VOLUME 160 NO. 12 DECEMBER 2020

# AMERICAN BEE JOURNAL

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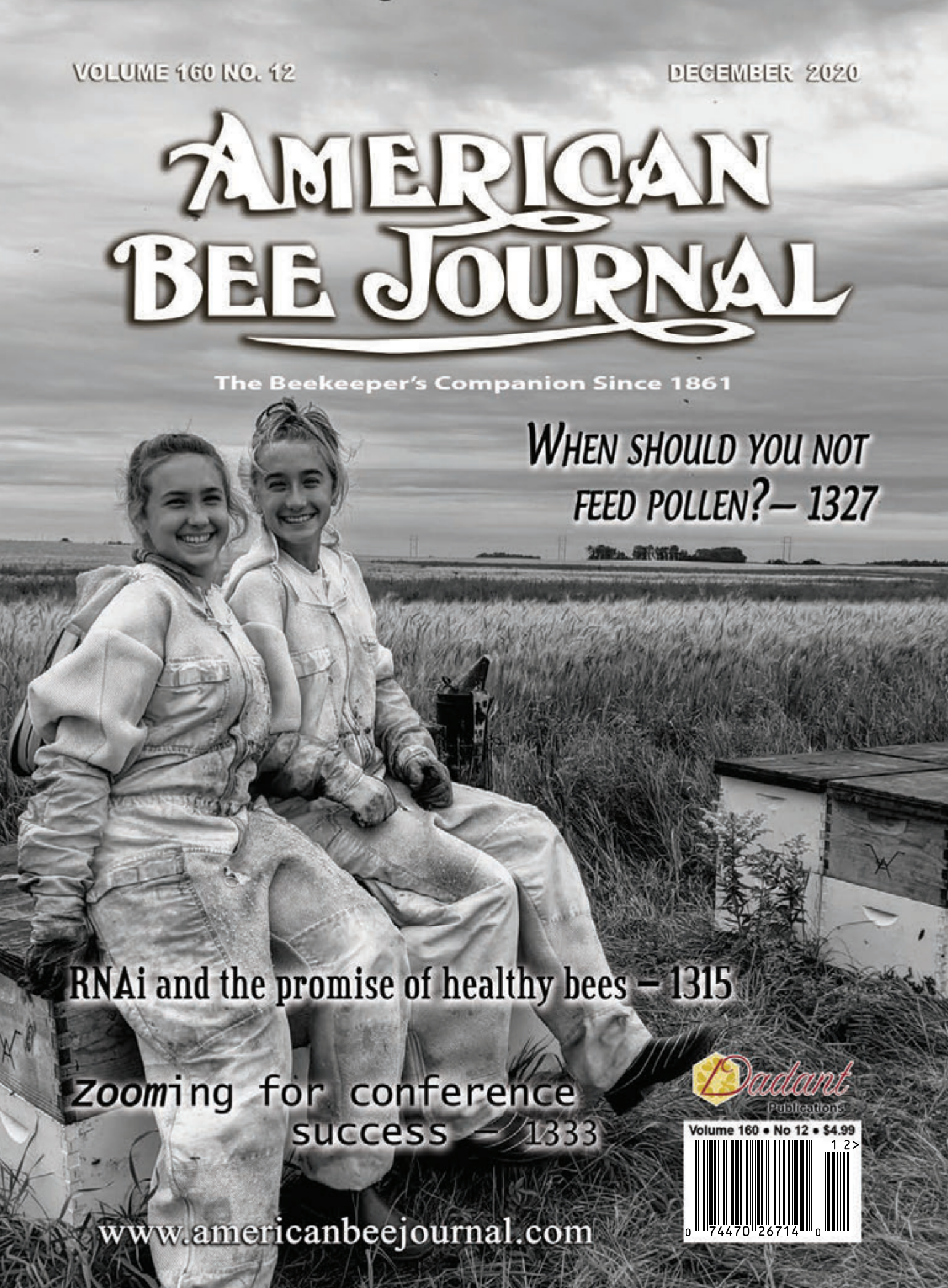

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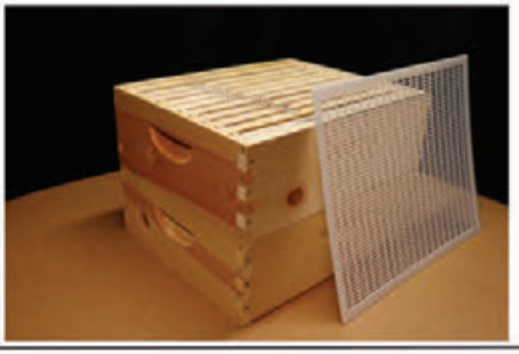

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# AMERICAN BEE JOURNAL

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## DEPARTMENTS



## COLUMNS



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## ARTICLES



## *ON THE COVER*

Shannon Wallace of Claremore, Oklahoma, shared this great photo and caption with us:
"With all the crazy things going on with the COVID virus and numerous changes to every part of life, my wife Jody and I decided to start homeschooling our two girls. They traveled with us up to North Dakota and helped work bees. On the first day of homeschooling we took a picture of our girls, Alesha (left, 9th grade) and Faith (11th grade), while working the bees. We did some school work and had a ton of fun!"

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# From the Editor

**Eugene Makovec**

*editor@americanbeejournal.com*

## The Grinchy Beekeeper

My very favorite Christmas program from childhood was the Dr. Seuss classic "How the Grinch Stole Christmas." One of our three channels would show it every December, and it was so special that, in years when we had a working TV, Dad would let us boys come in early from milking cows to watch it.

Of course, while both the rhymes and the graphics were hilarious throughout, the moral of the story came at the end, when Whoville's cantankerous northern neighbor discovered the true meaning of Christmas:

> *And the Grinch, with his Grinch-feet ice-cold in the snow, stood puzzling and puzzling, how **could** it be so? It came without ribbons! It came without tags! It came without packages, boxes or bags! And he puzzled three hours till his puzzler was sore. Then the Grinch thought of something he hadn't before. Maybe Christmas, he thought, doesn't come from a store. Maybe Christmas, perhaps, means a little bit more!*

In his "Three Things" article last month, North Carolina bee inspector Lewis Cauble said he advises beekeepers that if they properly manage varroa, queen events, and feeding (if needed), lesser issues tend to take care of themselves.

Yet in so many of our interactions with newer beekeepers there is entirely too much time spent worrying about trivial matters. Much local club Q&A is spent reassuring folks about secondary pests (no, wax moths did not kill your colony), while tamping down old wives' tales, magic elixirs and quick fixes.

I got a call one April from a beginner who was *frantic* because her packages were on the way and she'd not found a source for the essential oils that, according to the workshop she'd attended, were *critical* to keeping them healthy. I managed to talk her down, explaining that essential oils — which Ana Heck of the Minnesota Bee Squad has described as a "fire hose" of scents overpowering the bees' natural pheromones — are not in fact "essential" to a functioning bee colony. In two decades, I told her, I have never put essential oils in my hives, save for occasional, short-term use of thymol-based Apiguard for mite treatment.

Small hive beetles are certainly an annoyance, but I've yet to see them take down an otherwise-healthy colony. Yet there is a great trade in both commercial and homemade SHB traps, while many of the beekeepers using them are inadvertently drawing those beetles into their hives by feeding pollen supplements when they are not needed. Worse, I've seen more than one conference speaker instruct beekeepers in the placement of hive beetle traps containing actual roach poison (!) *inside their hives.*

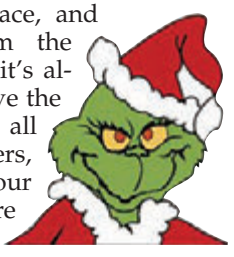
This time of year, the worries are about getting colonies through winter. For context, we're talking in my case about Eastern Missouri, where winter is child's play compared what some of you experience in the northern U.S. and Canada. Still, for my Dad in Central Wisconsin, winter prep meant finally getting his supers off in about October, then stacking some straw bales at the end of the row to temper the worst of the north winds. Granted, this was pre-varroa — but again, take care of the mites, and …

Beginners especially have a hard time believing that their tender charges can survive in a thin-walled wooden box outside in the elements. So they often go to great lengths — and sometimes great expense — to protect them. Quilt boxes, insulation boards, black tarpaper or poly wrap, light-bulb heaters, essential oils again (this time in feed), bananas (yes, bananas), and shelters of all kinds. One Facebook post showed a row of a half-dozen hives, surrounded by straw bales and covered entirely by a plastic tarp. Don't get me wrong — insulation can be helpful in colder climates, late-winter protein may be in order for early spring splitting, and more commercial pollinators have taken to inside wintering to be ready for the early almond bloom.

As for me, I make sure the lids are on — though I have seen abandoned hives that survived winter without benefit of covers. I also attach mouse guards, and ensure they have enough honey. One of 13 is light and just got a candy board. A fourteenth went queenless at some point and dwindled to nothing last month, and a couple of the late splits have small populations and might be iffy. But with luck I expect to bring 10-12 colonies through to spring — at which point I will again invoke the Grinch:

> *And the beek, with his beek-feet all wet in the grass, stood puzzling and puzzling, how **did** they all last? They lived without tar-paper, or electrical coil. They lived without quilt-boxes, or essence of oil. Then the beek thought of something he hadn't been taught. Maybe bees can survive without something I've bought. Maybe they've done just that for more years than we've thought!*

I'm out of space, and the aroma from the kitchen tells me it's almost time to carve the roast beast. To all of our ABJ readers, here's hoping your holiday feasts are delicious.



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*Due to size and content, we may be unable to publish all information received. We may also edit your letter to avoid offensive language. Thank You!*

## BEEKEEPING IN NATIONAL FORESTS

After reading the "Say No to Banning Honey Bees in National Forests" letter [Letters to the Editor, October] and downloading and reading the Xerces petition, I would say both have valid points. The petition pointed out a concern of mine; that introduced managed bee colonies might bring the risk of introducing diseases and parasites into any population of natural (feral) honey bee colonies already residing within the National Forests/Parks. Another concern I would have is the effect of maladapted genetics from managed bee colonies brought into the Forests. As Seeley and other researchers have shown, large natural areas of woodlands can harbor a population of adapted natural bee colonies which may possess unique genetics and unique solutions to the diseases/pests within their own environment. They have then become a part of that environment worthy of the protections afforded inhabitants of our National Forests and Parks. More studies would be beneficial, however I have seen research already showing that there are effects both ways between native and introduced pollinators. Most of the beekeeping literature I've seen doesn't recommend woods/forests as very productive apiary locations, and possibly one is not collecting honey, but rather honeydew from some of them.

But there is a reason that nullifies all others as to why I say Yes to banning managed honey bee colonies in our National Forests and Parks: I want to see them as close to natural as possible; I don't want to see beehives/beekeepers within them any more than I'd want to see a coal mine, oil well, or any other unnatural intrusion.

*Terry Combs*
*Beekeeper and retired Coal Miner*
*Keyesport, Illinois*

## SCIENCE AND SKEPTICISM

I found Rusty Burlew's article on science and all the many human errors, mistakes and bias that can destroy its accuracy, a very good article. Good science with peer review is how we learn the truth, with repeatability.

Of course varroa is probably our biggest problem, and its effect on winter survival. What was screaming to me though was, the global warming theory of sure linkage to fossil fuel use. It seems to be guilty of almost all of the mistakes mentioned in the article. I mean there is only one example (our earth) and the variables are as many as the world has.

There, I said it, so let the music start. The proponents usually call us skeptics unkind names.

*Dale Lesser*
*Dexter, Michigan*

## BAN ALL NEONICOTINOIDS

We were pleased to read the Notes from the Cornell University Pollinator Laboratory concerning the risk assessment for the neonicotinoids [Notes from the Lab, September 2020]. This was an exhaustive study with important information for beekeepers and others who are interested in bees. There are a few items that we would like to bring to the attention of the authors and the readers. The first item concerns the statement that acetamiprid is much less toxic to bees than the nitroguanidine insecticides (imidacloprid, clothianidin, thiamethoxam, and dinotefuran). If you look at EPA's recent assessment of acetamiprid (**https://www.regulations.gov/document?D=EPA-HQ-OPP-2012-0329-0026**, pp.44-45), you will see that the acute and chronic toxicity bee studies submitted by the pesticide manufacturer were not fully acceptable. Some of the early acute bee studies lacked a dose response curve. Chronic studies (semi-field studies) with bees were conducted at less than the maximum application rates, were not conducted long enough for a chronic study, and may have been affected by rain events. A full field study also had serious deficiencies and was not fully acceptable. Despite these deficiencies, EPA determined that for bees the dietary acute and chronic risk quotients exceeded the levels of concern for foliar applications of acetamiprid.

The European Food and Safety Authority (EFSA) reviewed the industry-submitted chronic studies for bees and concluded (**https://efsa.onlinelibrary.wiley.com/doi/full/10.2903/j.efsa.2016.4610**) that they had "severe deficiencies and drawbacks" based on "short duration [of the studies], lack of exposure measurement, and low number of colonies used." For these reasons, EFSA further concluded that "these studies cannot be used to draw any firm conclusion on the risk [of acetamiprid] to honeybees."

EPA's risk assessment noted that the only industry-submitted test that was acceptable was one of the $RT_{25}$ assays. The results of this study, though, are highly variable depending on the species of bee, age and sex of the bee, foliage used in the test, formulation of the pesticide product, weather conditions, application rate, etc. Because of the high variability of this test, it is not used by risk assessors to determine the toxicity or safety of a pesticide. Unfortunately, EPA product managers are using the results of this assay for labeling purposes to indicate when it is safe for bees to forage on a treated crop.

Another item that we would like to bring to your attention is the idea of using neonicotinoid-treated seeds as an insurance policy for infrequent, occasional pests.

The idea of using pesticides for occasional, infrequent pests conflicts with established Integrated Pest Management practices, which recommend only applying a pesticide "when

pest populations reach an economic threshold." (**https://www.pnas.org/content/117/37/22609**).

A number of studies have been published in the literature, showing little to no benefits from neonicotinoid seed treatments in corn and soybeans, the dominant crops for these products. Furthermore, recent evidence has shown that only 5% of crop fields benefit from neonicotinoid seed treatment. Saturating millions of acres of crops with chemicals that are not efficacious is irresponsible and not morally or economically justified. Eliminating the use of neonicotinoid seed treatment on the 95% of crops that do not benefit from this treatment would reduce environmental pollution by an enormous amount.

The neonicotinoids, including acetamiprid, are very soluble in water, mobile, and persistent. They have a high potential to run off into water bodies and are highly toxic to aquatic invertebrates on an acute and chronic basis. Adding more neonicotinoids to the environment unnecessarily will be a sure way to kill more aquatic insects and terrestrial insects (e.g., bees). It will also be a sure way to kill the natural predators of the insects, which will result in the need for additional pesticides. According to EPA's risk assessment, acetamiprid seed treatment poses a chronic risk for birds and mammals. Killing off their food supply (insects) would make the risk to birds and mammals from exposure to acetamiprid much greater.

Finally, another item that we would like to raise is the comparison of acetamiprid risk to vertebrates versus pyrethroids risk to vertebrates. There are a number of published studies (**https://onlinelibrary.wiley.com/doi/abs/10.1002/em.20309**), that found evidence of genotoxicity of acetamiprid in human and mammalian cell lines. In addition, the European human health risk assessments classified acetamiprid as Category 2, meaning a substance that is suspected of having carcinogenic potential for humans. USEPA, on the other hand, concluded that acetamiprid "does not pose a cancer risk to humans" (**https://www.federalregister.gov/documents/2012/03/28/2012-7461/acetamiprid-pesticide-tolerances**). In light of the varying results of these studies and assessments, it would be premature to conclude that the risk of acetamiprid to vertebrates is much less than the risk of pyrethroids to vertebrates.

Flawed industry studies should not be allowed to confuse the simple truth that systemic neonicotinoid insecticides represent an unmitigated disaster for pollinators. The Pollinator Stewardship Council supports a total ban on the use of neonics including acetamiprid, for all outdoor applications, including foliar, drench, and seed treatments.

*Sincerely,*
*Steve Ellis*
*President,*
*Pollinator Stewardship Council*

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## ABJ COLUMNIST JAMIE ELLIS WINS NATIONAL EXCELLENCE IN EXTENSION AWARD

**October 12, 2020 – University of Florida**

**By Samantha Murray, grenrosa@ufl.edu, 949-735-1076**

Recognizing visionary leadership and diversity in educational programming, the U.S. Department of Agriculture's (USDA) National Institute of Food and Agriculture (NIFA), Cooperative Extension, and the Association of Public and Land-grant Universities (APLU) announced that Jamie Ellis of the University of Florida will receive the 2020 Excellence in Extension Award.

USDA-NIFA and Cooperative Extension have sponsored the awards since 1991. The awards will be presented virtually on October 28.

"Each year, these awards showcase the fundamental, transformative difference Cooperative Extension continues to make in our society," said NIFA Acting Director Parag Chitnis. "Excellent programs like these are a testament to the true value of Cooperative Extension capacity funds more than a century after the Smith-Lever Act created this unparalleled system of outreach and education that enriches every community across the nation."

"This year's National Cooperative Extension Award winners demonstrate educational excellence," said Mark Latimore, Jr., associate dean and administrator for Extension, Fort Valley State University, and chair of the Extension Committee on Organization and Policy. "They stand as a powerful example of the impact of Cooperative Extension to address real-world problems in communities across the country."

The Excellence in Extension Award is given annually to one Cooperative Extension professional who excels at programming, provides visionary leadership and makes a positive impact on constituents served.

Jamie Ellis is the director of the UF/IFAS Honey Bee Research and Extension Laboratory, as well as a professor and Extension specialist the UF/IFAS department of entomology and nematology.

The laboratory's mission is to advance the understanding of honey bees in Florida, the U.S. and globally, with the goal of improving the health and productivity of honey bee colonies everywhere. Ellis advances this mission through basic and applied research with managed and wild honey bees, communicating his findings to assorted clientele groups through diverse Extension programming, and training future generations of bee educators, researchers and conservationists. His work has contributed to a four-fold increase in the number of managed honey bee colonies and a five-fold increase in the number of beekeepers in Florida.

"Dr. Ellis is a model for faculty not just at our university but within the land-grant system and across the world," said Nick Place, dean of UF/IFAS Extension. "He is the go-to person for all things honey bees. Dr. Ellis has gained national and international recognition for his innovative Extension programming, which has allowed beekeepers and other stakeholders to adopt science-based practices that improve the health and productivity of honey bee colonies. Dr. Ellis' program has also increased the public's awareness about the importance of honey bees within the food system and how all of us can support pollinators."

Ellis said he was honored to receive the award.

"Successful Extension programming is always the result of the investment of many people. I am grateful to my UF/IFAS colleagues, my collaborators, and the beekeepers we serve. I am excited that our efforts are making a lasting impact in the communities we support," Ellis said.

## HEALTHBERRY FARM WINS GOLD AWARD FOR OLD WORLD MELOMEL

DRYFORK, West Virginia — Healthberry Farm awarded a Gold medal in the Pyment category for their Honey River Pyment in the 2020 Mead Crafters Competition.

"We are proud to represent West Virginia by winning this award," says Healthberry Farm's owner, Ben McKean. "This wine is made with 100% West Virginia grown ingredients, and represents a long tradition of mead-making in the region."

