. The pre-heated Provap-110 vaporizer stem is inserted into a pre-drilled ¼" hole in the hive and two grams of oxalic acid are heated to a temperature of 230°C and vaporizes (sublimates) in about two minutes. The hive remains sealed for ten minutes and this process is repeated for each hive. Hive preparation takes longer than the treatment.

Oxalic acid vapor permeates the interior of the hive and condenses into fine crystals. Mites are killed by slow contact toxicity that may involve changes in the pH of the mite's hemolymph, but the mode of action is not completely understood. However, it is commonly accepted that the pulvilli and mouth parts afford an avenue for OA to enter the open circulatory system present in mites (not in honey bees) and kill the mite. OA is an effective acaricide with minimal toxicity to the bees. In controlled experiments, some mites died within 12 hours, reaching a maximum kill period sometime later (Papezikova, et al., 2017).

My data was collected from 2016 through 2021; the figures demonstrate the effectiveness of end-point monitoring, but only representative graphs are presented for this article. The line graphs illustrate the dead mite count plotted on each graph at 48 hours after treating every five days – weather permitting.

Some hives differ in brood population dynamics over others in the apiary and Figure 1 is a good example of hive variability in 2016. The initial treatment resulted in a high mite drop which decreased over time with five treatments. Hive #5, a robust and populated colony, required a total of eight OAV treatments to bring the mite levels to an endpoint. The other hives responded well after only five treatments when their numbers approached zero. The last treatment on January 4th confirmed the effectiveness of this method; all hives survived the Winter.

A warm Autumn is a concern when the bees are still active. In 2019, the Fall treatment had to begin in October, as shown in Figure 4. There is a direct correlation between mite load and warmer temperatures as seen with climate change (Smolinski, et al., 2021). The presence of brood prolonged the treatment window in some hives and required as many as seven treatments, but one colony required six. I relied on the visual cues from the graphs to continue to treat. A final treatment in January confirmed the benefits of this technique with diminishing mite levels so all hives survive the Winter.

I was concerned that repeated OAV treatments could harm worker bees, but numerous studies have concluded that OAV is safe for bees for serial treatments. OAV treated hives have a lower mite load going into Winter and have more brood in the Spring (Toufailia, et al., 2015).

When colony dynamics and seasonal influences come together, the general treatment picture as shown in figures 2, 3, 6 (figure 6, page 81) – is what you want to see – one general knockdown of the phoretic mites with a gradual decrease in the dead mite drop. A smooth curve approaching zero is the ideal treatment scenario. The anticipated decrease in mite population over multiple treatments is an encouraging sign that this technique is effective in producing an exceptionally low mite load.

OAV treatments were spaced five days apart over the course of seven treatments in 2017. All six colonies responded well to the OAV and confirmed the effectiveness of end-point monitoring.

Oxalic acid vaporization is a treatment of choice for eliminating the *varroa* mite in the late Fall/Winter when colonies have the least amount of brood. Treating an apiary every five days to catch gravid female mites in the open before they can hide in capped cells is a successful strategy where endpoint monitoring

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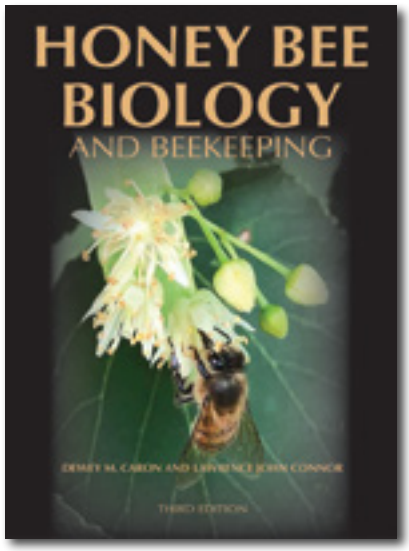

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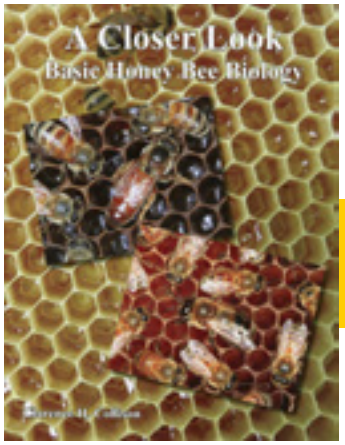

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is employed. Multiple treatments with OAV are necessary to control *varroa* mites and have the desired effect of killing mites while not harming the bees (Ratnieks, et al., 2016).

Endpoint monitoring involves the prepping of the hives, sticky boards, counting dead mites and populating an Excel sheet to create graphs. It is a repetitive process, but worth the effort. On the other hand, if endpoint monitoring is not employed the effectiveness of each treatment and current mite load are unknown. Endpoint monitoring affords the beekeeper visual cues in picture form to ascertain the apiary's mite load status and provides analytical data to determine when to stop treating. I began using this method in 2014 and all hives that entered the Fall healthy, survived Winter with zero hive losses. Endpoint monitoring ensures near-zero mite load in late Fall and the best chance for bee colonies to survive the Winter. The benefit to beekeepers of endpoint monitoring will dispel the notion of acceptable Winter losses and have a 99% Winter survival rate of their colonies. BC

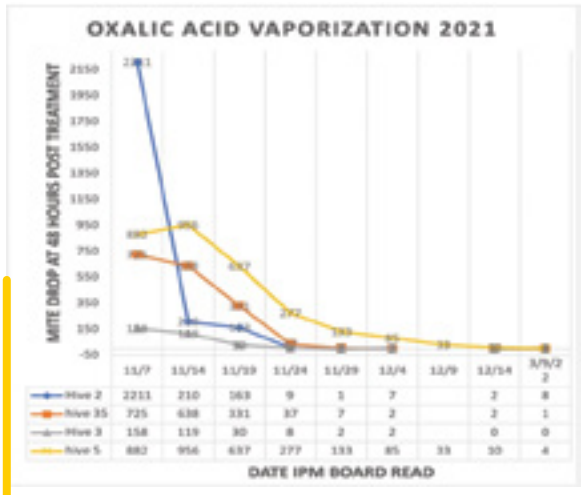

Figure 6. 2021 Mite drop at 48 hours post-OAV Treatment vs. Time
Fall mite treatment started in November 2021 was spaced five days apart over six treatments to bring the mite drops to an acceptable level. Mite drops started remarkably high but dropped rapidly. The presence of brood prolonged the treatment window. A treatment in March confirmed the effectiveness of this technique through the nectar flow. The ability to visually gauge the effectiveness of OAV treatments is the key to Winter survival.

