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JUNE 2022

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Cover Photo submitted by Lynda Bracken in the Image Contest. See the image gallery (page 19) to see other images from the same swarm!

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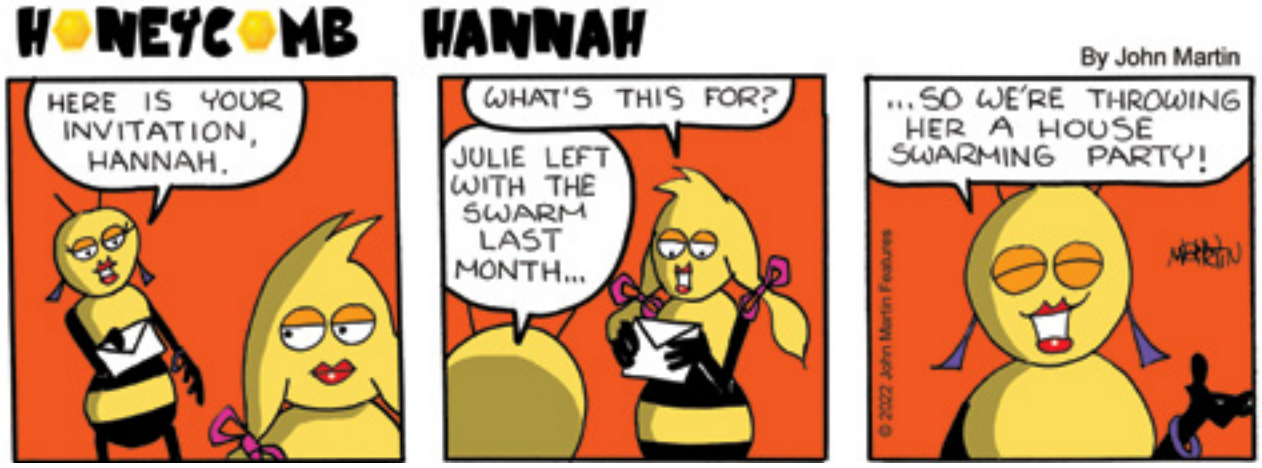

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M01461 M01460

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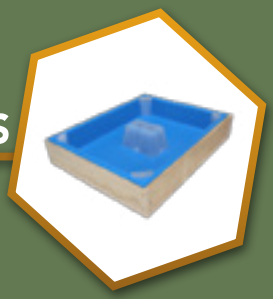

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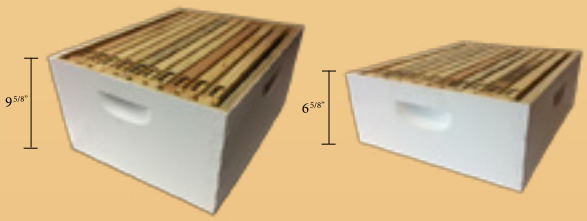

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5G

Dear Editor,

Please excuse ink as I neither own nor use computers. I was sent your Bee Journal by my friend; Fr. Daniel Jones T.O.D.M, and I wish to pay you a compliment please.

Very few respected journals have the integrity and courage to publish, hitherto, the truth about the communications industry and their use of microwaves i.e. wifi, 1→5G and smart meters.

Over an eleven year period during the Cold War, I questioned captured spies well versed in microwave warfare. We all knew then that any living species from microorganisms, soil, trees, the entire animal kingdom would suffer from longterm, low level microwave irradiation. This is not surprising as we all have the same cellular base structures.

The solution to this slow decay of life is deceptively simple, use one of the many types of fibre optic cable, hence, take the microwaves out of the air. Why isn't it done? Less profit.

Barrie Trower
Research Physicist
U.K.

Note: We received this handwritten letter in the mail!

Bees

Hello Jerry Hayes,

Hope you are doing well. I have three packages we bought, installed and working well. We used the slow release for the queens. My wife and I are waiting for the nucs to be ready for pickup. From our survivor stock, we have had three swarms and made two splits with queen cells. All of these seem healthy and working.

One split is in a nuc, it was made three weeks ago and has now filled nuc box. We put a five frame super on it last Saturday.

One split is still small, but it is only one week old.

One swarm has filled up six to seven frames and also has a super in it.

The only different method we have used this year is a Honey-Bee-Healthy and sugar water drench on the warmest day in March. We did this to our survivor hives.

We put one strip of Apivar in the packages. We will probably have to make at least one more split out of our survivor double nuc this week, weather permitting.

I am not really sure how the H-B-H drench works, but two weeks after, our hives exploded. We use 10 drops of H-B-H in a quart of sugar water. We leave out the lemongrass oil, it can trigger robbing, and substitute tea tree oil.

The packages were from Mountain Sweet Honey. The bees were actually making comb when they arrived; I have never seen this before. We didn't see any dead bees in the boxes.

To be as true to what a new beek would have to work with the were hive on foundation, just wiped down with honey, no drawn comb.

Take care,
Steve and Karen Phillips

Bee Trap

See image above
Bee Culture,

I hope you can do something about this.

With everything that threatens the bee population, we don't need a product such as this.

It is advertised by Publishers Clearing House, and I can imagine sold other places.

My family has a history with bees so this makes me angry and should all that know and appreciate honey and honeybees that produce it, not to mention all the other benefits honey bees provide.

Sincerely,
Carl

Cartoon

See image below
Inspired by Ross Conrad's article in the March 2022 issue called *EMFs & Honey Bee Health - Part 2*

APISTAN

beehealth NORTH AMERICA

PROBABLY THE WORLD'S NO.1 VARROA CONTROL

94% AVERAGE EFFICACY OVER 9 CLINICAL TESTS

TEST RESULTS

Apistan, lab study: **95.72%** Varroa mortality *(Insects, 2018)*

Apistan, field study: 84% efficacy (Apiguard: 86%; Apivar: 79%; HopGuard: 64%), @ Mississippi State University (Insects 2018)

Apistan: **94.90%** efficacy (2019, Veterinary Bee Inspector, Spain)

Apistan: **96.92%** Efficacy (2018, Veterinary Bee Inspector, Spain)

Apistan + 50 g Apiguard: **97.97%** Efficacy (2018, Veterinary Bee Inspector, Spain)

Apistan: **97%** Efficacy (2014, FNOSAD, France)

Apistan: **93%** Efficacy (2015, FNOSAD, France)

Apistan: **91%** Efficacy (2016, FNOSAD, France)

Apistan: **95.22%** (2017, FNOSAD, France)

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Apistan – *it's better* than ever before!*

* Actually, only the packaging has changed but if you haven't used Apistan for some time you may be surprised at how effective it is.

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NEXT MONTH

Region 1
- Extract early honey
- Do alcohol mite wash
- Make more splits
- Add supers
- Finish making new queens
- Bring in swarm traps
- Plan ahead, make nucs
- Check new queens
- Hope for good weather

Region 2
- Extract honey
- "Tools for *Varroa* Management Guide"
- Make splits/nucs
- Alcohol wash for mites
- Remove full honey supers
- Treat mites if necessary
- Replace poor queens
- Add supers
- Watch for Small Hive Beetle (SHB)
- Check brood production
- Inspect colonies for disease

Region 3
- Watch for Summer dearth
- Feed (see above)
- Sample for mites
- Provide water
- Check honey supers
- Monitor colonies for brood production
- Make more splits
- Extract honey
- Watch SHB population

Region 4
- Mite check
- Make nucs
- Remove honey supers / treat for mites
- Buy more bees
- Early July splits for Winter nucs
- Add supers if needed
- Extract early honey
- Check queen right colonies

Region 5
- Alcohol wash for mites
- Treat for mites before adding supers
- Get ready for August harvest / extraction
- Make splits / nucs
- Requeen is queen doesn't have four frames of brood
- Make water available
- More supers

Region 6
- Take off honey
- Cull 'old' frames
- Keep watching for swarming
- Super
- Mite monitoring
- Watch for Small Hive Beetle
- Provide water
- Check queen laying pattern

Region 7
- Check mite load / alcohol wash
- Add supers for anticipated nectar flow
- Check queen laying / replace if necessary
- Check for swarm cells
- Make splits
- Make queens
- Check on drone production
- Move colonies to potential nectar flow
- Hope for rain

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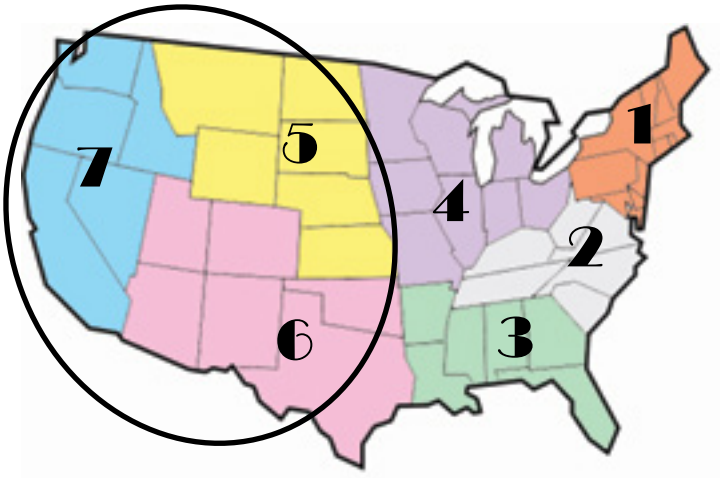

JUNE – REGIONAL HONEY PRICE REPORT

	REPORTING REGIONS							SUMMARY			History	
	1	2	3	4	5	6	7	Range	Avg.	$/lb	Last Month	Last Year
EXTRACTED HONEY PRICES SOLD BULK TO PACKERS OR PROCESSORS												
55 Gal. Drum, Light	2.48	2.18	2.62	2.62	2.42	2.30	2.73	2.00-3.25	2.48	2.48	3.96	2.23
55 Gal. Drum, Ambr	2.23	2.15	2.41	2.53	2.50	2.23	2.63	1.89-3.30	2.39	2.39	3.77	2.14
60# Light (retail)	222.00	207.00	204.25	211.67	215.00	188.67	263.70	120.00-310.00	215.12	3.59	211.41	198.70
60# Amber (retail)	227.33	199.00	209.00	177.50	220.00	185.00	231.67	120.00-290.00	212.91	3.55	213.90	193.46
WHOLESALE PRICES SOLD TO STORES OR DISTRIBUTORS IN CASE LOTS												
1/2# 24/case	101.94	98.83	86.88	90.00	108.00	-	-	64.80-151.20	98.62	8.22	100.41	99.36
1# 24/case	158.25	193.70	121.13	127.39	173.91	83.88	144.00	48.00-288.00	148.92	6.20	149.49	142.91
2# 12/case	153.85	181.00	144.65	115.70	82.42	-	156.00	41.00-264.00	142.26	5.93	139.08	118.81
12.oz. Plas. 24/cs	124.58	137.02	97.34	98.96	99.72	114.96	108.00	72.00-240.00	116.15	6.45	115.07	106.96
5# 6/case	160.46	190.03	52.95	133.53	126.87	-	-	52.95-330.00	150.43	5.01	150.84	133.44
Quarts 12/case	166.00	188.54	129.00	171.12	163.90	152.34	189.00	120.00-264.00	169.10	4.70	176.47	160.11
Pints 12/case	100.00	116.00	77.33	98.86	101.40	56.64	96.00	17.28-180.00	95.00	5.28	101.54	96.21
RETAIL SHELF PRICES												
1/2#	6.26	5.68	5.98	5.25	5.10	-	-	3.50-9.50	5.90	11.79	5.72	5.44
12 oz. Plastic	7.76	6.76	7.41	6.32	5.84	4.95	5.90	3.40-12.00	6.89	9.19	6.82	6.29
1# Glass/Plastic	9.84	8.92	10.07	7.78	8.13	6.66	8.00	5.00-16.00	9.05	9.05	9.06	8.30
2# Glass/Plastic	16.80	16.63	17.31	13.80	12.67	-	16.50	8.55-30.00	16.14	8.07	15.72	13.54
Pint	13.75	12.29	10.27	12.60	12.15	10.16	9.60	4.99-24.00	11.97	7.98	12.09	11.08
Quart	23.44	19.77	18.64	20.83	21.33	15.66	21.40	9.49-42.00	20.50	6.83	20.95	18.80
5# Glass/Plastic	34.26	37.60	45.11	28.40	29.93	17.99	-	17.99-75.00	34.08	6.82	32.19	29.27
1# Cream	11.99	8.85	9.00	9.36	8.68	9.00	-	7.00-20.00	10.21	10.21	11.94	9.38
1# Cut Comb	14.22	13.66	15.75	12.00	10.00	-	-	8.00-28.00	13.73	13.73	14.43	12.63
Ross Round	10.00	4.58	-	10.00	-	-	13.75	6.50-15.00	10.16	13.54	15.37	10.71
Wholesale Wax (Lt)	8.07	7.21	7.17	7.46	6.17	4.50	4.00	3.00-17.00	7.08	-	7.58	6.75
Wholesale Wax (Dk)	6.63	5.95	4.75	4.50	6.00	3.00	6.00	2.00-15.00	5.87	-	6.73	6.16
Pollination Fee/Col.	77.86	69.40	105.00	95.00	80.00	-	125.00	40.00-200.00	85.89	-	103.82	88.29

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.

The American Honey Producers Association continues to work diligently along with Sioux Honey Association and legal counsel on the Raw Honey Anti-Dumping Duty Orders case. The final vote is scheduled for May 11th at 11 am. The final hearing was on April 12th and transcripts are publicly available.

Chris Hiatt, President of American Honey Producers, Matt Halbgewach, Executive Committee, American Honey Producers, Ron Spears, president of Mountain Avenue Bees, Alex Blumenthal, CEO Sioux Honey Association, Craig Rodenberg, Vice-President, Honeyland Honey and others gave testimony regarding honey production, rising expenses, and recent falling raw honey prices. Following testimony, United States International Trade Committee (USITC) members questioned witnesses and counsel regarding the honey production business and details of the case supporting anti-dumping duty orders. Following the testimony and questions to Petitioners, testimony was heard by opposition to the anti-dumping duty orders and questions from the USITC members. Much of the opposition's testimony focused on the uniqueness of Vietnamese honey and its importance to the ingredient food market. Alan Luberda and Kathleen Cannon, both of Kelley Drye and Warren LLP gave opening and closing remarks respectively on behalf of petitioners. The hearing lasted over eight hours nearly evenly divided between petitioners and opposition. Various data sources show honey prices are rising which is a leading indicator that the initial rulings on the case are already working as intended. Many leaders of the honey industry have spent countless hours and contributed generous amounts monetarily to this effort. To join this effort by making donations to cover the ongoing legal fees, visit **www.ahpanet.com** or contact Cassie Cox **cassie@ahpanet.com**

The Value of the Industry to

Originally printed in BioAg World Digest.

This is 2022 and at the end of the day it's all about data/numbers, isn't it? Two hundred years ago, one billion people were on the earth according to **ourworldindata.org**.

As I write this, according to the U.S. Census Bureau, the population of the U.S. has 332,479,038 hungry people with a net gain of one person every 38 seconds. The world population is 7,875,805,340 and growing. The UN is forecasting that by 2050, the world population will be 9,735,033,900.

The UN estimates that 68% of the global population is in urban areas. That is a lot of people who require housing, electricity, transportation, water, sewage disposal and regular meals. Cityscapes are resource 'black holes,' however they are also the most efficient way to "house" people.

That means as populations increase, spread out and absorb agricultural areas, the remaining arable earth must exhibit phenomenal efficiency accompanied by parallel production agriculture crop protection accompanied by food safety. Considering all these factors as well as the "wild card" of climate change, finding a market while growing sales will become increasingly more challenging.

That is where bioag can play a significant positive role.

I am a beekeeper. Honey bees are a masterpiece of nature. As a result of my love and fascination of them, I have been associated with managed honey bees and the beekeeping industry while active in business, government, and media.

Here are some facts about the value of managed honey bees:

"Many of our fruits, vegetables, and nuts are reliant upon pollinators for their production. In fact, without pollinators, 70% of plants would be unable to reproduce or provide food. According to the United Nations Environment Programme, of the 100 crop varieties that provide 90% of the world's food, 71 are pollinated by bees. In North America, honey bees alone pollinate nearly 95 kinds of fruits, such as almonds, avocados, cranberries, and apples, in addition to commodity crops like soy. The health of pollinators is directly linked to food security. Pollination services are a core component of global agricultural production. In the U.S., the value of pollination services is estimated to be $20-30 billion annually."
~'Impacts on Food Supply,' Center for Food Safety

"Three out of four crops across the globe producing fruits or seeds for human use, as food, depend at least in part, on pollinators.

Improving pollinator density and diversity boosts crop yields – pollinators affect 35 percent of global agricultural land, supporting the production of 87 of the leading food crops worldwide.

Pollinator-dependent food products contribute to healthy diets and nutrition.

Safeguarding bees safeguards biodiversity: the vast majority of pollinators are wild, including over 20,000 species of bees.

FAO plays a leading role in facilitating and coordinating the International Pollinators Initiative 2.0."
~UN FAO, 'Why Bees Matter'

"Many areas of agriculture depend on pollinators. Scientists estimate that 200,000 - 350,000 different animal species help with pollination, from birds to bats, marsupials to monarch butterflies. But when it comes to the majority of crops around our globe, we have honey bees to thank. Pollinators are critical to the food system as we know it, but can we quantify their value? It turns out, maybe we can.

Every season, pollination from honey bees, native bees, and flies deliver billions of dollars (U.S.) in economic value. Between $235 and $577 billion (U.S.) worth of annual global food production relies on their contribution. With such an impact on the economy, it begs the question: if these critical insects were public companies, how might they stack up in the global marketplace?

Managed honey bees are the most valuable pollinators in terms of agricultural economics. These hyper efficient insects can provide pollination to virtually any crop. Almonds, for example, are almost entirely dependent upon honey bee pollination. Without honey bees, the harvest of blueberries, squash, watermelon, and other fruits would be greatly reduced, driving up prices and disrupting the marketplace. According to the USDA, one colony of honey bees is worth 100 times more to the community than to the beekeeper — meaning the value they deliver extends well beyond their actual price. Honey is more than just a by-product of pollination. This sweet nectar serves as an economic driver in its own right. Used commercially for food, skin creams, anti-aging lotions, and medical wound dressings, over 160 million pounds of honey are produced each year in the U.S. alone. In 2013, the honey crop was valued at over $300 million (U.S.).

Beeswax produced by these insects is used for candles, carpentry, lip balm and other cosmetic products while pollen is valued for medicinal purposes. Propolis, a resinous sealant created by bees to construct

From the Editor, Jerry Hayes

Beekeeping Agriculture

and protect the bees from bacteria and fungi, serves as a varnish for stringed musical instruments, and in some countries a toothpaste or mouthwash.

Agricultural leaders understand both the economic and ecological importance of pollinators. Each season these insects provide a service that boosts harvest size and quality, creates value for farmers, and drives the global food supply. It's hard to imagine an ecosystem without them.

Without pollinators, more than 39 different crops would see a decline in production. In order to meet demand, farmers would be forced to pursue more intensive and less environmentally sustainable practices. More land would likely be needed to match current production levels. Farming these greater land masses would result in greater carbon emissions from the increased operation of tractors and other machinery. And by expanding the physical footprint of farms, organisms in wild habitats would risk being displaced or disrupted.

These tiny insects play a large role in the preservation of our ecosystem and economy, helping agriculture grow enough while using fewer natural resources."
~Forbes, 'The Value of Pollinators To The Ecosystem and Our Economy'

There it is.

I am going to assume that you have been aware of the pest, parasite, disease, and environmental stressors that managed honey bees have had for the last three decades or so. This starts with the introduction of *varroa* mites to the United States in 1987 and Colony Collapse Disorder or CCD, described in 2006.

At that time, I was the Chief of the Apiary Section for the Florida Dept. of Agriculture and Consumer Services. Beekeepers reported these unusual honey bee colony deaths in Florida to me. I remember being on a call late one night with representatives from USDA, Universities, State Government and other entities. We didn't know what was causing these deaths, so we named it Colony Collapse Disorder – a disorder because we had no clue as to the reason.

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What we learned was that the invasive honey bee parasitic mite, *Varroa destructor*, was one of the prime causes. As the parasitic *Varroa* mite fed on all life stages of the honey bee, it also vectored damaging viruses.

The only control option, at that time (and even now) are pesticides introduced into the honey bee colony to try to kill or damage a "little bug" (*varroa*) on a "big bug" (honey bee). The "dose makes the poison," so these *varroa*cides are dosed to impact the *Varroa* mite but not show "acute damage" to the honey bees. But collateral damage has been noted from residues in the colony overtime. Unfortunately, we as beekeepers have no choice. If *Varroa* mites are left uncontrolled, colonies will be dead in 18 months as they continue to weaken from the effects of the parasites. Diseases and secondary pests also plague colonies making honey bee management post 1987 much more difficult than before.

The Bee Informed Partnership (BIP) conducts an annual survey of managed honey bee colony losses. Here is the latest from their report.

"Over the entire year (1 April 2020 – 1 April 2021), beekeepers in the United States lost an estimated 45.5% of their managed honey bee colonies. This is the second highest annual loss on record, 1.8 pp higher than last year's estimated annual loss (43.7%), and a 6.1 pp increase over the average loss rate (39.4%) over the last 10 years."

~ Bee Informed

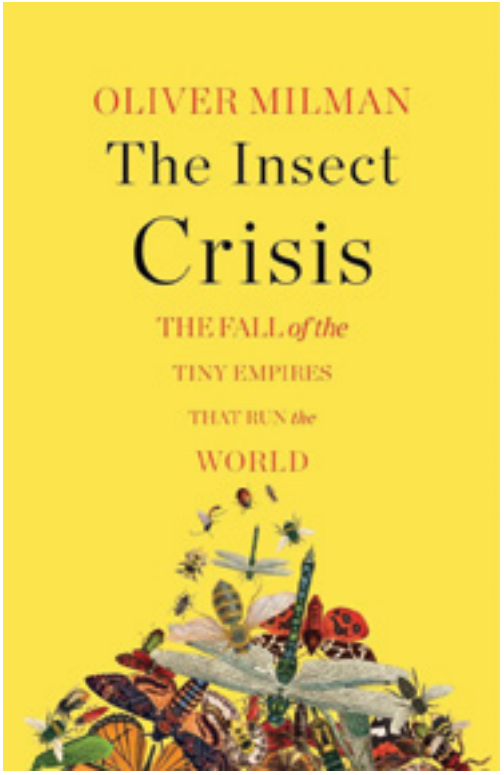
Let's say you are in production agriculture. And let's fantasize that you are fighting uncontrolled pests, parasites, diseases and environmental inputs causing you to lose 40% of 'your crop' every year. Think about it. Imagine losing 40% of a herd of cattle or 40% of your yield of corn, 40% of fruit production. What would you do? Who would you reach out to?

This is where bioag solutions can positively help the situation, resulting on an increased awareness and willingness to collaborate with beekeepers. The value of managed honey bees as the only viable pollinator for production agriculture, has been devalued for too long.

The managed beekeeping industry needs you – it is critical for you and them. Many organizations have made attempts to bridge gaps in understanding between the beekeeping industry, big ag, government agencies and the public but consistent, sustainable momentum has been missing. If we all work together, we can make beekeeping and pollinator dependent agriculture more successful – and more biologically friendly – for the long term. BC

Book Review

By: Dewey Caron



Every three of four living species on our planet is an insect. And several recent studies say they are in trouble. Oliver Millman, a journalist with the Guardian Newspaper (UK), documents the why and wherefor of their plight In *The Insect Crisis The Fall of the Tiny Empires that Run the World.* Norton ISBN 978-1-324-00659-6

Millman starts his third paragraph "…a torrent of recent findings have pointed to major declines in the abundance and species diversity of insects in places around the world." He then documents studies to support this statement. For the majority of humans, most of who are adverse to "bugs," that might be news to celebrate. As beekeepers, however, we know our beloved honey bees are suffering unsustainable annual colony losses (>40% per the BeeInformed survey). But the insect crises is more than just honey bees and pollinating insects. Millman thoroughly but interestingly weaves the insect apocalypse story.

If you are new to bees you will appreciate the coverage of Chapter 6, The Labour of Honeybees. In 28 pages, the longest chapter after a chapter discussion of pesticides, Millman discusses how almonds came to dominate California's Central Valley and our beekeeping. At just under 1.2 million acres, U.S. growers produce 80% of the worldwide product. To do so, almond growers need honey bees at the rate of two colonies per acre. The "Superbowl of Beekeeping" sucks up 85% of all the available managed bee hives. All those colonies in one small area, early in the bee growth phrase, means extreme stress and is ideal for transmission of harmful pests and pathogens.

Chapter 6 also discusses CCD, its beginnings in 2006, and how this calamity was a turning point in governmental recognition and support for the honey bee. Why and how we need to aggressively fight mites to reduce their transmission of viruses that cause sudden losses to our managed colonies, is also thoroughly covered. But this chapter, and the other eight chapters, are more than just an accounting of our state of knowledge of how factors such as climate change, habitat loss, modern agriculture practices and other factors are reducing insect, including pollinator, populations. The author "talks" with knowledgeable authorities and his chapters populate a human perspective to the crises of bees and their relatives.

In the chapter on honey bees for example, he mentions his conversations with over a dozen beekeepers, bee scientists and specialists in the field. He includes individuals such Alex Zomcheck (EAS Divelbiss 2017 Award winner), Denise Qualls (an almond bee colony broker) and George Hansen (past president of American Beekeeping Federation (ABF), an Oregon commercial beekeeper and almond (and other crop) pollinator). The author recounts how he donned a bee suit to examine healthy bee hives at the Beltsville Bee Lab with Bee Scientist Jay Evans. They all help give a human voice to the story.

New beekeepers will also appreciate the chapter on Pesticides. Millman takes us, following along with Doug Tallamy, for a ride across the agricultural landscape to explain how alien and unsupportive the habitat is to butterflies and bees. He then continues to document studies that support how changing agriculture and its increasing reliance on pesticides is harming pollinators. This chapter, as well as all the others, includes documentation from peer reviewed publications, BBC news coverage and popular press stories. The honey bee chapter (which includes other bees such as bumble and mining bees) has 26 references for example to allow us to dig further into topics of particular interest.

My personal favorite, besides the bees, was Millman's Chapter 7 on Monarch butterflies. We can easily follow his conversations with Art Shapiro, UC Davis Evolutionary biologist and world renowned butterfly expert. We quickly learn of the marvelous migratory habits of the Monarch. We even have an introduction to Cuauhtémoc Sáenz-Romero, as the author joins him to climb to the two mile high Oyamel fir forests of the Chincua sanctuary in central Mexico to view the clumped overwintering butterflies. A lofty adventure indeed, once one gets their breath.

In the words of May Berenbaum, renowned University of Illinois Entomologist, what we need is "an inaction plan." Do we have time to sit back and let nature, with its tiny empires of insects, have a chance against our assault on them? If you love your bees, and can tolerate insects, this book will serve as a call to arms – time for an inaction plan is now.

Drizzle

Mark Winston

I led a research laboratory for 35 years at Simon Fraser University (SFU), running around 200 honey bee colonies at our peak. Besides data, we also produced many thousands of pounds a year of pretty good honey. Don't take my word for it; our customers would call as early as May or June to line up for the honey we harvested in August and sold in September.

Why the strong customer base? For one thing, it was excellent honey. Never heated or filtered (both processes drive off aromatics and flavor), our honey was collected from a delightful mix of wildflower nectar that blended into an exquisite taste. The proceeds from honey sales went to support graduate students, and we dropped off quite a few cases to food banks on and off campus.

We had a brand, Heavenly Honey, and a distinctive hand-drawn label on each jar. I traded my barber four jars of honey for a haircut, and soon many of his customers were clamoring to buy a few jars. We gave jars away to anyone at the university who had helped us over that past year, from the President to the cheerful women with Italian accents who made specialty sandwiches at the SFU cafeteria, to the staff who cleaned our lab. Those free jars quickly translated into a wide customer base from the colleagues and friends and families of those who received their annual free jar.

I've always been attracted to smaller-scale, artisanal beekeeping, and to small batches of carefully curated honey that come with a story about the beekeepers and the land from which it was harvested. Thus, it's not surprising that I was intrigued when I recently came across **Drizzle**, a Canadian honey marketing firm out of Calgary, Alberta.