Ben studied under Master Meadmaker Ferenc "Frank" Androczi, proprietor of Little Hungary Winery in Buckhannon, West Virginia. Frank learned the winemaking practice from his family in Hungary, and he is most remembered for the grape and honey wine he bottled simply as "Melomel." In 1999, Ben and Frank began a formal apprenticeship through Augusta Heritage Center, also forming a life-long friendship.

Frank continued to be Ben's mentor and friend and, after Frank's death, Ben began his own line of meads and melomel. Honey River Pyment uses the traditional name for honey wine with grape, and is an homage to Frank's own beloved Melomel.

Since the beginning, Ben has been true to Frank's traditional methods, which means he does not add sulfites or chemicals, nor any sugar or additives, and he sources his ingredients locally if he cannot grow them himself. "Frank was doing things in a method. He didn't know the word organic, but his practices came from the old-world before chemicals were available to small farmers." This dedication to "better than organic" and local ingredients led him to a collaboration with Hank Kopple of Kopple Vineyards in Lehmansville, West Virginia. The Gold Medal-winning Honey River Pyment is made with Kopple's Chambourcin grapes. These are fermented as whole berries, a tradition he learned from Paul Roberts at Deep Creek Cellars in Friends-

ville, Maryland. Ben uses his own Tulip Poplar varietal honey and ages the wine for at least two years before bottling.

The Mead Crafters Competition, organized by the National Honey Board, received over 300 entries for their annual competition. In 2019, Healthberry Farm won a silver medal for their Basswood Mead.

Select varieties of Honey River meads and melomels are available at regional distributors. A full list can be found at **healthberryfarm.com/contact**.

Healthberry Farm's Honey River Meadery was featured in a February 2015 article in American Bee Journal.

## SUCCESSFUL GLOBAL COLOSS ECONFERENCE DEFIES COVID-19

The 16th Conference - and first eConference - of the COLOSS honey bee research association has now ended. Judged a great success by participants, this eConference had a record number of attendees, with 216 members from 41 countries taking part. This is a clear recognition that the COLOSS Membership (now in 102 countries) appreciate working together world-wide to make a sustained and valuable contribution to bee science.

Detailed updates were given on the COLOSS Core Projects: the BEEBOOK (standard research methods), B-RAP (Bridging Research And Practice) and colony loss monitoring; and of the COLOSS Task Forces: Apitox, nutrition, sustainable bee breeding, small hive beetle, varroa survivors, varroa control, Vespa velutina and viruses.

At the start of the year, and before the global Covid-19 crisis curtailed international travel, many constructive COLOSS workshops and meetings were held in a variety of locations. Notably, these included the well-attended first COLOSS Asia Conference, in Chiang Mai, Thailand.

Despite Covid-19 restrictions, the Executive Committee were determined to keep the spirit and activities of COLOSS alive. In the several weeks prior to the main conference, workshops for the individual core projects and task forces were held virtually. Run at times to suit the locations of those involved, attendances were generally higher than at previous physical meetings. Participants discussed experimental results, planned publications and proposed future collaborative experiments.

eConference delegates heard that a number of important COLOSS publications had been published in 2020, including two definitive reviews on bee viruses, the latest results of the international colony loss monitoring surveys and the BEEBOOK chapters on honey and bee venom. In addition, the COLOSS survey to determine the effects of the Covid-19 pandemic on bee research and extension activities had been published.

One novel feature of the conference was the addition of short video presentations of current work which replaced the normal physical poster presentations. The annual prize for the best student presentation was awarded to Birgit Gessler of the University of Hohenheim, Germany, for her poster on: "Detecting molecular markers for Varroa Sensitive Hygiene (VSH) trait in honey bees".

The COLOSS Executive Committee are particularly grateful to Dr Geoff Williams and his colleagues from Auburn University, USA., who hosted the eConference, and the conference sponsors: Auburn University, Alabama Extension, the Eva Crane Trust; the International Bee Research Association; Véto-pharma; Vita (Europe); and the Ricola Foundation, Nature & Culture.

COLOSS (Prevention of Honey Bee COlony LOSSes) is a honey bee research association formerly funded by the European Union COST Programme (Action FA0803) and currently by the Ricola Foundation – Nature & Culture, Veto Pharma, the University of Bern and the Eva Crane Trust ,which aims to explain and prevent massive honey bee colony losses. COLOSS does not directly support science, but aims to coordinate international research activities across Europe and worldwide, promoting cooperative approaches and a research programme with a strong focus on the transfer of science into beekeeping practice. COLOSS has more than 1,500 members drawn from 102 countries worldwide. Its President is Prof. Peter Neumann of the University of Bern, Switzerland. Website: **http://www.coloss.org/**

The full proceedings of the first day of the COLOSS eConference can be viewed free of charge on the COLOSS FaceBook page: **https://www.facebook.com/COLOSS-Association-216713901804099/**

The results of the COLOSS study on the impact of Covid-19 on research in apidology can be found here: **https://www.tandfonline.com/doi/full/10.1080/00218839.2020.1799646**

**FOR FURTHER INFORMATION PLEASE CONTACT**

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## ARS LURE ATTRACTS LIVE ASIANGIANT HORNETS, HELPS LEADTO NEST DISCOVERY

WAPATO, WASHINGTON, October 29, 2020—A scent lure designed by Agricultural Research Service (ARS) scientists to attract Asian giant hornets played a key role in the discovery of the first nest of these invasive insects in the United States.

Washington State Department of Agriculture (WSDA) entomologists have verified several finds of Asian giant hornets in Whatcom County since December 2019. They have been actively searching for the Asian giant hornets' nests ever since. But finding a hornet nest is a difficult hunt, even that of the world's largest hornet, when the nest is most likely a hole in the ground or a tree.


*A scented lure developed by ARS was used to live trap Asian giant* **hornets.www.ars.usda.gov/oc/images/photos/aug20/d4467-1/**

To increase the odds of finding the nest, the WSDA team planned to live-trap some of the Asian giant hornets, fit them with radio transmitters provided by USDA's Animal and Plant Health Inspection Service (APHIS), and track them back to the nest.

The first step was to attract the Asian giant hornets to the traps. Enter insect chemical ecologist Jacqueline Serrano with the ARS Temperate Tree Fruit and Vegetable Research Unit in Wapato, Washington. She is carrying on the work of late ARS entomologist Peter Landolt, a world leader in chemical ecology research, who developed traps and attractive lures used for wasp and hornet species like the Asian giant hornet.

"The ARS lure is a chemical mixture of acetic acid. It smells like sweet fermenting rotting fruit, which can be a food source for Asian giant hornets," said Serrano.

The standard lure used in Asian giant hornet traps has been a blend of orange juice and rice wine vinegar. The problem is the orange juice and rice wine vinegar combination continue to ferment and get "rather gross over time," said Serrano.

In contrast, the ARS lure is stable, so the traps don't need to be refreshed as often.

On Oct. 21 and 22, the WSDA team caught two live hornets using the ARS lure. The team successfully fitted several Asian giant hornets with transmitters and tracked one of the hornets back to its nest in a tree cavity near the city of Blaine.

On Oct. 24, personnel from WSDA and APHIS removed the nest. They continue to use the ARS lure in the search for more nests.

The Agricultural Research Service is the U.S. Department of Agriculture's chief scientific in-house research agency. Daily, ARS focuses on solutions to agricultural problems affecting America. Each dollar invested in agricultural research results in $20 of economic impact.

## STATES

### CALIFORNIA

#### California State Beekeepers Association

It was with heavy hearts that the CSBA board of directors decided to cancel the 2020 CSBA Annual Convention that was scheduled to take place last month in Lake Tahoe, CA.

Mark your calendars for the 2021 CSBA Annual Convention in sunny Santa Barbara:

**November 16th-18th, 2021**
*Location:* Hilton Santa Barbara Beachfront Resort
We look forward to getting to learn, network, and socialize with our fellow industry members in 2021!

**Californiastatebeekeepers.com**
**calstatebeekeepers@agamsi.com**
(916) 441-0302

### MICHIGAN

The Kalamazoo Bee Club (Michigan) is holding an online bee school for beginner and intermediate beekeepers, on February 20, 2021. Featured speakers are Dr. Larry Connor and Mike Connor.

For more information, visit **kalamazoobeeclub.com**.

# The Classroom

## by Jamie Ellis

Gahan Endowed Professor
Honey Bee Research and Extension Laboratory
Entomology and Nematology Department
University of Florida

Email questions to me at: classroom@americanbeejournal.com

Follow my lab on social media (Facebook, Twitter, Instagram - @ufhoneybeelab) or www.ufhoneybee.com.

Listen to my lab's podcast: Two Bees in a Podcast (can be found at my website and on most podcast platforms).

**Submitting a question implies you agree to have your name, location, question and my answer published in "The Classroom" column of the American Bee Journal. I typically answer Classroom-related questions once per month.**

## Q APIVAR'S SHELF LIFE

Yesterday and again today, the bees on one of my hives covered the entire front from top to bottom in a heavy mass. Clear skies and 70 degrees. The hive consists of two deep supers and both are full of honey for winter. Also, after treating the bees with Apivar, I have some left. Can I save this for spring or does it have a shelf life?

*Mac Daggett, Maine*
*September*

A

Sounds like your hive is doing well. I would guess that what you are seeing is simply a strong colony spilling out of the hive. I think this will self-correct soon.

Apivar does have a shelf life (i.e., expiration date) and it should be written on the package. It should not be used after the date indicated on the package. The expiration date indicates the time that the product begins to lose efficacy. This is usually due to the overall break-down of the active ingredient in the product. Thus, using an expired *Varroa* treatment exposes the *Varroa* to a level of active ingredient that may not kill it, thus increasing *Varroa*'s chance of developing resistance to the product. All pesticide labels also include information about storage and disposal of the product. Consequently, there will be something on the label that states how you should store the product when it is not in use. Phrases such as "store at room temperature," "keep out of direct sunlight," etc. are common on product labels. Storing the product per the label helps you ensure the product maintains its efficacy and is ready to use once you need it again in spring. Again, all of this is pending that the product does not exceed its expiration date before spring. If it does, you will need to dispose of it per the label.

## Q FEEDING HUMMINGBIRDS HONEY

My wife and I noticed a couple of hummingbirds working some flowers on a sweet basil plant a few weeks ago. We had not seen any in a few years. So, I got my hummingbird feeder out of moth balls and made some syrup for them. The recipe was 1 cup of regular white sugar poured into four cups of boiling water.

The hummingbirds frequent it. Then I got to thinking that is not a very nutritious diet; so, being a beekeeper, I figured maybe making the syrup from honey, same recipe, might be more nutritious for them. My questions: (1) Is that a correct thought? (2) Will pouring a cup of honey into boiling water sterilize it enough to feed the bees if the answer to (1) is yes?

*Douglas Doremus*
*October*

A

Well, full disclosure here: I know very little about birds. So, I am not sure my answers will be particularly useful. ☺ My guess is that humming birds do not get much nutrition out of nectar. I suspect they are a lot like bees in that case, i.e., they use the nectar for fuel rather than food. In fact, I looked this up online and found that hummingbirds mainly eat a variety of insects. That is where they get their nutrition. The nectar is simply their energy source. With that background, I would stick to feeding them sugar syrup rather than honey syrup. I really do not know what potential impact, if any, honey could have on hummingbirds. My gut always says "when it doubt, stick to the way that you know works." Without being an expert, I would recommend staying with the sugar water.

Your second question is an interesting one. I think pouring a cup of honey into boiling water and returning it to a boil will help clear the honey of pathogens. I think the key is returning it to a boil and allowing it to boil a few minutes. Then, you can feed it to bees with little concern. Beekeepers routinely feed bees honey from other colonies. They usually do this by moving frames of honey between colonies. To me, it is too much work to extract honey from one colony and then feed it to another. I would rather just move frames of honey between colonies. I have fed bees extracted honey in the past. I usually do this when the extracted honey turns out to be of low table quality (it does not taste good). In that case, I dissolve it in water and feed it to bees the way I would sugar water.

Of course, the danger in that is you can spread pathogens, most notably American foulbrood, between colo-

nies. As a result, I only feed honey from one colony to another if I have reasonable assurances that the colony from which the honey came does not have American foulbrood.

## Q SMALL HIVE BEETLES GOTCHA´ DOWN?

I have a problem with my colony. I had a few small hive beetles from the beginning (spring last year) in my hive; the nuc I started with came with them. Within the last few weeks, the SHB population exploded. I also think the strength of my colony is reduced. I see fewer bees and less activity. This may be normal for the time of year but I am worried. I tried several different SHB traps but without much success. What else can I do to manage the SHB in my rotation? Is there any "treatment" to get rid of them?

Another thing I recognize is that the bees consumed their own honey (some of the capped cells are disappearing and empty). What does it mean that the bees consume their own honey? We still have flowering plants around, etc. Should I feed them? With what?

*Matthias Herzog, Florida*
*October*

A

It is pretty normal for SHB populations to be higher the time of year you contacted me. You are doing what I would have recommended (trapping SHB adults). I would use a style of trap that fits between the top bars of frames and put vegetable oil or mineral oil + some apple cider vinegar into the traps. I would put up to four traps per box.

If, though, you are not seeing SHB larvae, you likely do not have a major problem. Colonies can withstand adult beetles reasonably well. Instead, you should be worried when you see SHB larvae.

I would also ensure there are enough bees to cover all the frames so that all combs are protected from the beetles. If the colony is strong, bees cover the frames, and you are not seeing beetle larvae — your colony is likely OK. Here are some links to good resources on SHBs:

**http://entnemdept.ufl.edu/honeybee/beekeeper-resources/pest-and-disease-resources/small-hive-beetles/** (alternatively: Google "UF Honey Bee Lab" and then navigate this way: > Beekeeper Resources > Pests and Diseases > Small Hive Beetles).

For the feeding issue — honey bees need about a medium super full of honey when heading into winter (which we do not really have here in FL). I like to have that available for the bees by Thanksgiving. If your bees are bringing in nectar at the moment, maybe they can increase their honey stores by then on their own. How much honey is already on this hive? If you have less than a medium super of honey, you might want to start feeding them 2:1 sugar water (2 parts sugar:1 part water) until they have enough stored resources.

## Q MORE ON SMALL HIVE BEETLES

I am a new beekeeper in Southern Ontario, Canada, and this past season my one hive has had a SHB infestation. The honey in the supers had a vinegar-like smell, which I believe is due to fermentation from SHB larvae excrement. I watched your extremely helpful video and I had a few follow-up questions that I thought you might have some insight to.

I was wondering:

(a) Is there any way to salvage the vinegar-smelling honey (eg. boiling it, making mead, etc.) or is it best to dump it down the drain?

(b) Is it healthy to feed this honey back to the bees (maybe boiling it first)?

(c) Should I be concerned about storing the wet supers (from which the vinegar-smelling honey came) over the winter? I froze all supers for 2-3 days prior to extracting the honey. Would it be better to store the wet supers in a freezer or would room temperature be fine?

*Dan Vacca, Ontario*
*October*

A

Sorry to hear about your SHB infestation.

1) Honey produces that smell when it ferments. Fermented honey is not great for bees. Thus, I would extract/dispose of it. It is not really possible to use the honey for human consumption.

2) I would not feed it to bees. Fermented honey is not good for them.

3) Freezing them (as you did) should be fine. You can always rinse out the combs with water as well. This will wash away the fermented honey. Let the combs dry a couple of days after this and then you can store them. Both strategies work. Just FYI, I prefer to freeze combs that are not in use. However, I realize that freezer space is a premium for many of us (me included). Consequently, I often return my pulled supers back to hives and simply store them on the hives over winter. Full disclaimer: I have only ever lived in southern (warm) climates so I am not certain this would work in Canada. However, it works really well for me. It saves freezer space and shed space.

**Reply from Dan:**

Thanks so much. Very helpful. Only remaining question (for which I am not really expecting an answer) is how does one eliminate/reduce a SHB infestation in a hive? Things I have done so far include:

- removed all vegetation around the hive and sprayed salt/vinegar into the soil,
- Beetle Blaster traps in the hive,
- temporarily replaced bottom board with tray filled with oil, and
- try to keep bees healthy (e.g., *Varroa* treatments).

I understand that there really is not a cure-all for SHBs and it is all about pest control rather than pest elimination. Also, the SHB does not appear to be as big a problem as other pests, so it does not get as much attention/research. My area is one of the first in Canada to have it. They do not even have this issue yet in neighboring towns 30 minutes away. If you have any further advice, that would be great, but I understand that there is not much more that one can do.

**ANSWER:**

There really is no way to eliminate SHBs once they are established in an area. When we have large numbers in our hives at the University of Florida, we use traps such as Beetle Blasters in every box that composes the hive. Sometimes, we will put up to four traps per box. One of my team members is also fond of using Swiffer sheets in each box. Collectively, this helps keep beetle populations "low"

but not eliminated. There are some really good resources on SHB control on the web. Both Clemson University and the University of Arkansas have good documents about this pest. My team has linked to those on our website. Have a look at these resources and see if any help:

**http://entnemdept.ufl.edu/honeybee/beekeeper-resources/pest-and-disease-resources/small-hive-beetles/** (alternatively: Google "UF Honey Bee Lab" and then navigate this way: > Beekeeper Resources > Pests and Diseases > Small Hive Beetles)

*At this point, I had no more questions emailed to me to include in this month's column. What follows is a list of some other questions I received this year about honey bees and beekeeping. Do you have a question you want answered? Feel free to email me at **classroom@americanbeejournal.com**. Maybe your question will appear in a future issue of The Classroom!

## Q SUN VS. SHADE

Is it better to keep hives in full sun, full shade, or somewhere in between?

## A

I get this question a lot. In fact, I end up answering this question many times per year. It is usually predicated on the idea that honey bees seem to "do better" (which is what I often hear) when they are maintained in the sun. I have heard *Varroa* and small hive beetle populations are lower in colonies kept in full sun than in colonies managed in the shade. I have also heard that colony temperament seems to be worse when colonies are managed in full shade. What to believe?

I can only provide an anecdotal response. First, colleagues and I conducted a sun/shade study on small hive beetles years ago. We found that colonies managed in full sun and full shade had statistically indistinguishable beetle populations. I have not seen similar work conducted for other pests (*Varroa* as an example) or pathogens. The truth is, we just do not know.

I have kept bees in full sun, full shade, and a mixture of the two and have not seen any differences between the groups. My guess is that keeping bees in full sun may help some colony parameters, but it can hurt others. In Florida where I live, colonies kept in full sun work hard to keep the nest cool during late spring and throughout summer. The energy cost to do this must be tremendous and surely would offset any benefit that the bees might get from being in full sun.

At the end of the day, I prefer to keep colonies in morning sun and afternoon shade. Practically speaking, this means I like the colonies to be in the sun first thing in the morning, until just after noon, and then in shade during the heat of the day. As an interesting aside, many commercial beekeepers keep their colonies in full sun, often placing hives in holding yards with no trees, in fields of low plants for pollination purposes, etc. They do this out of necessity. Some also keep the same colonies in full shade other times of the year, possibly to catch honey flows in the forest or for some other reason. If there is a benefit to keeping colonies in the full sun or the shade, it seems too small to celebrate. The good news about all of this … I could be wrong. That is why we have science. ☺ It will inevitably correct me some day.

## Q SMOKER FUEL

What should I burn in my smoker? What works best to calm the bees?

## A

I like to use whatever is (1) natural, (2) available, (3) non-toxic, (4) free, and (5) safe for me. Let me address the last one first. I have always wondered about, but never found an answer to, how safe using smokers is for beekeepers. Commercial beekeepers and their staff use smokers every day, all day long. They have no filters, no safety measures, etc. When I work bees, I try to avoid breathing in too much smoke, but I really do not know how much is "too much." It would be good to conduct a longitudinal study on the impact of smokers on beekeepers. Maybe someone reading this answer is an MD/PhD and looking for a great project ...