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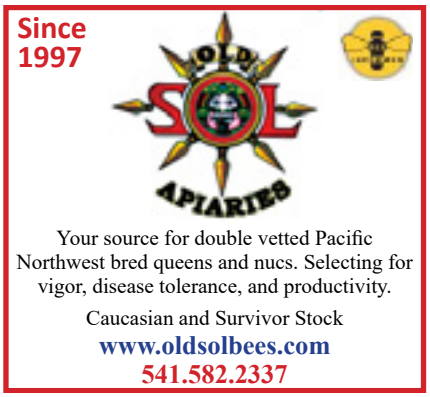
Author Bio

Vincent Penoso, a retired health care professional, lives in Alexandria, VA where he has kept bees since 2013. Chinquapin Honey, LLC provides a seasonal supply of honey for the community. Vincent recently completed the Master Beekeeping program at the University of Montana, his alma mater, where he earned two science degrees.



Jeff Kennedy

Spring Do Cometh

The return of daylight savings comes with an array of sensory cues that inform us Spring is on the way. My idle mind truly knows not what it wants during the cold, dreary days of Winter, so I long for extended daylight, warmer temps, buds opening, and the familiar trill of Red-winged Blackbirds, *kon-ka-reeeee*! As the bees resume daily flights, we embark on another season of beekeeping, making our rounds to the apiaries, assessing Winter losses and preparing for early Spring splits.

The coming method outlined allows us to make nucleus colonies from overwintered stock while most beekeepers in my region are still coming out of their Winter slumber. By implementing a version of the double screen bottom board, we are able to begin working the bees in late March once lows stop dipping below 32°F and drones are abundant.

Our colonies are overwintered in ten frame deeps with a medium super on top. This setup permits us to fill the medium with frames of honey in the Fall, providing ample stores during the Winter. The medium also acts as a buffer for the queen to begin laying, come Spring. They are stacked one colony over the other, in customized brood chambers. Our brood chambers feature a deep hive body that is screwed in to a double screen bottom board. The bottom board is the same footprint as the hive body with four (4) evenly spaced, double screen ventilation ports cut out. We run these bottoms all year long as the ventilation ports allow warm air to be exchanged amongst the two colonies during Winter, and assists with thermoregulation in the Summer.

WORKING TOWARDS AN INCREASE

The first step in the Spring is to move the top story colonies to another apiary so that we can begin working the colonies underneath. Some of you are familiar with the term "equalizing" and it is the first step of your Spring management plan. Equalizing is exactly how it sounds, the act of boosting weaker colonies with frames of brood from stronger colonies, making all the hives in the apiary equal. We equalize after we have taken the first round of splits from our colonies. As you will see, these first splits are not as invasive as a full-on hive inspection that would accompany equalization. Our temps are still unstable this time of year, so we try to refrain from busting up the brood nest too much for a few more weeks.

We begin by removing the telescoping cover and flipping it upside down to provide a suitable area to stack the medium super. There is no reason to remove the inner cover as this will likely trigger a defensive response from the colony. We have found that in early Spring, the queen is typically in the medium super and is already laying it up. For the time being, we remove the medium, set it aside, and begin going through the brood chamber underneath.

We bring with us an extra telescoping cover that is also flipped upside down and an empty deep to stack on it. We begin by going through a couple frames inside the brood nest, assessing the colony's strength and checking the queen's viability. All of our queens are marked; therefore, we give a quick look for the queen before shaking the adhering bees back into the colony. If located, the queen is caged and set aside while we conduct our manipulations. These quick frame audits usually give us a pretty good idea about the overall strength of the colony. If we encounter a weaker hive, one that is not yet worthy of being split, we close it up and give them another couple of weeks before re-assessing.

We then begin dividing the parent colony with the desired split. We remove a frame of resources (honey/nectar & pollen), a frame of mostly sealed brood, two frames of various stages of egg and larva and give them to the split. While doing this we are also looking for larva that has just emerged, and is suitable for notching. When notching, we take the flat end of our hive tool and push it through the wax, searing the bottom edge of the cells containing the chosen larva. After making contact with the plastic foundation, we push the hive tool down at an angle, crimping the wax underneath. This extra space allows the bees to draw out appropriately sized queen cells in older combs. Because of their rigidity, older combs present problems in frame-based queen rearing as the workers aren't able to construct suitable sized cells because old wax isn't as pliable as freshly drawn.

The transferred frames are grouped together and positioned in the middle of the split. We finish the split by filling the rest of the hive body with drawn frames on each side of the brood nest. The parent colony receives the same treatment. With the prolificness of Spring as their guiding light, the bees in the parent colony quickly begin working the empty combs and recover from the split in about a week's time. When managed throughout the season, this early division of strong, overwintered colonies also reduces swarming in our production hives.

The medium super is placed back on top of the parent colony, the queen is released (if caged), and a queen

excluder is placed on top. The split is then placed on top of the queen excluder with the inner and telescoping covers on top. The hive is left alone for the next 24 hours during which time the bees will divide themselves accordingly with whatever number of bees is needed to cover and care for the developing brood within the split.

THE DEVIL IS IN THOSE FINE DETAILS

The next day we return to the apiary with our customized brood chambers. We remove the telescoping and inner covers and then simply transfer the frames over from the split. Once complete, the empty deep is removed and the new colony set in its place with the entrance facing the opposite direction. The double screen bottom inhibits pheromone exchange from the parent colony; therefore, the bees in the split quickly realize that they are without a queen and begin queen rearing procedures. Although being situated in the same apiary can result in some minor drifting, the new entrance is unfamiliar to the bees and cuts down on the number of bees that will return to the queenright colony below.

A week later, we return to the apiary to inspect each of the splits, making sure that they are in the process of rearing a queen. The bees typically use the notched frames that were provided; however, some colonies can also be overly ambitious and draw a dozen or more cells. We cull all but three of the best-looking cells per split, ideally with each cell located on a different frame. These separate cells are beneficial if you encounter a split didn't begin rearing a queen. When that occurs, you just transfer one of the extra cell frames to the split in need. Once queen rearing is confirmed, the colonies are left alone for three weeks to allow ample time for the queens to develop, emerge, mate, return and commence laying.

Without the abundance of natural predators this time of the year, most nuptial flights are successful. As the season progresses on into the Summer months, rate of return increasingly drops. At the three-week mark, final inspections are performed on the splits. If during this inspection you find a queenless colony, simply transfer another notched frame of appropriately aged larva over to this hive and begin the queen rearing process again.