Drizzle was founded by backyard urban beekeeper Aja Horsley. She was working as an urban agriculture researcher in Calgary; one of her projects involved rooftop beekeeping for culinary honey. As she notes on their website, Drizzle was inspired because "*I believe in responsibly producing honey while also creating a collection of the highest quality raw honey products.*"

She saw a potential market for raw honey and started the Drizzle brand, initially selling honey from other urban beekeepers but eventually expanding to bottle and market honey produced by rural beekeepers in a manner consistent with her values for sustainable beekeeping

Drizzle's branding and marketing are brilliant, much more sophisticated than our Heavenly Honey marketing, focused on specific but broad subsets of consumers, particularly those concerned with sustainability and personal health. Their client base appreciates food that is perceived as high quality rather than mass-produced, and comes with details and stories of terroir: the soil, weather, climate and people that make each bottle of honey unique. Drizzle wants to make us feel good about buying their honeys: "*Better for you, better for your cooking, and better for the planet. Elevate your table with deliciously raw, superfood powered honey while helping honey bees thrive.*"

What makes Drizzle honey better than the typical packaged honey found on North American supermarket shelves? Drizzle tells us on their website that their honey is "natural," "raw," "unheated," "unfiltered," and "gluten-free," terms that resonate with consumers interested in quality assurance and superior products.

"Natural," is one term with little meaning at the hive, since all honey produced from floral nectar is natural. But it does have a compelling relevance once honey is packaged for sale. In recent years we've seen epidemics of honey adulterated with corn syrup and other sweeteners, and imported honey with detectable levels of banned pesticides. Indeed, the largest food fraud case in U.S. history had to do with adulterated honey imported primarily from China, and bottled and sold by American honey packers. Assurances that Drizzle's honey really is honey is of great value to careful consumers.

"Raw, unheated and unfiltered" are substantive terms that are better defined, and may indeed translate into better tasting and more healthful honey. "Raw" simply means the honey is as found in a bee hive. After being removed from the hive, raw honey hasn't been heated or heavily filtered, although it may be strained to take out debris and air bubbles. Most commercial honeys are processed with both heating and filtering, and Drizzle's marketing appeals to consumers who believe that raw honey has more taste and heightened health properties compared to processed honey.

Heating drives off some of the aromatic compounds that give each honey its distinctive taste and smell, and so consumers eating raw honey will have a more flavorful experience. Filtering does remove pollen, and while honey is not full of pollen, it does contain some unless it's been highly filtered, and that pollen may contribute to the taste and nutritional quality of the honey.

Health claims around raw honey are difficult to prove, but the rationale for raw honey being healthier is that it contains minerals, enzymes, vitamins and antioxidants, nutrients that are reduced or eliminated when honey is heated and filtered. Here we run into the conundrum that characterizes many claims for bee products: there's not been a lot of rigorous science directly linking honey and health, but there is considerable folk wisdom and passionate believers in the healthful qualities of raw honey.

As to gluten free: well, that's just clever marketing. Honey doesn't contain gluten, unless it's been contaminated. The Drizzle marketeers are recognizing a fad among many of today's consumers who avoid gluten, not only because of celiac disease but also due to an allergy or sensitivity. And Drizzle also points out that their honey is non-GMO, a term that reas-

sures consumers concerned about genetically modified organisms.

Drizzle also attracts another particular swath of consumers, those for whom "local" and "sustainable" are important. It's a Canadian company, and they make a point of advertising that their honey is "Canadian Made," and carries a sustainable designation by the **Certified B** corporation that certifies products that "*meet the highest standards of social and environmental impact.*" The details of what Drizzle considers sustainable beekeeping are vague on their website, but include honey sourced from "*honey pastures*" that are remote, and away from pesticides.

Drizzle is also certified Kosher, which opens up an additional market. A niche, perhaps, but yet another example of how certification to attract a specific clientele can add to the sales potential of a product.

Their final level of certification is as a female founded and run enterprise, with two certifiers, **WBE Canada** and **Women owned**. Beekeeping in general has seen an increasing frequency of women involved at all levels over the last few decades, a trend worth celebrating, and again a profile for Drizzle viewed favorably by a specific set of consumers.

Drizzle has not only taken the artisanal route in the honey they market, but made the decision to brand their honey away from the general market and towards specific, albeit still broad, subsets of consumers. Their brand may turn off some sets of consumers, but is highly attractive to those who are health and sustainability conscious, gluten avoiders, and those favorable to gender equality. Drizzle's advertising appeals to all these segments.

Of course, their honey will ultimately rise or fall on quality. Marketing may stimulate the first purchase, but at the high price point their honey retails at, it's going to have to satisfy more than just friendliness towards their brand. Drizzle's Golden Brand honey sells online at $13.40 (U.S.)/lb., considerably pricier than most non-specialty retail honeys in the United States.

So how tasty is Drizzle honey? Well, it's pretty darned good, flavorful and aromatic. I ordered their Golden and White honeys, both of which arrived crystallized, with nicely designed labels, and with flavor-specific suggestions for pairing with other foods. The White is "*a floral, delicate raw honey that is buttery in texture and perfectly paired with fresh, light flavours of fruit, lattes, and warm bread.*" The Golden is a "*rich, bold, raw honey perfectly paired with daring flavours like hot sauce, aged cheese or a cup of strong coffee.*"

Apparently others agree. Drizzle now has 650 retailers across Canada, has been profiled in numerous print outlets from airline to food magazines and was successful at attracting an investment from Dragon's Den entrepreneur Arlene Dickinson.

Drizzle offers a pathway for those who want to get off the treadmill of industrially produced honey, and on to the slower but perhaps as profitable a market for artisanal honey with an identified brand.

Think about it: What's special about your honey, and how can you add value through focused marketing? Honey, after all, is way more than just a carrier for sugars. Let's make honey the high-end product it deserves to be.

Mark L. Winston is a Professor and Senior Fellow at Simon Fraser University's Centre for Dialogue. His most recent books have won numerous awards, including a Governor General's Literary Award for *Bee Time: Lessons from the Hive*, and an Independent Publisher's Gold Medal for *Listening to the Bees*, co-authored with poet Renee Sarojini Saklikar.

Image Gallery
Swarms


Submitted by Steve Sweet


Both images are from the same swarm! (So is the cover!)
Submitted by Lynda Bracken


Submitted by Jonathan Hancock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Bee Swarm 04/20/2017, horizontal limb.
Submitted by Dennis Whetzel


Monster swarm
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FOUND IN TRANSLATION

Protein Sources and Colony Growth

Jay Evans, USDA Beltsville Bee Lab

Hopefully those in the Northern hemisphere have your bees situated so they are taking advantage of this month's bounty of flowers. Bees have evolved with, and driven the evolution of, flowers and honey bees and generally know when and how to harvest the good stuff those flowers produce. In ideal conditions your bees are surrounded by diverse, untainted flowers and resources. This is especially important thanks to the many components of natural pollen, which provides not just body-building protein but bee requirements from plant chemicals to fatty acids and micronutrients. A recent openly available review from Maciej Sylwester Bryś and colleagues in Poland ("Pollen Diet—Properties and Impact on a Bee Colony", 2022, *Insects*, **https://doi.org/10.3390/insects12090798**) hits the key points in the search for beneficial pollens. They end with ,"*While single species pollen has specific benefits, bees require pollen from diverse sources to maintain a healthy physiology and hive. Multipollen diet should be offered to the bees to derive requisite benefits and at the same time be secure of the colony requirements."* These pollen sources might be gathered over time as new plant species come into flower and others fade, leading to a mixed cupboard in the hive. While I do not know of evidence for this, it would be nice to know if bees, like us humans, draw from different parts of this cupboard for each 'meal', to make sure they are getting a range of diversity for their own needs and those of their offspring.

But what happens if your bees aren't lucky enough to live in a utopia of diverse flowers, or have not been able to store sufficient pollen when that window was open. Also, most of us live in highly seasonal climates and there is often a desire to supplement our bees either for our needs (i.e., fast growth for splits as well as larger workforces for pollination contracts or honey gathering) or the bees' needs (perhaps when bad weather or post-Winter weakness might conspire to make colonies miss key flowering events altogether).

Three recent papers tackle some of the current options available to beekeepers to give their colonies a boost, via natural pollen supplements or other sources of nutrients. I have no interest in recommending particular products, but appreciated the research insights into how honey bees convert specific supplements into new, healthy offspring. Shelley Hoover and colleagues in Alberta describe a three-year field study of bee feed supplements in their study "Consumption of Supplemental Spring Protein Feeds by Western Honey Bee (Hymenoptera: Apidae) Colonies: Effects on Colony Growth and Pollination Potential" (2022, *Journal of Economic Entomology,* **https://doi.org/10.1093/jee/toac006**). They gathered and scored colonies immediately after Winter storage and fed them feeds containing pollen or alternate protein sources (versions of Bee Pollen-Ate, FeedBee, Global Patty and Healthy Bees). With or without pollen, the feed supplements had protein ratios similar to natural pollen and many of the other diet needs reflected in pollen, albeit with shifts in relative amino acid abundance. All supplements were consumed readily, although FeedBee was taken at slightly lower rates. Interestingly, a 'Trio' of three protein supplements that perhaps better mimics a multifloral resource was consumed preferentially to single-type diets, to the tune of over 1,792 grams in five weeks versus the next-favored patty (Global Patty 15%, 1,379 grams). In the end, these consumption rates did not necessarily predict impacts on colony health and all diets were palatable. Here, the tested supplements indeed showed their worth relative to control colonies fed only sugar. The pollen-based diets did better across the three years than others, under local conditions, indicating they can provide bees an early season boost over natural forage, as advertised.

Vincent Ricigliano and colleagues carried out a feed supplement trial across the dearth season of a U.S. commercial beekeeping operation, a

key consumer group for bees and agriculture ("Effects of different artificial diets on commercial honey bee colony performance, health biomarkers, and gut microbiota" *BMC Veterinary Research* (2022) 18:52; **https://doi.org/10.1186/s12917-022-03151-5**). These trials started with 144 equivalent Californian colonies which were provided supplemental patties starting in August for a total of 12 times over the course of the subsequent months. The goal was to see how treated and supplemented colonies looked prior to the next year's almond pollination event, in apiaries not blessed with great natural forage over the measured time period. Two of the tested supplements held natural pollen (Global and 'Homebrew') while the rest used alternate protein sources (Ultra Bee, Bulk Soft, MegaBee™, AP23, and Healthy Bees™). All supplements had protein ratios within range of natural pollens (15-20%). Nevertheless, they differed significantly from natural pollen and from each other in key components including the ratios of specific essential amino acids and lipid levels. All diets were consumed equally well at the first feedings, although some were eaten less readily as the experiment continued. Six months later, in preparation for almond pollination, there were strong differences in colony strength based both on which of three apiary locations a colony had been placed into and the supplemental diet provided. While the apiary differences highlight the complexities of working with field colonies, the diet results give insights into the effectiveness of specific supplements in at least one part of the world.

Emily Noordyke and colleagues focused on the effects of late-season protein supplementation on colony survival in part of a mild Florida Winter ("Evaluating the strength of western honey bee (*Apis mellifera* L.) colonies fed pollen substitutes over Winter," 2021: *Journal of Applied Entomology*; DOI: 10.1111/jen.12957. Experiments were started in November with supplementation via two commercial protein supplements (Api23 or Megabee) compared to a non-supplemented control set of colonies. Experimental colonies faced an environment with diminished natural pollen and were further stressed by pollen traps. Both supplements led to stronger colonies (less weight loss) than those not receiving supplements, although the results were only significant for Api23. Brood mass was higher in both supplemental cohorts than in the controls.

These colony-level and season-relevant experiments show the benefits of protein supplements in times of dearth. For now, your bees are hopefully getting the bounty of great flowers and are building for splits and healthy long-lived foragers now and into the Fall.

A Closer Look

Oxalic Acid *Varroa* Mite Control

Clarence Collison

Numerous studies have investigated using oxalic acid to control Varroa *mites*

In order to get a potential acaricide registered and legal to use in the beekeeping industry, it takes several years of research to show that it is not hazardous to humans and safe to the environment, does not leave residues within the products of the hive, is not harmful to bees and brood and is effective against the target pest, in this case *varroa* mites. Besides the safety factors, it has to be determined how it will be most effectively applied to the pest population, what dosages are efficacious and what conditions may limit the effectiveness of the product. One difficulty associated with oxalic acid, was the finding that the acid does not penetrate brood cell cappings. Unfortunately, during active brood rearing in the colony, from ½ to ⅔ of the mites are found in capped brood cells. In addition, it was found that oxalic acid can be detrimental to larvae in open brood cells. Therefore, this treatment is most effective when the colony is broodless.

In the past two decades, the parasitic mite *Varroa destructor* has become harder to control with synthetic acaricide chemicals due to genetic resistance. Toufailia et al. (2015) determined the efficacy of the natural chemical oxalic acid (OA) in killing phoretic mites on adult worker bees under field conditions in southern England. They compared three OA application methods (trickling, spraying, and sublimation) at three or four (sublimation) doses, using 110 broodless colonies in early January 2013. Treatment efficacy was assessed by extracting mites from samples of c. 270 worker bees collected immediately before and 10 days after treatment. All three methods could give high *varroa* mortality, c. 93-95%, using 2.25 g OA per colony. However, sublimation was superior as it gave higher mortality at lower doses (.56 or 1.125 g per colony: trickling 20, 57% mortality; spraying 25, 86%; sublimation 81, 97%). Sublimation using 2.25 g of OA also resulted in three and 12 times less worker bee mortality in the 10 days after application than either trickling or spraying, respectively, and lower colony mortality four months later in mid Spring. Colonies treated via sublimation also had greater brood area four months later than colonies treated via trickling, spraying, or control colonies. A second trial in December 2013 treated 89 broodless colonies with 2.25 g OA via sublimation to confirm the previous results. *Varroa* mortality was 97.6% and 87 (98%) of the colonies survived until Spring. This confirms that applying OA via sublimation in broodless honey bee colonies in Winter is a highly effective way of controlling *V. destructor* and causes no harm to the colonies.

Laboratory bioassays were performed to characterize the acute contact toxicity of oxalic acid (OA) to *varroa* mites and their honey bee hosts. Specifically, glass-vial residual bioassays were conducted to determine the lethal concentration of OA for *V. destructor*, and topical applications of OA in acetone were conducted to determine the lethal dose for honey bees. The results indicate that OA has a low acute toxicity to honey bees and a high acute toxicity to mites. The toxicity data will help guide scientists in delivering optimum dosages of OA to the parasite and its host and will be useful in making treatment recommendations. The data will also facilitate future comparisons of toxicity if mite resistance to OA becomes evident (Aliano et al. 2006).

Jack et al. (2020) tested the efficacy of oxalic acid (OA) vaporization and brood interruption in controlling *varroa* mites. Sixty experimental colonies were randomly assigned to one of six treatments with 10 colonies per group. The six treatments were: 1) OA applied once, 2) OA applied three times, 3) brood interruption, 4) OA applied once + brood interruption 5) OA applied three times + brood interruption, and 6) no OA or brood interruption. The OA was applied via vaporization, with each application being one gram OA applied through the hive entrance (label rate), on the bottom board. Brood interruption was accomplished by caging a colony's queen in a queen cage for a period of 24 days. An additional 10 colonies were treated with amitraz (Apivar – positive control). *Varroa* mite levels were estimated before, during, and after treatment applications using sticky boards left in colonies for three days. Their data suggests that queen caging to achieve brood interruption during the Fall season can negatively impact colony strength and survival. They observed high colony mortality in some treatments, despite diligent colony management to alleviate the side

effects of the treatments. Colonies treated with amitraz were healthier and had better survival than those treated with OA vaporization. In conclusion, OA and/or brood interruption did not provide sufficient *Varroa* control.

Few studies of honey bee colonies exist where *varroa* mite control is achieved by integrating broodless conditions, through either total brood removal or queen caging, in combination with oxalic acid (OA) applications. Gregorc et al. (2017) observed significant *varroa* mortality after total brood removal or caging the queens and OA applications in broodless colonies, as well as in colonies with brood that received four consecutive OA applications. In laboratory tests, they recorded higher mortality of caged bees exposed to Apistan® compared to oxalic acid or untreated control bees. However, this mortality is not believed to negatively impact the colony. They therefore recommend combining OA applications with artificial broodless colony conditions achieved either by brood removal or queen caging as an effective management strategy for *varroa* mites.

Papežiková et al. (2017) studied the effect of oxalic acid on isolated *varroa* mites and on *varroa* mites parasitizing caged honey bees treated with oxalic acid *per os* or topically (by trickling or by sublimation). They also studied the effect of oxalic acid (trickling and sublimation) on individual bees, focusing on their lifespan, midgut morphology and function, and Malpighian tubule morphology. Effect on mites: contact of isolated mites with oxalic acid coated surface (Petri dishes treated by sublimation) significantly decreased mite viability. In an experiment on *varroa* mites parasitizing caged bees treated with oxalic acid, the strongest acaricidal effect was observed following oral application and the lowest when oxalic acid was applied through sublimation. Effect on bees: oxalic acid applied by sublimation did not decrease bee lifespan over the 21 days of observation contrary to trickling, where a nonsignificant lifespan decrease was observed. Topical application of oxalic acid increased the rate of midgut cell apoptosis, with a stronger statistically significant effect seen in the group treated by trickling. However, neither trickling nor sublimation caused epithelial destruction in the midgut and Malpighian tubules or loss of digestive tract function.

The effects of oxalic acid administered by the trickling method on brood development of honey bee colonies were evaluated (a) by observing the development of marked cells of young (< three days old) and old (> three days old) larvae, and (b) by measuring the area of open brood for several weeks post application. Oxalic acid, dissolved in a 50% sugar solution, with an end concentration of 3% w/ oxalic acid, was applied twice by the trickling method during Summer to 10 colonies. A high percentage of young (12.6% and 9.5%) and old honey bee larvae (10.6% and 5.6%) were removed from their cells after the first and second oxalic acid applications, respectively. The surface of the open brood area was also reduced by 17.5% after the two oxalic acid applications and stayed low for about two months. For the same period of time the open brood area in 10 control colonies increased by 34.5%. The two oxalic acid applications removed 60 ± 12% of *varroa* mites adhering to adult honey bees, while the natural fall of mites measured in control colonies (for a period of 40 days) was 32 ± 4%. Combining the detrimental effect on brood development with the low relative effectiveness on *varroa* removal, oxalic acid application by the trickling method when open brood is present is not as safe as has been regarded in the past. Consideration needs to be given to the use of different sugar and oxalic acid concentrations in the treatment solution in order to minimize its adverse effects on open brood (Hatjina and Haristos 2005).

Two oxalic acid treatments were given to five colonies in Autumn and five colonies in Spring. In each treatment, colonies were treated every seven days for four weeks with a 3% sprayed oxalic acid. Another five colonies in each season served as controls and were sprayed only with water. Efficacy of oxalic acid in Autumn was 94% and in Spring was 73%. A long-term study of the colonies for three to four months after the last application of oxalic acid showed a statistically significant negative effect of the acid on brood development. In addition, three queens died in the treated colonies (Higes et al. 1999).

An organic product based on oxalic acid was evaluated for use in *Varroa* mite control under Spring/Summer climatic conditions in Argentina. The formulation consists of four strips made of cellulose impregnated with a solution based on oxalic acid. Forty-eight beehives were used to assess the product efficacy. Residues of the product were also tested in honey, bees, and wax. Each trial had respective control groups without oxalic treatment. At the beginning of the experiment, four strips of the formulation were applied to the colonies belonging to the treated group. Falling mites were counted after 7, 14, 21, 28, 35 and 42 days. After the last count, the strips were removed and colonies received two flumethrin strips for 45 days. Falling mites were counted throughout this period. Average efficacy of the organic product was 93.1% with low variability. This product is an organic treatment designed for *Varroa* control during brood presence and represents a good alternative to the synthetic treatments (Maggi et al. 2016).

Since *varroa* mites are now resistant to synthetic acaricides worldwide, oxalic acid was suggested as an alternative for *Varroa* control. Oxalic acid is one of the most common natural miticides used against varroosis by spraying and sublimation administration techniques. It is a natural constituent of honey, very active against the *Varroa* mite, safe to use for beekeepers, and has no residue problems. Nevertheless, some authors have predicted that the risk of developing resistance to oxalic acid in mites is high. The objective of this research was to assess the susceptibility to oxalic acid of a *V. destruc-*

tor population belonging to a commercial apiary where 64 consecutive control treatments with this acid were performed. Bioassays to assess the oxalic acid susceptibility were performed on two mite populations: (1) a 'focal' population consisting of mites previously exposed to oxalic acid treatments, and (2) a 'naïve' population that was never exposed to this acid, which allows setting a reference in the absence of historical data on our 'focal' mites. The results reported here suggest that the *Varroa* population exposed during eight successive years to oxalic acid treatments remains susceptible to this acid (Maggi et al. 2017).

Numerous studies have investigated using oxalic acid (OA) to control *Varroa* mites in honey bee colonies. In contrast, techniques for treating package bees with OA have not been investigated. The goal of Aliano and Ellis (2009) was to develop a protocol for using OA to reduce mite infestation in package bees. They made 97 mini packages of *Varroa*-infested adult bees. Each package contained 1,613 ± 18 bees and 92 ± 3 mites, and represented an experimental unit. They prepared a 2.8% solution of OA by mixing 35 g OA with one liter of sugar water (sugar:water = 1:1; w:w). Eight treatments were assigned to the packages based on previous laboratory bioassays that characterized the acute contact toxicity of OA to mites and bees. They administered the treatments by spraying the OA solution directly on the bees through the mesh screen cage using a pressurized air brush and quantified mite and bee mortality over a 10-day period. Their results support applying an optimum volume of 3.0 ml of a 2.8% OA solution per 1,000 bees to packages for effective mite control with minimal adult bee mortality. The outcome of their research provides beekeepers and package bee shippers guidance for using OA to reduce mite populations in package bees.

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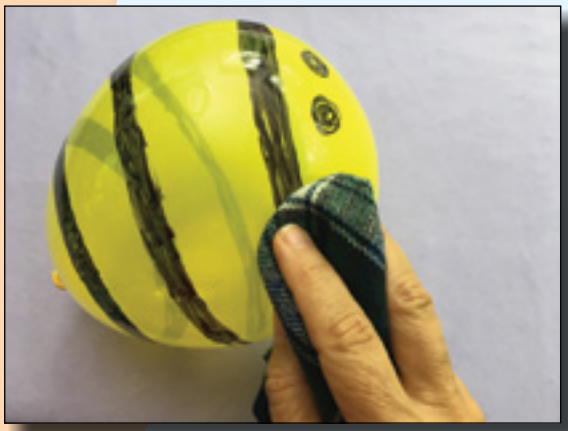
All The Buzzzz in...ooo

Hello Friends,
Enjoy the outdoors this summer!
Bee B.Queen

Bee B. Queen Challenge

Draw a picture and share it with me!

Charged Pollination



Bees bump into dust and small particles while flying. The friction removes electrons from the surface of the bee's body creating a positively charged bee. Flowers tend to have a negative charge. Since opposite charges attract, the pollen can "jump" from the negatively charged flower to the positively charged bee. Illustrate this process by using a balloon, pepper and static electricity.

You Will Need

- photograph of a flower
- paper plate
- balloon, round
- pepper
- black permanent marker, optional

Directions

1. Place a photograph of a flower on a paper plate to reinforce the flower/bee connection. Pour pepper into the middle of the flower to represent pollen.
2. Blow up a balloon and tie closed.
3. If desired, draw black stripes on the balloon using a permanent marker to signify a honey bee or bumblebee. Add tissue paper wings.
4. Imitate a bee flying through the air by rubbing on your hair, the carpet, or a piece of wool to build up static electricity.
5. Hold the charged balloon close to the paper plate flower without actually touching it.
6. What happens to the "pollen"?

... Bee kid's corner

Produced by Kim Lehman -
https://www.kimlehman.com
https://www.beeculture.com

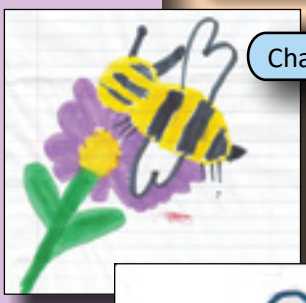
June 2022

Summer Pollinator Plants

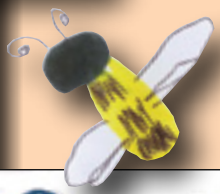
Find the names of these bee friendly plants.

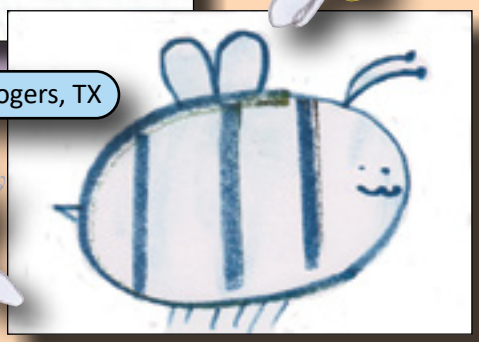
B	M	G	A	R	H	E	P	W	S	M	X	W	C	D
M	O	N	A	R	D	A	C	R	M	V	P	A	V	E
X	B	W	C	C	R	T	E	H	Y	Z	L	G	Z	E
Q	F	D	L	E	V	W	I	Q	I	E	K	E	R	W
V	H	R	V	Z	O	F	V	P	N	N	J	T	F	K
E	S	O	V	L	R	A	E	D	Y	Z	A	X	O	L
K	L	P	F	L	Y	D	U	U	W	M	P	C	Z	I
C	W	N	A	O	G	L	B	Y	Z	W	T	G	C	M
Z	U	U	X	V	A	N	S	D	H	N	T	O	_	A
S	M	I	W	O	A	X	P	C	A	W	X	Z	J	Y
A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

Calendula
Clover
Cosmos
Echinacea
Hyssop
Milkweed
Monarda
Salvia
Sunflowers



Charley, TX





Jillian Rogers, TX

Be a Citizen Scientist!

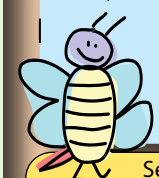
People all over the country are collecting data on pollinators in their yards, gardens, schools and parks. Join this project by counting the number and types of pollinators visiting plants (especially sunflowers). Thanks to thousands of observers, we can determine where pollinator service is strong or weak compared to averages. Be a part of this important science effort.

Getting Started
1. Read all about this project at https://www.greatsunflower.org/
2. Count the pollinators in your yard, garden or community.
3. Report your numbers on the website. Remember if you see no pollinators enter 0. This is very valuable information.

Beecome a Bee Buddy

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

Name
Address
Age
Birthday Month
E-mail (optional)



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

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

Analytics in Beekeeping

John Miller

In April 2022 *Bee Culture* I mused on the emergence of Analytics in beekeeping. Analytics is not new. Observant beekeepers have for thousands of years mused on the super organism, the beehive, and invested careers observing beehive and honey bee behavior. The tools now available, or soon to be available will not be revolutionary – but a **big** improvement in our practices, our business performance [profitability], and beekeeping is underway.

A few of the outfits occupying this Beehive Analytics space include HiveMind, Nectar, BeeHero, BroodMinder, Arnia, Apis Protect, osbeehives, Hivetracks and others. More outfits and software platforms exist. Others will emerge. Beewise, an Israel-based outfit with robotic hive care devices recently knocked down $80MM in the investor C round. The Capitalist economic system is messy. Some hive-management platforms will be gone in five years. Look at the emergence, and demise of computer manufacturers in the past 30 years. 'Hardware is Hard' is a well-worn technology term – that done right - produces the first $3 trillion-dollar company in history. Nearly all the above outfits [except Apple] have in-hive hardware devices linked in one way or another to software.

Beekeeping Analytics is slightly different.

With all the various parties working on the process there will be winners and losers. The thing to keep in mind though is the eventual outcome. Fragmentation is an economists-used term to describe how and who participate in market functions. Beekeeping suffers from perhaps the most fragmented business model in agriculture. Literally millions of beekeepers husband their hives with varying degrees of success. Big commercial outfits crash their outfits along with the single-hive hobbyist. We are fragmented, but in this beekeeping love affair together, right?

Now in use hive-management tools are much better than five years ago. This improvement is the product of another wonky term called Community Intelligence. We're getting better at controlling for example, Ms. *Varroa* and her children with different, better materials than five years ago. The beekeeping community intelligence was focused on Ms. *Varroa*. We have only scratched the analytics surface in beekeeping.

Take for example the above-named outfits. All of them. Crucial to success in any beehive diagnostic device or program is this question: Why Would I Do That? Why invest a ton of money, and dedicate lots of brain cycles to understanding how this gizmo placed in your hive – will **unalterably** change your world?... if it **doesn't**.

Community Intelligence might, in ways beekeeping might not yet see. All the gizmos and all the software summarize all the data collected. The customer receives a year-end, door-stop pile of data – that provides intimate knowledge of the *past*. This exasperates me. Our beekeeping and beehive data is in the rear-view mirror. I may be able to learn why my hive died with a post-mortem report. Does it inform the future?