Now let me discuss my other points. First, I like to use what is natural: pine straw, dried grass (though I do not like the way dry grass smells), leaf/twig litter, wood shavings, etc. I am not really a huge fan of burlap sacks, processed wood products, etc. I never really know what added ingredients are in those products so I tend to shy away from them. I am also pretty lazy and do not want to work too hard to collect smoker fuel. Thus, I prefer to use what is around me. I have lived in places where I have had a lot of access to pine straw (which is still my preferred fuel — it just smells like bee smoke to me). I only have access to cut grass at my home now, and that is only when I actually cut the grass. ☺ I lived in South Africa about 18 years ago and a beekeeper acquaintance there used dry animal dung (dung from herbivores) as smoker fuel. That was amazing to me at the time but I grew to accept it. After all, animal dung is just processed grass. Nevertheless, I like to use what is around me because it is usually free. Free beats not free every day.

So what is good for bees? Honestly, I think using pine straw, cut/dried grass, animal dung, wood shavings, and things like these items are acceptable. The key from the perspective of bee health is not to over-smoke bees. I have never killed bees by smoking them, but I have compromised a colony, though only temporarily. I do not believe smoke has any long-term impact on the bees.

As a final note, a lot of folks use paper, cardboard, burlap sacks, etc. as smoker fuel. I do not see any harm in using these items but just be mindful of any contaminants they may contain. Many of the beekeeping equipment manufacturers also sell pelletized wood shavings. This seems to work as well.

I do not recommend adding other compounds to your smoker. This includes essential oil, tobacco, any treatment of any type, etc. Not enough is known about these additives and I do not think the potential reward is worth the risk.

## Q What to do with queen cells when things are going well

What do I do with queen cells when the colony otherwise looks good? They have a queen and she is laying well. What do I do?

A

Honey bee workers make queen cells for different reasons. Sometimes, they make queen cells when a colony is getting ready to swarm. We call these cells … wait for it … swarm cells. Other times, the workers will make queen cells when they want to replace a failing queen. The queen can be considered failing for any number of reasons. Maybe she quit laying altogether, or is only laying drone eggs. Perhaps she is maimed in some way. Queen cells made in these circumstances are called supersedure cells. The bees are trying to make a new queen to supersede (replace) the old one. Finally, worker bees may construct queen cells when the queen is dead or missing from the hive. These queen cells are called emergency cells. Some beekeepers use the phrases emergency queen cell and supersedure queen cell interchangeably. I tend to use them to mean different things.

There is a final instance in which a worker bee will make a queen cell. That is when the queen is otherwise doing just fine. She can be present, young, laying lots of eggs, etc. It may even be outside of swarm season. During these times, it is really difficult to determine why the worker bees are making a new queen. It is likely that they are sensing something we are not. Maybe the opposite is true: Maybe we are sensing (seeing) something that the bees are not sensing (smelling). As an example, it is conceivable that the pheromone output of a queen can be low for whatever reason, even if she is a productive queen. In these instances, the workers are getting mixed signals. Brood is present, but they cannot perceive the queen. Thus, they may start to requeen themselves even when things look good to us. There are other times that bees seem to make queen cells when everything we know about bees tells us they should not be making them.

I certainly cannot pretend to know the reasoning behind making queen cells when the colony seems to be steaming along. Even still, I tend to remove these cells when everything otherwise looks good to me. To answer the original question: (1) I look for evidence of an existing queen (I look for her or look for eggs/young larvae). (2) I look to see if the queen is maimed in some way. (3) I determine if everything seems to be going well (the colony is productive, healthy, lots of brood, etc.). If these criteria are met and it is not swarm season, I remove any queen cells I find. I might destroy them altogether or place them in another colony that is queenless.

## Q HOW MUCH IS TOO MUCH?

How often should I work my colonies?

A

First, I work my colonies about once every 7-10 days during production season. I consider this from immediately before the swarm season (late March for me) through the spring honey flow (into the first week of June for me). I work my colonies every 2-3 weeks in summer/early fall (June-October). Then, I work my colonies maybe once in November, and not again through winter. I live in Florida so the word "winter" is somewhat relative. However, I tend not to work my colonies in December, January, or February. I visit them once monthly to hoist them from behind to see if they have enough food stores. If they do, I will postpone working them again until late February/early March.

At the recommendation of my wife, I wrote an article entitled "The time commitment associated with keeping bees" for the American Bee Journal some years ago. In that article, I go into more detail about how much time one can expect to work colonies if they are a hobbyist, sideline, or commercial beekeeper. You can find that article by going to **www.ufhoneybee.com** > beekeeper resources > management.

If you are a new beekeeper, I give you permission to work your colonies a few times a week. I hated to wait to work my colonies every 7-10 days when I was just starting out with bees. I wanted to work them daily. I think our bees are pretty forgiving so it is ok to work your colonies a couple of times a week as you get started.

## Q TIRED OF SMELLING LIKE SMOKE!

I smell like smoke the rest of the day after working my bees. Is there a trick to removing the smoke smell?

A

Why would you want to remove the smell? It is your right of passage! In all seriousness, this question has been my favorite one asked of me this year. Unfortunately, there is no trick. You have to remove/wash your clothes. You also have to take a shower. That is the only way to escape the smell.

My wife was not a bee person when we started dating. She could always tell if I worked bees prior to our dates. She even knew this after I took a shower and changed clothes! The smoke smell really gets in your hands. There is no escaping it.

As another example, we just built a new bee lab at the University of Florida. It is composed of two main buildings and an outdoor teaching facility. I made sure showers were included in the designs of both buildings. I even had a laundry room put in one. Why? There are times (albeit, less frequently these days) where I work the bees in the morning and then have to meet with my administrators or visitors later in the day. When this happens, the only way I can escape the smoke smell is to shower.

With that said, there is something nostalgic about that hint of smoke that hangs around on your hands for a day or two. I played basketball in middle and high school. Today, when I walk into a basketball gym, the smell of hotdogs, popcorn, and freshly waxed courts, the sound of squeaky shoes, etc., transport me to the days when I was young and playing ball regularly. That hint of smoke does the same for me now. It takes me back to the hives. I have learned to embrace the smell, even if the non-beekeepers with whom I interact find it unpleasant.

**This marks the end of The Classroom Q&A series for 2020. This year has been a very trying year for many of you. COVID has devastated some families and continues to be difficult to understand and address. Job and wage losses have been rampant. These and other issues produced a divided nation grappling with a polarizing election. Despite all the bad — and often over-sensationalized — news, there is still good in the world. As beekeepers, we have a common goal: Manage our colonies to make them as strong and productive as possible for the betterment of honey bees, mankind, and the environ-**

ment. We are united by our love of and fascination for honey bees. Let us remember 2020 for what it was, a time of struggle that has made us all stronger and more resilient. Let us welcome 2021 as a year of new opportunity. Let us unite with common purpose and celebrate what makes us similar *and* what makes us different. I wish you all the Happiest of Holidays and the Merriest of Christmases. I look forward to sharing my passion for honey bees and beekeeping with you in 2021.

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# Beekeeping Basics

# Using Wax to Preserve Woodenware

by MEGHAN MILBRATH


Photo by Kirk Mason

Ever notice that the word "pain" is in "painting"? While I love bees and beekeeping, I hate painting boxes. My sideline operation in Michigan is limited by both space and time, and paint needs both to dry. Since I operate out of a small shared building, and Michigan weather is not always reliable for drying paint outside, a few years ago I looked into alternatives to painting boxes as a method of woodenware preservation. I tried paraffin wax preservation, and I have never looked back. The process is quick, it does not require space for drying, and the boxes last much longer than those done with paint or stain. Even better, a hot wax system can sterilize equipment — including American foulbrood (AFB) spores, and I love reducing disease risk any way that I can. In this article I have tried to outline my experience so you can see if this is something that might work for you and your operation.

The whole process occurs by dipping woodenware in a tank of hot wax. The tank is basically a large stainless steel rectangle with a removable lid. Mine is big enough to dip six deep boxes at a time (two stacks of two side-by-side with one in the middle of each stack), though I've seen others that are much smaller. The nice thing about having such a large tank is that is ultimately saves a lot of time — between loading, unloading, and a 10-minute dip, each batch takes about 15 minutes. If you double the size of the batch, you halve the time it takes to get through your woodenware. Of course, this is only useful if you plan on doing a lot of boxes. The downside to a large tank is that I had to purchase a LOT of wax to fill the tank — about 700 pounds.

I have always been able to find the wax, though it is not cheap because it is an in-between size order for most companies — more than used for crafts, but less than used in industrial applications. Often, the cost of shipping is about the same cost as the wax, so if you have the vehicle and time to pick it up it is likely worth your while. I'm lucky because there are two other beekeepers in the area that I can order with to share costs. It is also important to know what size pieces the wax will arrive in if you have to hand-unload like I do. While I can accept a freight shipment at the farm, I have to hand-move it around the garage, so I get 60-pound boxes that I can easily lift. I use a mixture of **2:1 ratio of paraffin and microcrystalline wax**. I use this ratio because it is what most beekeepers use who dip their equipment (and write about it on the internet or answer my phone calls). I have not been able to find a lot of data or reasoning behind wax mixtures, but the current mix works fine, so I have not been motivated to mix it up. I do always talk to a dealer to check the specs, because it is really important to pay attention to the flash point and the melting point. You want a wax with a higher melting point, so that it will not get tacky and sticky in hot sun in the bee yard (this is why beeswax does not work). More importantly, you want to have a high flash point so that you don't create a driveway disaster.

*Note the foam caused by the new boxes. We try to leave at least 12" between the top of the wax and the top of the tank, but that is sometimes not enough if the wood is wet or you pack it full with lots of small pieces.* Photo by Kirk Mason

In order to sterilize boxes for AFB spores, you want wax that can be heated to 160° C (320° F). The wax also has to be hot because the process needs to be above the boiling temperature of water. Rather than coating the outside of the wood, the wax dip process boils the moisture out of the wood, and the wax is sucked inside. The hotter the wax, the faster this process occurs.

Becacause you are boiling water out of wood, the moisture of the wood is

a very important consideration. When the woodenware is brand new, and often very wet, there will be a lot of moisture. Because we do it outside, we also have to watch the weather so the boxes are dry and we don't get rain/moisture into the tank. Moisture will cause the wax to foam, and it can overflow. We learned this the hard way, and now also have an accidentially (and expensive) paraffin-sealed cement pad in our driveway. Now, we never fill the tank more than ⅔ with wax, to allow for the space of the wood and the wax, and our tank has a 2" baffle that drains into an overflow bucket. If I were to make a new tank, I would make a much larger overflow pipe to a bigger bucket, because when overflows happen, they are fast and dramatic.

Besides overflows, there is a lot of potential for fire. We minimize risk by keeping a fire extinguisher close by, keeping a clear space around the tank, and having a steel lid always accessible — it hooks to the side during use. Our bottom is flat, but in the beta version, I would have a lip that drops down to shield the burner from drips. Our tank is on casters, so it can be rolled out of the garage to an outdoor, open cement pad for dipping. If you had a forklift, I would just leave pallet jack openings rather than the casters in the design. If you do get casters, I would make sure they are metal — speaking from experience, if you have composite casters, and it is a cold windy day so you insulate around the bottom of the tank too well, you will melt your casters to the cement pad, and have a real fun afternoon trying to move an 800-pound tank that is melted to your driveway.

Our tank is not insulated, so on very cold days it is hard to keep the wax up to temperature. One very cold and very windy day we were using a ton of propane, and would have to take breaks between rounds to bring the wax back up to temp. Our solution was to insulate with rockwool and cement board. Those are both safe to use, and non-flammable. However, what we missed was that if there was an overflow, the insulation would keep the wax right next to the tank. It dripped down the side of the tank and onto the casters, causing them to burn. We chose to learn through experience, but you could use foresight if you like — either insulate the tank more safely, only dip on hot days, or assume that everything nearby is fair game for starting on fire, and purchase metal casters accordingly.

Our tank is heated underneath with a black pipe burner (from a meat smoker/grill company) with an adjustable regulator hooked to a 100-pound propane tank. I have seen photos of some people who heat their tank with an open fire. I believe this to be dangerous because the wax is so flammable and the flame cannot be "turned off" if there is an emergency and there is no way to control the temperature of the wax. Originally we used multiple 20-pound propane tanks. We have a gas station nearby with propane refill, and we would switch them out as needed during the day. That was a pain (there is only one employee at the station for both counter work and propane refills, so sometimes we would have to wait at the station for a long time). The 20-pound tanks also got maxed out a lot. They would freeze up and required a lot of maintenance to unthaw valves or to tip to get more pressure. We now use a 100-pound tank, and keep the small tanks to use while the large tank is getting refilled. I usually use a full 100-pound tank each weekend that I dip.

I get up around 5 a.m. and start the burners to melt the hardened block of wax. The time it takes to get the wax to temperature depends on the outside weather, but usually it is about 4 hours if the tank is uninsulated and it is cold, or about 2 hours if it is insulated and warm out. Usually by 9 or 10 in the morning we are busy dipping boxes. If the boxes are dry, we can keep the process going without stop. If they are wet, we often have to pause to let the excess water boil off and the wax get back up to temperature. We use an infrared thermometer to easily check the surface temperature of the wax so we aren't wasting our time trying to dip when it is too cold. When the wax is not hot, it takes much longer for the water to boil out, and the process does not seem as effective. I usually try to do at least two days in a row, because if it is warm enough (and I get up early enough) the wax will not completely solidify at night, and I won't have to wait for it to completely melt again.

The dipping can easily be done with one person, but it is better with two. The person working the tank protects themselves from the wax drips with a heavy duty apron and heavily insulated gloves. The other person moves boxes — we keep a pallet for woodenware that needs dipping on one side of the tank, and pallets of finished boxes on the other. The person working the tank adds the boxes slowly — preventing splashing, and watching the levels of foam/moisture. At 160 C (320 F) the boxes have to sit submerged for 10 minutes. The boxes will want to float, so you'll need something to hold them down. I have seen designs for bars with a spring and catch, but we just use some scrap metal (see the rebar and angle iron 'ladder' in the photo) that is held down by a concrete block. We had to add a similar rack to the bottom of the tank so we were not pressing the boxes against the hot bottom where they can burn.

*In this photo you can see bubbles as the hot wax is sucked into the corners of the wood. I have only had the dipping tank since 2015, so I cannot personally speak that well to the longevity of the boxes, but I have yet to see any signs of rotting corners from the dipped boxes.* Photo by Kirk Mason

The rack also keeps the boxes cleaner, as dirt and flotsam such as cocoons, propolis, etc. from re-dipped boxes will sink to the bottom. We have a metal mesh skimmer (homemade with hardware cloth) to get bees and cocoons that float, but it is almost impossible to clean the dirt from the bottom of the tank, so we are careful about what goes in. I use a wire brush on used boxes to remove spider webs and dirt, and we keep the lid on the tank when it is in storage. Over time, the wax is no longer totally pristine, but it kind of adds to the natural look, and we don't really care, so I have not put more effort into keeping the wax perfectly clean.

After dipping, the boxes have to sit for only a few minutes to dry/cool. Once they are cool to the touch they are completely ready to go. It is good to have a drying rack that collects the dripping wax — there is a lot that drips off the boxes in the process, and since it is so expensive we have found that it is worth it to reclean it and put it back in (we just put the collected wax in the tank in a strainer as the tank is heating, and remove the strainer once the liquid wax has melted out). It is better to have a place sheltered from wind to dry the boxes.

We tried to dip boxes on a cold and windy day (probably the same day as we melted the casters), and the wax was drying so quickly it wasn't getting drawn into the boxes. We had to scrape the outsides of the boxes, and wondered how much actually went into the wood. You can paint the boxes immediately after the boxes come out of the tank, but not really after they are finished. (I have never tried, but I can't imagine it would work well.) We had a beekeeper want to decorate their boxes, so we set up a tarp painting station on the grass next to the driveway, and they were ready to immediately paint them. I have not done that much, but I like the option so I can still easily mark mating nucs to prevent drifting.

You can wax dip most equipment, used or new, as long as it is clean, not too wet, and not cheap plywood (the glues will delaminate). Metal covers and screened bottom boards are just fine — the wax drains off the metal, and a quick shake rids the screen of the liquid wax. I have had no problems with dipping painted boxes — only one color faded — but I don't think it absorbed well into the painted side. You can dip unassembled or assembled equipment. At first I thought there was a great benefit to dipping unassembled equipment, because you can fit so much more into the tank. However, I soon realized that they often stick together — so tightly that the wax does not penetrate in between. Prying them apart is difficult, so it does not save that much time. It could be solved by a slotted rack of some sort, however you also have to watch the foam and overflow risk. If you pack the tank with a lot of new wood, that means a lot of moisture, easily boiling over.

*Here is a photo of the caster burning incident. The flames are all just melting plastic. It smelled horrible.* Photo by Meghan Milbrath

I only dip each box once, though I have seen that some people dip multiple times to make sure that the wood is fully preserved. I have re-dipped some boxes as the paint has worn off, or if they happened to be empty and nearby while I was already dipping boxes, and I have noticed that it takes much less time on the second round — there is so much less foam — indicating that the wax is holding up at least for now. While I was trying to catch up on my back stock of woodenware I would usually fire up the wax dipper twice per year — in the spring and in the fall. I would stack up equipment to be dipped in the garage, and when I would have at least 60 boxes of my own equipment, I would send an email out to local bee clubs and let them know what weekend I would be dipping. I would do all of my boxes on a Saturday, and then dip other peoples' boxes on that Sunday. I leave pallets in the yard so people drop off their equipment all

*A stack of woodenware sits ready to be dipped as a load of boxes sits submerged in the tank. The lid is hooked over the side for quick access.* Photo by Kirk Mason

*A mix of wax dipped and painted boxes in the field. I add the cleat at the same time that I dip the boxes so I can keep track of which boxes have been dipped. As I retire out old boxes I likely will not paint anymore except to add decorations to minimize drifting.*

week (every single piece has to be labeled and they either have to leave a note or email me their contact info and the inventory of what they left). In non-pandemic years, people often stay to help, or use the other jigs in the woodshop, and it is a pretty fun and social event. Usually someone orders pizza, and we spend the day talking bees. In those two days, and keeping a social pace, I can usually dip upwards of 200 assembled boxes. I estimate it costs $4-5 per box to cover the wax, propane, and initial materials. After each weekend of a few hundred boxes I have to refill the 100-pound propane tank and order a few hundred dollars' worth of wax to refill the tank. I only charge enough to cover my costs, because it isn't part of my business — it is more of a service I offer, but I do feel that the demand is high enough in my area that someone could make it part of their business model. I have not had any complaints from other beekeepers, and I've been quite happy with the way the boxes turn out. The real test of the economics of this system will be if the wax dipped boxes last without care as long as people tell me. I've read that a dipped box can last decades, while painted boxes rarely last a full decade. In my calculations, if I can prolong making new equipment by even a few years, the system will easily pay for itself. Only time will tell.

**Meghan Milbrath** is a beekeeper and honey bee and pollinator researcher and Extension specialist at Michigan State University.