The splits that have a mated queen are now officially a colony and are transported to a different apiary to build up over the next several weeks of prime weather and bloom. If the weather cooperates, our early Spring split procedure takes about six weeks from the time of split until customer pick-up. This period allows ample time for all of the biological processes mentioned as well as an additional two to three weeks of laying time for the queen. BC

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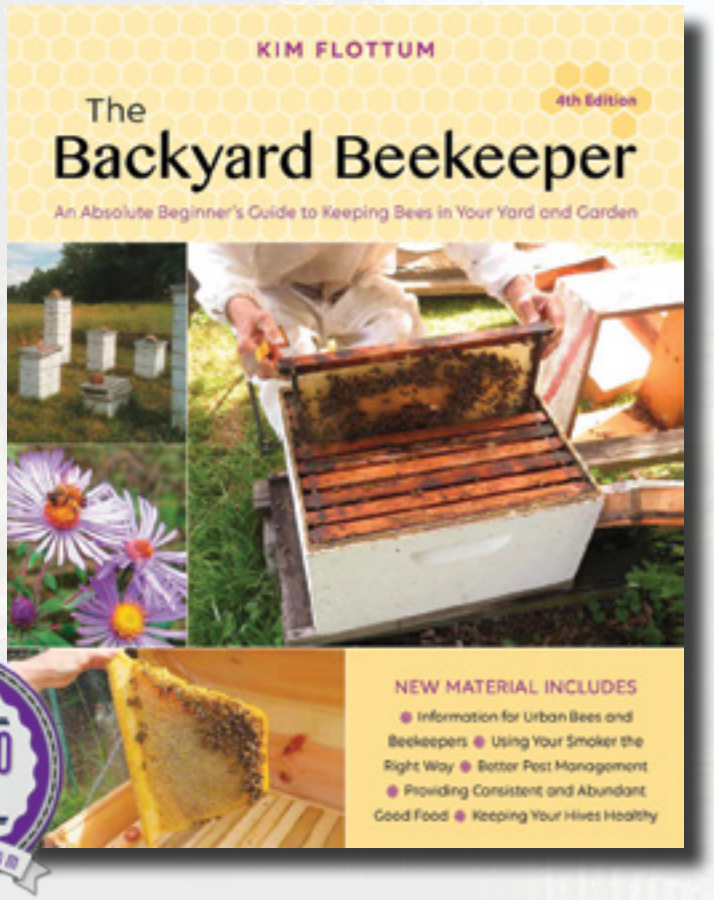

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Home Observation Hives

Dan Long

Warning! A home observation hive comes at great risk to completion of daily household tasks! You're going to want to stay and watch all day!

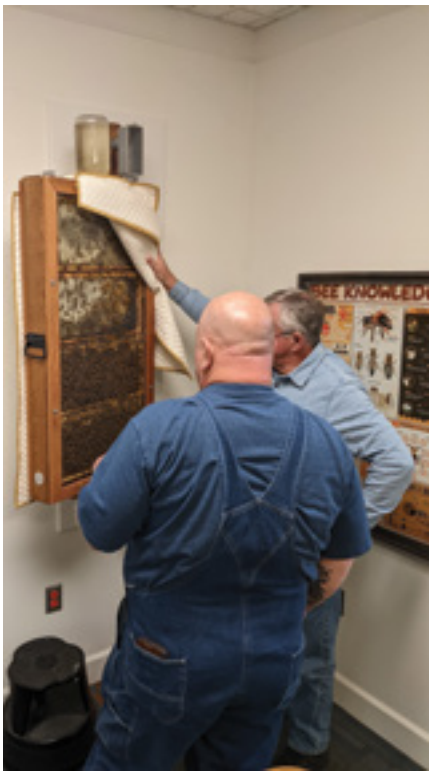
If you're reading this, chances are you're fascinated by honey bees. Every time we inspect a regular hive, there's something interesting to see. I find myself lingering sometimes until I remember that it's an unnatural condition for a part of the hive to be hanging in the air at the hands of a large mammal. Reluctantly, it is returned and I'm on to the next hive. Luckily for the honey bee obsessed there's another option! In various ways, temporary or permanent, we are able to linger to our heart's content and watch our bees with minimal disturbance to the colony. We can even see things that are less commonly seen during inspections like the queen laying eggs. Observation hives also make excellent conversation starters, marketing and educational tools. They are also very useful for research. These aspects will be covered in future articles.

Most beekeepers thinking about an observation hive want one for their home. This is a great way to start. I don't recommend it for anyone without at least a couple of years of experience and it shouldn't be their only hive.

A common layout is one frame thick. A single thickness has the advantage of being able to see essentially every square inch of the insides. With minimal effort, one can see the queen and can make a complete assessment of the colony's health. They are often a maximum of four frames but I've seen them as large as 21! A single thickness is less natural for the colony but it can work. They are best kept in a warm room. Bear in mind the number of frames will also correspond to colony stability. A single thickness with four deep frames will appear quite large inside your home, but it's still smaller than a five frame nuc in volume. A healthy colony will rapidly outgrow the space and will need nearly continuous efforts to reduce the population. Otherwise, it will swarm many times every year. Recovery from that much population loss is challenging for the colony. Also, the chances are high that eventually it will not successfully requeen itself.

A double thickness allows the colony twice as much volume without much more space in the room. A greater number of frames will also mean that the colony will be more stable. It will keep itself warm more easily and will take longer to reach a swarming population. However, it means only half of the comb surfaces can be viewed. There's no guarantee you'll see the queen unless you're lucky or patient. It will also be a good bit heavier than a single thickness hive but there is a weight savings because the windows, whether glass or plastic, will be the same and there's only a percentage more wood in the cabinet of the hive. This is important to consider because almost every beekeeper will eventually have to disconnect their observation hive and carry it outside to work the colony. It's a rare situation where a colony can be worked from inside a room!

Finding a suitable location for the observation hive will depend on the style and size. A common setup is to mount it to a wall on hinges or to a swiveling stand on a sturdy table. A short tunnel made of plastic tubing is then routed through the window or,



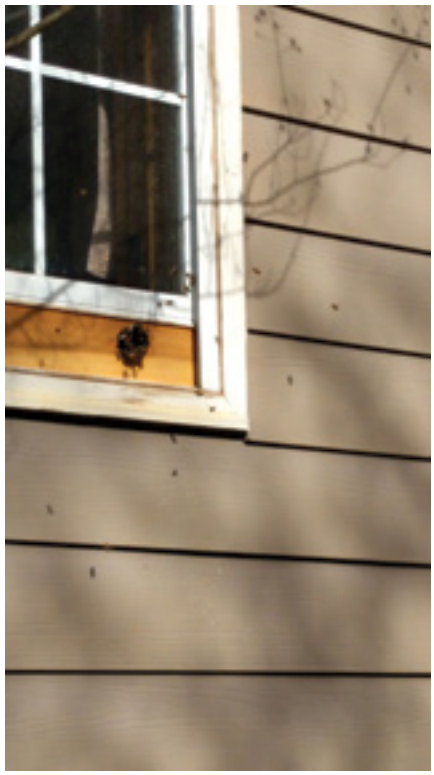
less commonly, through a hole in the wall. Be mindful of other occupants and uses for the room. A sturdy observation hive in my home once survived a direct hit with a football but it's not recommended!