Sort of. The rear-view report may rightly observe the deceased hive had too many diseases, vectored by a parasite, or maybe a fungus, or a bacteria; it might report the hive lost weight over a period of time – until the woodenware & three pounds of starved bees are all that remains. This is exasperating. These blinding flashes of the truth – all are looking back in time.

I'm tired of knowing too much about the past – tell me what will occur – when certain indicators trigger a change, a predictable – maybe even the precise moment or condition or set of conditions that will predict the hive future.

The above companies now harvest micro-troves of data. It is very likely the proprietary platforms used by each of the above... may turn out to use nearly universal tabulating and reporting platforms to document their gizmo's performance.

Think of Wikipedia. It's an open source of information. Contributors may comment or publish [vetted] data in support/scorn of a previously proven bit of history, or medicine or whatever, right? Open source information.

What could the above companies do to perhaps increase the value of micro-data troves?

Without compromising the customer relationship; without compromising their identity as a participant – what if millions of hive[s] data, accumulating to billions of data points, accumulated over time – went into an open source platform?

What if a bee research funding outfit hired a team of data miners to investigate; using computers to solve previously unsolvable questions. What if a predictive set of guidance emerged? What if we could knowledgably predict the optimum time to replace a queen?

What if we could know ahead of time if a hive will make or fail a pollination inspection?

What if we knew the individual hive and outfit wide optimal annual nutrition – months ahead of time? What if we could better husband our hives?

Analytics are in use from fisheries to tubers to everything above the ground. Some bee outfits will embrace the change. And I'm now thinking about a number; perhaps 30% of all commercial beekeepers who once ran their own outfit, or now do run an outfit, will die. Soon. These beekeepers are BC beekeepers, 'Before Computers.' We learned the art of beekeeping from a mentor, a parent, books [!], someone taught us beekeeping. Us 30%? – our centuries of accumulated observed behavior will die with us. Our successors embrace technology not because they want to; they must.

I'd say it's a good time to stomp on the gas pedal of big analytic beekeeping data.

JRM

A Foolproof Way to Keep Your Smoker Lit

Fool being the Keyword

Stephen Bishop

If there's one universal truth to life, it's that your smoker will die at the most inopportune time. Namely, when a battalion of bees is practicing war games with you as the main adversary.

BEE HEADQUARTERS: "Artillery, lay down covering fire on the veil!"

FIRST BEE SCOUT: *[peering through binoculars]* "Sir, the enemy appears to be taking evasive actions – it's twisting and gyrating and swatting erratically."

BEE HQ: "Concentrate fire on the t-shirt. That light armor is no match for our firepower."

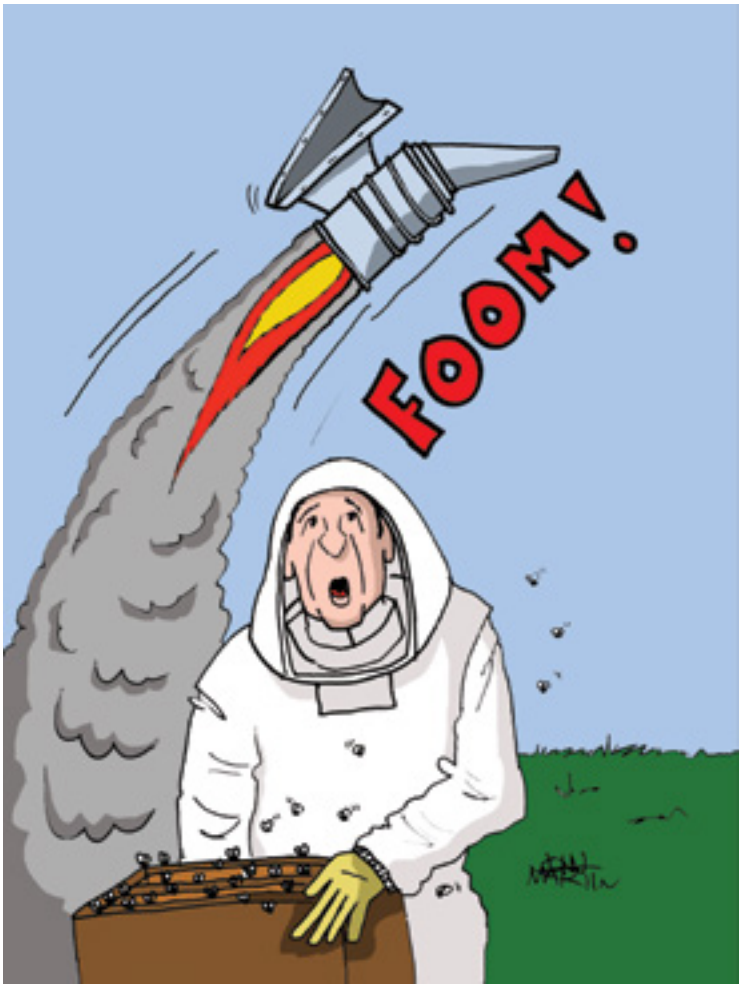
SECOND BEE SCOUT: "Scout to HQ—the enemy's smoker has been disabled! It's trying desperately to find dry fuel on the ground."

BEE HQ: "It's distracted—send in the infantry!"

SECOND BEE SCOUT: "Infantry advancing up the blue jeans. Forming two flanks. T-minus 15 seconds before bare skin is breached below the untucked T-shirt!"

FIRST BEE SCOUT: *[approximately fifteen seconds later]* "The enemy is retreating! It also appears to be signaling surrender—it's stripping naked and swatting with the white T-shirt."

BEE HQ: "Good job, soldiers—mission accomplished!"



As a man who has suffered once or twice from embarrassing performance issues with my smoker, I can tell you it's nothing to be ashamed about. It happens to the best beekeepers—and the worst beekeepers in my case. That said, through a decade of trial and error, I've slowly honed my method of lighting a smoker, and I've developed a foolproof way to keep it lit without incurring minor explosions. Thus, if I can keep a smoker lit, there's hope for any man of limited resources and intellect, or any "fool-headed numbskull" as my wife might say—yes, I've told her that's redundant.

When it comes to lighting a smoker, I can tell you that a dab of diesel fuel goes a long way, about a hundred yards from liftoff to touchdown. So don't, in desperation, use any petroleum-based propellant in your smoker. Also, if you live in the southeastern United States, don't even bother with matches. A match is no match (sorry) for our humidity, so I recommend getting a good butane torch to light your smoker. And I don't mean those cheapo grill lighters at the grocery store. I mean a proper torch—any torch that looks like it might require a background check will likely suffice.

A good torch will ignite kindling fast. As for kindling, I suggest the detritus littering your truck's floorboards. Receipts, napkins and petrified fries all make first-class kindling, at least if you remember to roll up your windows before a storm. Generally, anything dripping wet makes poor kindling, but if your torch came from an Army surplus store then it really doesn't matter.

The kindling needs to be burning good and hot so you don't smother the fire when you add more fuel. If while holding the smoker at arm's length your eyebrows feel endangered, then the kindling is burning hot enough, at which point you can slowly add the main smoker fuel. If you've got the money, mice nests are the best fuel money can buy. Thankfully, I don't have to buy mine because I have a large congregation of mice that meets nightly in my barn. A tightly shredded nest will smolder for hours. If you can't get your hands on a good nest, then the grass clippings that buildup on the deck of your lawnmower make an adequate substitute. Pinestraw is also good.

To keep your smoker lit, it helps to puff the billows every few minutes, especially the few minutes before the smoker goes out. Also, it helps to be a psychic to know when this moment will occur.

Well, that's it—my foolproof way to keep your smoker lit. I hope it helps. If it doesn't, you can just burn this page for kindling.

(Stephen Bishop keeps his smoker lit in Shelby, NC. You can read more of his humor writing at ***misfitfarmer.com****.)*

Beekeeping Critical Thoughts –

Honey Bee Queens, Drones, and Nurse Bees

Earl Hoffman

- May I suggest to you that the queen bee is potentially, not the most important bee in the hive
- Many behaviors and characteristics are not controlled by the queen, but by the drone genetics
- All eggs and sperm carry 16 chromosomes, drones only carry half of the 32 total chromosomes
- Each egg contains a unique combination of 50% of the queens genes
- The millions of sperm created by each drone, are identical clones of each other
- When a virgin queen mates with dozens of drones, hives are comprised of subfamilies
- Each subfamily has the same mother, but different fathers
- Thus, workers of the same subfamily are only related by 75% of their genes
- This amount of related genes may explain some of the cooperation and behaviors found in honey bees
- Hygienic behaviors which are controlled by seven or more genes, must come from both drones and queens
- Mitochondrial DNA is only passed on by the queens and not the drones
- Queens are replaced and superseded by hive bees when queen pheromones and performance is lacking
- Drones must be well fed to produce copious amounts of live semen
- During nectar and pollen dearth periods, drones may be starved and removed from the hive, year round
- Young drones are sexually immature and only contain white mucus with no tan colored semen present
- Not all of the semen in a mature drone is viable, above 90% viability is considered normal
- Semen that is not viable is broken and damaged, thus it is not alive
- *Varroa* mites reproduce well on drone pupa, thus drones are impacted by viruses vectored by *varroa* mites
- Queens normally fail because of many factors that you, the beekeeper, may or may not have control of
- One, queens that mate with only a few drones do not have a full spermatheca and become drone layers
- Two, queens may mate with drones that have low semen viability, the drone semen is dead
- Three, queens may mate with drones that vector viruses in the sperm
- The viruses in the queen spermatheca over time spread to other parts of the queen, resulting in her demise
- Synthetic chemicals used to suppress *varroa* mites in the hive reduce the amount of viable semen in drones
- How long should a well mated queen last that is virus free? One, two, three and sometimes four years
- In my own humble opinion, there is no perfect queen, chasing after the perfect queen is folly
- What I do suggest, is that we need perfect healthy drones, that are virus free and have viable semen
- Last may I suggest to you, in my own humble opinion, the young nurse bees are the most important bee
- Nurse bees feed the next generation and consume the protein in the pollen
- Nurse bees create and feed queen cells
- Nurse bees excrete the excess larval food that if shared with their sisters, can then express genes that store energy as vitellogenin
- Even if the queen lays 2000 eggs per day, if there is a shortage of pollen or nurse bees, the young bees will conserve protein by consuming the new eggs
- If there is a shortage of larval food in the hive, the nurse bees will eat the eggs
- Next time you're in your hive and working the bees, think about the queen, drones and nurse bees in a new light

The Reliability of Science - Part 2

Last month we looked at the systemic problems inherent in something we beekeepers have all come to rely upon: science. This month we look at the ways in which businesses and corporations manipulate and falsify science.

Science has become a valuable brand for those who can control it. For many it has replaced religion as a source of reliable knowledge, and if you can represent your idea or product as based in science, you gain an automatic advantage over competitors. To the extent that competitors can be discredited as being 'unscientific,' their products, services or ideas can be dismissed without directly addressing the issues involved.

The corporate usurpation of science

It starts with the revolving door between the corporate world and government regulatory agencies where regulators do not need to receive envelopes stuffed with cash to do industries bidding. All too often regulatory administrators hired from industry are hesitant to come down hard on their former friends and colleagues potentially jeopardizing future job offerings from the very industries they are supposed to regulate. Government regulatory agencies whose decisions impact beekeeping on a regular basis (e.g. EPA, FDA and FCC) all suffer from the revolving door effect. Once installed in key administrative positions within these regulatory agencies, former and future industry insiders overrule the studied opinions of their staff scientists in favor of their corporate clientele.

The EPA for example has a long history of scientist whistleblowers coming forth to expose industry collusion, corruption, and the censoring of findings harmful to industry by agency officials. The most recent whistleblower revelations reveal the role EPA officials play in pressuring scientists to falsify new pesticide risk assessments in an effort to make dangerous chemicals appear safe and quickly approve them for commercial use. (Lerner 2022, Perkins 2021)

The operational independence of scientists influenced by corporate funding, and the perception of collusion, whether real or not, is an ongoing problem. While industry involvement in science does not automatically mean the science is compromised, too often that is the case. For example, long-time readers of *Bee Culture* are familiar with Colorado beekeeper Tom Theobald's infamous revelation that an unpublished industry study that was scientifically meaningless, was never-the-less accepted by the EPA as "scientifically sound" and used to approve clothianidin treated seed. (Theobald 2010)

Scientific messaging and spin

Meanwhile, industry money influences science in numerous ways such as by causing researchers to change their rhetoric around issues. It can also influence administrators who often direct what research gets funded and what doesn't, or what gets released and what gets buried. In the world of honey bee science, this can translate into pressure for researchers to talk more about *varroa* and less about pesticide issues.

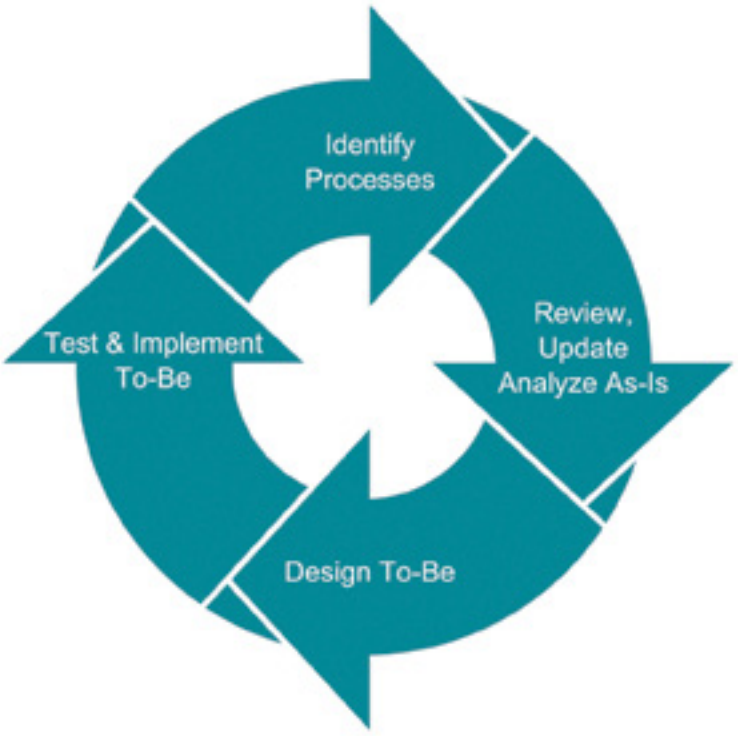
Even the recent International Panel on Climate Change report acknowledges that our reaction to the climate crisis "was slowed by misinformation around climate science." Consequently, many remediation and adaptation efforts are only in the planning phase when implementation is urgently needed.

Another common approach is to funnel industry messaging through celebrities who appear to be independent of industry and who carry a gloss of expertise and acclaim that gives them credibility with consumers, lawmakers, and regulators. In other cases scientists with opinions favorable to industry are financed to endorse products and positions despite weak scientific evidence. Great effort is expended to make these "experts" appear unbiased and unaffiliated with industry. What the public doesn't know is that behind the scenes, corporations are often funding and collaborating closely with these very same professors and professionals who tout propaganda that serves industry interests. It's all part of a strategy of spin that has been used so successfully by industries such as tobacco, soft drinks, pharmaceuticals, pesticides, fossil fuels and cell phones.

Corporations also habitually fund and support front-groups that appear independent and scientific but are really focused on spinning information to counter unfavorable press. Partner groups with neutral or science-y sounding names proliferate such as Academic's Review, The American Council on Science and Health, the Genetic Literacy Project, International Food Information Council, Sense about Science and GMO Answers, allow industry insiders and pro-industry academics to play leadership roles in their organizations and write for their platforms. These groups seek to create an echo chamber all using similar messaging and often referring back to each other as sources. While casting themselves as honest arbiters of science, they spread false information and level attacks against honest hard-working independent scientists who raised

We beekeepers put a lot of faith in science, but that faith isn't always well placed.

concerns detrimental to corporate interests. In the pseudo-scientific world, as in politics, when you can't best your opponent with the facts and reasoned logic, you attack them personally and seek to discredit them so their ideas or work is summarily dismissed due to association and not content. This has led to an "anti-science movement" that organizes and funds rejection of science and refutation of scientific principles and methods in favor of alternative views, often linked to the targeting and harassment of individual scientists.



Business Process Reengineering Cycle

Meanwhile, lawmakers who could influence regulation don't due to reliance on corporate largess through the legalized system of bribery we call campaign contributions. Politicians that have enough backbone to resist corporate money then have to face opposition candidates financed by deep pocketed industries.

Science reflects upon itself

The proliferation of compromised science appears to have become endemic. I have noticed that the overwhelming number of studies that find little-to-no-harm to bees from exposure to neonicotinoid pesticides have industry involvement, while most of the independently conducted studies raise serious concerns about neonics impact on pollinators. When European researchers analyzed how funding sources influenced scientific conclusions on the possible health effects of cell phone usage, they looked at privately funded, publically funded and studies funded through mixed sponsorship. It was the industry funded studies that were least likely to report statistically significant results. (Huss 2007)

In 2012 when a group of researchers looked at 2,047 scientific articles that were retracted by a single publisher: PubMed, they found that only 21.3% were attributed to error. In contrast, 67.4% of retractions were because of misconduct which included fraud or suspected fraud (43.4%), duplicate publication (14.2%), and plagiarism (9.8%). The percentage of scientific articles that had to be retracted because of fraud had increased ~10-fold since 1975 (Ferric et. al. 2012). More recently, studies have found that just over 65% of research paper retractions can be solely attributed to scientific misconduct. (Campos-Varela & Ruano-Raviña 2019; Mousavi & Abdollahi 2020)

Moving forward

To preserve the scientific establishment against the forces that would allow it to be manipulated to the benefit of industry or politics, society would do well to install firewalls between academic science and the corporate sector while educating young scientists and journal editors on the moral and ethical principles behind their respective professional roles. The institutional dependency on industry money that extends from policy makers, political candidates, congressmen and legislators, as well as scientific researchers and academic organizations needs to stop. Policy makers must not allow corporate-spun and funded science to guide decisions and the media needs to do a better job reporting and probing the conflicts of interest behind corporate science spin.

Science can be powerful and extremely useful, but systematic fakery and corruption has undermined trust in science and the capacity of individuals such as beekeepers to make informed evidence-based choices. In the eyes of the public, the tainting of science by corporate finances spills over into the questioning of legitimate science that is conducted with integrity. Scientific misconduct has even been shown to negatively impact the careers of honest scientists who are unlucky enough to co-author papers with colleagues that play fast and loose with ethical considerations. (Mongeon & Lariviere 2014)

While much has been said recently about science denial being driven by social media and the psychology of groups, this appears to simply be a symptom of the problem. The evidence suggests that the underlying cause of science denial is sowed by society's reliance on corporate financing that pressures scientists to falsify their work for personal gain and empowers corporations to manipulate science and its dissemination to favorably present their products and services for profits. The endemic nature of misbehavior within the realm of science has become so widespread and common that it has led us to the point that a person who doesn't like the results of a study, can simply state that it is "fake science" and many people will automatically believe them without looking into it for themselves.

One thing is clear: when it occurs, scientific misconduct overwhelmingly occurs when investigating ultra-high-profit industry activities. This is why pure honey bee research is rarely impacted. It is primarily in the fields where bee research intersects with things like pesticides, pollutants and electromagnetic radiation, that bee science

appears most susceptible to fraud and manipulation. Thankfully the majority of science is still conducted with integrity, but it is wise to consider funding sources and industry involvement when evaluating the quality of what is reported.

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

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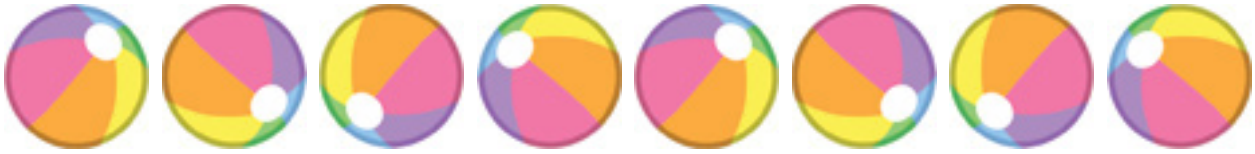


BEE VET

The Hexagon, Under the Microscope

Dr. Tracy Farone

Each Fall for about 10 years now, I have had the joy of teaching a course called "Histology." Histology is the study of cells, often with the aid of a variety of microscopes. It is not a sexy course title, but the course content is relaxed and involves looking at a lot of colorful pictures. My students spend hours peering through the lens of a microscope trying to visually decipher the blobs before them. By the end of the course, after enough staring, most students achieve the skill of identifying "the blobs" as some specific cell or tissue. Since the late 16th century, the study of histology has given humans the opportunity to give things a "closer look," and the technology is ever increasing our ability to "see" beyond the cellular level.

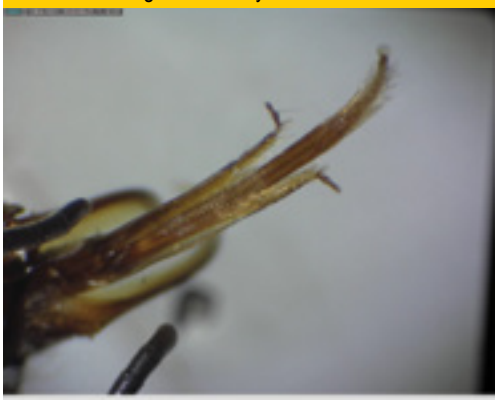
Histological identification certainly has many practical applications in biology, health care, disease diagnosis and in beekeeping. Closely examining our honey bees' *body cells* has led to the understanding of their functional anatomy, physiology, pathological tendencies and disease diagnosis. What I find incredibly fascinating is the link between the shape of our honey bees' *comb cells* and what is also found microscopically in many of our body's tissues. The hexagon. (See Photo 1)

I am sure you have read articles about this shape, which is so often associated with the beautiful honey comb pattern of our bees, and how hexagons are the most effective and efficient geometric shape. These six sided polygons can tessellate any plane to completely fill the area with no gaps. From art to architecture, in snowflakes, soap bubbles and soccer balls, natural design or man-made, hexagons are everywhere, appreciated as a symbol of strength, stability and security. But have you heard about the hexagon from a histologist's perspective? Well, allow me to give you a different take. Here is today's lesson:

Common types of microscopes and honey bee applications

1. Dissection scopes: Dissection scopes are commonly used to view smaller, 3-D things (like bees) with up to a 100x magnification. These scopes are helpful in studying plant and insect morphology, and for taking "zoomed-in" photographs. (See Photo 2)

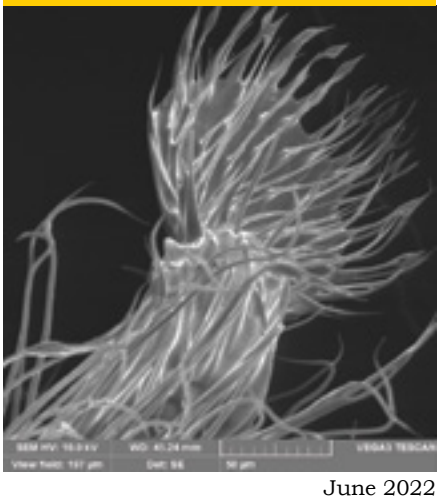
Photo 2: Dissection scope view of a honey bee tongue. Photo by Farone Lab.



2. Optical light microscopes: These scopes are probably what you imagine when you hear the word "microscope." Using visible light and a series of lenses, these scopes typically can magnify objects up to 2000x. Examined specimens are typically prepared onto slides for viewing. These microscopes are invaluable in diagnosing a variety of abnormal cellular formations and infections in man or bee, including parasitic, bacterial and fungal diseases.
3. Electron microscopes (EM): Electron microscopes actually use a beam of electrons (not light) to create images magnified millions of times. They are typically found in research labs and universities. There are two major types:
   a. Scanning Electron Microscope or SEM: Scanning electron microscopes create a sharp almost 3-D like image of the surface of a specimen. Magnification ability of a SEM can reach one-half a

Photo 1: Honey bee comb, a classic demonstration of the hexagon. Photo by Farone Lab.

Photo 3: SEM view of the very tip of a honey bee tongue. Photo by Farone Lab.



million times. We have a SEM in our lab that my students use to capture cool images of honey bees and their parasites. (See Photo 3)

b. Transmission Electron Microscope or TEM: Transmission electron scopes capture a flattened slice of tissue magnified up to fifty million times. TEMs can be useful in diagnosing and studying pathogens.

4. Fluorescent microscopes, FS: Fluorescent scopes utilize fluorescent dyes added to a specimen to tag certain tissue components or pathogens. When exposed to UV light, these fluorescent dyes absorb lower wavelengths of light and then emit a higher wavelength or seem to "glow." If the examined sample glows appropriately, we know that we have found what we are looking for… amazingly, there are now small, portable FS that work with a smart phone to detect Nosema in honey bee samples in the field. Yep, there's an app for that!

Histological Hexagon Examples

Many of our body's cells are designed in a hexagonal mosaic. Chemists could even argue that at a molecular level, all carbon-based life forms contain a base of hexagonal carbon rings, but I am not a chemist, so let us just look at what we can see (through a microscope).

The urinary bladder, for example, has a unique and specialized ability to expand and contract over short periods of time. This can come in handy when you have had that extra cup of coffee! This peculiar capability also comes with a unique design. As with most things in nature, form and function are always complimentary. The bladder has a specialized type of tissue that lines its interior called **transitional epithelium**. It is called transitional because these cells of the bladder are shapeshifters. They range from almost flat to taking on the appearance of an overstuffed marshmallow. When the bladder is full, the cells spread out and take on the shape of, you guessed it, the hexagon (See Photo 4). Even a vessel that is given the lowly task of holding urine, has a beautiful design from the inside out.

The liver is the second largest organ in most mammals and performs thousands of functions necessary for the preservation of the body. (Even honey bees have an organ that mimics the important work of the liver, in their fat bodies). The liver is arranged in rows of cells, stacked in columns forming a sieve in which blood can slowly flow through the organ, so that each drop can be processed by the liver cells, or hepatocytes. What shape to best accomplish such a feat? Yep, again – the hexagon. Each hepatocyte itself is a hexagon, which then combines in groups to form larger units called lobules, also hexagonal, collectively, in shape. Again, the hexagon is the best way to get the most things done in the best use of space. (See Photo 5)

Photo 4: Full urinary bladder lumen. https://histologyguide.org/EM-view/EM-238-bladder-stretched/16-photo-1.html Accessed 03/29/2022

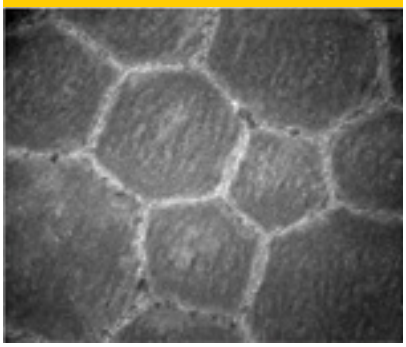
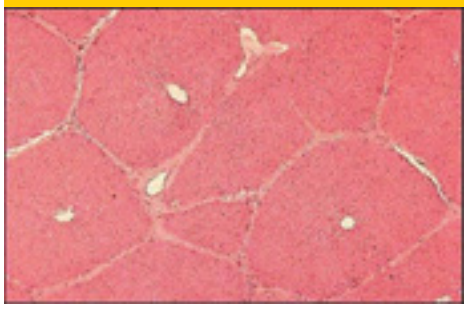


Photo 5: Liver lobule under a light microscope. http://www.vivo.colostate.edu/hbooks/pathphys/digestion/liver/histo_lobule.html Accessed 03/29/2022



Other six sided cell examples in histology include the inside surface in much of the small intestine, which takes on the appearance of hexagons with a fuzzy border of projectiles, called microvilli. These shaggy microvilli help to increase surface area to facilitate the absorption of our latest meal (See Photo 6). Another example are insects' eyes, including our honey bees' eyes. These compound eyes are made of thousands of individual eyes arranged in a hexagonal mosaic pattern (See Photo 7). Even the very fibers of our own eyes' lenses are composed of long layers of hexagonal cells. (See Photo 8). Hmmm, ironically, I suppose we are looking at hexagons through a bunch of hexagons.

Photo 6: SEM of small intestinal lumen. https://www.cram.com/flashcards/histology-of-gi-tract-3823044 Accessed 03/29/2022

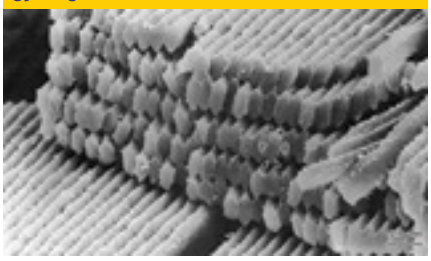


Photo 7: Honey bee eye SEM. Photo by Farone Lab.