# TIME WARP

## *Cryopreservation of Honey Bee Germplasm*

## Part 1:

## *The drone contribution*

**by M.E.A. McNEIL**

*This array of liquid nitrogen tanks is at The National Animal Germplasm Program (NAGP), at Fort Collins, Colorado, where thousands of samples from agriculturally beneficial animals are cryogenically preserved. Only recently has honey bee germplasm been added. Harvey Blackburn, left, Coordinator of the USDA program, places vials into a tank with Biological Technician Ginny Schmit.* Photo credit: USDA/ARS

"Cool it. First, we cool it." "What?" The young student, Brandon Hopkins, was ready to put some vials into a vat of liquid nitrogen, and he did not understand what his Master's advisor, Charles Herr, was telling him. They were at Eastern Washington University, attempting in 2008 to preserve frog spermatozoa and a last-minute addition of some from honey bees. Herr explained that the semen should be brought down in temperature before freezing. "I didn't know anything about it," said Hopkins. "My lack of knowledge resulted in the comparisons that we did." They froze half of the samples directly from room temperature, and the other half was cooled slowly to refrigerator temperature before it was frozen. Herr knew the process from mammalian cryo-preservation as a way to avoid cold shock.

"We found that the semen had much better survival in the treatment with the slow cooling effect," said Hopkins. The goal was to eventually be able to inseminate queens with stored semen. "It was a big step."

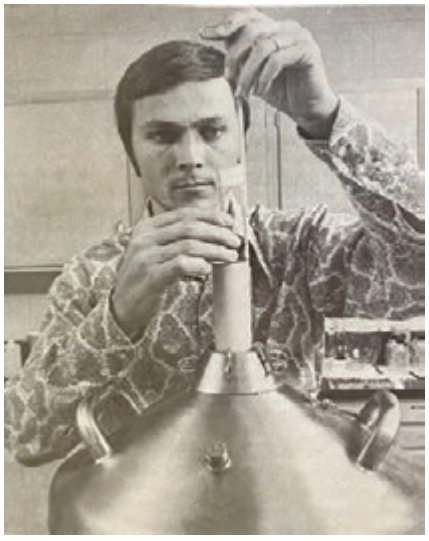
That work was done in a lab over a decade ago. "Anything that's not tested in the field has to be taken with a grain of salt," said Hopkins. "We had good results according to fluorescent staining under a microscope," which shows the proportion of live cells. "But that doesn't necessarily mean that it results in fertilized progeny to produce queens from."

Hopkins subsequently came to Washington State University to study for a PhD under Steve Sheppard, a population geneticist who has examined the genetic diversity of domestic bees with a large lens and found it imperiled. Sheppard saw that cryopreservation of honey bee sperm could be developed as a tool to conserve and augment germplasm.

That motivation can be appreciated by a digression into some history. A small number of queens from eight subspecies were originally brought to the New World, and further importation was cut off by a 1922 law intended to stop tracheal mites. "For each subspecies that was brought, there were just a few tens or hundreds of queens," said Sheppard. "The stock was almost certainly not selected from across the parent range. If you bring characteristics over that are in relatively low frequency in your original sample, you can lose those characteristics." Numbers of colonies can increase, but not genetic diversity. "That's a bottleneck, and that's just to start with," he said.

In a 1993-94 study he found that most queen breeders sampled in the

*Brandon Hopkins learned a gradual method of cooling germplasm that has created possibilities for cryopreservation of bee genetics both at Washington State University and at the National Animal Germplasm Program. Here, he places tubes of semen into the liquid nitrogen tank at WSU.* Photo credit: Sue Cobey



*John Harbo, now retired as a research leader at the USDA/ARS bee lab at Baton Rouge, performs early experiments in 1977 with cryopreservation of bee sperm in liquid nitrogen.* Courtesy of John Harbo, Photo by Leah Taylor

West grafted from 10 to 20 breeders;in the Southeast, from one. A decade later, Debbie Delaney, then at WSU, found that nationally, about 500 mothers produced 870,000 queens, with a net genetic loss over the previous ten years of 26% of the alleles from 10 microsatellite loci — although some new alleles were found.

In 1999 Sheppard traveled to Central Asia and discovered apple-pollinating bees, a subspecies not previously known, *Apis mellifera pomonella*. Over several trips he applied to the USDA to bring samples of those and other subspecies back, but he could not get a permit. He was impeded by the 1922 law, which prohibited importation of honey bee germplasm in any form.

*Steve Sheppard in Kazakhstan in 2015 where he was collecting semen samples from* A. m. pomonella*, an apple pollinating bee that he discovered. He and a team from Washington State University are cryopreserving germplasm from several subspecies in remote areas of Europe and Asia.*
Photo credit: Brandon Hopkins

The same law and its iterations had thwarted bee breeder Sue Cobey's attempts since 1990 to import germplasm to build her New World Carniolan stock, a subspecies she was retrieving from the genetic mix. She'd gotten one ephemeral permit, but when she relocated to UC Davis she could not get USDA approval for a quarantine site there, as it was not remote enough. In the meantime, Sheppard had at last gotten approval for an isolated quarantine location outside WSU in Pullman. Cobey's goals segued with his, and they joined forces. Their mutual quest was to bring back new alleles from stocks of *A. mellifera* in Europe and western Asia to invigorate the U.S. gene pool.

They found themselves in the same boat going nowhere. With reports of Colony Collapse Disorder, importation permits stopped. Perhaps it was the irony of the government allowing importation of 100,000 unregulated bee colonies from Australia for pollination, but in 2008 Sheppard got a permit for WSU. It was highly restricted. They could bring in semen only, and from just three subspecies of the many that were known to have been previously introduced to the U.S.: *A.m. ligustica*, *A.m. caucasia*, and *A.m. carnica* — Italians, Caucasians and Carniolans. The semen would need to be tested at the USDA lab for pathogens, and the inseminated queens had to be kept in quarantine in the isolated apiary in Eastern Washington.

Their first shipment, *A.m. carnica* semen from Germany, was caught up in customs and then missed delivery to the lab in Pullman. Cobey chased down the errant FedEx truck for miles and retrieved the sample as its viability waned, and she ignored bawdy jokes about her package at the bar where she found the driver.

To eliminate the delivery drama, the team got permission in 2009 to hand-carry imports. "All these trips were a maximum of about one week," said Sheppard, who traveled to remote areas of Europe and Asia. As soon as he gathered the live samples, the clock ticked down to a complex choreography performed on spermatozoan time. He rushed the vials to a flight back and drove them to Pullman to meet Cobey, who flew up from Davis to do the insemination. The arrival of virgin queens, selected by members of the California Bee Breeders Association, had to be carefully timed as well. Coordinating the segues was critical: "The semen loses about 50% viability every week," he said. They established a bank at Pullman and their quarantine apiary soon held resultant Carniolans and Italians, and the next year developing Caucasians were added. It was a challenge.[1]

**It was not a new challenge.** John Harbo recently recalled his work to preserve honey bee genetics nearly 50 years ago. The USDA Honey Bee Stock Center was built in Baton Rouge in 1967 to preserve important lines of honey bees for research and commercial use. Not long after he arrived there in 1971, Harbo was assigned the task of conserving some 20 lines of bees that had been collected mainly by William Roberts. Some were imported, such as Russian and Anatolian Caucasians or Brother Adam's Buckfast. Others, from as early as 1936, were domestic lines from across the country.

"Pure lines probably do not exist, at least in the U.S.," Harbo wrote in the American Bee Journal in 1973, explaining that all of the lines had been named with letters for that reason. For want of a better method, the collection had been categorized by color, from dark to light. For example, the Y line came from a yellow queen from a New Orleans queen breeder in 1938, and YR came from Roberts' subsequent experiments with color inheritance. The Ka line, grouped with the darker bees, had been created in 1963 from Carniolan eggs shipped from England to Guelph, Ontario, where queens were produced and virgins shipped to Roberts in Baton Rouge; semen was shipped from Germany by Friedrich Ruttner for Roberts to inseminate the queen bees from Canada. And Harbo's job was to preserve it.

Standard stock was maintained in a round-robin system, for which he needed to bring drones from particular places, and the inbred lines were kept by making aunt-niece crosses, one generation per year. Looking back recently, he said, "The longer we maintained these inbred lines, the more inbred they became. You quickly got down to the sex allele problem, two sex alleles and the brood was not viable. When we had 15 or 20 of those inbred lines it was hard to keep them going through the summer, much less over the winter. It sounds easy until you get into it, and when you're into it, man, it's just labor."

The Stock Center had research objectives, too, "but you can't do much research when you're running around taking care of stock," said Harbo. "We asked, when we get 20 years up the road what are we going to have? You're going to lose material; you can say you're going to preserve it, but every time you do a generation you're going to have a little bit of loss."

He understood half a century ago that semen storage was key to preservation. He was counseled by those doing cryopreservation for livestock, as Hopkins later was. "Bees were late into the game," said Harbo, since by that time the science for cattle had already been developing for decades. He was able to freeze bee semen and store it for as long as two years. "We produced viable progeny from frozen sperm and produced queen and worker progeny from queens that were inseminated with frozen spermatozoa. The queens laid well enough to preserve the germplasm, but none of them was good enough to head a productive colony. However, most of the next generation, the F1 queens, were normal."

He reported, in a 1983 paper,[2] a decline in progeny that he speculated was related to duration of cryogenic storage: Four-day-stored spermatozoa produced 22% worker brood, while two-year-old spermatozoa produced 8%. He compared his results to bovine spermatozoa storage, which at that time showed a decline in viability after 12 months in liquid nitrogen.

Reflecting on that work so many years later, he categorized the failures: Some queens became drone layers, some had no sperm in the spermatheca, some had mortality in the embryos, some had more than one sperm entering the egg, creating a gynandromorph or a mosaic. "You would think the sperm would be either dead or alive. But we learned it's not that simple." To improve the viability of the sperm, he experimented with the temperature drop, cooling at various degrees before freezing, but he did not settle on an ideal protocol.

"There seemed to be some genetic damage," he said, and he feared introducing it into the bee population. "I thought maybe the cure is worse than the disease." In addition, the original purpose of the Center, to retain and distribute the stock, "didn't work out very well. There was a lot of labor involved in maintaining those inbreds. We were charging $25 a queen, but that was outrageous for the time

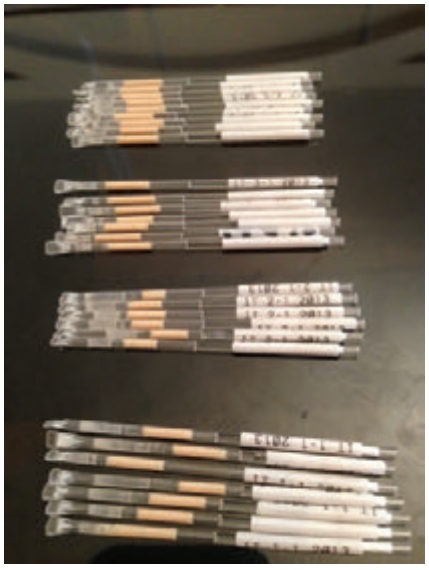
*Sue Cobey collecting Carniolan honey bee semen in Slovenia that will enhance her longtime efforts to bring the subspecies back in the US. Dr. Observing are Prof. Aleš Gregorc of the University of Maribor, a bee scientist, and Stane Plut, who keeps Carniolan stock, holding a cage of drones.* Photo credit: Sue Cobey

perhaps. It seemed like that was the logical place to end the project. And if somebody else wants to take it up, God bless them."

Later, when the Honey Bee Stock Center was combined with the other USDA bee lab in Baton Rouge, they kept some strains with mutant markers they'd gotten from Harry Laidlaw. "They were handy to have," said Harbo, "for determining if progeny comes from a certain place. We kept them for about ten years, but gradually they dwindled away." As did the Honey Bee Stock Center and all of its lines. But John Harbo can take credit for successfully reviving cryogenically preserved honey bee semen and later breeding the VSH bee, which lives on.

**Hopkins needed proof** of concept to regenerate frozen semen. "I did it," he said. "I had to prove this technique was viable before it was worth taking some student overseas and freezing a bunch of this valuable semen. I did

*When John Harbo, right, arrived at the USDA Honey Bee Stock Center in 1971, he was charged with maintaining some 20 lines of bees. Most were collected by William Roberts, left, who soon after retired.* Courtesy of John Harbo



*Honey bee sperm is collected and stored in the WSU cryopreservation bank. Samples such as these from 2013 have been thawed and used to successfully inseminate queens with desirable genetics.* Credit: Brandon Hopkins

*To cryopreserve Caucasian bee semen collected that day in the Republic of Georgia, the Washington State University team turns a hotel room into a lab, with liquid nitrogen rolling down the hallway. Brandon Hopkins is bending over the equipment while Steve Sheppard (at left) and an unidentified local observe. The trip required schlepping the dry shipper in the foreground, microscope, tanks, collection and freezing equipment and computers, as well as finding N2 to maintain the stored material.*
Photo credit: Sue Cobey

it by collecting [thawed] semen, and inseminating queens and putting a whole bunch of them in nucleus colonies with fresh semen controls. And dragging Steve [Sheppard] out to the be yard to show him that these queens were producing worker progeny." The results were uneven, but Hopkins was able to raise three generations of queens from semen that had been frozen in liquid nitrogen, demonstrating the viability of this method of cryopreservation.

Sheppard was amazed. He said, "If you put [the semen] directly in the refrigerator it cools too quickly. If you put it in a glass of water at room temperature and put it in the refrigerator for a few hours, it works fine. After that you can use a special machine to lower it down to -40° C at 3° per minute floating in a bath of liquid nitrogen, using a computer. But the real secret is: Put it in a glass of water. It's not the temperature but the rate of change that makes the difference."

Now, with a proven method of storage Hopkins' ingenuity got him a ticket to come along to preserve samples on the next trip, in 2011. That nearly didn't happen when they didn't get all their equipment on the plane. They couldn't persuade the TSA people that lingering condensation from the team's empty liquid nitrogen tank was not smoke; as the boarding gate threatened to close, they managed to get the tank shipped. Cobey and Hopkins went to Slovenia for Carniolans, and Sheppard to France for *A.m. mellifera* — the little black bee that was the first imported to America — allowed on a new permit. They met up in Georgia to travel back into the Caucasus Mountains for *A.m. caucasia* — where they escaped some drunken locals accusing them of exporting a national treasure.

Each day, Hopkins managed to find an unrefrigerated chicken egg for the small bit of yoke as the diluent used to preserve the semen. To hedge their bets, they brought fresh semen back as well, the quality of which is better than frozen. "At first I gave Brandon as little as I could [to freeze]," said Cobey, "but now I give him as much as I can." It was Cobey who had supplied Hopkins with that first few ounces of honey bee semen in hopes that he could learn how to successfully preserve it. She is now at WSU and Hopkins is now an assistant professor and peer collaborator with Sheppard.

Like Harbo, they see inconsistent results with frozen semen. Hopkins

*The Washington State University honey bee cryopreservation project has the first continuing bank preserving honey bee germplasm. It's maintained by Brandon Hopkins, now an assistant professor there.* Credit: Brandon Hopkins

reports drone layers among other inadequacies. "That is why we never really expect that a queen inseminated with cryopreserved semen will head a full-size production hive," he said. "We just need a few undamaged sperm to fertilize a few eggs so we can produce a queen from that desired cross." The technology is adequate, though, and WSU is currently the only lab using cryogenetics for breeding. They even make their own custom glass vials by heating, stretching and fire-polishing capillary tubes. They have used seven-year-old semen to inseminate queens, and Cobey said they have just regenerated a ten-year-old sample.

Hopkins summarized two goals for their work as "the introduction of this material to enhance the genetic diversity of the U.S. breeding population, and a conservation effort, too."

"This is a game changer," said Sheppard.

**A longtime dream come true** for Sheppard is a germplasm repository for honey bees. The National Animal Germplasm Program (NAGP), at Fort Collins, Colorado, is a USDA cryopreservation bank preserving the genetics of agriculturally beneficial animals in the U.S. Now, because of the cryopreservation work at WSU, it includes honey bee semen. Together with Bob Danka, the WSU team had already collected and stored samples from the USDA Baton Rouge lab; VSH, Pol-line and nine Russian lines have been transferred from the Pull-

*Steve Sheppard in Kazakhstan collecting drones from a local beekeeper. He and a team from Washington State University are cryopreserving germplasm from several subspecies in remote areas of Europe and Asia.* Photo credit: Brandon Hopkins

man bank to Fort Collins. They have added lines from Jackie Park Burris and Ray Olivarez, California commercial queen breeders. Sheppard heads the Honey Bee Species Committee and works with Danka and Hopkins to expand the collection.

The head of the NAGP is Harvey Blackburn, an animal geneticist who oversees vast tanks holding over a million samples from 56,000 domestic animals from chickens to yaks. With honey bees, "biodiversity is an issue that we need to be concerned about," he said, citing the devastation caused by varroa — which he called, in a misspeak that deserves to enter the lexicon, "the corona mite." He recognized Sheppard's important indicative work, but "there has been no national baseline study on a genomic level, so that we don't know how much diversity we've lost over these years of declining population." Beyond preservation, he is hoping that samples will be analyzed using quantitative genetics, to determine relatedness, and molecular genetics to determine diversity.

"This is a government repository," said Blackburn, "and our sample collections are intended for the public good. Our main mission is to have this material in case industry and science needs it." The bulk of the collection is donated, and, in some cases, held by agreement for a number of years before access is offered. "The producers are a pretty independent group of people. But they say about donating to the bank, this is a responsibility that I have. They donate material to us with that kind of mindset."

As for the honey bee germplasm samples, "We don't have enough to give out now," he said. "We're a long way from having a collection that's large enough and deep enough and broad enough that we feel comfortable distributing anything." He values Sheppard and Hopkins' continued project to collect more samples from diverse environments. "You can have some pretty low success rates in an attempt to undergo cryopreservation. If you can, you can make up for that by collecting more material."

And the future? "We will have embryos once Arun has gotten far enough with his work." That is Arun Rajamohan at the USDA Fargo lab. His remarkable science is a subject of Part 2 of this article, to be found in next month's issue.

**Imagine if** it had been possible to save the genetics of the 20 lines of bees that Harbo nurtured, each collected for a reason, the unique definitions of each now gone; to save the useful lines of mutants sent to the USDA by Laidlaw, disappeared; the Starlines and Midnites, which Danka called "perhaps the most successful breeding program ever," lost; Caucasians from the Sears catalogue, a memory; Rob Page and Kim Fondrk's pollen hoarding lines, dispersed; carefully bred strains up in smoke with the California fires.

"That genetic population could've been maintained in a liquid nitrogen container here in the corner for however long without the cost and labor and risk of maintaining living colonies," said Hopkins. "All kinds of issues can affect breeding programs that have value for conservation. And climate change is going to become a bigger and bigger problem. Some queen breeders, smaller ones too, have a lot of valuable genetics. The value of this cryopreserved genetic material is that it could contain alleles, copies of genes that contain genetic information that may be valuable in the future and could be lost by random chance or breeding pressure. It's a hard concept to envision, but some unknown threat in the future may require a large genetic pool in order to find the one copy of a gene that has some function that is now unknown."

"If this piece inspires folks to allow us to come in and collect for the USDA program that would be great," he said. "It's a big ask to allow a stranger to come into your outfit and collect a bunch of your material and freeze it. Hopefully it inspires some people in Florida, Georgia, the Midwest to let us come in." To volunteer when the project resumes, contact **bhopkins@wsu.edu**.