A nice side benefit of the view is that visual inspections through the window(s) are often enough since so much can be determined just as a regular hive is inspected visually. Provision for removal and opening must still be made, of course. It usually involves sliding closures or some method of plugging the opening in the hive as well as the entrance to the outdoors. This prevents the room from filling with bees from inside the colony as well as returning foragers. Once both are closed, the hive is carried outside carefully. It should remain in its upright position at all times. The beekeeper's ability to carry the full hive (or successfully recruit a helper!) will be the limiting factor in overall size. Once the entrance is closed, the hive should be carried gently and kept vertical, of course. Outside, it may be leaned slightly if necessary to prop it against a sturdy surface. Whether you make your own or buy one, there will be screws or latches to be opened. Frames should be pulled gently from the cabinet and the beekeeper should never use the window surfaces for leverage with the hive tool. I'll often bring an empty hive just in case more work must be done. A well designed observation hive won't get a lot of burr comb on the windows but it should be kept clean for best viewing. Simply move all of the frames to the hive body and give the windows a quick cleaning. If extensive work must be done, the colony can be moved into a regular hive which is then placed as close to the observation hive's entrance as possible for the duration of the maintenance. Once the work is done and frames are returned, a bee brush will be very handy before closing the hive. I also like to stop at least once on the way to the house to brush stragglers off before entering. A helper is useful here to hold doors open and to close them before stray bees enter the home. Depending on the size and mounting system, a second pair of hands will be… well… handy!

This type of hive is meant to be occupied year round or at least for a large portion of the year. It means all of the regular needs of a colony like feeding and treatment should be considered. Provision for feeding is usually accomplished with a mason jar type feeder inserted in the top or an extension of the bottom board opposite the entrance. I like a 71mm hole saw to make the opening. 2¾ inches works if it is sanded out a little wider. Screening can be used to keep the bees inside while refilling the jar as long as the lid comes close enough for their tongues to reach. Some observation hives are built with a feeding trough inside the top but this is less common. The beekeeper can also add frames of capped honey as needed. Bear in mind that feeding is often done in colder months and the brood will be subject to more chilling due to the configuration and extra time it takes to add a frame of honey. External feeding really is a better option here.

The beekeeper must also consider pests and diseases just as they would for any hive. Interestingly, I've found that small hive beetles don't

The massive observation hive (pictured to the left) has a total of 21 frames! The owner, Henry Long (no relation to the author), built it for fun but has begun researching interesting honey bee behavior. It's too big to carry outside so he made it modular. Each individual pane can be closed off and removed from the hive to manage the colony or colonies inside. Photo credit: Henry Long



thrive when an observation hive is left without covering the viewing windows. It's a common misconception that they must remain covered most of the time for the colony to thrive. I've found that they completely ignore light and activity on the other side of the glass. In my experience, it's only important for the first couple of days for orientation to the entrance or in cases of insulation being needed. Unfortunately, *Varroa* mites don't care one way or the other and should be managed as you would any other colony. Apivar or other strip type products are handy. Formic and oxalic acid treatments can be a little more challenging. This is another time it could be useful to transfer the colony to a regular hive and return them at the end of the treatment period.

Once the colony is established, it really is a joy to sit and watch! For some, it will be the first time they see a queen diligently laying eggs and young workers patiently freeing themselves from their cells. I also love watching foragers do their waggle dance or returning to deposit pollen. It's an easy way to watch the beekeeping year with ready reminders as pollen and nectar begin coming in or tapering off. It reminds me to grab my gear and get outside to the other hives. BC

Plant Yarrow Tomorrow

Alyssum Flowers

A. millefolium *'Sassy Summer Sangria' at A.I. Root Company*

An interesting plant to add texture and detail to any garden is Yarrow, *Achillea* species, also known as Devil's Nettle, Dog Daisy, Dog Fennel, Milfoil and Soldier's Woundwort, to name a few. Introduced to the United States from Europe by early colonists, this perennial was used for many health benefits and was a must for those immigrating to a new world. Early records showed that the entire plant was used, either fresh or dried in tea, as a poultice or crushed for burns, to stop the flow of blood, help reduce stomach pains, alleviate kidney ailments and reduce fevers and colds. Named after the Greek hero, Achilles, it was used to heal soldiers' wounds and prevent infection. A leaf applied to a bad tooth would reduce the pain, as it contains the anti-inflammatory chemical, azulene. Note though, that some people develop a skin sensitivity to the leaves if handled too much, and pets should not be allowed to eat the plants. As with any medicinal product, one should consult their doctor before using it.

Yarrow has flower heads about two to four inches across and look similar to Queen Anne's Lace but are tighter. They arise from branched stems near the top of the plant with each flower cluster comprised of smaller flowers, forming an umbel. They are favored by many butterfly species as well as bees and other pollinators. Leaves emerge from a central stem and are long and finely divided (much more so than Queen Anne's lace), technically termed pinnatifid. In the Spring, yarrow produces basal fern-like leaves then as the stem elongates, each tier of leaves are slightly shorter, so that the mature plant is slightly tapered, averaging one to three feet. This tough and easy to grow perennial can flower from April through October if it receives full or mostly full sun.

The wild yarrow, *A. millefolium* has white florets and grows well in wildflower plots, perennial gardens or in open sunny areas, in almost any soil type. Although it prefers well drained soil, it will tolerate dry and wet conditions and is tolerant of poor soil. For a more compact growth habit, cut the spent flower heads directly above a lateral branch. In open plantings, they can be mowed at the highest setting in late Fall after all the flowers have formed seed heads The flowers can be cut and placed in water for fresh floral decor or dried for later use. The pungent leaves keep their form and add a soft sculptured look in wreaths, potpourri or vase arrangements.

Common wild yarrow Achillea millefolium
https://www.minnesotawildflowers.info/flower/common-yarrow

Bumble bee on A. tomentosa, *Woolly yarrow*
https://plants.ces.ncsu.edu/plants/achillea-tomentosa/

A. millefolium *'Sassy Summer Sunset'*
https://www.darwinperennials.com/Products/plantinfo/?phid=000408393005424

A. millefolium *"Firefly Amethyst'*
https://www.provenwinners.com/plants/achillea/firefly-amethyst-yarrow-achillea-hybrid

Cultivated varieties include 'Sassy Summer Sunset' and 'Sassy Summer Sangria' (grown at A.I. Root) with orange or pinkish flowers, 'Coronation Gold' a brilliant yellow cultivar and *A. tomentose*, called Woolly Yarrow, a dwarf cultivar, reaching six to eight inches tall with gray, fuzzy leaves.