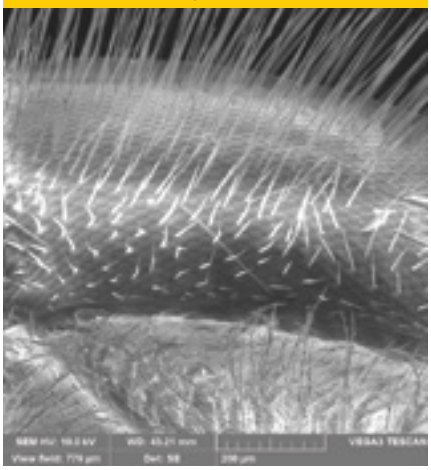
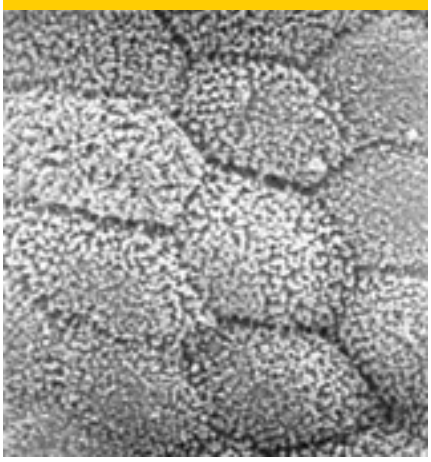


Photo 8: Lens fiber SEM. https://basicmedicalkey.com/crystalline-lens/ Accessed 03/29/2022



Well, that is enough for today, class. If you look around, you may be able to find a dissection or optical scope on the cheap to play around with and get a closer look at your bees. Since I have become a beekeeper, I am yet to find a subject that does not somehow relate back to bees or the study of them.

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Minding Your Bees And Cues

Summer Bee Convention Conversation Starters

Becky Masterman & Bridget Mendel

Beekeeping is a solitary occupation. Many of us are drawn to the peace of being out with the bees, quiet and focused. Let's all agree that the best beekeeping companion is one who also gets into the zone; lifting and passing frames almost wordlessly, taking their cues from the hives, working seamlessly together to get whatever job done.

Then convention season hits and suddenly a group of solitude-prone individuals sharing an obsession with social insects, get social. For the new attendee, it can seem like everyone has known each other for decades (many have) and are too busy catching up with old friends to meet a newcomer. At a dinner party, your beekeeping habit fascinates the other guests, but amongst beekeepers... it pretty much still does!

A fun non-bee encounter can not only be an attention grabber on social media channels, but shared in person at a meeting might just be an entry to a delightful hive critter conversation. **Photo Credit:** Rebecca Masterman

Beekeepers talk bees. For the convention hesitant, we've created a little guide to getting social. We do encourage you to attend a convention or two and binge on enough new beekeeping information to last the year.

Let me show you my favorite bee photo!

A great bee themed photo can be a nice conversation starter. If you want to become the center of a crowd, choose a mysterious photo with a tricky brood disease and have people guessing. Photos of bees on flowers always get the nectar conversations flowing. Interesting creatures visiting your hives is a good way to bond with someone from another geographic region ("What? I've never seen that type of bumble bee!"). Swarms you've caught are fun to look at, and super bad mite infestations are always crowd pleasers (as long as it's your photo, not theirs).

So, how do you monitor and manage your *varroa*?

If you are a beekeeper, you are also an unwilling *varroa* manager. While you might not like the response you get to this question, everyone will have one. Your *varroa* conversation might get scary if you are talking with someone who says their bees don't have *varroa* (perhaps they are into magical realism – you could suggest a novel by Isabell Allende. Or you could ask them about the weather in Australia!). Maybe you'll hear that your new friend is intimidated by testing their bees for mites? Time to name drop the the Honey Bee Health Coalition's *Varroa* Management tool. (You can sound hip by randomly knowing that their 8th edition is out soon – even better than before!) We suggest bookmarking the website. Be prepared to go deep sharing *varroa* management strategies. Perhaps you can convince a sad annual loser of bees that there is indeed hope, if they face their mite problem head on.
https://honeybeehealthcoalition.org/resources/varroa-management/

Hey, did you hear about the Minnesota Honey Producers Association's Habitat Committee?*

Luckily, the MHPA, led by President Dave Schroeder and his bee habitat loving membership, eagerly supported this organizational initiative. We are admittedly extra biased regarding this conversation starter as we think that every beekeeper should be thinking about bee habitat. Follow up this question with, "Does your local beekeeping club have a Habitat Committee?" It would be a game changer if every beekeeping club had a dedicated committee to: 1) create partnership opportunities with governmental agencies, community groups and the public and 2) report habitat and nutrition research to the membership. Our honey bees deserve an organized effort to get more flowers into the ground.

*The authors both disclose that they are members of the MHPA Habitat Committee

Did you know that (insert state here) has (insert number here) different species of native bees?

What a great way to let your fellow beekeepers know that you take an interest in both honey bees and native bees. With the concern about endangered and threatened native bee species, now is the time for beekeepers to step up and commit to keeping the conversation about supporting all pollinators, not just honey bees. Simply learning more about the native bees in your area can make a difference. In preparation for this

This photo was taken on a trip to Bermuda where the beekeepers were even lonelier than the bees! It is a great way to get a conversation started, especially with weather envious northern climate beekeepers. **Photo Credit:** Rebecca Masterman

conversation starter, we suggest a little Googling. You will be surprised at how much you can learn about your state's native bees in a simple Google search.

Have you heard about honey bee anarchy?

A body of research work by Dr. Ben Oldryod in the 1990's investigated worker reproduction in honey bee colonies (Baron et al. 2001). A more recent anarchy study reported a subset of workers raised in recently swarmed, temporarily queenless colonies as having more ovarioles and being more likely to lay their unfertilized eggs even after new queens emerge (Woyciechowski et al. 2012). This less often discussed honey bee topic might be fun to bring up with a fellow beekeeper: **https://www.sciencenews.org/article/rebel-honeybee-workers-lay-eggs-when-their-queen-away**

Do you know how to get propolis stains out of clothes?

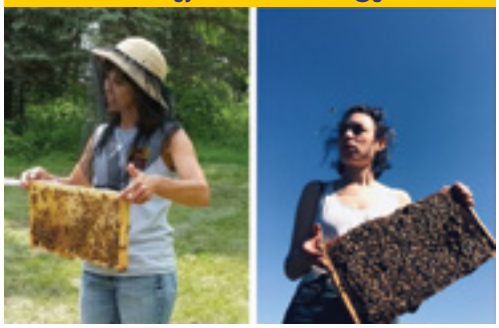
Sometimes conferences are disconcerting: there are so many beekeepers wearing clean clothes! You yourself might feel weird without your propolis-stained bee jacket and syrup-caked boots. Whether or not you've gotten propolis out of your clothes is worthy of discussion. And if so, how? **https://sciencing.com/remove-bee-propolis-stains-7712909.html**

How did you get into beekeeping?

The best part of a convention is learning from the beekeeping elders and hearing crazy beekeeping stories. A few years back, the U of MN Bee Lab and Minnesota Extension's Dr. Katie Lee spearheaded a collaboration with Story Corps and the American Beekeeping Federation where beekeepers could interview each other about their stories. It's a treasure trove and worth exploring: **https://archive.storycorps.org/communities/american-beekeeping-federation/** But for regional conventions without a story corps booth, try out some of the questions that really get beekeepers talking: how did you get into beekeeping? What do you think about the future of beekeeping? What do your bees mean to you?

We hope to have inspired some shyer beekeepers to get out there and join the Summer convention fever. Try out our conversation prompts. And email us to let us know what happened.

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 convention conversation success stories or other thoughts, please send an email to **mindingyourbeesandcues@gmail.com**



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Off the Wahl Beekeeping

HIVE INSPECTIONS

Richard Wahl

As a new beekeeper that first time hive inspection can seem like an intimidating task. After all, looking in on and moving frames and supers with thousands of potentially stinging insects is not for those who may be faint of heart. There are some steps that can make the task less intimidating than it may seem. Staying calm and using slow deliberate movements will go a long way toward keeping the bees in a calmer state. Even with a full bee suit, veil and gloves I was very nervous the first time I went into a hive. My first inspection would happen with no prior experience with bees and no assistance from any other beekeeper or individual. The fact that it was a swarm catch with unknown origins and unknown demeanor did not help to ease my nervousness. I was probably breathing a little harder than normal as well. With all their sensory acuity I am sure the bees could hone in on the bit of extra carbon dioxide that I was exhaling. It is said that bees go for the face of an animal or human first because their sensory perceptions are tuned to picking up that slight change in the air quality that occurs with the exhaling of air. I certainly had a dozen or so bees testing my veil to see if they could get to my face that first time. But since that first inspection I have learned several useful techniques and I now find it to be the exception to have more than one bee in an aggressive mood testing my veil.

Preparation for Inspection

For any inspection there should be a reason to inspect. The first deep Spring inspection will normally be checking to see if the queen is laying and to assess if there are enough food stores available. It may also include looking for any indications of possible disease in the hive. It can also include that first seasonal check for mites.

Later inspections may be looking for indications the hive might be getting ready to swarm. In any case having potentially needed equipment at the ready will decrease the time the hive needs to be open. If it is thought a super may need to be added or a split might be in order, having those extra supers or nucs with frames ready and set out by the hives in advance will save time. It is far easier to have extra equipment at the ready rather than to need to retrieve it after the hive has been opened.

Once that initial inspection is done I like to wait another week or two before doing any splits or frame adjustments unless immediately needed due to space or food store requirements. Later inspections may only require a quick opening of the inner cover with no frames being manipulated. I am of the opinion that the less the hive is disturbed, the better it is for the bees. Also consider adding one to one sugar syrup and a pollen or protein patty to aid in bee build up if this has not already been done earlier in the Spring. Once honey supers are put on the hive, remove any sugar syrup feeder since you do not want the bees making honey from your syrup. Bees require a lot of nectar and protein during brood build up and any help that can be provided until honey supers are put on will increase the hive's later honey productivity. Any partially or fully drawn wax comb from the previous seasons that has been emptied by the bees and that can be replaced in a hive is a real asset. It is estimated that bees need to eat eight to ten pounds of honey to produce one pound of wax.

Weather Considerations

Current weather conditions are a big factor in how calm the bees will be during an inspection. If there is a storm front coming or sometimes just a recent change in the weather the bees may be more irritable. Bees can sense bad weather and are more protective of the hive on a rainy, cloudy day than on nice days.

It is best to try to pick a warm, sunny day between 11:00 a.m. and 3:00 p.m. as that is when most of the forager bees are out collecting nectar and pollen which lessens the number of bees presently in the hive. Additionally, the foragers are the bees more likely to be the aggressive guards of the hive and the ones to become the first attackers if the hive feels threatened. In my northeast corner of Macomb County, Michigan, it is recommended the first deep inspection occur no sooner than

An empty drawn comb frame ready for replacement.

Hives in front of my barns on a sunny day, notice the swarm hive on the very far left.

when the dandelions are in full bloom. Prior to this time there is still a chance for weather to turn cold for a few days and if the cluster does not reform it could prove very detrimental for the hive. A case in point is that last year in my area, from the 10th through 12th of May temperatures returned to below freezing during several days and dropped into the 20°F range at night. I learned this lesson the hard way when I inspected two hives in a late March warm week one year and a month later found several clusters of bees dead in various locations in their hives.

Using a Smoker

One of the first inspection steps is to get a smoker properly lit to provide a cool white, dense smoke. A very thin wispy smoke is more likely to be a hot smoke and more likely to irritate the bees. If there are flames or sparks exiting the smoker, the smoker has not been lit properly. This can be the result of the flame being on the top of your smoker fuel rather than the fuel being on top of the burn area. To get the proper result, start the flame with a bit of fuel dropped in the bottom of the smoker. Press the bellows several times to get a nice flame started and then add more fuel on top of that which has already started to burn. This should produce a dense whitish smoke that will be cooler and less irritating to the bees.

There are many types of smoker fuels used by beekeepers. Starter fuels may be newspaper, pine needles, dried leaves, burlap or wood bedding chips, among many others. Using a starter fuel different from the added fuel is not an unusual practice. Naturally the commercial bee catalogues offer a variety of fuels that can be purchased. I find that bedding wood chips work quite well with the downside being that there is quite a bit of creosote buildup in my smoker after repeated use. Another method that does not create as much creosote is to start the smoker with a wad of newspaper and once a nice flame is going make a tight wad of the brown packing paper often sent in boxes received with commercial bee products and shove several wads on top of the starter newspaper. This makes a nice dense, cool smoke that will smolder for some time. A common mistake is to light the smoker and set it aside while completing several other tasks before using it. This will burn up fuel and the smoker flame may even die before it is used. Use the smoker immediately after lighting it when a good smoke occurs. Once the smoker is lit, give two or three light puffs at the entrance to confuse the guard bees. Lift the inner cover a crack from the back and send a few puffs into the hive just below the inner cover opening. Close the inner cover and let it sit for a minute or two and a light puff might also be given at the center inner cover hole if the bees seem to be a bit agitated. It should not take a lot of smoke to settle the bees. The less smoke used the better since smoke is only meant to mask the bee's alarm pheromones. Bees sensing smoke will think there is a fire in the hive and will retreat to eat honey in preparation to leave the hive. Too much smoke can confuse the bees and make them more aggressive. It can also be absorbed by the honey comb if used in excess.

Smoker with a white, dense smoke.

Steps for a Smooth Inspection

Set the outer cover to the side and if in a grassy area it is best to set it upside down on the grass. It can be used to place supers on it if supers need to be moved. This keeps grass and dirt from collecting on the bottom of a super that might be set directly on the ground. I like to first slowly remove one of the outer most frames in the super being inspected.

These frames are usually filled with pollen or nectar if not partially empty. The queen is also not likely to be on an outer most frame although it is a possibility. Carefully loosen the frame away from any propolis and slowly remove it from the super. I find a frame hanger on the outside of the super to be most useful. I've made several out of a few scrap pieces of plywood and some "L" brackets.

First frame removed and held on homemade frame holder.

Now that there is room to move other frames, slowly pry them free and inspect each frame in turn as the previous frame is moved one space over. I find it useful to remove a second frame and also hang it outside the super if that frame has no brood or eggs on it. The reason for keeping egg and brood frames inside the hive is that the queen is more likely to be found on one of these frames than those that are capped with honey or that are nectar or pollen frames. If the queen is not spotted and she is on a frame moved to the outside of the hive there is the chance of losing her outside the hive. In any case, there is no need to remove any more

frames after a nice capped brood and egg pattern is spotted. This is a sure sign a queen is present and if eggs are also seen, the queen has been present within the past three days as this is how long it takes before eggs hatch. Once the initial deep hive inspection is complete the frames should be slowly and gently returned in their original order and location unless a split or need for a replacement frame such as a drone comb frame is desired. Close up the hive and move on. A general rule of thumb is that inspections occur about once every two to three weeks during the Summer. These need not be deep inspections with frame movement unless there is a question about the queen's presence or performance. Often just a quick peek under the inner cover to see how many frames are being worked by the bees is enough of a clue as to whether an additional brood or honey super is needed. If all but one or two frames are covered in bees and filled with eggs, larva, capped brood, nectar and pollen, an additional super will need to be added. With a bit of experience the state of the hive can be determined simply by watching the bees arriving and departing the hive entrance. If in a prior inspection things were fine, a look at the hive porch entrance with bees bringing in pollen is often enough to warrant not going into a deeper inspection. There are sometimes months during the Summer when I have not done a deep inspection with a newly established hive. I have found it useful to carry a clipboard or notepad and jot a few notes down as I go as to what I see in each hive. I transcribe these notes to a file on my computer. I cannot count the times I have gone through a previous year's notes to refer to some action taken that seems similar to some current state while inspecting my hives. In any event, watching your bees is the best learning tool. Your beekeeping experience could vary based on your environmental conditions, experience or state of your hives. Have fun with it and hopefully there are a few new things mentioned here that may work for you.

Homemade frame hangers.

What can drones tell

Bradley N Metz & David R Tarpy, NC State Dept of Applied Ecology

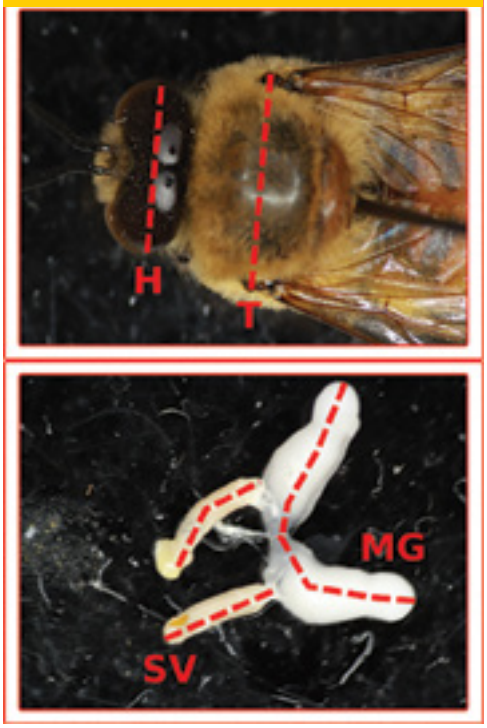
In the "girl-boss" dystopia that is the honey bee colony, drones are the dopey, do-nothings that are at best an annoyance, or at worst the signs of disorder and amplifier of parasites. Unlike the workers, queens, or even larvae, drones have no utility in the day-to-day operations of the honey bee colony. In fact, the boys have only a single, shamefully obvious task—to propagate their mother's (usually the queen) genes to the next generation, flying *en masse* to mate with any virgin queen they can catch. This task is fatal to the drones, so even the fulfillment of this single job proves overwhelming. To make matters worse, honey bees are highly polyandrous, with several different drones mating with each queen. Therefore, the final fate of the honey bee male is to exist solely as a tiny proportion of stored spermatozoa to be meted out by the queen in the formation of future workers, themselves sterile dead ends, which busily contribute to colony growth, provisioning, and development. It is the rarest drone that will become a grandfather – siring a queen – and successfully pass his genes to the next generation.

I was trained in beekeeping as part of my graduate work on chemical communication among larvae and adults. Drones were a nuisance; we pulled comb and froze the boys in their cells to minimize *Varroa*. Once, in a fit of bravado induced by an errant internet search, we fried the brood and served them at a party (they tasted like sweetened vegetable oil). So, when I started working for Dr. David Tarpy at NC State and the first project proposed was on the evaluation of drone reproductive health, my first thought was—"*why?!*" In my mind, these disposable social gametes were as unremarkable as a single spermatozoan, which (despite any Monty Python songs that might be evoked) are generally more interesting in aggregate than individually. Nevertheless, upon joining the Honey Bee Queen & Disease Clinic, I was tasked with doing for drones what Dr. Tarpy and colleagues had previously done for queens (*see* Tarpy et al., 2012 *or my own prior article in this magazine*): establish a measure of reproductive quality and variation to develop a national-level database so that we can begin to understand how and why drones vary, and the consequences of this for the queen and colony.

The first thing I had to get over was the idea that the production of drones was, in and of itself, pathological. In my myopic viewpoint, I neglected to consider that while yes, a colony that is anarchical or headed by an aging or poorly mated queen will produce an excess of drones, producing a seasonally appropriate number of drones is a sign of a colony doing *well*, growing sufficiently well so that it can commit to reproduction! Typically, a healthy colony will produce around 10% of their brood as drones, with that proportion increasing prior to swarming season (*reviewed in* Boes, 2010). However, colony size also plays a factor, as we learned (anew) that smaller colonies will neither rear nor foster drones. A colony that refuses to produce drones is likely not a colony that is in good shape. Drone production by healthy colonies plays into the second factor that I needed to understand, the overall ecology of the mating environment. Very few operations in the U.S. perform instrumental insemination at scale. That means that the million-plus queens produced commercially each year are largely mating on the wing, with little to no input from the breeders. That means whatever characteristics we want in the workers must be added indirectly by raising colonies for drone production (i.e., large, healthy colonies) that have desirable characteristics and that those drones are successful in mating. But which drones are successful?! Also, what are the characteristics of a successful drone for the traits we want in a daughter colony? That's a thornier question.

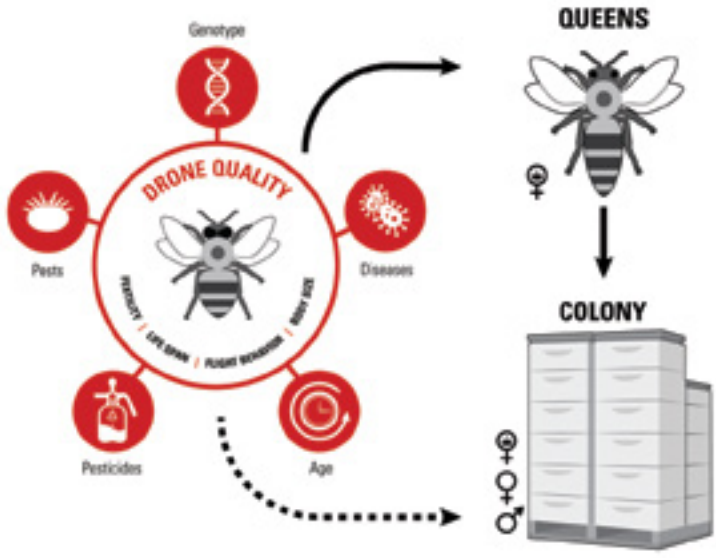
For a drone to successfully mate, they typically need to be LARGE. The research on this usually compares drones reared in drone cells to those reared in worker cells to create a bimodal (two humped) size distribution to show that small drones produce less sperm, are less likely to successfully mate, and tend to sire a lower-than-expected proportion of the worker population (*reviewed in* Gençer and Kahya, 2020). So bigger is better, right? We-ell, not necessarily, since smaller workers appear to exhibit differential flight behaviors consistent with different mating strategies or life histories (*see* Couvillon et al., 2010), suggesting the little guys might have other plans. Also, because siring workers is a genetic dead end, the real prize is siring a queen, and it's not necessarily the father of the most workers that succeeds there.

Figure 1: Measuring drones is conceptually identical to how we measure queens. Body size measures are made using a microscope and a scale. We measure head and thorax width, and whole body and thoracic mass. Reproductive potential is measured both with morphometrics: seminal vesicle and mucus gland length, and by measuring sperm count and viability using fluorescent microscopy.



us about the colony?

Figure 2: Impact of drones. Measuring drones and the impact of modern mechanized agriculture on their fertility is important for its own end, and to understand potential threats to male reproductive in *general*. However, the more proximal importance is for understanding how drone quality impacts queen through sperm with lower longevity or other subtle problems.



In fact, rather than nepotistically rear their own super sisters, workers tend to select larvae from relatively *rare* patrilines to become queens (*see* Withrow & Tarpy 2018 *for a recent example*). Therefore, maybe size isn't the only metric important for drones. Certainly, we know from sampling throughout the country that drones adapted to the climate in the southwest tend to be smaller, although no less fecund, than their more northern brethren and they seem to do just fine. That then leaves the other main characteristic of import for a drone: their sperm.

Since his sperm will far outlive the adult drone, sperm viability at ejaculation and their longevity in the queen are the prime traits which we study. Knowing that a queen spends a ridiculously meager two spermatozoa per egg, lays something like 2,000 eggs a day at peak, we know that to keep the queen laying for the year, we'd want something like 1.5 million sperm (numbers from Baer et al., 2016). Since the average queen from our Queen Clinic database stores about five million sperm, that should give a queen a theoretical lifespan of around four years, if sperm count were the only determinant in her longevity. However, only about 85% of those sperm are viable on average, and since we largely measure queens shortly after production, that's a big hit to a queen's stores right off the bat. Thus, it's incumbent to understand the factors that affect sperm during storage so that this number doesn't drop even lower.

Even with the best intentions, I still tend to only think about drones in the context of the wider superorganism. But how important are the drones to the colony? It's unclear how much the health of the drone impacts the health of the stored sperm –which is what we really care about. It's commonly thought that only live sperm will make it into the spermatheca, so the quality of the drone shouldn't matter. Although there's a paucity of data on this, an interesting study by Kairo et al., (2016) showed that drones who were exposed to fipronil exhibited signs of reduced sperm quality but also passed those declines on to the queen. This means that poisoned drones probably provide sperm with a lower shelf life! The laundry list of things that can impact drone reproductive potential is huge (*reviewed most recently in* Rangel and Fisher, 2019) and all are familiar to anyone in beekeeping today (e.g. parasites, pesticides, temperature fluctuation and disease). The challenge now is to more firmly draw the line from effects on drones to effects on the queen and colony. The prevailing theory I'm therefore operating under, while building this database of drone quality, is that drones can be a prior-generation red flag—the rose bush in the vineyard that will enable us to detect potential problems with reproduction before they have a chance to impact the next generation's queens. The next steps involve testing drones stressed in various ways and following those drones through the mating process into the next generation.

I want to learn more about drones. The nation-wide database we've built at the Clinic has set a baseline for the expected size, reproductive potential and the relationship between the two. We must now learn what disrupts that relationship, what impact that has on colony health and reproduction and what levers we possess to manipulate it. I wish I'd have an answer, but I only have a long list of questions. One of the greatest aspects of the Clinic from my perspective is that I'm not asking questions in an ivory tower; when I interface with beekeepers, it's *their* ideas, questions, and perspectives I develop. I then explore those questions until we can learn more about what these little boys are made of after all.

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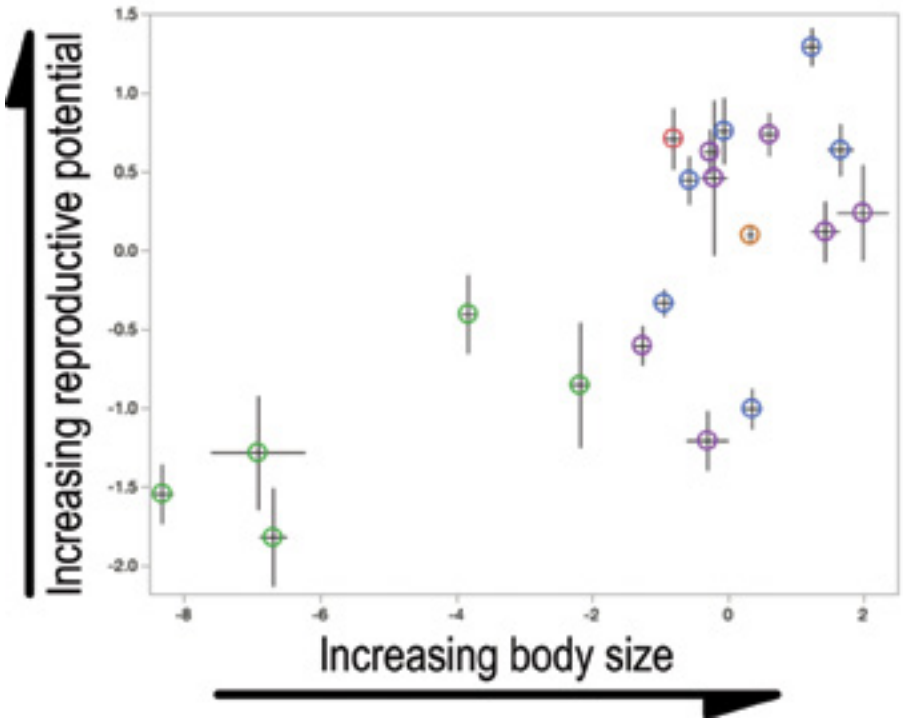
Figure 3: Colony variation in drones. Colonies vary significantly in the size and reproductive quality of the drones they produce. While this has well-established impacts on the competitive abilities of drones, it's unclear whether smaller, less fertile drones represent a pathological colony condition, differential reproductive choice, or simply random variation. Though we tend to think larger drones means better drones, the best advice we can give the beekeeper is to ensure that there are *plenty* of drones flying and trust the natural mating process to sort things out. These data are reported on more fully in Metz & Tarpy, 2021.



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A Moving Experience

Stuart Rowan

I recently saw a bumper sticker that read, "Yes I have a pickup truck, no, I won't help you move!" Nothing seems to separate one's true friends from the fair weather variety quicker than looking for help to move. Add to that a million or so stinging insects and the list gets pretty short! A commercial beekeeper reading the following account will scoff at the thought of moving bees as anything but another day at the office. Their whole operation is built on the premise of moving bees to make a profit. Hives on pallets, forklift loaders, large trucks, netting, all just tools of the trade. A backyarder is typically seeking advice on how to move a hive from one spot in their yard to another. There are many articles and much advice on this kind of move. But what about that space between those two options?