Some of the collected WSU genetics are dispersed to beekeepers. For example, Heitkam's Honey Bees of Orland, California, sends virgin Caucasian and Carniolan queens for insemination at WSU. Through DNA sampling, it was found that genetic diversity has increased above 1994 levels among queen producers who use that progeny.

"If you look across the world," said Cobey, "we're losing, what are there, 26, 27 subspecies and a lot of ecotypes of each subspecies. Pesticides, loss of habitat, malnutrition, all these things. With worldwide movement of bees, we are losing their ranges. You can preserve that with cryopreservation techniques. My dream would be to get all that stuff in a liquid nitrogen tank and be able to bring it back out sometime in the future.

"But you have to know how to collect semen, and store it. I'm wanting to train more people in insemination so it's a more common practice, so people can run with it, I hope. The brood viability is not going to be a productive colony, but we can recover the stock by learning how to do that and grafting off of those queens. The diversity is so critical. The more diversity you have within the bee population, the more vigor, the more health you're going to have. Cryopreservation is going to be an incredible tool."

### Endnotes


1 For further backstory see: McNeil, M.E.A. Steve Sheppard: Genealogy Toward a Better Bee, Parts 1 & 2, American Bee Journal, April & May, 2012.

2 Harbo, John, Survival of honey bee spermatozoa after two years in liquid nitrogen (-196°C), Annals of the entomological Society of America, volume 76, number five, September 1983.



**M.E.A. McNeil** is a journalist, Master Beekeeper and Northern California organic farmer. She can be reached at: **mea@meamcneil.com**.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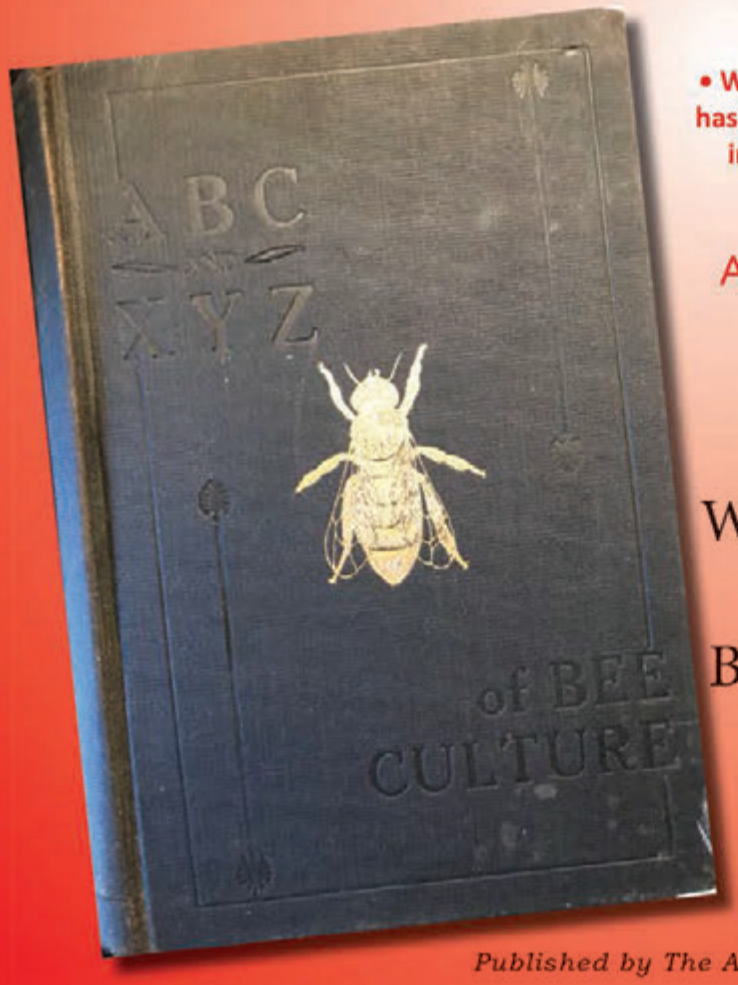


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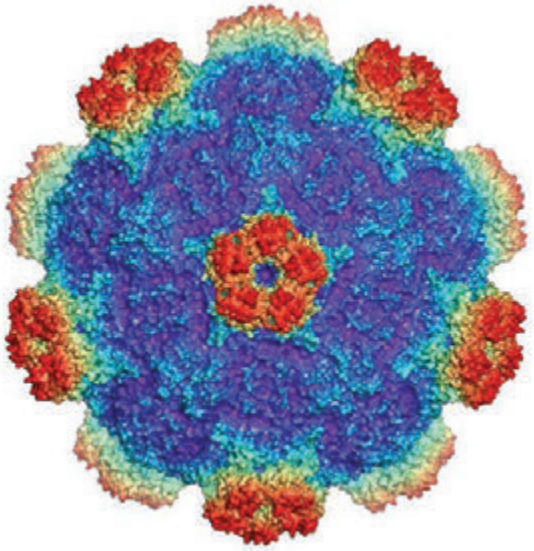

# Running Interference

## RNAi and the promise of healthy bees

**by BILL HESBACH**

**Fig. 1** *This DWV particle is only 30nm. As a comparative aid, that would be the size of a marble compared to the earth. They are invisible using light microscopy but are viewed in detail using electron microscopes.*

In the human world, a virus particle that enters a body has several obstacles to overcome before it can infect us. Humans and other animals mount an immediate and formidable immune defense. These innate responses signal other defenses, which are eventually memorized by our adaptive immune system to fight future attacks. Humans can become immunized by natural viral exposure or vaccinations, which teach our immune system to defend against a specific antigen by making antibodies and other specialized cells to fight it.

In the bee world, it's much different. Bees don't have the biology to memorize the characteristics of a pathogen. Since bees lack an adaptive immune system, they don't make antibodies, so each time they encounter a virus, like Deformed Wing Virus (DWV), they must mount a defense as if it were a novel pathogen.

Fortunately, bees are not defenseless, and we are learning more and more about the different elements of their immune system and how they operate. There is one particularly exciting defense that works inside their cells and is a focus of recent research. You've heard of it before, and you will continue to hear about it in the future; it's RNA interference (RNAi).[1] The "interference" part denotes a reference to how RNAi can chop up a virus before the cell is damaged.

In this article, I'll discuss some of the microbiology of RNAi and reference some promising research on how this conserved cell function can be enhanced to kill DWV and, surprisingly, also be used to kill varroa.

Before discussing RNAi, it will help to review why viruses can be deadly to humans and bees. A virus particle is nothing more than a small collection of amino acids protected by a coat of protein known as a capsid[2,3] (Figure 1). They are not alive, and without a cell to invade, they would eventually desiccate in the environment and become harmless.

When a virus particle, such as DWV, which has evolved to function as an intercellular parasitic, invades a bee's cell, it begins to control the cellular machinery and reproduce. Unimpeded, virus particles can reproduce at exponential levels and start to bud from the invaded cell's surface until healthy functions stop, and the cell begins to die.[4] When the viruses overrun a bee's RNAi defense, we beekeepers observe the resulting pathology as deformed wings and shortened lifespan (Figure 2).

### Viral cell invasion

Once a virus particle finds its way inside an animal, it begins to circulate until it finds a cell type that will allow entry. It's a kind of lock-and-key arrangement where the virus particle binds to a specific protein site.[5] Once the binding sites are connected, the particle can enter the cell. Binding may occur on one kind of cell or many. For example, in honey bees, DWV particles can be found in many parts of the bee's body, indicating that multiple cell types allow access.

You may be wondering why a cell would present an opportunity for a virus to gain entry — rest assured it's unintentional. Cells require many micronutrients that allow for normal functions. Those micronutrients are carried into cells using specific modes of entry that involve recognizing surface proteins — the "lock and key" arrangement mentioned earlier.[6] Over many thousands or perhaps millions of years, virus particles mutate, and sometimes those mutations will accidentally develop surface proteins that mimic those of a micronutrient. The cell has no way of distinguishing between a legitimate nutrient or a virus, and as a result, a cell will often help a virus enter. But once a virus particle moves inside a cell, it begins to reveal its real identity as a particle and not a micronutrient. In the case of DWV, standard cellular functions release its

**Fig. 2** *Deformed wings occur when viruses reach the brains of bees.*

RNA genome to start the reproduction process.

### The RNA-interference pathway

Fortunately, exposing its RNA genome to a cell can be the end of the virus's journey. Viral genomes come in many shapes and forms, and with DWV, its genome is referred to as double-stranded RNA (dsRNA).

When RNAi detects dsRNA, it goes into action, reads the genome as foreign and sends the genome down the RNAi pathway. The interference occurs when RNAi chops the dsRNA into small micro-sections that the cellular machinery then can use as templates to recognize and chop up similar viruses that enter the cell (Figure 3). The interference process can keep a minor infection under control by continually chopping up the viral genomes and preventing uncontrolled reproduction.

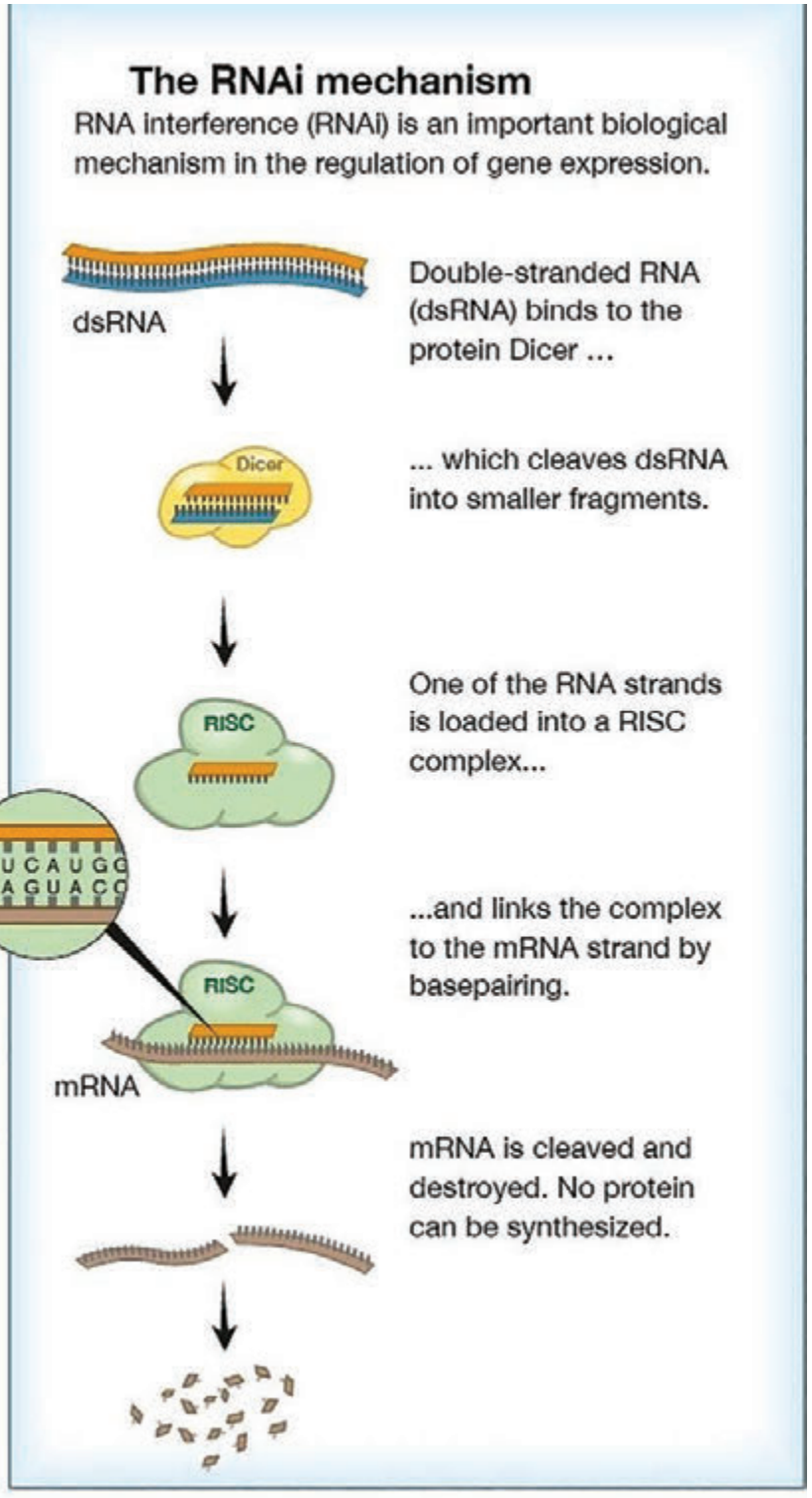


**Fig. 3** *The RNAi pathway involves several complicated cellular mechanisms. But, for our purposes, it can be understood as chopping up intercellular parasites like DWV. In this figure, think of the dsRNA on the top as DWV, and the result is that no protein production occurs to support viral reproduction.*

So far, so good until the RNAi machinery gets overrun. With the constant infusion of new virus particles, cells begin to lose the RNAi battle and allow unabated viral reproduction leading to pathology.

But what if you could start the RNAi machinery ahead of time and gear up cell defense against an attack? It turns out that science may be able to do just that. The first attempt was to feed or inject bees with dsRNA that would trigger RNAi against viruses and transfer destructive RNAi to feeding varroa. It would be a magic bullet that works against viruses while, at the same time, interfering with cells in varroa, leading to their death.

It can work, but releasing dsRNA viral-like genomes into the environment raises issues that include possible drift to non-target organisms with gene sequences similar to honey bees. In practical terms, the manufacturing of dsRNA material is expensive, labor-intensive to administer, and not stable in the environment.[7]

Another approach is to get bees to do the work of stimulating RNAi by producing dsRNA. But that can be tricky because bee cells do not naturally produce dsRNA. One way to get it done is to have bacteria that typically reside in bees make it. In a recent study, molecular scientists engineered a bacteria called *Snodgrassella alvi* to do just that.[8,9]

### Beneficial bacteria

Bacteria are capable of maintaining small rings of DNA inside their cells called plasmids. Plasmids remain separate from the bacteria's genome, are independent and self-replicating, and can perform specific functions. Plasmids are a natural way bacteria adapt to their environment. For instance, some plasmids can digest antibiotics that enter bacteria, making those bacteria resistant to treatment. Other genetically engineered plasmids make our national supply of insulin (Figure 4). As long as a molecular engineer knows how to make a plasmid function specifically, they can insert them in bacteria to do the work .

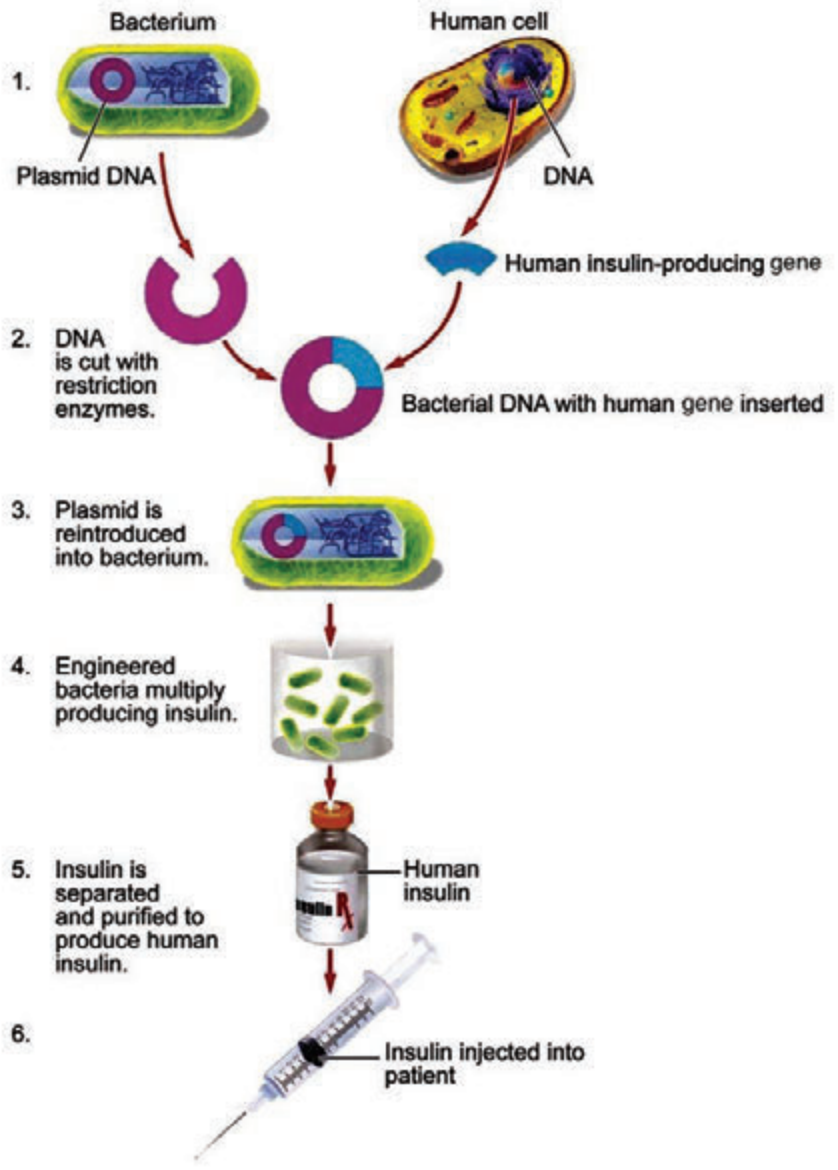


**Fig. 4** *As an example of a plasmid at work, in this figure, the human gene that produces insulin is combined with a bacterial plasmid and then reinserted in the bacteria to produce human insulin. The world's supply of insulin is manufactured this way.*

In the study mentioned above, *S. alvi* was successfully engineered to produce dsRNA — the exact ingredient needed to stimulate RNAi. The theory is that with a harmless bacteria plasmid making specifically targeted dsRNA, the bee's cells are primed for defense and can resist infections. In the study, the plasmids targeted DWV, and the results indicated that it could work.

In another part of the study, plasmids targeted essential genes in varroa. When the varroa fed on the bees' fat bodies, they ingested the dsRNA, and this time the varroa's RNAi did the work to interfere with essential genes in the varroa. When compared to a control group, the varroa ingesting the dsRNA died sooner.

RNAi seems to have value in our war on viral infections, but it can't do it all. Despite the RNAi cellular machinery's best efforts, a recent study concluded that varroa-vectored viruses disrupt critical players involved with wound response, immunological balance, and cellular function.[10] Under increased viral pressure, the systems break down, and pathology begins. Even with all the research and promise of molecular biology, the ball inevitably is passed back to us beekeepers to control varroa populations.

In any event, molecular engineering seems promising, especially if off-target insects remain unaffected.[11] September 25, 2020 marked our 33rd year dealing with varroa. There may be a time when a simple application will clear bees of both viruses and pests. It's in the future, but it can't come too soon for beekeepers.

### End notes and citations


1 RNAi is a term used to describe a complicated cellular function. For more information, see this wiki: **https://en.wikipedia.org/wiki/RNA_interference**

2 The capsid protection of virus particles and the exine coating on a pollen grain function the same — they both preserve what's in the center. In the case of a virus, it's a genome that replicates the virus once inside a cell. With a pollen grain, the exine protects the nutritional protein in the center used in fertilization. The similarity is striking, but the results are far from equal.