Tough and deer repellent, yarrow is easy to grow with few problems. The rhizomatous roots allow the plant to form dense patches which can be divided in Spring and Fall. It freely self seeds and is a beautiful fragrant addition to any landscape. Although the wild species can look straggly in the Fall, it can be mowed to three inches tall to provide cover for caterpillars and other small insects and provide some soil protection. Cultivated varieties have a denser canopy and are very attractive in a flower bed. Hardy from zone three to nine, it would enhance any landscape. Plan to add it to your plant scene this season. BC

References:

https://www.missouribotanicalgarden.org/PlantFinder/PlantFinderDetails.aspx?taxonid=277129

https://www.fs.usda.gov/wildflowers/plant-of-the-week/achillea_millefolium.shtml

https://www.illinoiswildflowers.info/weeds/plants/yarrow.htm

A FEW UNIQUE BEEKEEPING TOOLS

And some other cockamamie ideas

Listen along here!

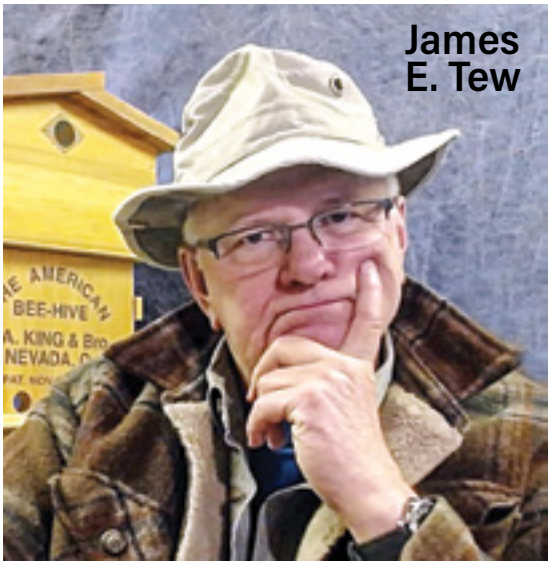
I've done this all my beekeeping life

One of my very first beekeeping thoughts when I was first accidentally introduced to beekeeping was, *"I can build this wooden equipment."* So, I did. As a totally new beekeeper with above average woodworking abilities, I set up the shop, bought pine lumber, built jigs for making repetitive cuts and went to work. For a couple of years, I even built my own wooden frames. While I was never cost competitive, I got a strange satisfaction from cutting my wooden equipment[1]. It was ***my*** beekeeping project and not something I just bought. I loved doing this work… until I didn't.

After only about two seasons, the simple construction procedures and the mindlessly repetitive cuts became monotonous. When running power woodworking tools, boredom is a great way to be awarded a trip to the emergency room. In my life, I have made two of those trips, but I am happy to say that I still have all my body parts. I have not built my own equipment for many years now. I still could, but why bother. Been there – done that.

All my beekeeping life, I have looked at non-beekeeping devices and various procedures and wondered, *"Could I use that in my beekeeping efforts?"* I'm not talking about things like a woodworking shop, a pickup truck, a mobile phone or a good pair of boots. Rather, I am talking about odd items that were never intended for beekeeping use that could possibly be effectively used in my beekeeping craft. Be forewarned readers that much of what follows is half-baked. Only a few recommendations will be made. *As it were, "do not try this at home."*

[1]Of the hundreds and hundreds of frames, boxes, lids and inner covers that I built, not a single one remains. Not one. I wish I had just one of the pieces that I built. At the time, it was not important. Bummer.



An electric heat gun

I am amazed at how often a heat gun fulfills an unanticipated use, both in life and in beekeeping, but in this article, I want to stay within beekeeping. I have used heat guns to soften heavily propolized frame rests in bee boxes. Quickly heating the gummy propolis makes it significantly easier to scrape and clean. I have used heat guns to quickly liquify small amounts of honey when I was in a rush. I have used heat guns to loosen the sticky bottom bearing in my old extractor. I have used heat guns to clean and sterilize my hive tool. On the web, some of you have described how to use a heat gun to uncap honey. The uses seem endless. But then I became too excited. Could I use this heating device in the beeyard?

So, I set the heat to a level low, and opened a hive and hit the alerted bees with a waft of very warm air. It *did not* have the desired effect. In fact, it may have even energized the bees a bit. I quickly decided that the idea was one for the beekeeping idea trash heap. I rolled up the extension cord and put the gun away.

But wait. I just saw in an advertisement, that major heat gun manufacturers are producing battery-powered units. No extension cord would be required. Obviously, I will be needing one of those.

This is my tentative plan. Next Spring, I want to see if I can use the hot air produced by the battery-powered heat gun to soften the propolis seal on the inner cover when I want to gently open a colony. Secondly, I want to see if I can use the battery unit to soften propolis on the top bars to loosen them without having to pry and bang them from the bottom side. While it looks good on paper, I'll have to get back to you next Spring. Stand by.

Ratchet straps

Ratchet straps are essentially complicated Bungee Cords™. While both are beautiful devices, the ratchet strap is now a significant part of my beekeeping equipment and is listed in some supply catalogs.

Of course, as I have told you time and again, I am no longer a young man. In my youth, when preparing to move hives, the best recommendation that I had was hive staples or the early non-ratcheting version of straps. The non-ratcheting straps were too difficult to tighten and loosened too easily. They failed the test. Staples were a different story. During those times, beekeepers bought staples by the case. There were even instructions on how and where to position the staples on the hive bodies.

An aside…

Many years ago, *Trucker's Hitches* were a style of rope knots that were used to tie down bee colonies (and anything else that one wanted to keep from falling from a wagon or a trailer). This tiedown system is even older than staples. Today, video instructions for tying this simple knot are readily available on the web. I have personally used ropes with *Trucker's Hitches* to lash eighty colonies for a round trip from Ohio to Florida. This old idea, that greatly predates ratchet straps, is still useful – but rarely used – today.

Installing staples was somewhat comical. Nothing alerted the bees like banging on the sides of the hives as the staples were being installed. Envision this scenario. So, there we were – preparing to move colonies and banging on the colonies to get them agitated before loading them. Then, more banging on the hive when the

staples were removed. Staples were not a perfect plan, but at the time, the procedure was the best we had – grumpy bees or not[2].

An aside...