Recently my wife and I retired early to care for our aging mothers. This involved a pretty significant disruption in our "comfortable" routine. Unlike post college and early marriage moves, we were now able to enlist the services of professional movers and were able to dispatch those chores fairly easily. Albeit, after 36 years in the same location, we experienced a bit of sticker shock at the current cost of replacing the goodwill of "friends" with "professionals." On the other hand, moving my apiary was not something easily delegated or sourced to others. The conversation was more nuanced and went something like this.

Me: I would like to hire you to help me move my business/hobby.

Them: We are your guys, let's talk about what you will need.

Me: I am moving about two hundred miles, I will need a truck, and two or three able bodied folks.

Them: No problem.

Me: We will be moving overnight.

Them: Oh, one of those kinds of moves.

Me: Not exactly… but yes. I am moving 20-25 bee hives.

Them: (After a short pause) By bee hives, you mean empty bee boxes, correct?

Me: Well, no. All of the colonies I am taking are healthy and the hives should be full. A million or so…live honey bees.

Them: Doesn't look like we have any availability around that time. Let me give you the name of one of my competitors, (one I don't like much). Turns out, this was going to be a "MOVING EXPERIENCE."

When I took up beekeeping about five years ago, my mom told me my dad had been a beekeeper when he was in high school, circa 1945 as part of the Future Farmers of America (FFA). When dad went to college, his father took up beekeeping and his apiary. On a side note, my grandfather worked for Florida Power and Light (FPL) for 49 years. He started in the early 1920's, a teenager working as a lineman. By the 1940's he was working as a supervisor of some sort and was regularly in the field. I have pictures, where it appears he is dispensing a jar of honey to someone out of the back of his FPL pickup. A practice I am told FPL would not approve today. With that new information from my mom, I am claiming to be a third generation beekeeper, albeit, in a very convoluted way.

My dad, circa 1945. Dad took up beekeeping in high school as part of the FFA.

This brings me back to the current situation. I was going to be moving my apiary from East Central Florida to North Florida. While much of the family farm has been sold and developed, several hundred acres still remain in managed pines. This meant moving from an area of known Africanized bees, to one that is still considered non-Africanized. (I am told by beekeeping friends in the North Florida area that is probably not true). However, in keeping with both BMR (Best Management Regulations) and BMP (Best Management Practice) I wanted to be as judicious and careful as possible. I certainly did not want to be thought of as the guy who introduced *apis mellifera scutellata* to North Central Florida. This meant dealing with both unknown source queens and drones. Had we been in a more Northern climate, this could have been simplified by timing the move to correspond with the natural "culling of the drones" as the colony prepared for Fall and Winter. However, in Central Florida, August-October continues with a strong nectar flow and brood build up. It is not uncommon to see a hive supersede well into December.

So for this move, we had to first, come up with a plan which included the removal of drones and the replacement of queens!

Secondly, we were going to make the move using "make shift" tools and equipment.

Thirdly, I had to consider timing in order for all of the pieces and parts to work together smoothly. I discovered that preplanning and improvising were equally important components to the process.

The "plan" we crafted called for implementing multiple steps.

This apiary is managed by the South Brevard Beekeepers Club. It is operated to teach and model "BMP beekeeping." Every Sunday afternoon we host any beeks interested in hands on experience.

- Preparing the receiving apiary. This was actually the simplest and most fun for me. I began this step about five months before the move. The property to which we were relocating is about 130 acres mostly covered in planted (managed) pines. There is a creek running through the middle of the acreage hosting a variety of trees and vegetation other than pine.

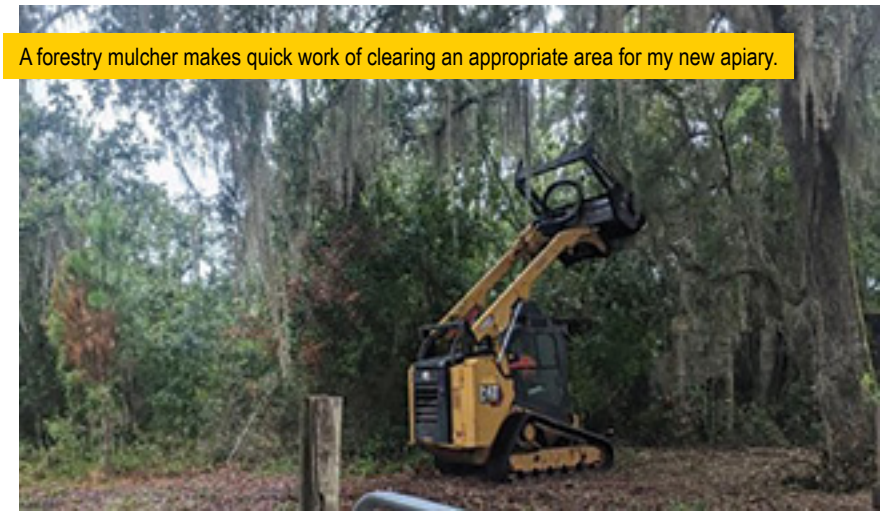
I was able to review aerial maps and surveys to find an area that was high enough to ensure it did not flood, but at the same time close enough to provide a reliable source of water for the bees. Contracting a forestry mulcher, we were able to clear a two acre area in about half a day. I was able to create a southeastern facing exposure that received maximum sun in the Winter, while providing some relief from the hottest sun in midday of Summer. I placed my hive stands to allow a tractor with a six ft cutter to clear between them in a single pass.

- Food Source. This is where "local knowledge" is very important. University of Florida and the Bee Lab (also located in North Central FL), provide excellent resources including the Mellito Files Newsletter. Monthly, it highlights the variety and availability of various food sources.

In Central Florida, an ubiquitous source of nectar starts at the end of August and runs through September. The Brazilian Pepper Tree fuels a large honey bee migration by commercial beekeepers. Tens of thousands of hives are relocated to this area to replenish food stores and facilitate brood build up in preparation for January/February deployment to the California almond groves. Since I was planning to move my apiary at the end of August, it meant this natural replenishment would not be available. North Florida beeks also advised me that late Summer/early Fall often experienced a nectar dearth. Because of this, I made the decision to leave all honey in the hive, forgoing a honey harvest. I wanted to ensure there were no "weaker" hives, subjecting them to the possibility of robbing and other perils. I began in July/August to equalize resources across the apiary. This also meant moving the hives would be more difficult as they would be much heavier. A fact I wish I had given more consideration.

- Clearing the hives of queens and drones: This one was a bit of a head scratcher. While I do everything (well, maybe not everything) in my power to maintain calm hives, there is no way to guarantee there is no hybridized stock. Queens in Central FL lay almost year round and are likely to supersede more frequently. Sometimes it is impossible to catch the transition. With the compatibility of mother/daughter queens, you can still have a laying queen in the middle of a supersedure. The hive can be calm and forty five days later you can have a fully Africanized hive given the right (or wrong) combinations of genetics. Some advised that people move hives around the state all the time without worrying about this. While this may be true, I made the decision to take this additional step. For several days we went through EVERY hive we planned to move searching for queens and excluding drones. Not sure how this would have been accomplished without the help of friends (thanks Suzan Bryant). On a couple of days we forgot to take a lunch break and Suzan persisted with me! The timing was critical since we had just a few days to be queenless before other problems are created.
- Actual move: This was the area where careful planning and improvisation do a delicate dance. As a small time keeper, 20+/- colonies, I have not invested in specialized moving equipment. More often than not, my pick-up is adequate to load up a couple of hives and transport between apiaries. For larger moves, multiple trips are easy. Moving equipment consisted of a ratchet strap and two strong keepers, one on either side. I have a small fourteen foot utility trailer I use around the house and apiary, but I had never planned on using it for a longer move. Suffering a breakdown in the middle of a move was not an option. Several weeks before the move I bit the bullet and did the work. New tires, replaced the wheel bearings, and a new set of magnetic lights. Several days before the move I serviced the truck and had a full tank of fuel. I called the Florida Department of Transportation (DOT) and clarified the rules for agriculture transport and truck weigh stations. Fortunately, I did not pass any agriculture inspection stations on my planned route and I was exempt from weigh stations. I also checked the day before to ensure there were no known detours or road closures. (NOTE:

Moving colonies from a known Afircanized area, to an area considered non-Africanized required special precautions.



A forestry mulcher makes quick work of clearing an appropriate area for my new apiary.

First half of the apiary deployed. Spacing allows a tractor with a six foot cutter to pass between stands.

I checked for overnight road closures since we were planning to get on the road by four am.)

I also spent time the week before the move making sure I had enough straps to secure every hive we proposed moving. This meant buying additional straps and borrowing others. I precut entrance excluders from #8 hardware cloth and made sure my stapler was stocked. (I am glad I did! Had I not taken this step I would have been sitting at the apiary the night before with no staples.) Having done the best pre-planning we could, improvisation was still important. I found out hives full of honey and brood stacked three high are heavy. What we had planned to pick up and set on the trailer turned into getting the trailer close enough to drag the hives into place. Securing them meant using 2x4 lumber and a screw gun. Loading four wide turned into three wide when you factor in the extra width of the boards. This meant an extra row of hives throwing off our tongue to tail weight ratio; which meant moving the hives again; which meant… you get the picture. In the end, the trailer was loaded, balanced, secured and lighted. (I am certainly glad I had new tires and bearings!) We had planned to do most of this in the dark, with the aid of a full moon, however, when clouds obscured the moon we were left in pitch black, an eventuality we had not planned for. Fortunately, Suzan had a couple of red bandannas we were able to place over lights….great improvisation!

- Requeening: A critical part of our plan was to remove the queens over a two day period before our move. We also needed to close and secure the hives the night before the move, load the trailer and be on the road by four am the next morning. This did not leave much time to pick up our new queens. I cannot say enough good things about Elizabeth Wessman and Bottomstungbees.com. When I was making my initial plans, Elizabeth told me she would have queens available. When I called her a week, and then the day before, she assured me she had the queens. As I was trying to work out how to pick them up she offered to meet me at an interstate exit near her house and on our route. I calculated we would probably be at her exit at five am. Without hesitation, she responded she would recognize my truck since I would probably be the only one with a trailer load of bees! Beekeepers are… (for the most part) a great bunch of folk. It felt a bit clandestine, when we met in the parking lot of a Dunkin Donut at 5:00 am, exchanging a wad of cash and taking delivery of an orange package. My wife went in to get coffee stating she wanted no part of the optics!
- Repopulating the new apiary: Thankfully, the least eventful part of the trip was the actual over the road transfer. The plan was to arrive by 8:30 am to insure heat was not an issue. Fortunately, there were some clouds that shielded us from the early morning Florida sun that can be quite warm. We immediately began the process of unloading and placing the hives on stands. With the exception of one small mishap there were no casualties. One super had slightly turned exposing frames. Fortunately there did not appear to be a mass exodus from the hive. The problem was corrected when we placed the hive on the stand. All in all a fairly uneventful trip.
- Requeening: By the time all hives were unstrapped, screen excluders removed and bees had begun reorienting to their new location, we were pushing close to seventy-two hours of being queenless. While I did not notice a difference, my unloading helper, a local beek, was concerned that these were the most agitated bees he had ever worked with. I took this as confirmation that we had done the right thing and needed to begin the process of requeening immediately. Conditions were favorable and within the hour we had inspected all hives with queen cages installed.

As a beekeeping mentor, one of the most common misconceptions (at least in my opinion) is that it is the job of a beekeeper to try and figure out what the bees need to do. For instance, "how do we get the bees to accept a new queen?" My experience is that bees know a lot more about beekeeping than I ever will. I have never had good

A sampling of some of the flowers in this transitional forest.

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success getting them to do anything. Rather, I find the most success when I will listen, watch and learn what it is the bees want and need. When the bees tell me they are queenless, all I really need to do is make a queen or resources available. Once that is accomplished, they will figure it out, without much help from me.

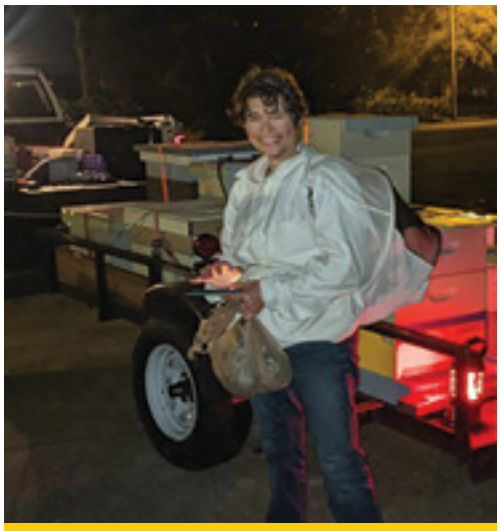
Unfortunately, I was not able to stay at the apiary and returned to Central Florida later in the day. When I was able to do an inspection some two weeks later, all queens appeared to have been successfully released. One hive had absconded, but the apiary had done a good job appropriating any remaining resources. I was also pleased to see that despite my fears, the bees were finding sources of pollen and nectar, bringing it into the hive in high volume.

At twelve weeks after the move the regional bee inspector had scheduled a visit to the apiary. Inspection revealed brood in ALL of the remaining hives in all stages of development. This was in early December and it also appeared food supplies in all the hives were remaining constant or had increased. At the time of writing this article I had not yet followed up with a mite count. I was depending on the brood break as the most efficacious treatment at the time.

While a Northern beekeeper would roll their eyes when I use the term "overwintering," here in North Florida, there is definitely a decline in outside hive activity in the January/February time frame. We will sometimes go three or four days in a row where the high temp will not climb above 50 degrees. Fortunately, highs in the 60's are much more common and at the time of this writing we had not yet experienced a significant freeze and diminution of foliage. All in all, the learning curve for the bees seems to be a lot shorter than that of their keeper. Turns out, this moving experience was also a great learning experience.

Stuart Rowan is a third generation beekeeper (sort of). He was also president and founding member of the South Brevard Beekeepers. Stuart is a Master Beekeeper and manages his new apiaries in Columbia County, FL.

Early morning in the beeyard. The girls didn't get much rest last night.



What two hard days of chasing queens looks like! Thanks Suzan!

Because of our climate, Central FL bees are active almost year round.

Planning and improvisation result in a successful effort.

Recently, a friend of mine suggested that I watch "an old but prophetic" movie titled, "Soylent Green." The film, loosely based on Harry Harrison's 1966 science fiction novel *Make Room! Make Room!* features a young Charlton Heston playing the lead role of Detective Sergeant Thorn. Eerily, the movie is set during the year 2022, in New York city, population "40 million people." I would bet that when Harrison penned this work of fiction some 56 years ago, he thought this number of 40 million to be overly inflated, an absurd amount of people. Or didn't he?

According to the most recent numbers provided by the United States Census Bureau, New York city had a reported population of 8,804,190 people in April 2020. This was just before the Covid-19 pandemic had fully sunk its teeth into not just our bodies, but our economy, livelihood, bank account and most importantly, our spirit. At the time I am composing this article (February, 2022), New York city has reported a total of 39,011 deaths and a staggering 631,000 jobs lost as a result of Covid-19.

As I watched the movie, I certainly felt the prophetic-ness that my friend had alluded to. Staircases full of sleeping vagrants with physically nowhere else left to go. Everyone appeared uncomfortable and hot, always in a flux of sweat due to the over crowdedness and increased warming of our sphere. Most of the fresh produce items that we in the western world take for granted on a daily basis, are the most precious commodities in Harrison's projection of 2022. Fruits, vegetables, beef... all available in limited quantities and are only attainable by the most elite. The bulk of the population, can only afford to sustain on a series of man-made, food items that provide just a semblance of nutrition, while large corporations and government profits. Sounding more prophetic by the paragraph, isn't it?

So, has it already begun?

I try to consume a healthy, whole foods diet, and I can personally attest that since the pandemic, my American dollar goes nowhere near as far as it once did just two years ago. To add insult to injury, Covid also provided an opportunity for industry to price gouge consumers as a result of mandatory governmental shutdowns, supply chain issues, ships stuck at ports, etc. The same number of fresh produce items now costs me on average $80 - $120 more then what I was paying just two years ago. Yet my wages have stayed the same. Bring on that overly processed, fast food dollar menu!

In a documentary that debuted in January titled "The Green Planet," renowned naturalist Sir David Attenborough warns, "the world, it depends upon plants and we treat them with so little thought, so little care and exterminate them without little thought or little care. And we will pay the price." Attenborough continues, "We caused it; our kind of industrialization is one of the major factors in producing this change in climate. So, we have a moral responsibility even if we didn't cause it, we would have a moral responsibility to do something about it." Despite being 95 years young, and living his life day-by-day, Attenborough still feels the responsibility to utilize his worldwide platform to help garner attention to this impending crisis that will begin to affect all of us with more regularity in the coming decades. On biodiversity, Attenborough offers, "it's never been more important for us to understand the effects of biodiversity loss, of how it is that we ourselves are responsible for it."

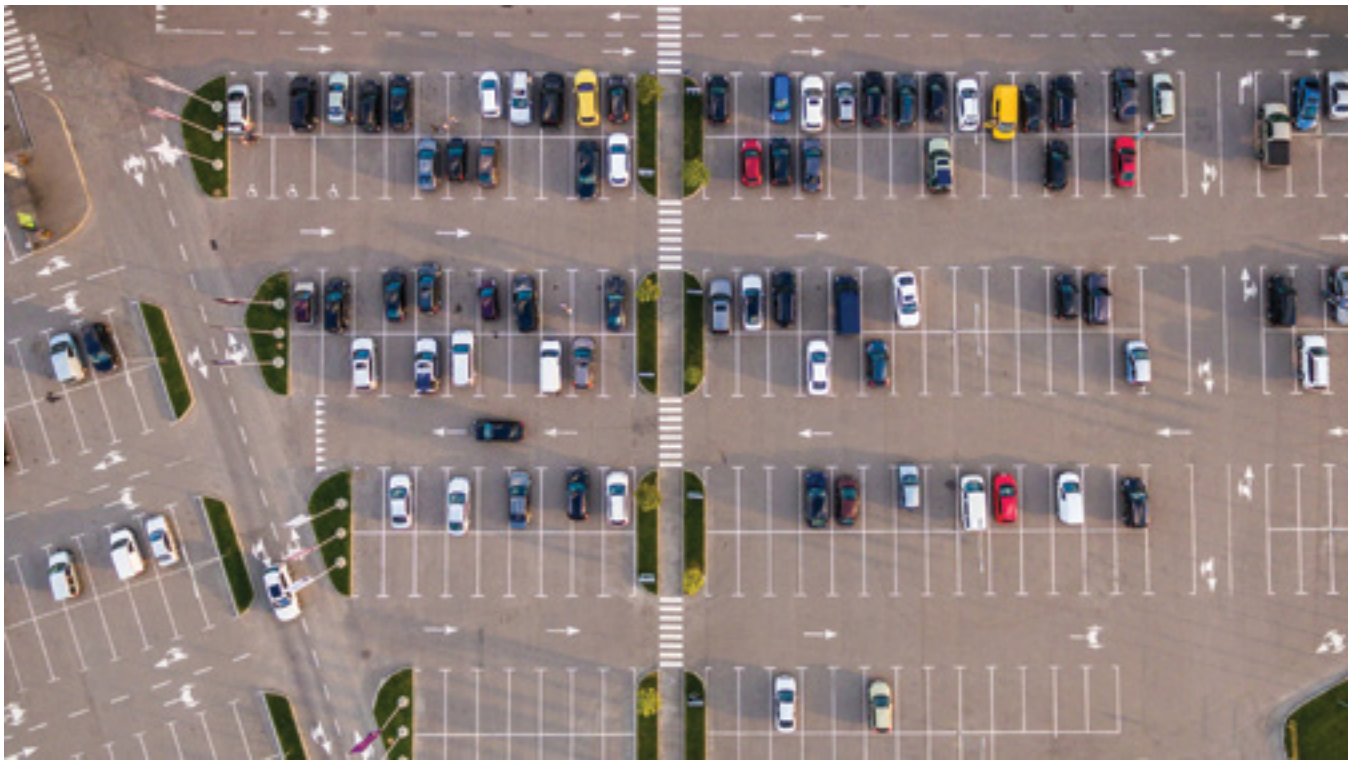
As beekeepers, we are all too familiar with the negative impacts that increased industry has had on our bees, yet rarely contemplate it any further than how it affects our own operation or wallet. The trial is over and the verdict is in. The loss of biodiversity around the world, and especially the reduced biodiversity of insect populations, poses extremely serious consequences down the road for us. Earths conqueror.

The Staggering Loss of Biodiversity

In December 2020, *Nature* magazine published a report that found that human-made materials now exceeded the mass of all living things on the planet. Let that sink in. The concrete, steel, plastics, and other man-made materials now physically weigh more than the people, plants, bacteria and animals that with whom we share the planet.

One of the most obvious effects of our massive ecological footprint is the staggering loss of biodiversity that we now see. The recently created Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES) has been given the task of performing regular and timely assessments of knowledge on biodiversity and ecosystem services. According to the IPBES chair Robert Watson, "the health of ecosystems on which we and all other species

Is Your time



depend is deteriorating more rapidly than ever. We are eroding the very foundations of our economies, livelihoods, food security, health and quality of life worldwide."

More specifically, the IPBES reports that well over one million animal and plant species are now threatened with extinction, many within the coming decades. Though species have gone extinct throughout human history, the scale of the threat of extinction has never been higher than today. The report goes on to find that the average abundance of native species in most major land-based habitats has fallen by at least 20% in the past century.

Unfortunately, many people associate this drastic loss of biodiversity with the disappearance of exotic species of plants or animals on the other side of the world. The biologist trying to spot the elusive and nearly extinct Guatemalan Small Eared Shrew. We fail to realize that a decline in biodiversity could have palpable and realistic effects on our own livelihoods. This selective form of naivete' is self-serving and affords us the luxury of not taking action. Of not implementing changes to our daily lives that would affect the greater good.

Of course, biodiversity is of fundamental importance for all of life on earth. Besides creating more resilient and vibrant ecosystems, biodiversity is at the core of ecological life support. The millions of unseen species of plants, bacteria, fungi and insects combine to create the conditions for life upon which we depend. Oxygen to breathe, clean water to drink, pollination of plants for the crops we grow, pest control, wastewater treatment and thousands of other "ecosystem services" all depend on the complex interactions of bio-diverse ecosystems.

The Underappreciated Importance of Insects

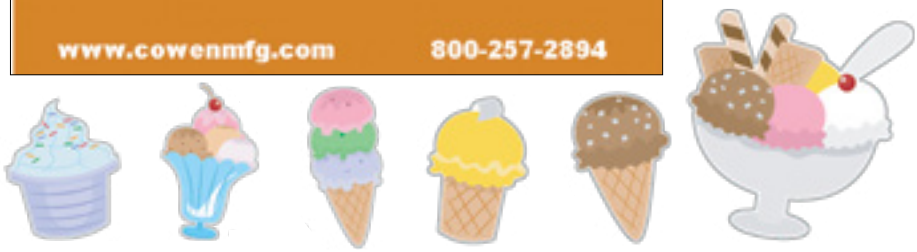
Insect populations around the world are similarly affected by the rising threat of species extinction. According to one recent estimate, more than 40% of all insects are declining worldwide with one third of insect species being placed on the endangered list. This data suggests that the rate of decline for ALL insects is at least 2.5% annually. While we may worry about white rhinos and other emblematic species that are in danger of extinction, insects face extinction rates that are eight times higher than vertebrates!

So, what would a world without insects look like? For one, the amount of food that we could produce would be greatly reduced. The USDA finds that "three-fourths of the world's flowering plants and about 35 percent of the world's food crops depend on animal pollinators to reproduce." A significant loss of pollinator insects would severely affect the production of crops such as apples, almonds, avocados, cucumbers, onions and hundreds of other common foods. Even without complete extinction, the reduced pollination rates of these plants due to drops in insect population would lead to lower seed or fruit set, lower plant regeneration rates and other, cascading effects on other animal species that rely on plants and their products for food.

Insects also play an important role in other vital ecological functions including pest control, decomposition and maintenance of wildlife species.

Worth Savin?

Jeff Kennedy



Native Pollinator Loss in the Midwest

One of the major causes of the massive drop in insect populations around the world (often referred to as the "Insect Apocalypse") is the increasing usage of herbicides, pesticides, fungicides, and other synthetic agricultural chemicals. A 2019 study determined that America's agricultural landscape is now 48 times more toxic to honey bees, and likely other insects, than it was 25 years ago. This landscape toxicity is closely related to the widespread use of neonicotinoid pesticides.

So how much pesticides are we actually using here in the land of the free? In 2007, for example, we collectively sprayed 1.1 billion pounds of pesticides on our lawns, parks, and farm fields, which is almost a quarter of the total worldwide pesticide use. In my home state of Indiana, a recent USDA report finds that "herbicide was used on 99 percent of Indiana's 5.7 million corn acres during 2000 while insecticides were applied to 30 percent of the acreage."

The toxicity of Indiana's farm fields is not only leaching into our watersheds and affecting aquatic organisms, but is also directly responsible for the loss of native pollinators in the region. According to Purdue University, the native pollinator communities in Indiana face many threats. During the past 15 years, researchers have documented reduced populations of honey bees, bumble bees and several butterfly and moth species. While bees are primarily affected by the use of certain types of pesticides, other Indiana insect species are dropping due to loss of habitat. For example, over the past 100 years, the Karner Blue Butterfly (*Plebejus melissa samuelis*) has seen its population drop by 99%, mostly due to habitat loss and the slow disappearance of Wild Lupine (*Lupinus perennis*), which is its primary food source.

What Can You Do to Assist Native Pollinator Populations?

The loss of biodiversity, and specifically the drop in native pollinator populations, is an issue that affects all of us. While we may consider installing solar panels or purchasing an electric vehicle as a way to limit carbon emissions that are driving global climate change, most people have no idea how to contribute to the resilience and resurgence of insect populations. To end, I offer a few strategies for supporting and encouraging pollinators and insect populations in general.

- Plant a pollinator-friendly lawn: Instead of monoculture turf grass that requires an enormous amount of synthetic chemicals that hurt insect populations, consider sowing native wildflower seed for a more beautiful, healthier, and pollinator-friendly lawn.
- Eliminate pesticide use in your landscape: For both your yard and garden, eliminate all pesticide use, especially neonicotinoids. There are several "biological pest controls" that are extremely effective for gardens and lawns, and are much healthier for both humans and other non-target insects.
- Extend your flowering season: Planting a diversity of flowering plants and trees can also help increase the food supply for native pollinators. When planning your landscape, consider purchasing flowers, trees, herbs, and other plants that flower throughout the Spring, Summer and Fall.

And if you've never seen it, pick-up or stream a copy of Soylent Green. There are several other eye-opening scenes in the film that I haven't touched on here for fear of spoiling the film for those that want to watch it. Some of these things are already occurring and others I fear will soon begin happening if we all just sit idle and trust in our government.

Come gather 'round people, wherever you roam
And admit that the waters around you have grown
And accept it that soon you'll be drenched to the bone
if your time to you is worth savin'
Then you better start swimmin' or you'll sink like a stone
For the times they are a-changin'
- Bob Dylan *The Times They Are A-Changin'* (1964)

FEEDING

Greg Carey

I should start by stating my opinion that all feeding of bees is emergency feeding. I hope to provide support for that statement here. As you will learn I am not one of those who say that feeding your bees is bad and should be avoided at all costs. On the contrary, I am the guy who sits in the meetings and proclaims, "If you got 'em, feed 'em!" In fact, I was raised on a farm, and we never kept anything that we didn't feed. It was just considered good husbandry. Our chickens (today they could be called free range) were tossed grains from the barrel every day. Everything under our care was fed.

I read somewhere (internet) that the average survival rate of swarms in the wild these days is around 25 percent. What beekeeper, farmer, or parent would consider themselves successful with that kind of batting average? The fact that no one would explains the explosion in human population with the accompanying population of livestock to keep them fed. So, I think we can agree that we wish to have all our honey bee colonies survive 100%.

Typically, we get started after reading a book, taking a class and/or talking to a beekeeping friend. Next, we order a package of bees to arrive in the Spring. When they arrive, it does not much matter how we decide to house our new bees, they will not be natural unless we take them to a hollow tree in the woods and shake them out and walk away. There is not much natural about beekeeping any more than raising chickens. We put them in a box in our apiary with frames of foundation or bars with starter strips, etc. They arrived with a can of syrup, half consumed. That and their stomach contents are what they have to start building comb to raise their brood. This is what I call an emergency situation. I am sure a swarm would have arrived better prepared.