3 **Karel Škubník, Jiří Nováček, Tibor Füzik, Antonín Přidal, Robert J. Paxton, and Pavel Plevka** Structure of deformed wing virus, a major honey bee pathogen

4 **D. J. T. Sumpter S. J. Martin** The dynamics of virus epidemics in Varroa-infested honey bee colonies **https://besjournals.onlinelibrary.wiley.com/doi/full/10.1111/j.1365-2656.2004.00776.x**

5 Diverse virus particles enter almost all living cells on earth and exist in every niche on the planet, including all the oceans.

6 A binding site on a cell exists for healthy cellular functions. With the coronavirus currently ravaging humanity, the virus particle's binding site helps with blood pressure regulation.

7 Large-Scale Field Application of RNAi Technology Reducing Israeli Acute Paralysis Virus Disease in Honey Bees (*Apis mellifera, Hymenoptera: Apidae*). Wayne Hunter et al., December 23rd, 2010 **https://doi.org/10.1371/journal.ppat.1001160**

8 **Leonard, S.P.; Powell, J.E.; Perutka, J.; Geng, P.; Heckmann, L.C.; Horak, R.D.; Davies, B.W.; Ellington, A.D.; Barrick, J.E.; Moran, N.A.** Engineered symbionts activate honey bee immunity and limit pathogens. *Science* 2020, 367, 573–576

9 The *S. alvi* bacteria, named after the extraordinary entomologist R.A. Snodgrass who in 1910 changed the understanding of bee anatomy with his groundbreaking book, *The Anatomy of the Honey Bee*.

10 **Zhao, Yazhou, et al.** "The Dynamics of *Deformed Wing Virus* Concentration and Host Defensive Gene Expression after *Varroa* Mite Parasitism in Honey Bees, *Apis mellifera*." *Insects* vol. 10,1 16. 8 Jan. 2019, doi:10.3390/insects10010016

11 **Christina L. Mogren, Jonathan Gary Lundgren** In silico identification of off-target pesticidal dsRNA binding in honey bees (*Apis mellifera*). December 13th, 2017, **https://peerj.com/articles/4131/**



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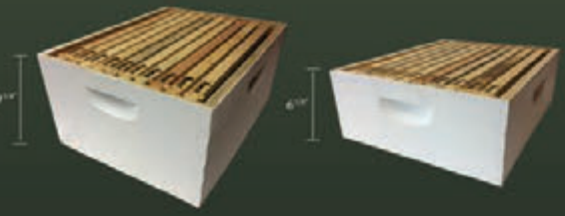

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# Bees and Beekeeping Past & Present

By Dr. Wyatt A. Mangum

## Summer Swarms: A Prelude to Usurpation (Colony Takeover)

Beginning in late June, well after our spring nectar flow, comes the time I call usurpation season. I stop the truck well away from my hives and walk slowly into my research apiaries looking down, searching. I keep the area clear around the hives so I can spot any unusual bee behavior — especially on the ground (see Figure 1).

I carefully search the area around the hives and the hive stands. I look over the outsides of the hives and under them too. Then I look around the bushes and up into the trees. What am I looking for?

The bees on the ground could be swarms clustered in variable sizes, flat like a dinner plate on the dirt. The swarm cluster could be under the hive, tangled in the hive stand. Or a small swarm might have landed under the front end of the hive entrance, appearing cryptically as a small bee beard, belonging to the established colony. In reality — it is a small independent swarm. Other clusters could be only a small knot of bees, around a queen (here called a queen ball) about the size of a hickory nut.

Off the ground, I search for swarms, variable in size from a handful of bees to a three-pound package in size. This search is not how I look for spring reproductive swarms, where my vision sweeps high up among the tree branches. Those spring swarms on the ground are rare, caused by a queen with damaged wings, or fragments of a soaked cluster hurled from tree limbs, the bees barely surviving a night of violent spring storms.

Back to the summer; on the ground, these small masses of bees are easily missed among hives in thick grass, especially with beekeepers busy with numerous jobs in the apiary. Small swarms off the ground are not very noticeable either. Moreover, these bee behaviors are relatively new occurrences in our apiculture. Beekeepers do not routinely look for them. And to make matters more cryptic, we do not know how widespread these behaviors have become across our country. Before proceeding, we need more background information on bees balling a queen.

We just finished a six-part queen introduction series and observed bees of an established queenless colony

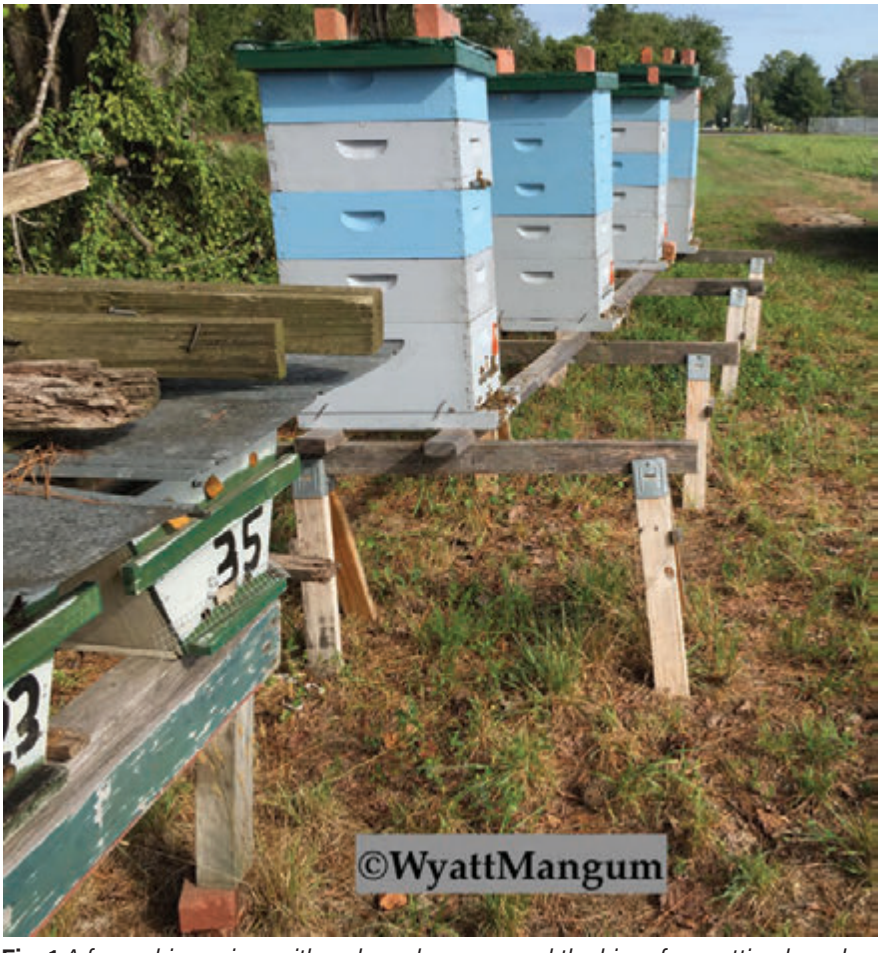


**Fig. 1** *A frame-hive apiary with a cleared area around the hives for spotting bee clusters on the ground. The hives are on elevated hive stands so I can load and move full-size hives with honey supers without needing help.*

balling the cage screen containing a new foreign queen. In that situation (context), without the cage, the bees would form a small ball around the new queen and hold her until she died. For bee management, beekeepers should avoid queen balling to safeguard their queen bees; queen balling is complicated, and far from being completely understood.

Bees can ball a queen, apparently to "hold" her or maybe protect her. When that happens before a usurpation swarm invades an established colony, the queen balling might stall the takeover process. However for now that statement remains an untested hypothesis. Yet I know when the usurpation swarm rushes into the established colony (host colony), the usurpation queen is immediately balled, the ball being found near the entrance. Presumably the bees in the ball are usurpation bees, but that has not been confirmed. Deep in the brood nest a ball of bees quickly forms around the mother queen of the colony. The origin of those bees is also unknown.

Remarkably then, early in the invasion, the bees ball both queens, usurpation and mother. Not only are the origins of bees balling the queens unknown, but their origin could change over time. At this time, limited fighting breaks out between the usurpation swarm and the colony. The dead bees appear in front of the hive. In addition to searching for bee clusters on the ground, one should look for a scattering of dead bees, as a possible recent usurpation event, although it needs verification with a hive inspection. (Foraging ants and small animals can remove the dead bees, so expect this symptom not to persist.)


**Fig. 2** *Ground swarm under a hive, clinging to the hive stand. Below the hive is a typical location for these summer swarms. It could be a prelude to an invasion or the swarm might just fly off. This swarm was very calm, allowing my attention to shift to other bees around the hives.*

Most astonishingly, the usurpation queen can become the accepted queen of the colony in as little as 13 hours — about half a day. The usurpation queen can begin laying her eggs in the brood nest of the mother queen as the mother queen dies in a queen ball. In my bee house where I can house up to 30 single-comb top-bar observation hives, I observed this incredible takeover in one of those glass hives. From that hive and others, I know the usurpation queen becomes balled near the entrance. The ball around the mother queen may slowly descend to the hive floor. Therefore when searching the host hive for queen balls, go all the way down to the bottom board.

On the other hand, usurpation queens do perish in these balls, perhaps if the usurpation queen cannot get through the entrance fast enough, and she becomes encased in a ball of her protecting bees, situated well inside the hive. While questions abound for how the usurpation swarm takes over a colony, the factors for when their process fails are also worthy of study.

Currently, I think a reasonable assumption is that the small summer swarms and queen balls on the ground might be usurpation swarms (or parts of them) that have become stalled or delayed in their attempt to take over an established colony. As a rough working hypothesis, queen balls on the outside of the hive could occur because the usurpation bees protect their queen(s) when their swarm encounters too many foreign bees (as they would upon invading a host colony). One way that could happen is when the usurpation swarms unite, which they readily do.

Swarms uniting are another aspect of summer swarm biology that needs appreciation. Consider first, a beekeeper finds three regular spring reproductive swarms hanging in trees above a row of hives. The immediate concern would be how to catch the swarms before they launch for places unknown. A matter so trivial it never occurs is: What if one swarm launches, hovers, and lands on one of the other swarms, uniting with it? Even more unlikely, what if the remaining smaller swarm flies over and joins with the other two, forming one huge mega-swarm? These summer swarms will routinely unite that way. Although the swarms begin smaller, the resulting swarm may not be all that large, although I am sure there have been exceptions.

I am still trying to observe the sequence of events leading to when these swarms would unite, and the bees, being among foreign bees, begin to ball their queens. I would like to shoot it in slow motion movie clips, for later frame-by-frame study (called scrubbing the film).

One must also concede that some of these summer swarms may behave as absconding swarms or early fall swarms, without any of these more complicated survival behaviors. Far past July, those swarms were des-


**Fig. 3** *Two queen balls with attracted bees. They blend in with the ground and make hardly a sound. Under foot, it is easy to step on them. It may be their swarms were on the ground with them, but moved on with another queen among the bees; or their bees, confused in the apiary bee flight, just joined other swarms.*



**(L) Fig. 4** *Small swarm on the hive cover (side view). Swarms landing on an active hive warrant immediate suspicion of being a usurpation swarm.* **(R) Fig. 5** *Small swarm on the hive cover (top view). Even with suspicion, the bees remain a summer swarm until they invade an established colony. Then their behavior is beyond doubt — the swarm is a usurpation swarm.*

tined to perish, since honey bees returned to America in the early 1600s. Remember the last line in the old rhyme: A swarm in July isn't worth a fly. Meaning those bees were doomed — but not now. A usurpation swarm can take over an established colony, survive the winter on its honey, and shatter the old survival rules of honey bees in a temperate climate.

See how these summer swarms I am describing here are fundamentally different. If you are accustomed to just working with and thinking of swarms as spring reproductive swarms, my goal here is to broaden your understanding into the more complex swarm biology now shown by at least some of our bees in the summer. That summer behavior could be during a dearth, but I have seen these swarms during a summer cotton bloom, a long slow nectar flow.

An example illustrates the futility of treating these summer swarms like they were spring swarms. At a state bee meeting, an elderly beekeeper told me, his tone still hung up in dismay, that he hived up a swarm on drawn comb, caught in late summer. Let's assume he caught the queen in his hive. Although it sounds absurd for swarm catching, in this situation — it didn't matter. While he was preparing to help the swarm with feed for the winter, to his utter consternation — the swarm left the hive. How could the swarm reject that comb? Already built? That baffled him. Answer: He was thinking about a spring reproductive swarm. He had most likely a usurpation swarm. A usurpation swarm is out to take over a fully established colony: honey stores, brood nest, combs and its bees. Empty comb is not attractive to that kind of swarm. Whether the caught swarm had the queen or not, I would expect the bees to fly off and leave their generous gift of empty comb and hunt a big strong queen-right colony to conquer. Now we are ready for a couple of crazy days in September.

After mostly an uneventful usurpation season, a boring July matched by a tranquil August, that malaise changed on September 7, 2020 when I parked back from my main frame-hive research apiary.

Even from the truck, I saw the most obvious concern, a diffused swarm of bees flying aimlessly around in the apiary. I knew that flight pattern. The bees appeared lost. Watching where I stepped among the hives, I saw a swarm clustered on the ground clinging to a hive-stand support (see Figure 2).

Adding to the general complication, on the ground, not under any cluster, were two small queen balls, which had attracted some additional bees. The queen balls were well apart from each other, as if merely tossed into the apiary. Where did they come from? I never could tell for sure (see Figure 3).

More pressing seemed to be a small swarm on top of one of the hives (see Figures 4 and 5). The cluster was against a brick. I could tell the bees were balling queens, probably two, by the way the balls interrupted the normal festoons of bees, even with them lying against the brick.

As I have reported before, the queen balls slowly detach from the festoons of a free-hanging swarm. The queen ball descends little-by-little and falls out. That is how the little ball of bees ends up on the ground. Hence my advice, given often when approaching a summer swarm — look down. Watch where you step; you might kill the queen in the ball. And expect more than one queen ball on the ground.

The day reminded me that exceptions lurked close by to general rules, and not to let these rules form restrictive ruts in one's thinking. It seemed unlikely these queen balls fell with the nearest shade branch some 40 feet above. I would not expect two queen balls to land adjacent to each other from such height (and survive hitting the hive). This small swarm, situated on the hive top, could not drop queen balls either, and none were under the hive. A swarm may have landed on the hive, and was joined by others, hence the balling.

The hive-top swarm seemed to be related to the lost swarm bees flying around in the apiary. I wanted to cage the queens from the hive-top swarm so I could account for them. First I had to disengage the balls from the cluster. I just gently inserted my index finger into the cluster and hooked it around what appeared to be mostly a queen ball. Then I slowly pulled a mass of bees from the cluster, part of which was the queen ball. Most all the bees were buzzing and whining as I withdrew the first ball from the cluster. The bees usually will not sting if handled gently. After separating the first queen ball, I could clearly tell another one was in the cluster. Using the same technique, I extracted the second queen ball from the cluster.



**(L) Fig. 6** *Queen ball removal. I shot a movie clip of the double removal in one long take. I held the camera in my right hand, removing the queen balls with my left hand while balanced on the elevated hive stand next to the telescoping cover with the swarm. Here I am pulling out the second queen ball from the small swarm.* **(R) Fig. 7** *Queen ball in hand. As I gently roll the queen ball around on my fingers, it did not "feel" like a queen-killing ball, more like a queen protecting/confining ball. Sometimes I cannot tell.*

Figures 6 and 7 show my technique of queen ball removal.

Remaining in the cluster, small groups of bees appeared as little knots. Suspicious that they might be queen balls, I teased them apart with two fingers, delicate and touchy work, until I saw they did not contain additional queens. Most likely those bees were balling workers who had been near a queen in the balls and acquired some of their pheromones. Eventually this remnant balling will cease.

The swarm cluster began spreading out on the hive top as the bees became attracted to the separated queen balls. In the confused layer of bees running to the queen balls and bees landing on them from the swarm, I caught a third queen running in the crowd, not being balled (see Figure 8). She may have been with the bees on the hive top, or she might have just landed, coming down with the flying part of the swarm. While some of the swarm landed on the hive top, most of the bees found me as a better place to pitch (see Figure 9).

I let the rest of the swarm finish collecting on me, scent fanning, and buzzing loudly on my neck and around my ears, while I carefully removed the queens from the balls. That removal was difficult to photograph or film because the queen removal takes two hands. I have tried hanging the lens end of the iPhone over the edge of the hive. Then using both hands and looking through the screen finger-probe through the tight mass of bees until I spot a bit of queen anatomy: legs, wings, head, or abdomen, which helps me locate her more closely. Finding a queen in a tight mass of bees from any angle is far different from seeing a queen mostly from the top view on the comb. (Knowing queen anatomy compared to worker anatomy is critical.) Eventually, I removed both queens from their balls and caged them. (The movie clips of the queen removal were not worth keeping.)


**Fig. 8** *A caught queen running among the bees. Bees were beginning to clump around her, possibly the beginnings of a ball.*

When first examining the apiary, I had noticed something odd. On the upper side of one of the frame hives were about ten bees crawling up under the telescoping cover. With the new hive equipment, I knew no entrance was up under the telescoping cover. Clearly though, that site was attractive to the bees. It may have been a recent bivouac site for a swarm and retained an attractive scent. I shook off the bees on me and put the third queen of the swarm in a top-bar hive nuc box, turned on its side to shelter the swarm from weather (see Figure 10). Some bees found the queen as expected while other bees landed on the side of the hive (see Figure 11). The bees on the hive never settled down like a queen-right swarm. Also from Figure 11, see how the bees form a single layer on the side of the hive. Those bees were very active.

Numerous bees on the side of the hive performed waggle dances, apparently not advertising nest sites like a spring reproductive swarm, one of which would be a future home for the swarm. Of course trying to establish a colony, building combs, rearing


**Fig. 9** *The swarm on me. I let the bees land on me while I sorted out the three-queen confusion on the hive top. Letting the bees stay on me seemed the simplest thing to do until I figured out what to do with them.*

brood, and storing a vast amount of winter honey, beginning in September, far past the seasonal flowering period would be doomed to fail. So then, why all the waggle dancing? What were the dancing bees advertising? Nectar flowers. The summer swarm was foraging. I have watched returning foragers feed other bees. During the morning, in shaded locations with small summer swarms comprising a few dozen bees down to merely about 10 bees, some waggle danced and fed others (which tends to negate water hauling for cooling because the context is wrong).

Although usurpation is a profound behavioral change in our bees, just as stunning are summer swarms that forage. Some of these swarms may never take over an established colony (like what occurred here in the apiary with all the confused queen balling). Yet by foraging, these swarms presumably have more time to locate an established colony, without losing bees by starvation. Moreover, I do not see heavily engorged bees in these summer swarms, certainly not like spring reproductive swarms. So astonishingly again, instead of engorging on the honey stores of the parent colony, to survive the spring swarm to its new nest site, the summer usurpation follows another survival path. It forages, even on the meager few flowers it finds. From a survival perspective, both of life and genes, the usurpation bees need to keep strong enough to take over an established colony. It does not matter if all of them are killed in the fighting. Provided the usurpation queen survives, where reside all their genes, their progeny bees will live on.

After bees clustered on the side of the hive, they finally moved over to the bees in the nuc box, although it seemed some were lost. I left the third queen, the one I caught running free, in a cage with the swarm in the nuc box. I turned the nuc box to shield the bees from storm winds. I left the swarm overnight with only one queen. Any incoming swarms would be apt to unite with the swarm in the nuc box, resulting in a larger swarm and queen balls.