Hive staples are a historic bee supply catalog sleeper. While I can't say when they were first offered in bee supply catalogs, I can find them in catalogs in 1931, but not in 1928 catalogs. For sure hive staples have been used in beekeeping for ninety-two consecutive years. In the earliest years, staples were copper coated so they could be used multiple times without rusting. It should be noted that, over time, re-occurring staple use caused considerable damage to wooden hive bodies.

Yet, another staple aside...

Hive staples have been handy for uses other than beekeeping. I have used them to improvise a gate-closing mechanism. They work well as hanging hooks. I have used them for quickly joining two boards together. For the improvisational person, these large staples can provide quick, clever solutions to immediate problems. They can also puncture tires when dropped in the bee yard.

I don't remember the first time I was introduced to the ratchet strap. Now, I must have twenty of them. I use these common tools for multiple things, but I particularly use them for moving colonies. I always buy the heavy duty, narrow straps.

For heavy colonies being loaded under rough conditions, I ratchet strap the hive components together with a single strap, and then I ratchet strap the whole hive to the hand truck I am using. Propolis is useful in restricting the slippage of the strapped hive components.

They work best if the ratcheting mechanism is in the center of the hive top. Locating the ratcheting mechanism along the side is second best. Letting the hooks hang along the side while the strapping mechanism is still on the top is least desirable. The only quirk? Threading the strap into the ratchet mechanism has a bit of learning curve. You will figure it out. These gadgets are field tested and proven.

The limitation to ratchet straps is the sheer number required for moving large numbers of colonies. They become impractical. These devices would seem best suited for hobby keepers or at best, smaller sideline beekeepers.

[2]My Dad took a typically novel beekeeper approach to securing hive parts. He used brick-ties and attached to hive boxes with dry wall screws for securing hives when moving to watermelon pollination. He used a battery-powered drill to drive the screws. Brick-ties are reasonably cheap and can be used time and again. Just another beekeeper idea.

Figure 1. A ratchet strapped hive ready for moving. I had broken the propolis seal, so I also used Dad's brick straps.

Foldable work platforms

I use two foldable work platforms as a support base for my extractor and settling tank. The platforms tolerate "some" wobble and are stout enough to withstand the weight. Initially, I tried a single platform, but it was too unstable. For a larger working surface, I ratchet strap two platforms together. While not perfect, it is a quick and simple procedure.

Figure 2. A collapsible work platform used as an extractor stand. Later, to provide a wider platform, another stand was added.

Figure 3. A heated snow mat and ratchet straps for securing the extractor.

This is yet another beekeeping item I found at a home supply company.

Snow mats

Beekeepers in warm climates will be at a disadvantage here. For those of you who never see snow, it's premature to rush out and buy several of these things. Stand by. For those who deal with snow, heated mats seem to cry to be used in beekeeping.

I wrap my extractor tank with these large heating mats. It helps keep the tank barrel warm so that the honey flows to the bottom faster. I was reluctant to put the heating mat beneath the vibrating, wobbling extractor. I was afraid that it would wear through the mats and cause an electrical short circuit.

I tried putting the mats beneath a large, heavy aluminum flat pan to see if I could use the mats to heat honey supers before extracting. That didn't work. Primarily, the problem

seemed to be that the mats did not produce enough heat.

But what would happen if I put heating mats beneath my wintering hives? I have no idea how that would work, but I continue to be intrigued by my lingering idea. The mats are about two feet wide and about five feet long. There is enough length to have two colonies sit on one mat. This is one of those ideas that works well on paper. Maybe one Winter day I will give it a shot.

An aside...

I emailed the manufacturer of the snow mats and told them I was exploring using their mats in my honey extracting operation and how I was using them. The company did not respond. Later, in response to an advertisement for their snow mats, I sent an iMessage again describing my interest. They did not respond to that message either. Two messages with no response. Don't you think that should tell me something?

Moisture Meter

I have a moisture meter for determining the water content of wood that I am working with. Of course, I immediately wondered if I could simply put the moisture meter probes in honey and get a moisture reading from the meter. Didn't work. I contacted the company and they sent a different detecting connector, but I could not make that work either. The scale was not sensitive enough.

Beekeepers, that would be so slick if it would work. Rather than having to load and clean a refractometer, I would only need to put the probes in the honey and – *voila* – a moisture reading. I have backed away from this use for my wood moisture meter use. Someone else can give it a try.

Pry bars

In my experience with beekeeping, hive tools have come a long way, but still not far enough. If a beekeeper is working a smallish hive that is regularly worked, all is well when using the traditional hive tool. However, when trying to dig out frames from a behemoth colony that has not been opened in a long while, the light hive tools are pushed to the maximum. I have an assortment of larger pry bars – to include a wrecking bar. None were purchased from a bee supply catalog. But be aware that there is an upper limit. When using pry bars with significant leverage, the soundly stuck top bar will rip from the end bars rather than pull the frame out.

Propolis-embedded plastic frames are miserable to pull out with any type of hive tool. The plastic flexes allowing the pry bar to break free. Those frames will require being driven out from the bottom of the super. I have a modified short-handled hammer that I use for that purpose. Plus, I can still use the hammer to drive nails and staples.

I'm out of space

There is seemingly no end to this rambling thread, but I must stop.

1. I presently use HVAC pads as leveling foundations beneath some of my hives.
2. I have wondered if an old, retired sleep apnea air compressor device could be used to deliver smoke or oxalic acid fumes to my colonies.
3. A leaf blower can clearly be used to remove bees from supers, but is there some way that it could also be used to deliver smoke to a colony?
4. Can the flame from a propane-powered weed killer be used to sterilize wooden equipment or to melt away burr combs and propolis? One day, I will try this device for these purposes.
5. I have successfully used a pet bowl heater for providing a Winter water supply for my bees. Wintering birds also greatly appreciated this rare water supply.
6. I use a three inch wide scraper with a disposable blade for removing old combs from foundation inserts. I found the scraper at a big box home supply store. Ironically, I use my heat gun to soften the combs before scraping.
7. Would a deer cart be more (or less) useful than a typical hand truck for moving a bee hive? I don't know.
8. Could the plastic bags that my newspaper comes in be used as a disposable syrup feeder bag for wintering colonies? I don't see why not. Presently, I have about one hundred of these bags crying for some bee use.
9. Does a mylar survival blanket have any use for the wintering bee colony – especially when used inside the hive. I'm still thinking.
10. Archery equipment has been used to string a retrieval line to a high swarm. While I have not personally done this, others of you have. You know who you are. You sent me photos.

Figure 4. Some of my non-beekeeping heavy duty hive tools. The blue one in the lower left is my favorite.

What have you done?