This is where I advise to feed your bees one to one (sugar/water weight) syrup and keep those feeders filled 24/7 until they have all the comb drawn and enough stores to overwinter. I am not one of those quart-jar-with-a-few-holes-in-the-lid feeders. I am a bucket feeder who places two buckets on the frame tops. A good colony can empty these buckets in less than a week if they have comb to move it into. You can use a deep hive body to enclose them. During warm weather, the Miller type hive top feeders work fine, but in the cold the bees would need to break cluster to get to the syrup. The same goes for a frame feeder which I use in my Long Lang. The cluster can nuzzle up against the bucket and warm the syrup as they take it. Those quart jar things are okay for water, but I would never actually use one to feed. We have an emergency here!

I am sure you didn't, but let's assume you failed in the above task. Fall is upon us, and your bees do not have enough stores for Winter. We are still in an emergency. How bad is it? I am hoping that you did not fail so badly that your bees do not have enough comb drawn. They draw comb better when there are heat and thin syrup (nectar) for wax production. We will come back to this worst case in a bit. For now, we will assume they have enough comb but are short on stores. Now is the time to switch to thick syrup two to one sugar/water for feeding. This thick syrup can be readily taken into the cells for storage and processed for capping a lot easier than thin syrup. It can be bucket fed the same as the thin syrup. It does not greatly stimulate brood production, which brings me to a word of caution. The bees will not distinguish a bucket of thin syrup from a good nectar flow. If you feed thin syrup late, watch for congestion and the inevitable swarm after July. We all know what they are worth. In my area most recommend that you have a frame of stores for each frame of bees around the middle of October. Your area will most likely be different. You should talk to other local beeks for advice on this.

Okay, let's talk about that worst case. Your bees are hopelessly unprepared for Winter. The stores pantry is not properly drawn out and stocked, and the weather is getting cold. Now is the time to breakout the recipes for candy feeding.

There are two types of fondant that I have used to success. The first is the cooked candy fondant. It carries more moisture than the second and takes longer to make. Some have trouble with it. My main caution to the begin-

ner is to never turn your back on boiling sugar. It is highly flammable. If it boils over onto a hot burner there will be black smoke in your kitchen. That said, I have made it many times, and my bees consumed it readily. You will need a large pot. I just placed the candy directly on the frame tops or in a candy board and have never covered it as called for below.

Here is that recipe:

From *The Hive and The Honey Bee*, page 637, which credits Clarence Collison for it.

Fondant Recipe

15 pounds sugar

3 pounds glucose or white syrup (Karo) (Note: 16 fl oz is more than a lb.)

4 cups water

½ teaspoon cream of tartar

Dissolve the sugar (ingredients) *in the water by stirring and boiling the mixture until the temperature of the syrup rises to 242°F. Let syrup cool to 180°F, and then beat until thick. Pour the candy into molds lined with wax paper. Place a cake of sugar on two small, ½-inch square strips of wood in an empty super above the cluster of bees. Cover the candy and the space around it with cloth or newspaper to keep it warm. Remove any remaining candy and feed syrup when the weather gets warm.*

Now our purest friends tell us that this type of cooked food is not the healthiest thing your bees can eat. This may be true. Some evidence suggests that caramelized sugars contain HMF (Hydroxymethylfurfural) which could shorten your honey bee's life. I recommend you make an informed decision. You can start by looking here: **https://pubmed.ncbi.nlm.nih.gov/24127696/**. The page has many links for study, and the abstract reads:

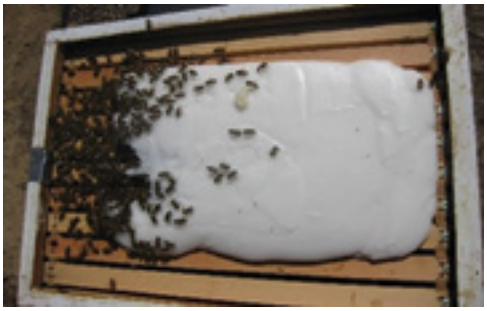
"Hydroxymethylfurfural (HMF), a common product of hexose degradation occurring during the Maillard reaction and caramelization, has been found toxic for rats and mice. It could cause a potential health risk for humans due to its presence in many foods, sometimes exceeding one g/kg (in certain dried fruits and caramel products), although the latter still is controversial. HMF can also be consumed by honey bees through bad production batches of sugar syrups that are offered as Winter feeding. In Belgium, abnormal losses of honey bee colonies were observed in colonies that were fed with syrup of

inverted beet sugar containing high concentrations of HMF (up to 475 mg/kg). These losses suggest that HMF could be implicated in bee mortality, a topic that so far has received only little attention. This paper reviews the current knowledge of the presence of HMF in honey bee environment and possible consequences on bee mortality. Some lines of inquiry for further toxicological analysis are likewise proposed."

No one will argue that cooked sugar is better than their own honey, but, as I said, I have used this recipe many seasons with success. I use cane sugar and watch the recipe temperatures like a hawk. I will say that sugar is better than starvation. The earlier folks boiled shoes and animal hides for a meal, and we are still here today. I am not trying to develop a genetically superior stock. I am just hoping to get through an emergency. None of my colonies have ever outlived the queen more than two months. The life span of all colonies pretty much matches that of the queen. Replace the queen and in two months you have a completely new set of genes in the colony, a new creature.

The second recipe that I used this year is called fluffy fondant. It is a no cook recipe which does not have much moisture but absorbs moisture from the cluster kinda like a moisture board would do only the bees can eat it. Notice, this is another reason for using candy boards. I use my ⅜th drill motor with a kneading attachment from the kitchen blender to mix it. It is much simpler to make than the cooked recipe. I use a large bowl and then spoon it onto a lined cookie pan or candy board. Once you make a batch you will understand why it's call fluffy fondant. Here is that recipe:

Fluffy Fondant:
White granulated sugar (table sugar), 10-lbs
Cold tap water, 1-cup
Pail or large bowl in which you mix the sugar and water
Stir until mixed. No cooking!
No hot water.



Both recipes, once made, can be put into a cookie pan or into your candy boards with a sheet of wax paper or other thin paper to keep it from flowing out before it hardens. Once hardened it can be stored indefinitely or the paper scratched and placed on top of the frames where needed. An obvious advantage of solid candy over pouring granulated sugar on the frame tops or inner cover is that it can be easily removed, with very little waste, to be used later in solid form or watered down into syrup. If you don't have a candy board, you can use the cookie sheet idea and an Imirie shim as you see here. If you don't have an Imirie shim you can use an empty super to give room for the candy.

You have gotten them this far, don't let them down in the stretch. BTW, I usually start some pollen patties and thin syrup in early March to stimulate brood before that main nectar flow begins around my yard. Not everyone does this. That's why I used the pronouns "I" and "my." If you got 'em, feed 'em!

Current Status of Loop-Mediated Isothermal Amplification Technologies for the Detection of Honey Bee Pathogens

Timothy C. Cameron, Danielle Wiles & Travis Beddoe,

Department of Animal, Plant and Soil Science, Centre for AgriBioscience, La Trobe University, Melbourne, VIC, Australia and Centre for Livestock Interactions With Pathogens, Le Trobe University, Melbourne, VIC, Australia

Abstract

Approximately one-third of the typical human Western diet depends upon pollination for production, and honey bees (*Apis mellifera*) are the primary pollinators of numerous food crops, including fruits, nuts, vegetables, and oilseeds. Regional large scale losses of managed honey bee populations have increased significantly during the last decade. In particular, asymptomatic infection of honey bees with viruses and bacterial pathogens are quite common, and co-pathogenic interaction with other pathogens have led to more severe and frequent colony losses. Other multiple environmental stress factors, including agrochemical exposure, lack of quality forage, and reduced habitat, have all contributed to the considerable negative impact upon bee health. The ability to accurately diagnose diseases early could likely lead to better management and treatment strategies. While many molecular diagnostic tests such as real-time PCR and MALDI-TOF mass spectrometry have been developed to detect honey bee pathogens, they are not field-deployable and thus cannot support local apiary husbandry decision-making for disease control. Here we review the field-deployable technology termed loop-mediated isothermal amplification (LAMP) and its application to diagnose honey bee infections.

Introduction

The European honey bee, *Apis mellifera,* is a significant component of agricultural systems worldwide. The honey bee is classified as a livestock species due to being a food-producing animal specifically related to honey production (1). Honey bees also produce wax, pollen, royal jelly, and propolis which are all commercial products of the apiary industry. However, honey bees' most significant ecological impact is that they are a critical contributor to food production via pollination (2,3). The majority of crop species depend on pollination, with some crops such as almonds, onions, sunflowers and avocados being 100% reliant on honey bees for pollination (2,3). Despite the importance of honey bees to agricultural systems, there have been reports of large scale losses in managed honey bee populations in different parts of the world. These mass losses have been due to various environmental stressors such as pathogens, agrochemical exposure, lack of quality forage, climate change and reduced habitat (4-8).

The prevailing view is that the increasing prevalence of pathogens and parasites are a significant driver in honey bee colony losses. Honey bees are infected by a variety of pathogen and pests such as bacteria (*Paenibacillus larvae*, *Melissococcus plutonius*) (9), fungi (*Nosema* spp., *Ascosphaerea apis*) (10,11), mites (*Varroa destructor, Acarapis woodi*, *Tropilaelaps* spp.) (12) and insect pests such as the greater wax moth (*Galleria melonella*) and the small hive beetle (*Aethina tumidae*) (13). In particular, honey bees are known to be infected by several viruses; most of these are positive-strand RNA viruses belonging to the order of Picornavirales (14). They include several important viruses, such as the Israeli acute bee paralysis virus (IAPV) and the black queen cell virus (BQCV), which belong to the Dicistroviridae family. In contrast, the Iflaviridae family contains the deformed wing virus (DWV) and sacbrood virus (SBV). These viral infections result in deformities, paralysis and/or death; however, most of these viral infections remain asymptomatic until external stress is applied (7,15). Due to honey bees being predominantly asymptomatic when these virus species are present, molecular-based diagnostic techniques are critical for the accurate diagnosis of infection and making informed management decisions.

Current molecular detection of honey bee pests and pathogens

The majority of molecular techniques utilize the ability to detect specific pathogen or pest nucleic acids. The most common technique for detecting honey bee pests and pathogens is by quantitative PCR (qPCR), and in the case of a virus, this requires the use of reverse transcriptase to amplify the RNA, which is termed RT-qPCR. There are many individual qPCR assays to detect specific pathogens, such as *P. larvae* (16), *M. plutonis* (17), *A. woodi* (18), *Nosema* spp. (19) Furthermore, a range of viruses (described within (19)) with many of these qPCR tests being multiplexed to perform rapid detection of several pathogens within a single PCR run (20,21). In recent years, the use of matrix-assisted laser desorption/ionization time-of-flight (MALDI-TOF) mass spectrometry (MS) has emerged as a clinical diagnostic method for the identification of bacterial species (22), and this technology has been applied to honey bee pathogen diagnostics in the identification of different strains of *P. larvae* (23). Despite these techniques' power to identify infected honey bees and hives, they still require specialized labs and trained

personnel. The early identification of pests and pathogens in managed honey bees is crucial for the decision-making process regarding disease control, prevention, the strategy of treatment and, therefore, mitigation of the impact of a particular disease. This has been highlighted recently where an integrated management strategy was used to prevent outbreaks and eliminate American foulbrood (*P. larvae*) in a commercial beekeeping operation (24). Several field-based diagnostic technologies that can amplify nucleic acids have emerged in recent years, such as loop-mediated isothermal amplification (LAMP) and recombinase polymerase amplification (25,26). These technologies have the potential to revolutionize disease management in livestock industries, including honey bees. Currently, the only field-based diagnostic technologies applied for the detection of honey bee pests and pathogens is LAMP. Here we review the current status of field-based nucleic acid amplification techniques, with a particular focus on LAMP, to detect various honey bee pathogens and discuss the implications with which these new diagnostic techniques can impact and inform apiary management practices.

Principles of LAMP

Loop-mediated isothermal amplification (LAMP) is a novel nucleic acid amplification technology that rapidly amplifies nucleic acids under isothermal conditions (27). LAMP utilizes *Bst or Bsm* DNA polymerase with a strong strand displacing ability and functions at isothermal conditions between 60-65°C, thereby eliminating the need for thermal cycling. LAMP does not require an additional reverse transcription step for the amplification of RNA viral gene products and amplifies DNA with high specificity, sensitivity, and speed (27). Additionally, the LAMP amplification is very robust, which is ideal when using a crude DNA extract purified from a range of environmental sources (25). This allows the use of non-invasive sampling techniques to be implemented, such as swabbing hive entrances rather than sampling honey bees themselves, minimizing stress applied to the hive due to excessive human handling. However, to avoid false-positive (due to contamination) and negative results, in-hive samples/bees should be recommended. These characteristics allow LAMP assays to be performed in field-based settings with cheap and portable equipment (28). It has been proven to be a suitable molecular diagnostic method for field detection of a range of pathogens (29-31).

LAMP reactions are highly specific, involving four primary primers designed to target six distinct sequences on the target DNA (27) (Supplementary Figure 1). These primers are termed the forward and backward inner primer (FIP and BIP) as well as the forward (F3) and backward outer (B3) primer (Supplementary Figure 1). Both the FIP and BIP primers contain complementary regions that bind to form loop structures, providing more sites for primers to bind, initiating further amplification. Optional loop forward (LF) and loop backward (LB) primers can also be added to increase reaction speed by hybridizing to the loop structure to provide additional amplification initiation sites (32)Overall, LAMP is an ideal method for providing cheap (≈AU$ 5 to 7 per sample), rapid and robust detection of pathogens in-field with high sensitivity and specificity using minimal, simple equipment.

Application of LAMP for the detection of fungal pathogens of honey bees

Nosemosis is a worldwide distributed infectious disease and constitutes a severe problem in both managed European (*A. mellifera*) and Asian honey bee (*A. cerana*) populations as well as wild bumble bees (33,34,11). There are three causative agents of nosemosis; *Nosema ceranae* and *N. apis*, which infect both *A. mellifera* and *A. cerana*, while *N. bombi* is a major pathogen of wild bumble bees (34). *Nosema* spp. belongs to a spore-forming fungal family termed microsporidia. They are obligatory unicellular parasites that infect a range of agricultural important livestock (35,36). In particular, *N. ceranae* is the major pathogen of *A. mellifera* that results in a range of symptoms such as suppressed immune function, lipid synthesis, pheromone and hormone production (37-39). If an infection is severe, it can lead to death and the resulting colonies' collapse (40,41). Transmission of *N. ceranae* between hives can occur via honey, pollen, nectar and bee fecal matter. It can be controlled by treatment with fumagillin if the infection has been diagnosed in the field. The application of antibiotics has several problems, such as the potential to lead to resistant strains and honey's residue contamination. In many parts of the world, such as the European Union, antibiotics for Nosemosis treatment are banned. There have been three separate LAMP assays developed to detect *N. ceranae* and one for the detection of *N. apis* (Table 1) (42-44). Also, one has been developed for *N. bombi* infection within wild bumble bee populations (45). All three of the *N. ceranae* LAMP assays are extremely sensitive for the detection of infection; however, the LAMP assay developed by Lannutti *et al.*, (2020) uses primers targeting the polar tube protein 3 (PTP3) gene, a highly specific and conserved gene of *N. ceranae*. Targeting the *PTP3* gene overcomes non-specific amplification that can occur due to polymorphisms in the 16S rRNA gene, which is the other two assays' target gene (46). Furthermore, only the PTP3-LAMP assay has been successfully evaluated using a panel of field samples (44).

Two brood diseases, stonebrood and chalkbrood, are caused by the fungal species *Aspergillus flavus* and *Ascophaera apis*, respectively. Diagnosis based on visual symptoms is difficult as both diseases have very similar clinical symptoms (47). Two LAMP assays have been developed to amplify different regions of the 18S rRNA gene to allow detection of an infected hive (48,49). In laboratory testing, both assays were shown to be highly specific for the target species only, detecting *A. flavus* with no amplification of *A. apis* and *N. ceranae* DNA. To date, neither test has been optimized for field sampling and detection, with in-field validation of these tests required.

Application of LAMP for the detection of viral pathogens of honey bees

Honey bees can be infected with a range of RNA viruses. However, most of the time, the bees are asymptomatic until external stress is applied, which results in severe loss of honey bees and reduced hive functionality (50). For example, the deformed wing virus (DWV) is often present in low levels in *A. mellifera* with no impacts on hive health; however, the *Varroa destructor* mite's introduction causes the virus to become more virulent, which results in massive mortality (51,52). Current detection for honey bee viruses has mainly focused on molecular

Pathogen	Target gene	Specimen	Detection limit	Loop primers	Field samples[1]	Reference
Fungal						
Nosema ceranae	16S rRNA	Adult bees[2]	0.3ng	No	Yes	(43)
	16S rRNA	Adult bee[3]	100 fg	Yes	No	(42)
	Polar tube protein 3 (PTP3)	Adult bees[2], Spores	1 pg	Yes	Yes	(44)
N. apis	16S rRNA	Adult bee[3]	100 fg	Yes	Yes	(42)
N. bombi	SSU rRNA	Adult bees[2]	$4.57x10^1$ spores/µl	Yes	No	(45)
Aspergillus flavus	18S rRNA	Adult bees[2]	N.D.[4]	No	Yes	(48)
	18S rRNA	Adult bees[2]	10^5 copies/reaction	No	Yes	(49)
Viral						
Sacbrood virus	SBV-pol gene	Adult bees[2]	10 copies/reaction	Yes	No	(63)
	SBV-pol gene	*A. cerana indica* Larvae, Pre pupae	N.D.	Yes	Yes	(64)
Korean *Sacbrood virus*	VP1 gene	Adults bees[2], Larvae	1000 copies/reaction	No	Yes	(65)
Chinese *Sacbrood virus*	VP1 gene	Larvae	1 pg	No	Yes	(66)
Bacterial						
Melissococcus plutonius	DNA gyrase subunit B	Adult bee[3], Larvae	2 fg	No	No	(67)
Insect pests						
Aethina tumida (Small Hive Beetle)	28S rRNA	*A. tumida* Adults, Pupae, Eggs	12 pg	Yes	No	(60)
Vespa velutina nigrithorax (yellow-legged Asian hornet)	COX1 (cytochrome oxidase subunit 1)	*V. velutina nigrithorax* Adults, Larva, Egg, Nest Material	5 pg	Yes	Yes	(68)

[1]Samples collected from the field.
[2]Pool of adult honey bees were used for extraction of nucleic acid for LAMP assay.
[3]Individual adult honey bee was used for extraction of nucleic acid for LAMP assay.
[4]N.D. = not determined

Table 1. LAMP assays developed for the detection of pathogens and pests of honey bees.

techniques in specialized laboratories (19,20). Currently, LAMP tests have been developed only for the sacbrood virus (SBV) for country-specific outbreaks (Table 1). SBV causes the larvae to die shortly after capping; however, the disease incidence is higher after stress events such as a shortage of nectar or pollen (53). The assays either amplify the SBV polymerase gene or viral protein gene with a range of sensitivities from 1 pg to 1000 copies per reaction (Table 1). The range of sensitivity of detection is most likely due to sampling processing. Apart from SBV, there is significant scope for developing LAMP assays to detect a range of viruses that affect honey bees, particularly DWV. Currently, Australia is free of DWV (as well as the *Varroa* mite), thus has not suffered large colony loss due to these pathogens. It would be advantageous to have an assay to detect this virus in honey bees imported into the country to maintain Australia's DWV free status (54).

Application of LAMP for the detection of bacterial pathogens of honey bees

Of the several pathogenic bacteria species that cause disease of managed honey bees, there are only two economically relevant pathogens, *Paenibacillus larvae* and *Melissococcus plutonius*, the causative agents of American Foulbrood (AFB) and European Foulbrood (EFB), respectively (9). *P. larvae* and *M. plutonius* are listed by OIE (World Organisation for Animal Health) as category B organisms, which are defined as disease-causing agents considered to be of socio-economic and/or public health importance within countries. There are limited control options against theses pathogens; antibiotics such as Terramycin are effective against *M. plutonius* though in many parts of the world such European Union antibiotic treatments are strictly prohibited while there are no effective treatment options for *P. larvae* as antibiotics will not kill the infective spore stage thus burning of infected hives are required to minimize the spread of the pathogen (55). Prevention is better than the cure, and to this aim, there are commercial lateral flow devices that detect AFB and EFB infections; however, they all work only on larval samples. However, there is a demand for highly sensitive field tests from environmental samples to aid in disease control, prevention, monitoring and treatment strategies for bacterial diseases of honey bees. The predominant method utilized to distinguish the two diseases is visual inspection, which requires subjective expertise. Given the differences in treatment of AFB and EFB, more precise diagnostic methods are urgently required for use in the field. Currently, there is only a LAMP test for *M. plutonius,* which is extremely sensitive (detection limit of 2 fg) on laboratory prepared samples; however, this test has not been used in the field. Future work should be directed towards developing and validating LAMP assays for the causative agents of AFB and EFB in the field. A multiplex assay for the differentiation of these two species would be ideal.

Application of LAMP for the detection of insect pests and mites of honey bees

Several species of insect pests and mites of *A. mellifera* can cause significant problems in commercial apiaries worldwide. The *Varroa destructor* mite is the primary biotic cause of colony collapse syndrome and is found in nearly every continent except Australia (56,57). Other exotic pests such as the small hive beetle (SHB, *Aethina tumida*) and various species of hornets that have been introduced into a range of non-native countries can have a devastating effect on honey bees (58,59). The ability to rapidly and reliably identify invasive species at all life stages, and within the nest and hive debris is crucial in mounting an effective control response. As LAMP technology is well suited to aid biosecurity, there have been two reported LAMP assays for insect pests of honey bees (Table 1). The small hive beetle LAMP assay targets the 28S ribosomal gene and is able to detect the presence of SHB DNA down to 12 pg within 20 min (60). True hornets belong to the *Vespa* family and are naturally found only in Asia, Europe and Africa. They all prey on other insects, including honey bees; thus, introductions into non-native areas can have severe consequences for honey bee populations in these areas. Only one of the 20 species of true hornets have had a LAMP assay developed for their identification (Table 1). The yellow-legged Asian hornet (*Vespa velutina nigrithorax)* has been rapidly spreading throughout Europe after being accidentally introduced into France from China (61). The LAMP assay can reliably identify all life stages of *V. v. nigrithorax* as well as from nest material as low as 5 pg in 10 min. Both assays allow rapid unequivocal identification of insect pests which are normally identified via manual inspection of morphological features. An additional benefit of using LAMP is it can provide identification on decomposing or incomplete insect samples; thus, these assays will be useful in control programs to limit the damage caused by these pests. In the future, an entire suite of LAMP assays should be developed for the rapid identification of insect pests of honey bees to aid effective biosecurity control measures.

Application of LAMP for in-field detection of pests and pathogens of honey bees

Several LAMP assays have been developed to detect pests and pathogens of honey bees; however, none have been applied in the field. The current sampling methods for detecting pathogens require the use of specialized equipment in a laboratory setting. Further research is required to establish methods for lysing honey bees in the field such as the use of ball bearing and small capped tubes which have been used previously for plant and insect samples (62). The majority of LAMP assays are performed in an eight strip tube, thus providing a negative and positive control and six tubes for testing. The six sample tubes could contain a single or duplex reaction and have the ability to analyze six different samples or you can have six different individual assays and the ability to use a single sample. What configuration the field-based LAMP test kits are will be determined mainly by consumer demand.

Conclusions

The increasing awareness about the important roles honey bees play in food production and security has led to many advances in understanding honey bees' health and well-being. Honey bees are under threat from a range of environmental stress and infection from a large variety of pathogens. The ability to identify specifically and rapidly infection at the hive-site will allow for improved management and treatment strategies. LAMP assays in the last few years have become an important tool to aid in the detection of both exotic and endemic pathogens in the livestock industry. Several LAMP assays have been developed for honey bee pathogens, with a number of these still requiring in-field validation to confirm its use as an on-site diagnostic tool. It is important that researchers continue to develop assays against other honey bee pathogen and promote them for use in the field, with consideration given to non-invasive sampling methods to maximize the benefit from LAMP assays and reduce stress on honey bee hives introduced by humans.

Conflict of Interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

Author Contributions

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Supplementary Material

The Supplementary Material for this article can be found online at: **https://www.frontiersin.org/articles/10.3389/fvets.2021.659683/full#supplementary-material**

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The full list of references can be found online at: **https://www.frontiersin.org/articles/10.3389/fvets.2021.659683/full#h15**

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Queen Excluder, or Honey Excluder...

Tina Sebestyen

It can be frustrating to try to figure out when and how to use a queen excluder. Sometimes, the queen excluder seems more like a honey excluder, since the bees refuse to go through it, and end up super-filling the brood chamber with honey. This is dangerous, too, since this kind of crowding can cause even a first year colony to begin swarm preparations. Then, too, if no queen excluder is used, that young queen can lay so many eggs that she fills several boxes with brood, and all of the colony's resources go to raising brood rather than being split between brood and honey production. Like everything else in beekeeping, there is no one-size-fits-all answer to when and how to use queen excluders, but understanding bee biology and how bees think can help you make proper decisions.

Keeping it from becoming a honey excluder

The colony's first priority is expanding the number of colonies in the world, so the amount of effort they put towards making lots of babies is understandable. When they have a young queen who can lay 2000 eggs per day, and there is a lot of pollen and nectar coming in, it works well to let them build a large population of bees to take advantage of the coming nectar flow. But just before the flow begins, the queen should be confined to two deeps or three mediums, and the colony should be given plenty of room for honey. It sometimes takes a colony of bees a long time to make the collective decision to do something new. This is why, when you put a queen excluder above the working part of a hive, they never move up, but just super-fill the brood chamber with honey. The solution is to move a frame of brood or honey above the excluder. It will pull the bees right up to work it. You have effectively communicated to your bees that the working part of the hive is above the excluder, too. Yes, one of the "rules" of beekeeping is that we should never break up the brood nest. If you put the frame directly above the center of the brood nest, you haven't so much broken it up as changed its shape. Of course, if the cluster isn't big enough to handle this, moving honey will work, though maybe not as quickly as moving a brood frame would have.

Another solution is to close the lower entrance and add one above the queen excluder. According to one study, this will have the salutary effect of helping the bees raise more brood than they would if they had to haul the honey all the way through the brood chamber before getting to the honey super. With this set-up, the honey ends up almost all above the queen excluder, with only brood and bee bread in the brood chamber. It also puts a stop to skunk predation. Beware... working a colony with only an upper exit puts a lot of bees in the air, since their entrance is essentially "gone." This might not make your neighbors or spouse happy.

Danger from open screened bottom board

Is it necessary to use a queen excluder to limit the amount of brood raised? Absolutely not. A full super of honey will work just as well. Occasionally a queen will cross honey to lay eggs, but usually they prefer to keep the brood nest compact. Sometimes just the arch of honey above the brood nest is enough to keep the queen confined. If they seem insistent upon moving the brood up, the problem may be too much ventilation through the entrance, or that the solid floor under the screened bottom board is out. This makes it very difficult for the colony to control the temperature and humidity well enough, so they try to move up and away from all of that incoming air. It has recently been shown that this reduction in humidity can make it easier for mites to reproduce, so the solid floor that slides in under the screened bottom board should always be in place, with something sticky on it, like Vaseline. This will make the bees happier, and the mites less happy.

There are some conditions that could increase the tendency to swarm, and these should be taken under consideration. One of the biggest reasons for swarming is reduced queen pheromone which leads to an increased swarm impulse. Since queen substance is not volatile (it isn't very airborne), but is passed from bee to bee by touch, a really large population of bees stretches queen pheromone thin. A young queen, one who has not been through a Spring build-up, usually has enough pheromone to cover a large population, but by her second Spring, the queen's pheromone might not cover all of those bees. If the queen is in her first season, a large population of bees combined with the fact that the queen is confined to just two deeps or three mediums should not trigger swarming if adequate space is available in the supers. If the queen is one year old or more, she should be removed to a nuc, with two or three frames of brood and at least one frame of food, and this nuc moved to a distant apiary. Or extra shakes of bees from over open brood should be given to ensure that the queen is not abandoned by too many foraging bees who will always return to their original home. This reduces her workforce enough that the swarming instinct is quelled. A young queen can be introduced to the parent colony, or it can be allowed to raise its own. Raising their own has the beneficial effect of giving the colony a brood

Having lots of colonies makes it too time-consuming to mark queens. It is impossible to tell which of these two identical queens is the mother, and which is the daughter. Photo credit: Beth Corney

break that can be an important part of Integrated Pest Management for *varroa* control.