Upon returning to the apiary the next day (September 8, 2020), no swarms had united with the one in the nuc box. Remarkably though, another swarm was on the ground right in front of the hives at the end of the row (see Figure 12). It is tempting to think these swarms must originate from my hives. In my apiaries with a few hives, where their queen states are easier to determine to be normal, I know usurpation swarms can arrive from elsewhere.


**Fig. 10** *Nuc box shelter for summer swarms. Before leaving the apiary, I will turn the shelter to better protect the bees.*


**Fig. 11** *The swarm as seen from below, showing the large area of bees directly on the hive. Numerous bees danced on the side of the hive.*


**Fig. 12** *Another summer swarm found the next day, as it would appear coming into the apiary. Looking down, on the ground, searching for summer swarms is not a common beekeeping habit.*


**Fig. 13** *The summer swarm with its caged queen*

The queen in the ground swarm was not balled. In the thin plate-shaped swarm I easily caught and caged her (see Figure 13). The bees were becoming restless, not because I had the queen caged among them, but rather they were preparing to launch. In only a matter of minutes the swarm began flying, breaking into a diffuse cloud flying in front of the hives row. I held the queen cage, suspended from a wire in the cloud, as best as I could, trying to simulate the queen in the swarm while filming one-handed. I wanted to film the usurpation swarm rushing in a hive like I have seen and photographed. I want to study a slow motion, frame-by-frame, of the invasion behavior.

While filming, keeping the queen in the swarm cloud, I was also watching for the first scent fanners at a hive entrance signaling to the usurpation swarm which hive to invade. Then through intuition, I knew too much time had passed for the swirling bees to render their decision. Suddenly I knew. The swarm from the day before, in the nuc box shelter, the flying swarm was going to unite with it. Sure enough, the swarm's scent fanners had just begun to accumulate at the edge of the box, furiously fanning out scent calling down the swarm. I checked all around the nuc box for competition scent-fanning. (The swarm could have been making another choice.) There was none. I put the caged queen near the scent fanners, like she would have landed with the flying swarm (see Figure 14).

The swarm bees quickly covered her cage. Only one bee balled the cage. Once the swarm from the day before became aroused and mixed with the incoming swarm, the bees balled the queen cage of the incoming swarm. Also initially the bees on the cage of the prior queen (from the overnight swarm) had not been balling their queen cage, as best as I could tell without disturbing them too much. As the bees of the two swarms became mixed, balling bees covered the screens of both cages. However because the bees were so similar in appearance and temperament, I could not tell which group initiated or maintained the balling on the respective queen cages.

At least for now I have observed one occurrence where summer swarms united and balling was initiated around both queens. For usurpation, matters seem stalled because the bees must have a mobile queen. So can the bees resolve matters and get back to a usurpation pathway?

I need a more undisturbed situation (no queen caging) to try for that determination — maybe next summer.

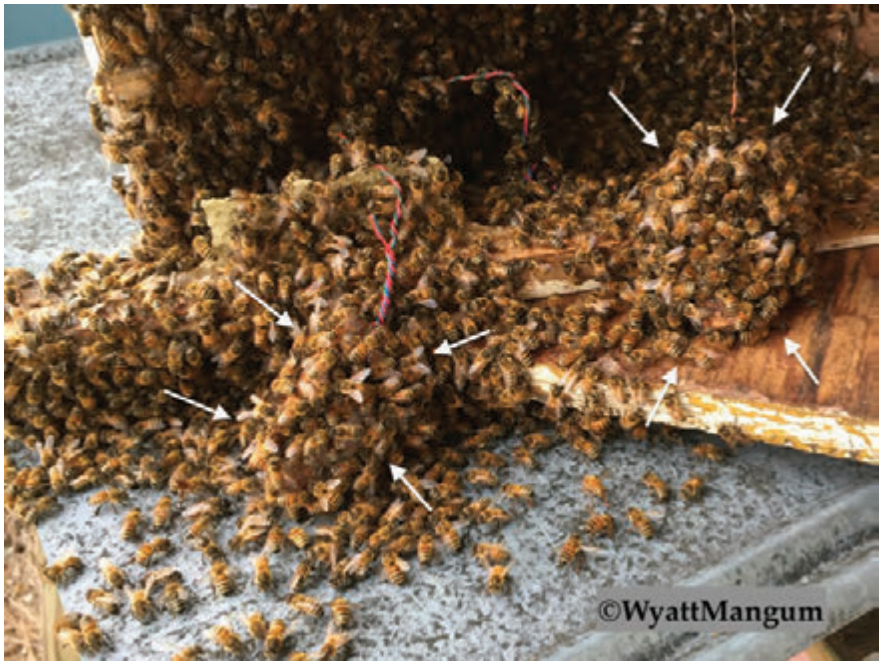


**Fig. 14** *The swarm landing at the nuc box. The incoming swarm and their queen (cage) is to the left. The queen (cage) and the previous swarm are mostly to the right. Caging the queens may have disturbed matters too much, but I had to keep the swarms low and not high up in the trees.*


### Acknowledgments

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# Feeding Pollen Might Not Be as Useful as You Think

*By Alison McAfee*

**It might make us feel like good beekeepers, but fall protein supplementation doesn't produce more winter bees**

Many beekeepers do it. Local bee clubs suggest it to their members, and some old-timers have done it for decades. Even some apiculture authorities suggest it. But it might not be providing our colonies with the benefits that we think it is.

Feeding pollen or pollen substitute in the fall is so routine in some spheres that its utility doesn't seem to be questioned. This protein boost, says conventional wisdom, promotes brood rearing at a time when pollen availability is dwindling. More fall brood reared by well-fed nurses means more fat winter bees, and more fat winter bees means there's a higher likelihood of the colony coming out in good shape in the spring. Right?

Actually, research suggests otherwise. Dr. Heather Mattila, an associate professor of Biological Sciences at Wellesley College, Massachusetts, conducted a sequence of studies, starting in 2002, showing that fall pollen feeding has no impact on the winter bee population size nor their longevity.

Mattila, who was studying in Dr. Gard Otis' laboratory in Guelph, Ontario at the time, fed five colonies supplemental pollen patties, giving them one pollen patty a week for four weeks between September and October. For five other colonies she restricted pollen during the same period using pollen traps, and she applied no treatment to five more.[1]

*Eager workers are devouring a pollen patty in the spring. Feeding protein supplements in the spring is more important than feeding protein in the fall.* Photo: Alison McAfee

Mattila carefully measured how fat the winter bees really were by recording their dry mass. She tediously marked cohorts of newly emerged bees with colored number tags, and recorded who was left alive in the colony at different time points to determine longevity. And she painstakingly measured capped brood area — data which she incorporated into a model to estimate adult population size — every twelve days until brood rearing ceased, and again when rearing commenced in the spring.

"In full-sized, established colonies, providing a pollen or pollen substitute in the fall promoted a short-term boost in brood rearing," says Mattila. But, she explains, "This brood-rearing boost delayed the transition in colonies to a population of long-lived winter bees, and didn't translate into improvements for the winter bee population."

Pollen supplementation indeed had the desired effect of nourishing the nurse bees and supporting the colonies' ability to rear brood. It just wasn't the right type. Despite the onset of fall outdoors, those bees were summer bees, and soon died off to leave a similar population of winter bees compared to the other colonies.

"Evidently," Mattila and Otis write in their research article, published in The Canadian Entomologist,[1] "none of the extra pollen provided to colonies was invested in enhancing the quality of winter bees that colonies reared, nor did the performance of

winter bees suffer from a restricted supply of pollen during the fall."

"I was surprised that [Mattila] found no positive effect of feeding pollen supplements," says Heather Higo, a lifelong beekeeper and bee researcher in Langley, British Columbia — a response echoed by many beekeepers. "In this area, because we sometimes have long, mild fall weather, I think we are more prone to feed pollen supplements in the fall as well as spring to ensure we get well-nourished nurses."

Ontario and BC do have very different climates — Ontario winters are colder and longer — but average temperatures in September through November are surprisingly similar. Mattila expects that, although her work was conducted in Guelph, Ontario, results would be comparable in other Canadian provinces and the northern U.S.

"I don't feel I can make concrete recommendations to beekeepers about the utility of feeding in the fall," says Mattila. "It is possible that the effects of a late-season brood rearing boost would be more advantageous in smaller colonies. However, there is no information available about whether fall feeding would help winter bee populations in newer colonies in a way that is different from the larger colonies we used in our study."

In a second research article, Mattila and Otis show that pollen availability is actually an important cue that controls the timing of rearing winter bees, which may explain why pollen feeding did not improve the quality of winter bees.[2] When they fed colonies pollen patties for different lengths of time into the fall, they found that colonies whose pollen supply dwindled earlier had a correspondingly early onset of rearing winter bees. Conversely, those receiving extended pollen supplementation into the fall delayed their winter bee rearing. But all groups still produced similar numbers of winter bees, in the end.

Feeding pollen in the fall does not "fatten up" winter bees, as I have seen written numerous times online. Yes, winter bees are fat, in a sense — they are indeed heavier than summer bees, with higher levels of proteins, fats, and sugars in their blood and swollen glands. But that fatness isn't facilitated by feeding colonies extra pollen — instead, feeding pollen just puts off fat-bee-production until they finally get the signal that pollen is running out. And that delay doesn't have a significant impact on the strength of the colonies at the beginning of spring, either.

But I still hear fall feeding come up as standard colony management procedure, particularly within bee clubs. The practice is encouraged in the "First Year Beekeeper" guide on a prominent beekeeping blog. And the Atlantic Tech Transfer Team recommends feeding pollen in the fall if it looks like the colony has fewer than 3-6 frames of pollen going into winter.

"I was advised years ago to feed pollen in the fall if you plan to use your bees early the following spring to make nucs or early splits," says Higo. "The thought was that it would act as insurance that the overwintering bees are strong and well able to rear plenty of brood early in the year."

*This photo was taken on October 17 in Vancouver, BC. Despite being in an apiary with about sixty other colonies and lots of resource competition, these bees are still bringing in late-season pollen.* Photo: Alison McAfee

Higo normally feeds a pollen patty in September, and then not again until February. She notes that the speed at which the patty is consumed in September, even if the bees don't necessarily need the protein, can also serve as a useful diagnostic. "If it doesn't get eaten quickly, that can be a sign that the colony is not strong or has a queen issue that requires more investigation," she says.

Well-known management guides, like Canadian Best Management Practices for Honey Bee Health (commissioned by Agriculture and Agri-Food Canada), the Beekeeping Calendar for the Northeast (from Cornell University), and Best Management Practices for Honey Bee Health (from the Honey Bee Health Coalition), don't mention fall pollen feeding at all. This, while being, strictly speaking, aligned with Mattila's work, may add to the confusion when new beekeepers are trying to figure out what to do.

"Beekeepers generally want the best for their best, and upon hearing success with a management practice, they may be willing to try it," says Kerry Clark, president of the BC Honey Producers' Association and long-time beekeeper in the Peace region. But Clark cautions that feeding pollen comes with risks, regardless of the time of year.

"For pollen collected from other hives," he says, "the freedom from pathogens is critical. Trials done in Saskatchewan showed that colonies fed pollen did worse than those unfed, owing to the loss of brood in the fed group from chalkbrood infections initiated by spores in the pollen."

Clark says that pollen irradiation — which sterilizes it of pathogens — is now standard practice for pollen on the market. Feeding pollen substitute, of course, avoids this risk altogether. But in regions with small hive beetle, fall patties of any variety may feed the beetles as much as they feed the bees.

Fall pollen feeding may not be beneficial, but what about the spring? Mattila performed experiments in the spring that were similar to the fall studies, while also measuring total honey production over the course of the year.[3] For three years in a row, she fed colonies either pollen patties made with real pollen, pollen substitute (Bee-Pro, in this case), or nothing.

The fed colonies had all-you-can-eat pollen or pollen substitute in the early spring for five or six weeks, depending on the year.

Unlike fall feeding, spring feeding led to significant improvements in colony performance — in the short term. In the first year, when cool, wet weather prevented the colonies from foraging for their own pollen, supplemented colonies (whether with substitute or real pollen) produced approximately twice the amount of honey compared to the control hives.

In subsequent years, however, when conditions were more favourable, supplementation did not affect honey production or other colony outcomes — findings which are echoed by Clark. "Whether added protein is a benefit depends on a beekeeper's environment and objectives," he says. "I have tried feeding pollen substitutes in spring in the Peace region, but it was mostly a waste." In his region, early spring pollen from natural sources is usually abundantly available.

Pollen supplementation only makes sense if the goal is to rear summer bees — according to Mattila and Otis' research, that is what it stimulates, whether it's fed in the spring or the fall. And in the spring experiment, the colonies that weren't supplemented caught up, in terms of population size, by mid-summer. For a hobby beekeeper, the benefits of spring feeding may be marginal. For a commercial operation aiming to produce as many early pollination units or nucs as they can, the benefits are likely more substantial.

Although spring feeding only led to a bigger honey crop in one year of the trial, Mattila still recommends feeding in the spring for the sake of insurance. Summarizing her numerous research papers,[1] she writes: "Beekeepers willing to invest the time and money in supplementing the pollen diet of colonies would be better served by ensuring that colonies have an ample supply of pollen during the spring, when surplus nutrients can be directly incorporated into the brood rearing effort of colonies. If beekeepers feed pollen to colonies during the fall, then they will only artificially delay the production of the population of winter bees, and they are unlikely to improve the survival or spring nursing capacity of those workers that do winter."

Exactly why fall pollen feeding is so commonplace is still a bit of a mystery to me. Perhaps it is the same reason why I myself was surprised to learn, while listening to Mattila's seminar on pollen supplementation at the Virginia State Beekeeping Association's fall conference in 2019, that extra fall pollen wasn't beneficial: I had learned that it was from my mentors, and assumed it to be true.

Fourteen years after the research was published, some of us are still holding on to old habits. "This work was done in 2002-2003," says Mattila. "It would be interesting to repeat it in the current climate of challenging beekeeping. The multiple stressors that most colonies currently endure likely would play a role here."

**References:**


1 **Mattila HR and Otis GW. (2007).** Manipulating pollen supply in honey bee colonies during the fall does not affect the performance of winter bees. *The Canadian Entomologist*. 139(4): 554-563.

2 **Mattila HR and Otis GW. (2007).** Dwindling pollen resources trigger the transition to broodless populations of long-lived honeybees each autumn. *Ecological Entomology*. 32(5): 496-505.

3 **Mattila HR and Otis GW. (2006).** Influence of pollen diet in spring on development of honey bee (*Hymenoptera: Apidae*) colonies. *Journal of Economic Entomology*. 99(3): 604-13.



**Alison McAfee** has a PhD in genome science and technology from the University of British Columbia, where she studied mechanisms of hygienic behaviour in honey bees. She is now a post-doc at North Carolina State University in David Tarpy's lab, and studies what keeps honey bee sperm alive.

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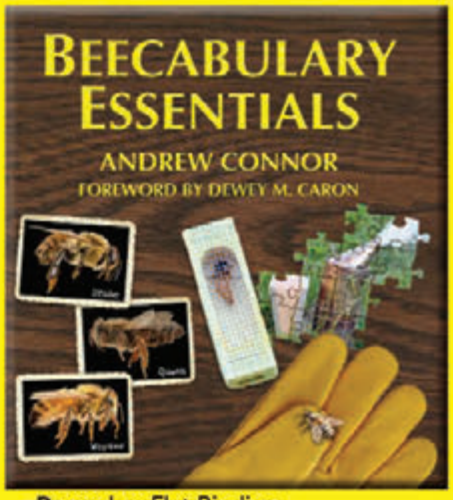


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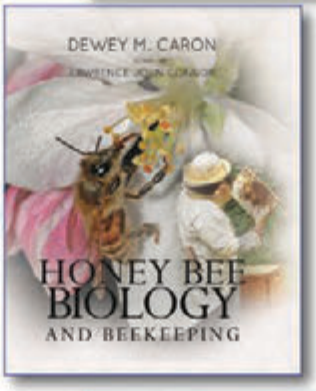


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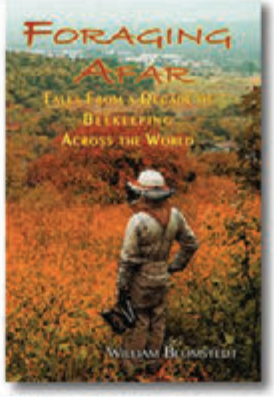


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# A Zooming Success in Georgia

by Jonathan Hayes and Linda Tillman


Putting together a conference is a challenge in normal times. There are venues to organize, food decisions to make, speaker travel and lodging to arrange, programs to design and print, registration to set up, and much more.

In 2020 the Georgia Beekeepers Association reached our 100th anniversary. We celebrated at our spring conference with cupcakes, honey ice cream and singing "Happy Birthday" to GBA. But our big anniversary blow-out was planned for the fall conference in September.

In March, all of our plans were scrapped because of COVID. Refusing to give up, the conference committee resolved to plan an online conference. We are a volunteer-run organization and were determined to accomplish this all on our own. As the King of Hearts in "Alice in Wonderland" says, we decided to "Begin at the beginning; go on to the end and then stop." We would learn what we needed along the way.

### The planning process

When the shutdown began in March, GBA subscribed to three Zoom accounts. We offer use of these free to our 46 local clubs to help them maintain connection throughout the pandemic. The clubs have speakers, use a video from GBA's library or have a Q&A session. Using these accounts with clubs, we quickly learned the ins and outs of Zoom. This experience helped us feel undaunted by the idea of presenting a whole conference on the Zoom platform. Local club use of Zoom also added to the willingness of our members to register for the fall conference. Our typical conference draws 250 beekeepers. We purchased a large meeting add-on from Zoom to accommodate more than 100 attendees.

Sitting all day for two days in a row could be more than some people might want to do. We decided to make available to registrants all keynote and breakout talks for two weeks following the conference. We got signed permission from each speaker to record their presentation for post-conference use. We set up our YouTube account.

On the Zoom platform, you can record speakers in the main Zoom room, but not in the breakout rooms. We decided to pre-record the break-

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|---|---|
| 8:45 - 9:00 | Opening Remarks, Linda Tillman, GBA President |
| 9:00 - 9:45 | **KEYNOTE 1**<br>*Jamie Ellis:* WHAT IS KILLING OUR BEES (AND WHAT CAN WE DO ABOUT IT)?<br>Beekeeping is harder than ever. Colony loss rates are high in many areas around the world. Old pests and pathogens continue to cause problems. New pests and pathogens threaten colony health. Herein, Dr. Ellis will discuss what is killing bees around the world and what can be done to reduce the losses. |
| 9:50 - 10:00 | BREAK - Visit Virtual Vendors |
| 10:00 - 10:50 | **BREAKOUT A** *(see page 7 for details)* |
| 10:50 - 11:40 | **KEYNOTE 2**<br>*Cindy Bee:* THE APPALACHIAN BEEKEEPING COLLECTIVE - AN APPROACH TO PROBLEM SOLVING IN POVERTY-STRICKEN COMMUNITIES<br>This talk discusses the efforts to connect the unemployed workforce of Appalachia with the power of beekeeping as a supplement for income. The approach is two-fold: teaching beekeeping for a source of income, and reforesting the sections of mountains devastated by coal mining. |
| 11:40 - 1:00 | LUNCH |
| 1:00 - 1:50 | **KEYNOTE 3**<br>*David Tarpy:* DIAGNOSING QUEEN PROBLEMS: IS IT THE QUEEN, THE COLONY, BOTH, OR NEITHER?!<br>Practical advice–based on empirical research–looking at different symptoms and attributing whether or not the problem is the queen's fault. A lesson in showing how we blame the queen way more often than it's actually her fault. |
| 1:50 - 2:00 | BREAK - Visit Virtual Vendors |
| 2:00 - 2:50 | **KEYNOTE 4**<br>*Keith Delaplane:* THIRTY YEARS OF PARTNERSHIP; RESEARCH AND EDUCATION COLLABORATIONS BETWEEN UGA AND GBA<br>A retrospective of the fruitful collaborations between GBA and UGA and the luminous personalities who made it possible. |
| 2:50 - 3:10 | **Honey Show Awards Announced** |
| 3:15 - 3:30 | Honey show video viewing with Brutz |
| 3:30 - 3:45 | Linda says "Good evening." |

*The schedule for Day 1. Brochure designed by Holly Bayendor*


*David Tarpy begins his first keynote talk.* Screenshot by Jonathan Hayes

out talks and present the videos at the conference with the speaker on hand to answer questions. You might think to yourself, "Now that's a great idea," but our breakout plan was one of the more difficult parts of our conference. Originally we were afraid that the speakers would have issues with background noise like lawnmowers or phones interfering with the audio of their talks. Hopefully recording ahead of time would take care of that. We found moderators to play the presenters' videos for the conference and held two training sessions with them to make sure they knew what to do. But in reality, the moderator hosting the breakout room also had to have complete quiet, which didn't always happen! In one breakout session, the moderator's dogs began fighting, and since he was the host for the video, he had to keep his mic live. We will handle this differently next time.