Beekeepers are an adaptive lot. If you have novel uses for tools or devices that you would want to share with others, let me hear from you. Clearly, I love cockamamie gadgetry.

Thank you

I appreciate the time you take to read my articles. I enjoy hearing from you. Thank you. BC

Dr. James E. Tew
Emeritus Faculty, Entomology
The Ohio State University
tewbee2@gmail.com

Co-Host, Honey Bee Obscura Podcast
www.honeybeeobscura.com

An audio presentation of this article is posted at: **https://www.beeculture.com/a-few-unique-beekeeping-tools/**

Almond Brittle

Shana Archibald

Ingredients

□ ½ cup butter (1 stick), softened
□ ½ cup honey
□ 2 tablespoons sugar
□ 1 cup sliced almonds

Directions

Step 1
Line an 8x8" pan with aluminum foil or parchment paper, leaving 2" extensions on two sides for easy removal.

Step 2
Coat the foil (if using) with butter. Set aside.

Step 3
Add butter, sugar and honey to a saucepan.

Step 4
Heat over medium-high heat, stirring constantly.

Step 5
Continue cooking and stirring until the mixture is golden brown.

Step 6
Add sliced almonds (you can use whole or smash up your own as well) and pour into buttered pan.

Step 7
Place in the refrigerator and let chill for 1 hour.

Step 8
Invert pan, take crunch of aluminum foil and break into bite-sized pieces.

Note:
Because there's more honey than sugar, this may turn into a more caramel consistency when it hardens. BC

CALENDAR

♦INDIANA♦

The Beekeepers of Indiana 2023 Bee School will be held on February 25, 2023 at Horizon Convention Center in Muncie, IN.

There will be two plenary speakers: Jerry Hayes and Scott McArt. The event will also include sessions and discussions for beekeepers with any level of skill, experience or ability. Session topics include Tricks and Tips for Installing Packages, All About Drones and How to Grow Your Business Using Social Media, among many more! The raffle, live auction and silent auctions will also be held again. There will also be many vendors with a variety of displays and supplies on-hand.

The cost to attend is $50 for members and $60 for non-members. All registrations include lunch.

A Beginning Class will be held at the same time this year. The cost for that is $55 for members and $65 for non-members. All registrations include lunch.

For more information about speakers, topics, vendors, hotels and to see the registration links, go to **https://indianabeekeeper.com/events/indiana_bee_school_xxi**

♦IOWA♦

Central Iowa Beekeepers Association's (CIBA) annual Winter Seminar is Saturday, March 18, 2023 at the Iowa Arboretum and Gardens in Luther, IA.

Speakers include Dr. Judy Wu-Smart of the University of Nebraska-Lincoln; Dr. Mike Simone-Finstrom (via Zoom) of the USDA, ARS, Baton Rouge, LA; Andrew Joseph the Iowa State Apiarist; Kurt Rueber of the Iowa Department of Inspections and Appeals; and Pat and Peggy Ennis of P&P Honey in Goodell, IA.

This is a full day seminar with lunch included in the registration cost.

Details and registration process at **www.CentralIowaBeekeepersAssoc.org**.

♦MICHIGAN♦

Holland Area Beekeepers Association are conducting their 2023 Bee School on February 11, 2023 from 8am to 4:30pm. The Bee School will be held at Grand Valley State University Meijer Campus (515 S. Waverly Rd., Holland, MI).

Registration is currently open at **https://www.hollandbees.org/events.** Adults cost $60 with the second adult in the family cost $30. Students cost $15.

The Bee School includes keynote speakers, breakout sessions and vendors. The School is for new beekeepers and individuals interested in exploring beekeeping. It is also for individuals who need a refresher on the basics. Topics include how to get started, honey bee behavior and equipment and supplies needed.

For more information go to **www.hollandbees.org**.

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Contact Jen Manis to place an ad: Jen@BeeCulture.com

Michigan Beekeepers Association and Michigan State University will be holding the 2023 Michigan Spring Beekeeping Conference on Saturday March 11, 2023 at MSU Kellogg Center in East Lansing, MI.

The keynote speakers is David Peck, Director of Research and Education at Betterbee.

The conference includes multiple tracks for beginners, all-day track on sustainable beekeeping and beeswax crafts.

Presenters include Meghan Milbrath, Mel Disselkoen, James Lee and Adam Ingrao.

The best local vendors will be there. They have all your beek needs.

Pre-conference virtual keynotes will be held on March 2 with Marla Spivak, March 7 with Frank Rinkevich of USDA and March 9 with Randy Oliver.

For more information, visit **michiganbees.org**.

♦OHIO♦

Lorain County Beekeepers Association is holding their Beginner Beekeeping classes again in 2023. The classes will be helf from 7-9pm on March 3, 10, 17 and 24, 2023.

Each week will have a different topic:
March 3: Beekeeping Equipment
March 10: Managing your Beehive
March 17: First Two Months as a Beekeeper
March 24: Summer & Fall Management

For more information, visit **http://www.loraincountybeekeepers.org/**.

♦PENNSYLVANIA♦

The **Western Pennsylvania Beekeeping Seminar** is back! It will be held on February 10, 2023 from 7pm to 8:30pm and February 11, 2023 from 7:15am to 4:30pm at Gateway High School (3000 Gateway Campus Blvd, Monroeville, PA 15146).

Registration is currently open. The cost for adults is $75 and $38 for children under 18.

Featured speakers include Dr. Thomas Seeley, Dr. Jay Hosler, Dr. David Peck, Dr. Robyn Underwood, Joe Zgurzynski, Randy McCracken and Roxanne Swan.

For more details and registration go to **tinyurl.com/WestPABee**.

♦SOUTH CAROLINA♦

South Carolina Beekeepers Association's Spring Conference entitled "Show Me the HONEY!" will be held on February 24-25, 2023 at SIMT Florence-Darlington Technical College (1951 Pisgah Rd, Florence, SC 29501).

The keynote speakers are Bob Binnie, Steven Coy and Marina Marchese.

Learn anything and everything about that sticky stuff! Hear industry experts share how they manage and grow their honey operations and market their honey. The conference will include a variety of presentations and discussions, workshops, a honey show and vendor fair.

Registration is currently open online. Early bird discounted registration through January 31, 2023.

Visit **SCStateBeekeepers.com** for additional attendee and vendor information and registration. Send conference questions to **info@scstatebeekeepers.com**.

Happy Valentine's Day!

If you are having a beekeeping event, we are happy to send back issues to give to your attendees and students. Please email Emma at Emma@BeeCulture.com with the number of magazines needed, a complete mailing address and a contact person.