Queen includer

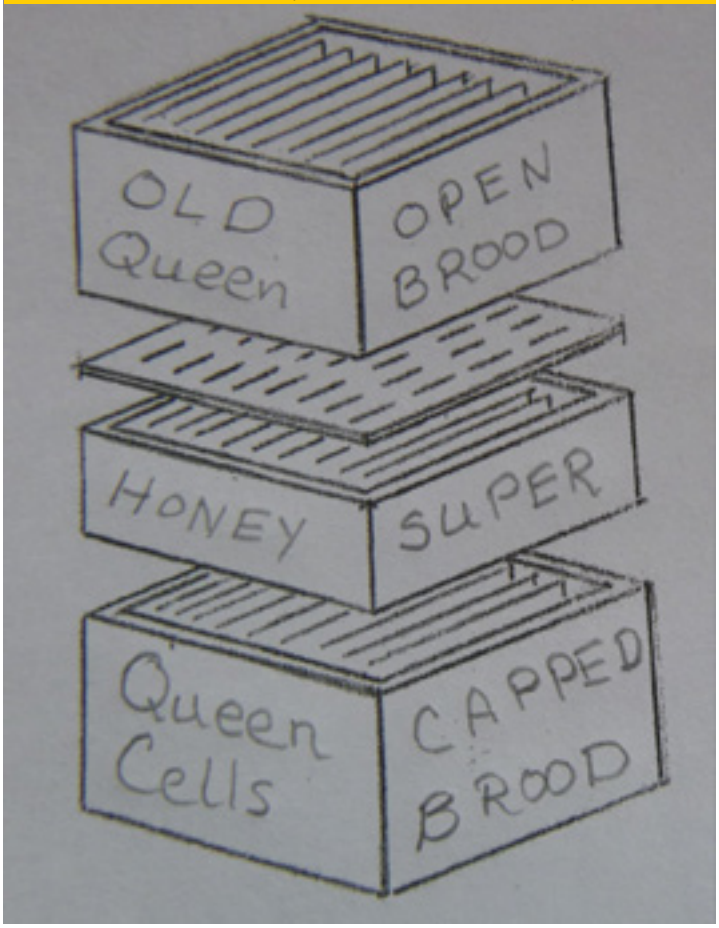
There are other interesting uses for queen excluders, so it is a good idea to always have one on hand when visiting the bees. The queen excluder also makes a nice queen includer that can be helpful when installing a package of bees in new woodenware or when an imminent swarm is discovered, when adequate equipment is not immediately available. It is important to note that colonies that are preparing to swarm have very large populations of drones, and that they cannot pass through a queen excluder. It should never be used as a queen includer for more than a day or two.

Making a vertical split, or a two-queen colony

Another way that the queen excluder can be used to great advantage in swarm management is in making a vertical split. Here is an easy method that does not require the finding of the queen, which might be impossible with the huge population that accompanies a swarm-ready colony. Take the boxes apart, down to one on the bottom board. All of the frames that have open swarm cells should be placed in this hive body (open, so that we can see the age of the larva inside. We want queen cells all of one age). If all queen cells are capped, choose one to place in the bottom box and cut out or release the rest of the virgin queens. This will avoid the after-swarm that can occur when queen cells of different ages are left to emerge naturally. Be sure never to shake a frame that has queen cells, as this could damage the developing queen's wings. Brush bees aside, so that there is a clear view of all potential queen cells which may or may not be on the edge or bottom of the frame.

Set another hive body next to the first one on a bottom board. As each frame is removed for inspection of queen cells, the bees should be brushed or shaken into this extra hive body. The queen will automatically end up here, because you brush or shake every single frame into this box. The nurse bees will stay with the queen while foragers go back to the original location. Open brood cells mostly go in this box, while capped brood mostly goes into the hive body with the queen cells. Leave one frame with larvae that are almost ready to cap, thus attracting soon-to-be unemployed nurse bees who will feed the queen cells. There must not be one single queen cell in the box into which the queen is shaken. When capped and open brood have mostly been separated, and every frame has been shaken into the box with the open brood, a queen excluder is applied above the box that has the queen cells. It can be helpful to place a honey super on the box containing the queen cells to further separate the old queen and emergent virgin queen. The hive body containing the old queen and most of the open brood go above the queen

Even if you get to an out-yard without extra woodenware for making splits, a swarm ready colony can be vertically split with just a queen excluder, as long as there is an upper exit of some kind. It isn't necessary to see the queen to accomplish this easy split. Photo credit: Neil Sebestyen



excluder with an auger hole drilled so that drones can fly. In this way, we have separated the capped brood and a lot of the workforce from the old queen, and these two steps allay the swarm impulse. When the new queen emerges, she can go out, mate and return and begin laying while the old queen above keeps the population growing. You now have a functioning two queen colony that will make a lot more honey than it would have, or than the two colonies could have alone. At the time of the Summer dearth, remove the queen excluder, and the colony will return itself to a single queen state, usually with the new queen at its helm (a good reason to mark queens).

Starting queen cells

There is an expensive piece of beekeeping equipment called a Cloake Board that is used for producing queen cells. It is a wood-rimmed queen excluder with a metal floor that slides into place. The queen is confined to one hive body, and with the metal floor in place, the bees think they are queenless, so they will start new queen cells. Once the cells are started, the colony will go ahead and finish them even after they realize that they are queenright, and now the metal floor can be removed so that the colony can care for its old queen and her larvae, while finishing the queen cells. It is then only necessary to keep the old queen away from the queen cells so that she cannot kill the young queens before they emerge. This method of cell building can be accomplished just as well with a queen excluder and a piece of plywood, or even cardboard.

Finding the queen

A queen excluder can be used to find the queen, which might be necessary when replacing an old queen. Set all of the boxes aside that make up a colony, and place an empty hive body on the bottom board. Put the queen excluder on top of this. Start with frames that have eggs or very young larvae, and shake all of the frames from the colony over the queen excluder and set them aside, or quickly lift the excluder and put them in the box under it once they are bee-free. It can be helpful to set another empty hive body on top of the queen excluder too, to help funnel the bees through. It might be necessary to push the bees through the excluder with smoke. The queen will end up walking around on the excluder, and she'll be easy to pick up with a queen catcher or with ungloved fingers.

Making Nucs

The queen excluder can be helpful in making nucs when it is difficult to find the queen. Choose frames that have open, or open and capped brood that will go in the nuc along with food frames, and after shaking the bees off into the lower hive bodies, place the chosen frames in a hive body above a queen excluder on top of the colony to be nuc'd. Nurse bees will come up through the queen excluder overnight, and the box can then be set down on a new bottom board and the new caged queen placed. Young nurse bees are more likely to be accepting of a new queen. It is also helpful to feed any colony that is receiving a new queen. Be aware that while this is a fine way of making a nuc, it is not a good way to split a colony to keep it from swarming. Leaving the queen with most of her capped brood and her workforce means that they will recover fairly soon, and want to swarm.

For beekeepers with top bar or long Langstroth hives, plastic queen excluders make it simple to trim to fit. Leaving the excluder a bit taller than the bars or frames makes it easier to keep queens from crossing over, using a piece of burlap or bubble wrap. The queen excluder is a valuable piece of equipment, and while it might not be necessary to have one for each colony, it is wonderful to have a few on hand for these various needs.

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Shaking frames over a queen excluder is an easy way to find the queen for marking or replacement. Photo credit: Kristie Hinds

BIGGER PICTURE

Jessica Lawrence

Hunting and Bees

There are a lot of different types of beekeepers out there. In fact, I'd say that most any two beekeepers will be totally different in nearly every aspect of their life. We are all crazy, but it's never the same two types of crazy, so we're just out here keeping the non-beekeeping population on their toes. There might be a few broad generalizations you could make about bee people though. Most of us have an appreciation for nature and the outdoors, wildlife, an interest in plants above the general population and some level of self-sufficiency. Most bee people will also take any opportunity to talk about bees to nearly anyone who will stand still, and try to add bees into every other aspect possible. There's probably a decent amount of rural beekeepers who are also farmers and/or hunters. This is the type of beekeeper I grew up with, but definitely not the type I went to college with.

The part outside of hunting is where bees come in. If you are lucky enough to have consistent land to hunt on, whether you lease or own, food plots can be a big benefit to your local animal population and something that a lot of hunters invest in. If you are a beekeeper that does not hunt, it may benefit you to find a hunter who does food plots and ask to put your bees there, or nearby. Now, there are typically some herbicides involved, but most of these would have zero effect on bees both from timing, proximity and target. Weed control is one of the biggest issues for food plots, but these aren't typically the weeds that bees like. It's almost always some form of grass or something related to grass. Some people will treat with a version of glyphosate (which does not give you cancer, don't buy the hype) in the very beginning for total plant control and start from scratch. This is typically either in the very early or very late season during site cleaning and prep. In this instance, there won't be a lot of reason for the bees to be in the area in the first place. The next herbicide will be some sort of grass selective chemical like Poast, Vantage or Clethodim. These will likely be used throughout the season in food plots planted with clover, soybeans, peas and brassicas (like canola) to keep the grass from outcompeting the target food crop. There's also the opposite for plots with Winter wheat or rye, but your bees wouldn't care about those anyway.

Speaking from a practical standpoint, most chemicals like herbicides are definitely not cheap, and you want to make sure you get the biggest bang for your buck. Spraying in the early morning after the temperature inversion is the best time of day to get the best coverage possible from an herbicide. Inversions usually happen near dusk and last through the early morning. The radiation of ground heat from the sun warms the air close to the surface, but as the sun sets and the ground cools, the air temperature also drops and becomes trapped against the surface. In areas with dips and valleys, fog will begin to form there first because the cooler air will flow with the ground sink, and those are typically high humidity areas with lakes, ponds and rivers. Once this happens, an application of herbicide will often sit trapped in this cold air cap and drift farther than anticipated, and may never fully coat the target plants. Temperature inversion avoidance is often written into the directions on herbicides and can be both ineffective in the target area and also cause damage outside of the application range. Most herbicides do well in hot daytime applications because of the mode of action of various pesticides, although grass seems to be affected by timing less than broadleaf plants. High humidity can lower efficacy in an herbicide, no matter the time of day. There are so many factors that can affect an application. If you are the one with the food plot, make sure you take the time to really understand the herbicides you have chosen to use. If you are the beekeeper and want to put your bees on a nice stand of clover, make sure you ask about the regime. It's really not that bad to close up your hive for a few hours or even a day and then let them resume normal foraging. Obviously, if you are heavily concerned about pesticide exposure, this may not be your best option. Food availability will always be top priority for me as a beekeeper, because adequate nutrition, in my

opinion, is the single most important factor outside of *varroa* control for keeping hives alive through the Winter.

Now, let's talk about those food plots. I only like Winter wheat or millet in areas that I'm planning to dove hunt, so I am far less concerned about bees in those spots unless I add in some buckwheat. For deer, I like soybeans and clover. There are so many options with clover though, that if you are also planting for bees, you need to be educated. Some clover is just not suited to honey bee proboscis and they won't be able to feed from the flowers. You'll have plenty of other pollinators, but not many honey bees. The common white dutch clover is acceptable. Now, I'm obviously partial to NC State since I graduated from there a couple times, but the Will Ladino clover would be hard to beat, both for bees and for food plots. NC State worked in conjunction with the USDA to produce this variety, which is sometimes considered an ecotype of white clover and sometimes it's considered a totally different clover. The features of Ladino are the runners it produces because they have good development and plot establishment, it will survive Winters far better than nearly every other type of clover, it is highly competitive against weeds, it will grow back vigorously after grazing, and it tolerates the southern drought we always seem to get with a lot more success than other clovers. Ladino is considered giant or jumbo due to the height growth and that is what makes it competitive with weeds. Most clovers prefer a more basic pH in the soil, but Ladino can tolerate low to moderate soil acidity after the plot is established. This means if you lime it well when you plant, you may not have to continue pH upkeep. If the soil pH isn't above six when you plant it… it's probably not going to do well. That's the case for any clover though, so bear that in mind. The drought tolerance means that it may slow growth, but it's less likely to die out than other clovers, and can also tolerate wetter soil than other clovers. It's basically just not as picky as the other options, although in the deeper south, you may want to add a durana clover mix because it loses the longevity as it goes further towards the equator. The leaves are more nutritious than even the typical white clover. White clover has the most crude protein of all types, averaging out around 25%. Ladino clover is closer to the 30% crude protein range. White clover also has 80% high total digestible nutrient, 10% more than the next closest clover (red), meaning that when consumed, 80% of the protein can be absorbed by the body. I could not find any numbers for other vitamins and minerals in Ladino clover specifically, but white clover in general typically has a more nutritious content than most other forage crops (I could not find any with higher, but there might be, so let's leave room for error).

Hopefully in the future I can follow this up with a full scale comparison of clover types and nutritional content. I really hope I can find more data to back up the numbers and claims, and I think this could be useful information to everyone. There won't be a lot of data on nectar and pollen nutrition, but the typical assumption is that a more nutritious and vigorous plant will produce everything better. BC

Healthy Soil = Healthy Bees

Aaron Weaver

As we know, our bodies work best if we are on a balanced diet. We are of the soil, therefore a soil that is well balanced will provide bees with healthy nutritious pollen and nectar. In today's farming, many acres of corn and soybeans are grown in the same fields year after year. There are very few earthworms and other microbes in the soil. Liquid manure is spread on fields at a high rate suffocating the microbes that were still present in the soil. Back when I started beekeeping most of my neighbors were spraying with herbicides. Today there are around 500 acres certified organic in my area. The bees are healthier throughout the year if I control the mites. I work with farmers throughout Ohio and surrounding states on balancing their soils, by doing soil tests with a lab to see what kind of minerals they need in their soils.

Most fields in my area are high in calcium, high in magnesium, low in phosphorus, low in potassium and low in sulfur.

Minerals in the soils have a positive and negative charge; too much of one or the other ties them up and they are not available to the plants. Animal manure can be used as a soil amendment, but you can add value by composting it for a year or so. It will be partially broken down and the microbes will not have to work as hard to make the nutrients available to the plants. Adding elemental sulfur will help loosen the soil colloids and provide proteins in high magnesium soils. Boron is a trace mineral that will help transport other minerals through the plant. But if you apply too much, it becomes toxic to the plants. We also recommend a humate to feed the microbes that are in the soil to keep everything working. Farmers are also seeing the benefits of planting cover crops rather than having bare ground and topsoil being blown away in the Wintertime. Cover crops also provide pollen and nectar for your bees and provide certain nutrients to the soil. Buckwheat provides some phosphorous. Rape, which is a brassica, provides some sulfur. Legumes fix nitrogen. Some farmers are using nine different varieties of seeds mixed together. If you walk into a field like that in September, it is very much alive with all kinds of pollinators and all kinds of microbes underground. We again have fence rows and woodlot edges that are blooming with native plants especially golden rod and asters in the Fall. Streams are fenced off to the livestock which now have trees and shrubs growing on the banks and plants that are in bloom most of the Summer. The pastures have a nice amount of white clover which increases the honey flow. I put some

bees on organic produce farms for pollination. They are incorporating some buckwheat or mustard between the vegetables to hold the nutrients and help keep the soil cool so the microbe population is thriving. The squashes provide pollen and some light colored honey. They are not spraying insecticides that kill the bees. I also scout the vegetable fields throughout the season for diseases and pests. A balanced soil is very noticeable. So there are a few farmers out there that are seeing the values of farming in harmony with our bees and nature.

Author Bio
Aaron Weaver is from Northeast Ohio and works for Green Field Farms co-op as a field coordinator and agronomist. He has been beekeeping for 15 years and has an orchard and berries at home.

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Believe it or Not

A Recollection of Arch Hockensmith, Beekeeper

Wes Henry

"Every time I see that smoker," said the doctor, "I think of your Dad..."

Arch Hockensmith, as a lot of folks do, wore many hats. He was a friend, a neighbor and fellow church-member to name a few; particularly to my father, but Arch was also a beekeeper, the only one I think I ever knew from my youth and growing up in Franklin County.

I was younger mind you, yet I recall that his hair was slicked back and jet-black as the horn-rimmed glasses that framed his eyes, and he spoke his Kentucky-ease quick-staccato-like- and in a high tone past thin lips. I don't know if it's true of folks like Arch, the fact that if you tied their hands they couldn't talk, but he told his stories with unfettered animation, and it made for some good ones.

Ruby, she never left his side all of those avowed-years and cooked a time or two for my father during a divorced and single time of his life. He told me of Arch going and robbing a hive of a queen bee in a cool time of the year, Spring maybe, and that after how it had warmed up in the car it crawled up his leg and stung him on the way home. Through the laughing of others' round about, I heard of and saw descriptions of his thrashing and hollering in the passenger seat. Lots of storytellers act their words out around here.

Knowing a thing or two of beekeeping, now that I'm all grown up and a beekeep' myself, something just doesn't seem completely accurate about that tale, but... I leave it alone, as we should a lot of things, for goodness sakes. I find myself often wanting to smell the cigarette smoke and hear and see the gaiety of those souls long passed, much of which took place on the porch of the church, nestled in the half-light of a hollow along the high limestone banks of a branch for which it was named – Camp Pleasant.

It's been more than twenty years since the bees were to be "told" of Arch's passing, and in a recent conversation with his daughter I confirmed what I had not thought of it for quite some time.

"Didn't your Dad keep bees?" I wrote, asking in response to a comment on a particular social media post.

"Yes, he had hives all over," replied Teresa. "He had some in Bald Knob, Gregory Woods and Georgetown. He loved his bees."

I sensed her enthusiasm to tell me more as she added to her recollection with a story worth sharing, again, a story that easily illustrates that beekeeping is more than just honey, and that Arch apparently knew that too.

Understand, as most mortals, the ills of age caught up with Arch and he suffered sore joints with arthritis. And though he may not have known to call it so, apitherapy was apparently real and a great help to Arch's ails.

"If his hands or his knees would start hurting," she recounted, "he would take the protective gear off and let them sting him and by the next afternoon he could move his hands and knees without any pain."

Of course, not all physicians chalked it up to the bee venom. However, the story she recounted didn't stop there, but continued with Arch's attempt to convince the medical community, bearing the burden of proof in himself.

She kept with the details in that "He had a heart doctor that was a friend of his and said 'that was crazy.'"

The doctor had apparently agreed to a wager of sorts and to go along to see for himself. Seeing is believing for a lot of people – for those of little faith, I suppose.

She recalled that, "One day I drove him and Daddy over to a couple of his hives and Daddy could hardly move his hands, they hurt and were so swollen. He said he made the bees mad so they would sting him. I'm not sure about making them mad, but they did sting him."

More acute applications would pinpoint the stinging to a precise spot. However, in her description I envisioned and made the claim that Arch used a "shotgun approach" to it, much as we fellow-keeps endure, unsolicited of course, when we might drop a frame or having had a top deep fall over and spill out all its contents when it was set on its side for just a moment to inspect the lower chamber. Ask me how I know.

"The next day I took Daddy by the doctor's office," she said of the results. "The doctor came out and Daddy started moving his fingers and hands up and down and started to dance across the room!"

Knowing Arch and his jovial ways, I can see it in my own mind's eye and hear him in the ears too. I laughed when I first read of it and still do even as I write.

"The look on the doctor's face was so funny," she continued. "He confessed, 'You really are feeling better. You could barely walk yesterday and couldn't move your hands.'"

"I told you," said Arch, "when this happens, I let the bees sting me."

The emotion leapt from her last sentences, "When Daddy passed away I took one of the smokers he used but had refinished and gave it to the doctor. He said, 'If I had not seen with my own eyes – the bees stinging him and he couldn't move, then could, I would not have believed it. I will never forget that.'"

With a believing nod and a smile I read her last words, "Every time I see bee hives, I always think of Daddy doing that."

As quickly as shadows fade so our lives are but for a moment, and what is left are the smiles at the thoughts of our memories.

Starting point to access rare beekeeping materials:
- Overview: **https://mann.library.cornell.edu/rad-collections**
- Registration: **https://cornell.libwizard.com/f/mann-rare-distinctive-collection-registration**

New York State privilege card (to borrow materials from circulating collection):
- Overview: **https://www.library.cornell.edu/services/borrow/policy/new-york-state-residents**
- Application: **https://cornell.libwizard.com/f/mann-borrower-card-application**

***The Hive and the Honeybee* online collection**: **https://digital.library.cornell.edu/collections/bees**

Biodiversity Heritage Library: https://www.biodiversitylibrary.org
Search full text, by title or author, or by subject:
- Subject: Bees: **https://www.biodiversitylibrary.org/subject/Bees#/titles**
- Subject: *Bee Culture*: **https://www.biodiversitylibrary.org/subject/Bee+culture#/titles**
- Title: *Gleanings In Bee Culture*: **https://www.biodiversitylibrary.org/bibliography/17323**
- Title: *American Bee Journal*: **https://www.biodiversitylibrary.org/bibliography/17325**

Items in the Phillips rare collection:
- Hill, Thomas. A profitable instruction of the perfite ordering of bees (1579)
  - Mann's copy: **https://newcatalog.library.cornell.edu/catalog/1178144** and digital version: **https://www.biodiversitylibrary.org/bibliography/65768**
- Dyce patent for creamed honey **https://newcatalog.library.cornell.edu/catalog/4169635**
- Butler, Charles. *The Feminine Monarchie* (1623)
  - Mann's copy: **https://newcatalog.library.cornell.edu/catalog/1164788** and digital version: **https://digital.library.cornell.edu/catalog/hivebees6371408**
  - "The Bee's Madrigal" by the Choir of Little St Mary's, Cambridge: **https://www.youtube.com/watch?v=p2eonteQEps**
- Langstroth, Lorenzo. Journal on matters relating to bees.
  - Mann's copy: **https://newcatalog.library.cornell.edu/catalog/10018007** and digital version: **https://www.biodiversitylibrary.org/bibliography/168243**
- Russian book on bee anatomy by Otto Verner, 1905: **https://newcatalog.library.cornell.edu/catalog/15037015**
- Guide to Rare Russian Language Beekeeping Works in the Phillips Collection: **https://guides.library.cornell.edu/rarerus**
- Collection of photographs of American beekeepers **https://newcatalog.library.cornell.edu/catalog/10383540**
- Collection of various NY beekeepers and honey producers associations pamphlets: **https://newcatalog.library.cornell.edu/catalog/10388019**
- Apiary Inspectors of America holdings at Mann Library: **https://newcatalog.library.cornell.edu/?click_to_search=true&commit=search&q="Apiary+Inspectors+of+America."&search_field=author_cts**

Articles referenced:
- Morris-Knower, James P. "The Bee Man Of Ithaca" *Bee Culture* v. 128 no. 11 (November 2000) p.23-25
- Sieling, Peter. "Walking In The Footsteps Of Giants" *Bee Culture* v. 145 no. 2 (February 2017) p.59-63. **https://www.beeculture.com/walking-footsteps-giants/**

Michael Cook mnc2@cornell.edu

Links from the Phillips Beekeeping Collection

Plant blocks of colors. Picture taken at Ohio Farm Science Review (2016).

Planning Your Pollinator Garden

Alyssum Flowers

The best way to learn about pollinators and help them thrive is to have established plantings of flowering plants whether it's annuals and perennials, Spring and Summer bulbs, shrubs and trees or preferably a combination of each, they all provide nectar and/or pollen and more for many insects and animals. Gardens provide interest for us and habitat, food and shelter for many insects, other arthropods, small birds and other wildlife. Add a water source and you have just created the best "Bed and Breakfast" for pollinators they could ever want.

Depending on the size of your landscape, the garden can be as small as a plant pot or old bathtub or be many yards in circumference. The key to the most successful garden is planning the best design for the location and maintaining it to keep unwanted weeds from encroaching.

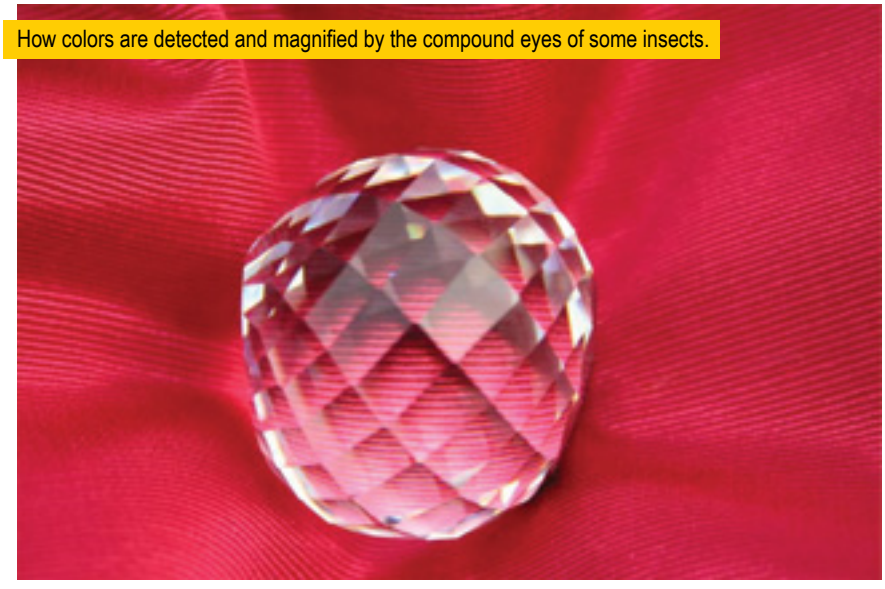
Imagine butterflies or bees flying above; their compound eyes are made of many individual facets, like a kaleidoscope. In order for them to "see" a garden or desirable planting, blocks of the same color are more likely to draw them to your yard. For instance, six pink flowering plants growing together is more appealing to them than a line of different colored flowers, even if they are all good nectar sources. Think patches of the same color although they can be different species. Next, choose plants of varying sizes and flower shapes to attract the most diverse number of visitors. Small, native bees often have longer tongues and can obtain nectar from "deeper" flowers such as salvia and nicotiana. Honey bees are general feeders with short tongues and require shallow flowers. They are also more attracted to blues and violets while butterflies are less picky.

'Bee' aware of water and sun/shade needs of each plant selected. If the garden will be far away from a hose or spigot, pick varieties that are more drought tolerant. Different textures and colors of leaves will add seasonal interest to your garden that may last well into Winter.

Season long flowering is critical for local pollinators who depend on early Spring, Summer and late Fall pollen and nectar. Stretch your garden to include crocus and *Scilla spp.* in early Spring, Liatris, coreopsis or rudbeckia for mid-Summer when most plants have stopped flowering, then aster and coneflowers for Fall resources.

Lastly, plant species that you like. Add herbs and ornamental annuals that add seasonal color. Don't be afraid to replace a plant if it is failing with another favorite. You can always pot or transplant a sick plant to another location that may be more favorable.

Whenever possible, choose plants that serve as hosts for butterfly and moth caterpillars to encourage them to stay in the area. Many milkweed species *Asclepias spp.* are very ornamental and serve as the only food for monarch caterpillars. Pussy toes, *Antennaria neglecta,* a fuzzy low growing perennial is the food for American painted lady caterpillar and is a lovely addition to your garden.



How colors are detected and magnified by the compound eyes of some insects.

Keep invasive weeds out by pulling while they are still small. Avoid using any insecticide, especially on the blooms. Remember that the caterpillars eating the leaves of some plants may be that of a beautiful butterfly or moth that you are trying to attract! Most plants can tolerate one to two defoliations, depending upon the size of the plant. If a borer is suspected, cut the top of the plant off instead of treating with an insecticide. Cut below the point where the plant is wilting. It will resprout.

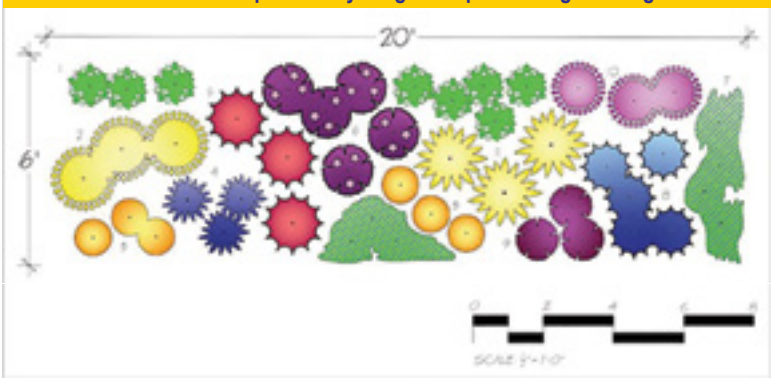
Lastly, leave the dead stems for the Winter and cut in early Spring. Several native bee species overwinter in plant stems, plus praying mantids may lay an

egg case on stems, as well as the fact that that seed heads are a feast for finches.

Research shows that each colony of honey bees requires one to three acres of different flowering plants to receive adequate nutrition. Other bees need more per acre. The latest data estimates that 50 million acres of lawn were maintained in the USA in 2020 using three trillion gallons of water and 59 million pounds of pesticides. If each of us planted more food for the pollinators, we could all help minimize lawn maintenance and help the pollinators obtain the nutrition they desperately need. Please see the links below for information on pollinator plants and planning your garden.

https://www.nwf.org/Garden-for-Wildlife/Wildlife/Attracting-Butterflies
https://ohioline.osu.edu/factsheet/ent-85/ohioline.osu.edu/factsheet/ENT-47
https://www.pollinator.org/guides
http://www.ccnybees.org/uploads/1/0/5/8/10585924/ohio_state_university_extension_factsheet_-_ohionectarplants.pdf?msclkid=3bd8bddab3b411ecb33067cfe13bfda9
https://www.fws.gov/story/how-build-pollinator-garden
https://extension.colostate.edu/topic-areas/yard-garden/perennial-gardening-7-402/
https://extension.psu.edu/planting-pollinator-friendly-gardens

Plant three to five of same plant together or patches of the same color. **https://extension.colostate.edu/topic-areas/yard-garden/perennial-gardening-7-402/**



Deeper flowers (more tubular) attract moths and butterflies.
Red colors are visited by hummingbirds.

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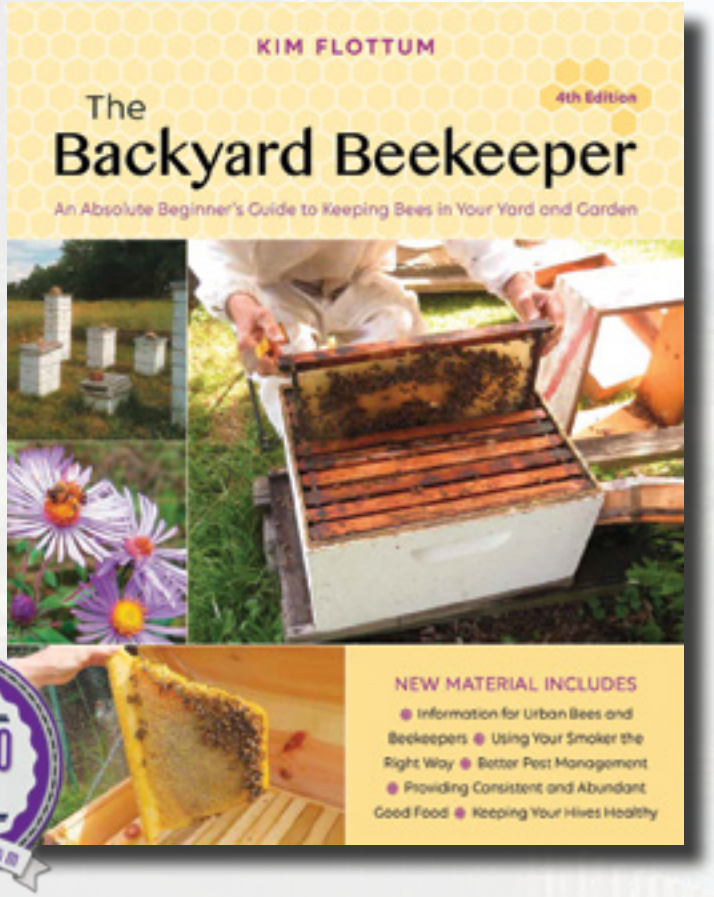
- USING TOP BAR HIVES
- HARVESTING THE PRODUCTS OF A BEEHIVE AND COLLECTING AND USING HONEY
- BEE PROBLEMS AND TREATMENTS



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Feeding Bees
How hard can it be?

Well, it's complicated.

Try this. Go to the established bee book of your choice and look up *supplemental feeding*. Be prepared for some extensive reading. Since I'm writing for *Bee Culture* magazine, I went to *ABC and XYZ of Bee Culture*. The supplemental feeding section in the new text is exhaustive – as it would be in most beekeeping textbooks. As is always the case in all-things beekeeping – if you have a lot of options – then the absolute best way for performing the task at hand has not been fully chosen. Supplemental feeding of bee colonies certainly fits that bill. There are presently many proven ways to feed bee colonies.

But it's not natural

Supplemental bee feeding is little more than beekeeper-assisted robbing. I suggest that foragers taking sugar syrup from a feeder have little in common with that same forager imbibing nectar from an apple blossom. *"But Jim, feeding procedures are in every bee book."* All beekeepers do it. Bees obviously love it. All those comments are true and feeding serves a good management purpose, but it's a beekeeper-developed task and is not practiced by bees in nature. I sense that is why there are so many varied techniques for supplementally feeding needy bee colonies. There is no *best* way to feed bee colonies.

(Crudely) Estimating colony strength

First, does a colony even need feeding? "*Hefting*" the colony is a common but easy way to check your colonies relative food stores. If you tip your colony forward, and it feels as though it is nailed down, it probably has good supplies of honey stores. It should be dead heavy. If the colony tips easily, even if it is sitting on a firm hive stand, the colony will surely need extra food stores. At this point, the "*north beekeeping vs. southern beekeeping*" issue becomes important. Bees can generally be fed during most cool months in the southern and southwestern U.S., but not so much in colder climates.

In more northern locations, bees will be clustered much more during the cold season so they will not be able to leave the cluster to visit a Winter feeder. *Feeding wintering bee colonies – anywhere – is a last-ditch desperation procedure.* In warm areas, the feed must be continuously present. In colder climates, the bees can't consume the feed on many days. Going into Winter with colonies light in stores is never the best management procedure but all nectar flows are not necessarily great flows. Even for the best beekeepers, sometimes late season colonies are lightweight. That's when beekeepers can help.

Figure 1 Sometimes, bad luck just happens. Years ago, a late season Winter squall made it difficult for bees to use my syrup feeders. Happily, most survived.

Supplement bee food options

Honey in the comb

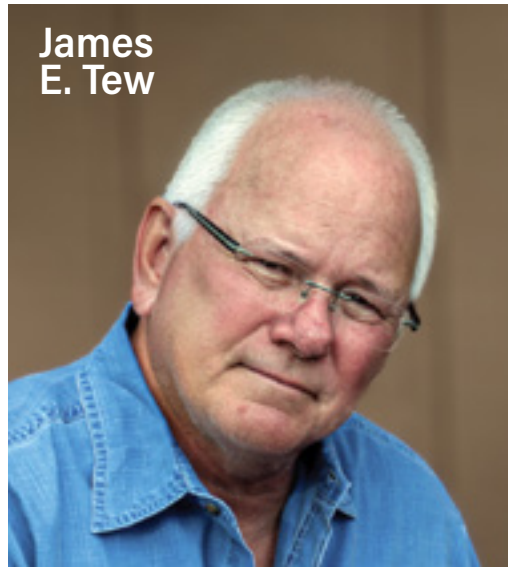
Honey in the comb is the best emergency food for hungry colonies. Obviously, few of us have significant amounts of reserved honey in the comb. But if perchance, it is available and disrupting the colony as little as possible, place full honey frames near the cluster. Ideally, the day should be warm so the bees could move to the honey. If the day is cold, be sure not to break the cluster.

Liquid honey

At first consideration, it usually makes very little sense to extract honey and then feed it back to the bees, but there are occasional instances. In my personal experience, the following event has happened to me several times. I acquired full deep-frames of honey from Winter-killed colonies. In truth, the colonies were Winter mite-killed colonies, but regardless, I had honey remaining in combs. I wanted the old honey removed from the combs so I could reuse them; therefore, I did all the extracting work and acquired honey that I did not want to use for human consumption. So, I acquired several buckets of usable but not high-quality honey (by my standards).

Figure 2 An old photo of a homemade top feeder used to feed diluted honey back to bees.

Why not just sell it for animal feed use? Why not use it in cooking? Why not strain and filter it, then blend it with better honey? Yes, all these suggestions are viable options, but in theory, I am only selling this substandard honey to acquire money that I will then use to buy granulated sugar.



(I hope I don't get a lot of unhappy mail for the brief discussion that follows.) Much like the comment I make in the following section on corn syrup, a full discussion of this topic is beyond the scope of this general article, but a few comments seem appropriate.

Anytime re-feeding honey is discussed, there is always a stern warning attached that American foulbrood or other viral infections could be transmitted when feeding honey from unknown sources. While I have read that warning hundreds of times, I cannot cite a single instance where it was conclusively documented to have happened. Not a single one. But, yes, technically, it *could* happen.

In my case, I know the honey source and foulbrood was not the issue that killed the colonies. General recommendations suggest that the honey be cut about 30% with hot water, mixed and fed back to the bees in quantities that the colony can consume overnight. My bees loved it.

Having written all of this, honey stores refed from Winter-killed colonies is not a good way to accumulate feed for hungry bees. But new packages will surely appreciate the food boost.

Corn syrup

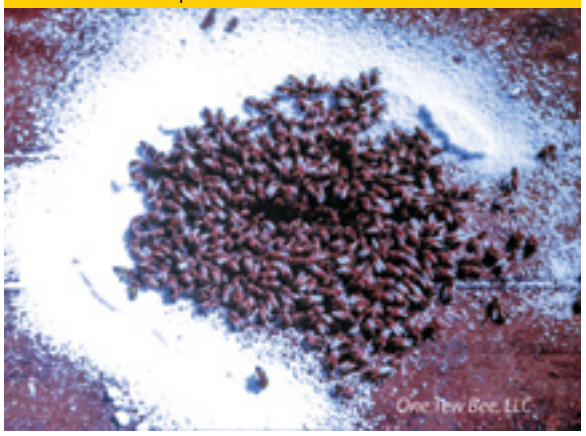
Corn syrup is a common carbohydrate supplemental feed for bees. It requires no mixing and seemingly is a nutritious honey substitute and is available from bee supply sources. However, some formulations of corn syrup have become suspect when used as Winter food sources. High fructose corn syrup (HFCS) is frequently fed to bees but concerned discussion has been directed toward that artificial feed. Some of you like it, some of you don't[1]. Maybe in future articles, we can more fully discuss this concern.

Sugar syrup

For beekeepers with a small number of colonies, feeding common table sugar is the traditional bee feed. For Winter feed, mix two parts granulated sugar to one part water by either weight or by volume. Heating the mixture will help it go into a more concentrated solution. The exact ratio of sugar to water is not particularly critical. But always remember that it is the sugar – not the water – that the bees need as a food source. If you scrimp – scrimp on water and not sugar.

Granulated sugar can be fed dry. It is simply mounded around the inner cover hand hole – most likely poured on a sheet of newspaper. Bees move up, gather the sugar, mix it with water, and use it as an immediate food source. If bees can't fly to water, they can (apparently) use a small amount of metabolic water produced by bees in the hive, but in general, if feeding dry sugar, bees should have ready access to water.

Figure 3 Bees feeding on granulated sugar that was poured on the inner cover.

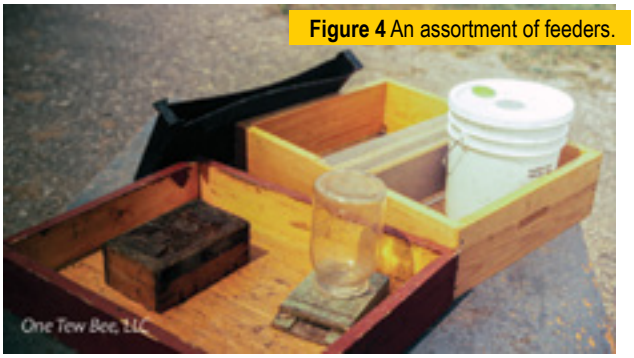


Fondant

Earlier in my beekeeping youth, in the beekeeping literature, there were common procedures for making candy boards or for making fondant to feed bees. Such procedures, as I recall, required cooking the mixture, mixing cream of tartar and possibly some vinegar. It was a significant task. I don't recall ever doing it a single time. It was just too easy to feed sugar syrup.

Always searching for easier ways, in later years, I approached a commercial bakery supply. Not knowing what product for which I was searching, I asked the baker for a sugar paste much like that found in the center of Oreo® cookies. I clearly recall the supplier saying, *"Oh, you want something like Karps[2] bakery fondant."* I bought a box of it. The bees seemed fine with it. In later years, this specific product name was changed, but I have still been able to purchase commercial fondant. You will need to find your own local source. In a few somewhat rare instances, feeding solidified sugar paste could be a useful procedure.

Figure 4 An assortment of feeders.



What common feeder device to use?

All feeders are positioned either inside the hive or outside the hive. There are numerous designs of feeders, but none are perfect. Most of these devices have about as many advantages as disadvantages. You decide.

Bulk feeders

Bulk feeders can be used to open-feed bees. So far as I know, no bulk feeders are commercially available. Many years ago, I cut a 55-gallon drum in half, the long way and improvised two large troughs. Using wheat straw as floats, I quickly fed large amounts of sugar to the colonies in my yard – and to countless other neighborhood colonies that also found the source.

Sugar feed, usually syrup, is simply put in open containers in the bee yard for the bees to gather themselves. The weather must be warm and flight conditions must be good. While easy to implement, this procedure encourages robbing and fighting among the foraging bees. There is also a risk of disease and pest spread. And finally, you are feeding all the bees in the community – not just yours – when using this

[1]A complete discussion of this topic is beyond the scope of this general discussion. For more specific HFCS considerations, see: **https://www.honeybeesuite.com/is-high-fructose-corn-syr-up-bad-for-bees/** **https://www.beeculture.com/a-closer-look-feeding-sugar-syruphmi/**

[2]**https://stovercompany.com/karps-fondant-50lbs/**

Figure 5 Foragers taking feed from an open source. I cannot recommend this procedure.

system. While the procedure worked for me and was simple, I did not use the system very often.

I know commercial beekeepers who have used this procedure, but it is not the best methods for those of us – like me – who are keeping smaller numbers of colonies in urban apiaries.

The classic Boardman Feeder

All beekeepers seem to have one of these gadgets. They are a right-of-passage device for beginning beekeepers. It is used at the hive entrance, and is the most convenient, but least effective of the hive feeders; however, this simple feeder is a good device for new beekeepers to use. The drawback is that wintering bees must walk too far to gather the syrup. Another disadvantage is that leaking Boardman feeders entice robbers to the entrance of the needy colony. You can easily use these devices but be forewarned.

Figure 6 An old photo of a classic Boardman feeder.

The typical division board feeder

The *division board feeder* is an internal feeder that gets food nearer to the cluster but often too many bees drown in the feeder; plus, the bees must have warm weather to make the trip to the feeder. The division board feeder can be located essentially anywhere in the hive, but generally the feeder is put at the wall of the hive, where it can be easily filled.

Hive top feeders

Beekeepers, in many ways, this is the best device to use. It has a fairly large capacity and is easily filled. It is readily available to inside bees, and if used during cool months, it is close to the cluster. Several designs are available from commercial supply companies or top feeders can be made in the shop.

I have found that an empty hive top feeder can be a place where burr combs are put for bees to clean them. Also, these empty feeders can be used for storing things like empty queen cages, matches or your hive tool.

A quirk of leaving the empty hive top feeder on the hive is that the bee restricting mechanism should be removed to allow the bees into the feeder basin to chase away ants, earwigs, roaches, or small hive beetles that would otherwise occupy the empty top feeder.

A unique variation of the hive top feeder, that I like, is a unit that puts the feeder on top of the outer cover. The bees take the syrup from the feeder through a hole in the outer cover. The plastic feeder attaches to the outer cover with an attachment device where it can be easily viewed and removed for filling without disturbing the bees.

Chicken or bird watering devices

Variations on chicken or quail watering devices can be used to feed bees. While the typical device holds approximately two quarts, and bees readily use it, I have found that forager bees get inside the device as it empties. Dumping the bees from the container agitates them.

Comb filling procedures

Using a new hand compression sprayer commonly used for applying pesticides, sugar syrup can be sprayed into open combs. When sugar-syrup-filled combs are put back into the hungry colony, the syrup is quickly gathered, concentrated, and reprocessed into food stores or is immediately consumed.

Figure 7 A telescoping hive top with attached feeder.

This is one sticky, messy task, but the supplemental feed in combs can be put near the bees. Any syrup not quickly consumed will crystallize, but the bees can still use some of the sugar crystals. Like several other feeding methods, this procedure works, but I rarely use it now. I have too many other options available to me.

For many years, a major bee supply company manufactured a gasoline-powered comb filler, but the device can now only be found as a secondhand device or at bee equipment auctions. Yes, it too was messy and expensive, but it worked.

Some final thoughts and comments

Mold

Many feeder containers will begin to support mold growth after a few uses. While this mold is (apparently) not harmful to the bees, it will plug feeder holes and is unsightly. It is annoying to clean but is a common side effect of feeding carbohydrates to bees.

Controlling the syrup flow rate

Whatever container you decide to use must have a firmly seated lid. Essentially, the upturned jar/container forms a vacuum that allows the syrup to drip or to flow very slowly. If feeder holes are too large (the diameter of a common frame nail seems about right) or the lid is not firmly seated, syrup will drain out too fast and flow out the front of the hive or drip through the screen bottom board. Robbing becomes a problem.

Allowing the bees to propolize the feeder holes closed

After the bees have emptied the feeder container, I leave it on the colony. Within just a few days, the bees will propolize the holes closed. The next time I use the feeder, I only open enough of the holes to allow syrup to flow at a controlled rate. If I want to provide a heavy flow from the container, I will punch more holes open.

It's not a perfect procedure

Spring feeding is normally practiced for stimulation and brood production. It's easier than Winter feeding. Feeding bees for survival is always a desperation procedure. At best, colonies will be kept alive but don't expect them to thrive. If possible, when preparing colonies for Winter, leave abundant honey stores on the hive for the colony to use. All too often, beekeepers spend time, energy and money on desperate Winter bee feeding procedures only to have the colony die anyway. It is far better to go into Winter with the colony prepared than to attempt long-term feeding – no matter what your climatic conditions are.

Feeding protein

I am out of article space here but feeding protein should be acknowledged in this piece. Pollen supplements are commercially available and are significantly helpful. But feeding protein is not like feeding carbohydrates. This process needs its own discussion at another time. Protein feeding is just one more task for the worried beekeeper.

Thank you

As usual, if you are reading this "*thank you*," you are a persistent beekeeper. I appreciate your time and any comments you might have on your experiences. Thank you for reading.

Dr. James E. Tew
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The Ohio State University and
One Tew Bee, LLC
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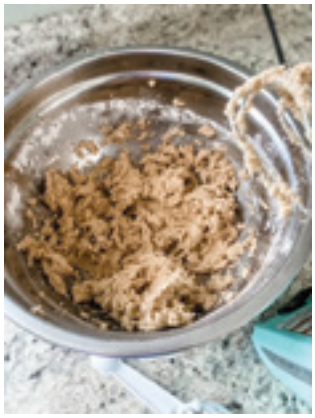
Honey Cookies

Shana Archibald

Ingredients

- ☐ ½ cup or 1 stick unsalted butter, room temperature
- ☐ ¾ cup brown sugar
- ☐ ½ cup honey
- ☐ 1 egg yolk
- ☐ 2¼ cup plain flour or all purpose flour, plus extra for dusting
- ☐ 1 teaspoon baking soda
- ☐ ½ teaspoon ground ginger
- ☐ 1 teaspoon cinnamon
- ☐ Pinch of salt



Directions

Step 1
In a large mixing bowl, beat the butter and sugar with an electric mixer until pale and creamy.

Step 2
Add honey and the egg yolk. Beat again to form a creamy mixture.

Step 3
Sift in the flour, baking soda, ginger, cinnamon, and salt.

Step 4
Beat briefly until dough starts to come together.

Step 5
Use your hands to gather the dough and form into a large ball.

Step 6
Wrap the dough in plastic and place in the fridge for 20-30 minutes to rest.

Step 7
Preheat oven to 350°F. Line two cookie or oven trays with baking or parchment paper. (Aluminum foil works great too!)

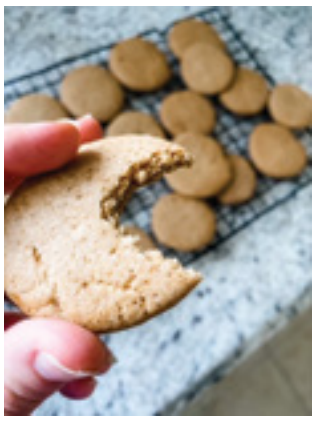
Step 8
Lightly flour your counter and roll out the dough using a rolling pin (or your hands) to about ½ inch thick. Dust your rolling pin as you go to prevent the dough from sticking.

Step 9
Cut out shapes using cookie cutters (or a small jar/mug) and gently place cookies onto the prepared trays.

Step 10
Bake for 10-12 minutes or until golden on the edges.

Step 11
Remove from the oven and transfer to a wire rack to cool completely.

This is a very 'simple' tasting cookie. You can pair it with your favorite tea, coffee, by themselves, or with some ice cream. Enjoy!



CALENDAR

♦ALABAMA♦

Alabama Master Beekeepers Program will be holding their 2022 program on July 28 - 30 at the Clanton Conference and Performing Arts Center.

Please visit their website **www.alabamamasterbeekeepers.com** for more details about the program.

♦INDIANA♦

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

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

♦IOWA♦

Iowa Honey Producers Association (IHPA) will be holding their 2022 Field Day on June 11.

Speakers will include Rogan Tokach, Duane Bajema, Eugene Makovec, and Amara Orth. Lunch is included in the registration fee.

To register visit: **www.iowahoneyproducers.org** or email **ihpatreasurer@gmail.com**

♦KANSAS♦

The Northeast Kansas Beekeepers Association (NEKBA) is holding their annual Bee FunDay Event on Saturday, June 4 from 7:30am-5:00pm.

Keynote speakers are Krispn Given and Jay Evans. It will be held at the Douglas County Fairgrounds. Advance registration is $70 and $75 at the door. Lunch and snack is provided. Dinner and t-shirts optional.

More information is available at **www.NEKBA.org**

♦MISSOURI♦

Harold's Famous Bee Co. is having their 2nd Annual Honey Festival and Market on Saturday, June 25 from 10am - 6pm.

Go to **https://fb.me/e/27rApzHkw** for details.

♦NEW YORK♦

EAS is having their 2022 Conference *Beeing Social, Again* at Ithaca College in Ithaca, NY on August 1-5.

A short course will be offered from Monday to Wednesday. The main conference will be Wednesday through Friday. A roster of excellent speakers is being assembled including Dr. Tom Seeley, Mike Palmer, and Dr. Dave Tarpy.

Details will be forthcoming on the Conference Page of the EAS Website: **easternapiculture.org**

CLASSIFIEDS

FOR SALE

- North Carolina Italian queens $30 each pickup or shipped. 5 frame nucs available all Summer $140 each. Singles and double deeps for sale. Timmy Holt **336-710-4904**
- Larry's Backyard Bees Beekeeping Equipment: USA Made Hive Boxes, Package Bees, Beekeeping Tools, Smokers, Bee Suits and more. Order online at **www.larrysbackyardbees.com** or Call Toll Free **(844)561-BEES**. Newburgh, NY

♦PENNSYLVANIA♦

Introduction to Beekeeping has been lengthened by popular demand from one weekend to two, spanning July 16-17 and 23-24 from 9am-4pm.

Topics include honey bee biology and behavior, building an apiary and harvesting honey, apiary equipment and supplies, and management practices for each season.

This course is taught by Master Beekeeper Vincent J. Aloyo, PhD. It will be held at Delaware Valley University in Doylestown, PA.

For more information or to register, see: **http://vincemasterbeekeeper.com/courses/**

♦TEXAS♦

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

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

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

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

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

Registration opens in August.

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

♦WISCONSIN♦

WI Honey Producers Association is having their 2022 Summer Meeting on June 11 starting at 8:30am with doors opening at 7:45am. This meeting will be at O'so Brewing Company in Plover, WI.

The guest speaker will be Brooke Nikkila. Registration is $30 for WHPA members and $40 for non-members. This fee includes lunch.

Register at **https://wihoney.org/meetings-and-events/whpa-summer-meeting/**

New on www.BeeCulture.com

There is a new Calendar section on the website. All of the events you see here are listed online with details, addresses (for easy access) and links. Go to www.BeeCulture.com/calendar-of-events/

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

Display Advertisers

Image Contest - Splitting Colonies

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

How To Submit:

Email your images to **Emma@BeeCulture.com**
Use the subject "**Image Gallery**"
Please include in your email:
- The image as an attachment (we will not consider it if it is embedded)
- Your First and Last name
- Your mailing address
- Your renewal code (if you know it)

If your image is chosen:

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

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

My 63 colonies emerged from our Colorado Winter in pretty good shape. As of today, April 10, I've lost only one. Its queen gave up the ghost, the poor darling, so I united these bees with another hive.

That's *so far* I've lost only one. I do have a few weak queen-right hives. Some have strong brood patterns. I'll leave them be and hope for the best. I once had a Spring colony that had dwindled to a single frame of bees, yet rebounded and made a super of honey!

The gal Marilyn owns a brick 1890 house in town that a real estate agent might call a handyman's dream. She rented it for a song to a struggling couple who told her they hoped to live there "forever." They were behind on the rent when they broke the lease and moved to South Carolina last month, only informing Marilyn at the 11th hour. They left behind pretty much everything they owned, notable exceptions being the '68 Corvette, the Bronco, and his AK-47.

A forfeited $500 deposit is scant consolation for Marilyn. These people lived here for five years. You wouldn't call them tidy. Can you picture a rundown old house crammed full of life's accumulated stuff, just abandoned? That's what Marilyn's up against, and I'm not. I refuse to go down that rabbit hole.

I did work on the toilet at her house today, but I have to be careful. This is a slippery slope.

I outlined our quandary to Marilyn: "You've got three jobs and a honey sales business, a junk-filled diamond-in-the-rough house that you need help with, plus the farm is a wreck, and I have way too many bees. There's no way we can keep up. These are my golden years, and the minute I start to feel overwhelmed, I'm going to drop everything and go fishing!"

That, ladies and gentlemen, was an exaggeration. The bees have to come first – even before fishing – or I won't have any. But once I get them squared away, I'll fish all I please.

Pat up in Steamboat used to work fulltime at the grocery store while he ran 900 colonies in his spare time. I asked him how he did it. "I take every shortcut there is," he confided. Maybe "every" shortcut is going a little overboard, but reasonable shortcuts allow us to be more productive in less time.

Last Fall I put some extracted wet honey supers back on my hives. After the bees finished cleaning them out, I put one super between the inner and outer cover of each hive, for Wintertime hive-top insulation. I never had to load them on the truck and stack them in the barn for the Winter. Would you call that a shortcut?

But I wasn't finished cutting corners with those supers. When I took 20 colonies 65 miles down the road to Palisade a couple of weeks ago to pollinate the apricots and plums, I left them on top of the hives. So now if the bees start making honey in the orchards, I've got honey supers on scene.

Marilyn's putting up a honey booth at the Palisade International Honey Bee Festival this Saturday, so I'll tag along. I can use her car to check my bees while I'm down there, and I won't need to make a special trip. Plus I can drop off some copies of my book, *A Beekeeper's Life, Tales from the Bottom Board*, at a local bookstore. More shortcuts!

You might consider my bee equipment pretty ratty, but my bees love it. I have plenty of perfectly good spare hive bodies I could put into service as replacements, but why would I bother? Those cracked and warped boxes in the bee yard provide innumerable little hidey-hole entrances that the bees find irresistible. Who am I to question their hive layout plan? And leaving well enough alone qualifies as a shortcut!

I knock down my *Varroa* mites with a weak oxalic acid dribble in November or December when the colonies go broodless. I don't fool around with oxalic vaporizers. I'd probably gas myself. The dribble knocks mites straight to the *Varroa* promised land. In the Spring, any survivors find their way inside capped brood to reproduce, so when I test I rarely find an exposed mite before June. I'm a devoted mite-tester, and I do a lot of sugar-shaking for mites. But prior to June I run just enough tests to assure myself that my December dribble worked. This saves me time and qualifies as a shortcut.

I customarily install 30 or so queens each year, when I make splits or pull nucs, or to replace problem queens. I don't routinely requeen annually, like some of the experts tell you to do. It feels too much like murder, and besides, why would I trade a productive three-year-old queen for an unproven young replacement? New queen survival is never a given, and you can make queen introductions as complicated as you want. I normally expose the candy plug in the queen cage and let the resident bees eat their way through to greet their new ruler. I stay out of it. I don't even check on them for at least 10 days. These are all shortcuts.

I still have a few brood boxes to reverse. I put the top super with all the bees and honey on the bottom, and the largely empty bottom super on top. Bees like to move up in the hive, and this gives them room to do it. It helps with swarm control. It shouldn't take me long. Then I have a bunch of other bee projects to get after. If I take enough shortcuts, I'm pretty sure I can still find time to go fishing.

Ed Colby

Shortcuts

BOTTOM BOARD