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Image Contest - Splitting & Nucs

We've started an image gallery! This month, we want to see any and all pictures you have of **Splitting Hives and Making Nucs**. 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:
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- Your First and Last name
- Your mailing address
- Your renewal code (if you know it)

If your image is chosen:

For the Gallery:
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For the Cover:
You will get twelve months added to your current subscription.

Ed Colby
Not Much of a Bee Dog

Bee Culture editor Jerry Hayes keeps me up to date with a constant barrage of bee-related news in his "Catch the Buzz" e-mail alerts. The latest is the remarkable announcement that a Dutch company will begin production trials of "bee-free" honey. The blurb asserts that their "bioidentical" honey "will address consumer concerns about animal welfare and sustainability, as well as provide all the traditional benefits of traditional honey."

I dunno. I put "bee-free" honey in the same category as "partner-free" sex.

Three memories stand out from my childhood movie watching: Richard Burton in *Alexander the Great*, taking his sword to the Gordian Knot, the terrifying Wicked Witch of the East in *The Wizard of Oz*, and the boy Travis bravely shooting his beloved but rabid dog Old Yeller, in the film of the same name.

The gal Marilyn and I face that same age-old dog owner's responsibility when Pepper the blue heeler's time comes.

Pepper's not a good bee dog, but then I never met one. Bees hate him, and they seek him out. If he chases a stick anywhere near a bee hive, he'll probably get stung. I used to take him along when I visited the out yards. He's not a wanderer by nature, but he'd simply disappear. He's gotten stung so many times in the truck, he won't get in anymore.

When you bring home a dog, the good Lord gives you the best, most loyal friend you could wish for. Your Pepper will adore you and stand by you and never criticize or judge you. But what the Lord giveth, the Lord can take away. Unless you go first, your best friend will one day surely break your heart.

We're spending a small fortune keeping Pepper's lymphoma at bay. He's on a chemo drug called lomustine, plus he gets a daily infusion of prednisone steroid, milk thistle for his liver, bee propolis and CBD. We'll try anything. At the recommendation of a friend, I added pumpkin to his kibble. Pepper's an enthusiastic omnivore, but he made it clear that pumpkin was a bridge too far.

Marilyn drives Pepper over the hill to Colorado Springs once a month for a checkup with his cancer vet, who assures us that before long the dear boy will succumb to his disease. We're just buying some time. She said maybe six months but no promises. We'll take it. Pepper still chases the ball, and he herds the geese in at night, all by himself. That's good enough.

Buying time is all any of us are doing, isn't it? No matter how rewarding our lives or how precious the moments we might share, it's only for a little while.

Tonight in the kitchen with Pepper at my side I sensed an odor, rich, pungent, unmistakable in origin. Any dog owner would recognize it. But overlaying it was the sweet stink of cannabis. "That's gotta be the CBD!" Marilyn laughed.

Now it's the wee hours. I woke up at three, with visions of honey bees dancing in my head. I struggled with a problem. I had a rough go with a few colonies this Fall. How do I coexist with the *Varroa* dragon?

I used to successfully treat colonies with pretty high mite numbers – like 20 or 30 in a 300-bee sugar shake sample. But the times they are a changin', and my experience is now coming into line with the warnings put forth by the experts – that even relatively low *Varroa* infestations can and will decimate bee colonies. My panic alarm currently goes off at 10 mites in a 300-bee sample. Of course mite tests don't count the little monsters breeding under capped brood. They could triple or even quadruple the real mite count.

Let's say I find a colony with four honey supers and 14 mites in July. With mite numbers naturally doubling every month, this is a ticking time bomb. Daytime highs are pushing 100, way too hot for formic acid. A single oxalic acid dribble would do the trick but only if there's no capped brood in which mites can hide and reproduce. This hive is full of brood. But what if you killed the queen? Off with her head! And what if you removed five frames of mite-ridden capped brood and scraped any remaining capped brood into a bucket for your chickens?

Now simply dribble oxalic acid between the hive's remaining frames, and voila! The oxalic zaps the exposed mites.

Small hives, like nucs, often harbor very few mites. What if you let the hive go queenless for a day and then replaced those five missing frames of brood with a nifty low-mite, five-frame nuc that you made up in the Spring, for just this purpose?

You dramatically reduced this hive's *Varroa* overpopulation with oxalic but introduced a few mites in your nuc. This is a good tradeoff. You now have a powerful, low-mite colony with a new queen and some brood. Do you feel better now?

I've never actually done this. It's just an idea that came to me in the middle of the night. BC

A Beekeeper's Life, Tales from the Bottom Board is an attractive paperback collection of 60 of Ed Colby's best *Bee Culture* columns, with photos. Signed copies are available from the author at **Coloradobees1@gmail.com**. Price: $25.

Pepper

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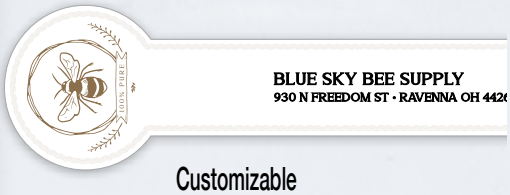

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WITH Caps
6 oz Panel Bears
$211.20 / 660 Ct. Case
No Caps
12 oz Panel Bears
$127.95 / 365 Ct. Case
No Caps
16 oz Panel Bears
$91.95 / 200 Ct. Case
No Caps

b DECO EMBOSSED JUGS

5 LB - $103.95 / 72 Ct. Case
3 LB - $127.95 / 126 Ct. Case *No Caps*
1 LB - $140.44 / 300 Ct. Case *No Caps*

CLASSIC PLASTIC JARS

c

32 oz - $79.95 / 110 Ct. Case
No Caps
16 oz - $96.95 / 225 Ct. Case
No Caps

d SQUARE PLASTIC

16 oz - $225.95 / 343 Ct. Case
With Lids

Glass

e GLASS 3 OZ. MINI MASON

$22.95 / 36 Ct. Case
Lids now available in Gold, Black or White

f GLASS 12 OZ. HEX EMBOSSED CYLINDER

$11.95 / 12 Ct. Case
Gold Metal Lids Included

g 12 OZ & 3 OZ GLASS SKEP JARS

12 oz Skep Jars $16.95 / 12 Ct.
3 oz Skep Jars $14.95 / 24 Ct.
Gold Metal Lids Included

h MUTH JARS

4 oz - $31.95 / 36 Ct. Case
8 oz - $14.95 / 12 Ct. Case
16 oz - $22.95 / 12ct. Case
Includes Corks

i CLASSIC GLASS JARS

8oz - $19.10 / 24 Ct. Case
16 oz - $10.60 / 12 Ct. Case
32 oz - $15.75 / 12 Ct. Case

ALL PRICES IN THIS AD ARE SUBJECT TO CHANGE

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