Jonathan Hayes recognized the need for branding and searched the internet for a good background to represent our conference. He found a modern, digital honeycomb design and superimposed our 100th year logo on it. This symbol of our conference he then added as an intro to each of the recorded videos. This way, he said, people watching the videos online would know that they originated with GBA.

Jonathan, whose job is in graphics design and technology at Robins Air Force Base, learned how to edit movies during his time working with the youth group ministry at his church. He and the youth group made fun movies for big events using green screen technology. Jonathan has done a lot of visual and audio work at his church running the sound and PowerPoint presentations. Because of that experience, he was comfortable with the process of editing the breakout speakers' videos and the recordings we made of the keynotes during the conference. If the speaker said, "Uh-oh," and advanced their PowerPoint too soon, Jonathan could remove the hiccup and make it look as if it never happened. Or if the recording had a drawn-out spot from slow internet, Jonathan could edit frame by frame. With his video experience and his use of Zoom through our GBA accounts, Jonathan became our video editor and also agreed to be the producer of our conference.

*The honey show entries begin to arrive in boxes.* Photo by Kara Bassett

For the past few years, we have been creating programs for our conferences that were both printed and online, so having our program brochure completely online was not new to us. Holly Bayendor, who had done the graphic layouts for our newsletter, created a vibrant program of events. We put this link in our registration information and sent it out to our registrants in numerous emails the week ahead of the event. However, on the day of the event, some registrants couldn't find their programs!

At our in-person conferences, we print more programs than the number of attendees because people leave their conference schedule on a table or in their hotel room. Some in-person conferences print a one sheet newsletter every day (the *Daily Waggle* at EAS, for example). A short announcement email on event day would probably address the issue of the registrants having the schedule for the day without having to search through back emails.

What to charge for the conference was also an issue. In the fall of 2019, our two-day conference cost us about $33,000 in expenses. This virtual conference, without printing costs, speaker travel costs, venue rent, or food expenses, totalled under $6000 to put on. We wanted to keep costs low as a gift to our members in honor of our 100th anniversary. The GBA Board voted to charge a $15 registration fee to members and nonmembers alike.

Our speakers were invited far ahead; we had a good line-up: Cindy Bee, Keith Delaplane, Jamie Ellis, David Tarpy and Virginia Webb. Most had used Zoom and the two who hadn't were open to learning. We asked each of our breakout speakers if they were comfortable online. They all said "Yes."

We decided to pay the speakers the same fee that we offer if they come in person. To give a talk to a conference, even if it is a talk already prepared, the speaker has to revisit the talk, research their topic, and present. More work is involved if they create the talk for the first time. We recog-

nize not only the work involved but the significance of their presence and knowledge. Because we value people who speak to us, we stayed with our usual payment rates.

Ahead of the conference we needed to make sure that all of our keynote speakers had access to good internet. David Tarpy and Jamie Ellis, both of whom are faculty at big universities, were set to go. Keith Delaplane, head of the UGA entomology department, was working from home. His internet functioned well as did Virginia Webb's. But Cindy Bee lives in a tiny town in rural Virginia. When she first tested Zoom with Gina Gallucci, her connection was almost impossible to navigate. Perhaps Cindy would have to go to the library or to the small college nearby to use their internet. Finally Gina and Cindy realized that Cindy did not have the latest version of the Zoom app downloaded on her computer. With that fixed, she was good to go. However, we were prepared for any speaker's internet to fail with a backup video from the GBA Library, edited for the conference and ready to go if needed.

We anticipated that non-Zoom users might have issues getting online. To address this, we hired a Georgia Tech student to be our technical support and emailed his contact information to our registrants. To help people who might be scared of Zoom, Linda Tillman invited our registrants and our members (we might get another registrant or two!) to a Zoom hospitality time on the Wednesday night before the meeting. She opened a Zoom meeting for two hours and was available for anyone to sign on who wanted to practice. Only about ten people actually came, but afterward, they wouldn't need to call technical help on the first day of the meeting.

Because we knew that bee meetings all over the country were being canceled, we invested in big ads in the bee magazines. Linda, then President of GBA, contacted the state presidents of nine nearby states to invite the members of their organizations to our GBA event. Several put the event on their Facebook or club webpages. Holding the meeting on a virtual platform made it possible for someone to register at the last minute. We left registration open for this online event until the conference was over.

We couldn't have vendors in attendance so we published a booklet of ads for them, each with some kind of discount for our registrants. We offered a one-page ad free to all of the vendors who usually fill our halls.

*Jonathan Hayes in Mission Control on Day 1.* Photo by Gracie Hayes

Sticking with our typical conference schedule meant that there would be breaks in the day. We wanted to have something to engage our participants' interest every minute. Our breaks were filled with everything from a slideshow of forty bee cartoons to a video made by our newsletter editors, promoting the GBA newsletter. We asked the vendors who usually sponsor us to make recorded ads and Jonathan put those into a video. Gina Gallucci planned to hold a ten-minute yoga stretching class at the end of the lunch break on the first day. The crowning glory was Eddie Gwaltney, a member who plays piano professionally. He offered to play keyboard at the beginning of each day's event and to play throughout the lunch breaks. We achieved our goal of avoiding any empty moments.

Central to most fall conferences is the honey show. Brutz English, our honey show chair and Welsh honey judge, worked with his committee to develop a "virtual" honey show. (See Brutz English's "Your honey show does not have to be a victim of the pandemic," August 2020 ABJ.) All of the entries were mailed to arrive by a deadline date and the rules were relaxed to accommodate the mailing of jars. If your jar had honey on the lid, for example, you were not penalized for that. A pile of boxes showed up in Barnesville, Georgia; they were placed in a donated high school room, and the judging began. We were able to bring the feel of the honey show to our event through videos made of the actual judging.

### Day One of the conference

On the morning of the event, 344 people had registered for our conference, including people from 22 states outside of Georgia. One man attended from Palmer, Alaska, where it was 5 a.m. when the conference started. Some people signed up, not planning to attend, so that they could watch the

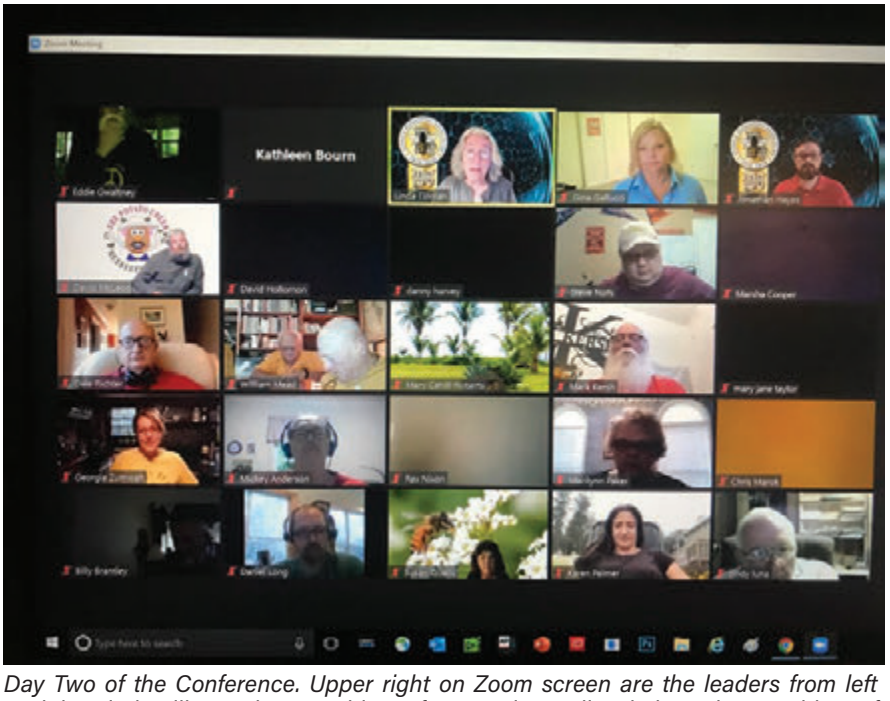

*Linda Tillman leads the GBA business meeting on Day 2.* Screenshot by Jonathan Hayes


*The honey show judges, properly protected. From left: Kara Bassett, Keith Fielder, Cindy Hodges, Rodney Garner and Steve Nofs.* Photo by Brutz English

videos in the two weeks following the meeting. We had about 220 people online each day.

Jonathan's setup looked like Mission Control. He had all of the speakers' videos in two folders — one for Friday and one for Saturday — on his main computer. He had another folder for all of the videos collected to show during breaks. He had his iPad Pro open with the program schedule on it. And he had his phone opened to text for our Game Day Text Group, which included the meeting committee. He was the host for the event and said his biggest fear for the day was unwittingly pushing "End Meeting for All."

While Jonathan was the meeting host, the four members of the meeting committee served as co-hosts. The five of us were able to mute attendees who left their mics open. Jonathan set the event up with a waiting room. This was a little cumbersome at the beginning as he and all of us were admitting loads of people into the conference at the start of each day. But the advantage of having the waiting room was that we could move someone out of the conference and into the waiting room to explain to them about the need to quiet their mic if need be. That didn't happen, but if it had, we were prepared.




*Day Two of the Conference. Upper right on Zoom screen are the leaders from left to right: Linda Tillman, then President of GBA; Gina Gallucci, then Vice-President of GBA; and Jonathan Hayes, producer of the event.* Screenshot by Kathy Bourn

Our schedule truly went like clockwork. We opened the meeting with a picture of the American flag on everyone's Zoom view and said the Pledge of Allegiance, as we do in every meeting. Standing for it was a little weird in that suddenly we didn't see peoples' faces but saw their beltlines instead! One of the disadvantages of Zoom is that when a speaker shares his/her screen, the clock disappears, but our first speaker, Jamie Ellis, is a stickler for timing and always sets his phone to let him know when he is close to the end of a presentation.

After Jamie's talk, participants were moved into breakout rooms. During registration, each of our participants selected one breakout to attend each day. They also had to register for the Zoom meeting each day. Using a spreadsheet of their breakout choices, Jonathan preassigned them to specific Zoom breakout rooms the day before. If anyone registered after Wednesday night, they stayed in the main Zoom room for the breakout offered there. We put popular topics/speakers in the main Zoom room each day because we had to work around the 200-person limit in Zoom's breakout rooms. When the moment came, Jonathan pushed a button and suddenly, like magic, everyone was whisked off into the breakout room of their choice.

Well, almost. If the person registered for the Zoom meeting with a different email address than they used for the GBA conference registration, they did not get whisked away. It was key that we provided a good breakout to hear in the main Zoom room for those who were not transferred to a breakout room. As host, Jonathan could message the breakout rooms to send a time notification so nobody would be surprised if they suddenly were whisked back to the main room in the middle of a sentence.

When we arrived at lunch on the first day, it felt like the wind was at our backs. We could DO THIS. People

looked alert and aware and all of the talks were going well.

Friday ended with the honey show awards. There were 55 exhibits in the GBA show and 155 entries in the national black jar contest. Brutz presented the awards to all the exhibitors who had made the effort to mail in their winning entries.

### Day Two of the conference

Our second day began with our GBA members' business meeting, which involved many moving parts. In addition to reports from the president, secretary, and treasurer, we planned to show videos from recipients of our Buzz Fund grants, to announce the Beekeeper of the Year award, to acknowledge deaths in our community of beekeepers, and to stay on time. To use time efficiently, Linda had put most of these items into a PowerPoint. She had to stop sharing the screen to allow the Beekeeper of the Year to be awarded. Bobby Chaisson, chair of the selection committee, announced that he had decided to award this like the Publisher's Clearing House and was at that very moment standing at the door of the recipient's house. He was online, sharing this event with our participants through the Zoom app. He rang the bell, and Linda, totally surprised, screamed and ran to her door! Jonathan (who was in on this plan) recorded the whole event and was prepared to step in if she could not recover from receiving this award. This moment of person-to-person connection during our online conference really delighted our participants. The video of it was watched 87 times in the two weeks after the event.

Because it was the GBA's 100-year anniversary, the talks on our second day were more historical and philosophical. Keith Delaplane reminded us of our long history with a lovely overlook of all the ways GBA and the UGA bee program had intersected. Cindy Bee shared with us how she has learned everything important in life from her bees and left some participants moved to tears with the twelve things she shared. And Virgina Webb offered an overview of our 100-year history, as the conference ended.

### What we have learned

In February we will have another virtual meeting. Most of our improvements will be about email: encouraging registrants to use the same email for Zoom that they did to register for the conference; emailing a schedule on the first morning; telling people to put our distribution email address in their contacts list. We'll get more member/club participation to create our videos for the breaks by collecting photos from members of their favorite beekeeping masks, T-shirts, beekeeping tips, bee-themed gifts, honey labels, etc. to put into slideshows.

We had very few glitches in the conference itself. One or two presenters had a pause or two as they shared their screen. Keeping the keynotes on time required actual interruption when needed. We learned that we should present the breakouts live next time. And we are much better at mastery of Zoom. Overall, we are very pleased and proud of our results.

Our evaluations were full of rave reviews. People had fun, enjoyed connecting with each other and loved the speakers. Others really liked watching the videos after the fact. Our uploaded videos were viewed 3437 times over the two weeks afterward. We discovered that we could still feel connected to each other and enjoy our beekeeping friends in an online format.

These are hard times with personal distance, masks and the pandemic making connection with each other difficult. We at GBA are delighted that we were able to achieve this connected conference for our members and our guests. We look forward to repeating this great experience on February 20 at our online spring conference.


*Linda Tillman receiving Beekeeper of the Year.* Screenshot by Kathy Bourn

**Jonathan Hayes** is a civil servant for the United States Air Force and a Georgia Certified Beekeeper. He started keeping bees in 2014 in his backyard in Warner Robins, where he lives with his wife Amanda and their four children. Starting with only two hives, he has grown to love honey bees and everything they can do for us. Currently he is the President of the Heart of Georgia Beekeepers Association and has served on the board of directors since 2015, first as a director and then as Vice President. In his spare time, he enjoys woodworking and making his own bee equipment.

**Linda Tillman** is a retired clinical psychologist and a Georgia Master Beekeeper. She recently completed two terms as President of the Georgia Beekeepers Association. Linda began keeping bees in 2006 and has beehives at a community garden and in her backyard in her intown Atlanta neighborhood. She has been coping with beekeeping in the pandemic by presenting 14 different virtual hive inspections on Zoom for her local club, Metro Atlanta Beekeepers. In addition to MABA members, the inspections were also viewed by visitors to her blog: **www.beekeeperlinda.com**. When Linda isn't working her bees, she is baking bread, quilting or having adventures with her four grandchildren.

# Skep Cakes

by M.E.A. McNeil


These traditional honey cakes come from Eastern Europe and are still gifted at Jewish New Year to convey wishes for a sweet year. We beekeepers on any calendar can welcome the sentiment with these spiced desserts, shaped like little skeps because, well, why not? Several dozen of them were made for a memorable Western Apicultural Society meeting at UC Davis years ago, and they are worth repeating.

*For a dozen skep cakes:*
1 recipe Eastern European Honey Cake
A choice between two frostings: Cinnamon Honey or Honey Cream Cheese
1 swarm marzipan bees

## *Eastern European Honey Cake (Lekach)*

***Preheat oven to 350°F.***

Oil dozen-size muffin tins, one regular (on the smaller side) and one miniature. Circles of parchment paper, which can be reused for subsequent batches, ensure that they come out easily.

*Combine and warm just to blending:*
½ cup — coffee
¾ cup — honey (a dark fall honey goes well)
¼ cup +2 T — canola oil
1 tsp — vanilla

Cool to room temperature.

*Combine dry ingredients:*
1¾ cups — all-purpose flour
½ tsp — baking powder
¾ tsp — baking soda
1 tsp each — ginger, cinnamon, allspice

*Beat until thick, four minutes or so:*
¼ cup + 2 T — sugar
1½ — large eggs

When honey mixture is at room temperature, beat it into the egg mixture. Add dry ingredients and blend well.

Scoop batter into an even number of miniature and larger muffin tins, filling no more than ¾ full. You may have some extra to put into a loaf pan, which is how this cake was traditionally made.

Bake about 25 minutes, checking to see that a toothpick comes out clean. The miniature muffin tins will bake faster than large ones.

Cool cakes. Prepare to stack them in skep shape in this way: Cut off the rounded tops of the cakes to make them fit when inverted and stacked.

*Warm in **two separate** bowls:*
½ cup — berry jam (or another bee favorite)
6 T — honey (a choice here)

Spread warmed jam filling on inverted bottom cake, just to the edge, not over.

Stack smaller inverted cake on top and spoon warmed honey over the two-layer cakes.

## *Cinnamon Honey Frosting*

This is a better match to the flavors of the cake than the cream cheese.

6 oz — unsalted butter, room temperature
¾ tsp — ground cinnamon
¼ tsp — salt (or use salted butter)
1¼ cup — powdered sugar
⅛ cup — honey (dark fall for the straw color of the skep)

Beat the butter in a mixer several minutes on high until fluffy, scraping sides.

Add cinnamon and salt and beat until smooth, several minutes.

Add powdered sugar and then honey gradually. Beat until fluffy.

Spread on cakes and score skep pattern around with a chopstick.

## *Honey Cream Cheese Frosting*

Cream cheese and honey frosting is simple to make. Spread and score the pattern with a chopstick.

**Recipe:**
About ¼ cup honey mixed with 8 oz cream cheese

**Acknowledgements:**
To Jerry Draper for photography and washing legions of dishes. To the worms in the worm bin and the microbes in the compost for consuming the failures.

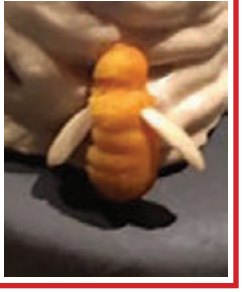
## *Marzipan Bees*

You can buy marzipan, but it's easy and far less expensive to make it. You'll have some left over for other modeling projects; it freezes well.

*To make marzipan, grind in food processor until fine:*
2 cups blanched almonds

*Add until it sticks together:*
1½ cups — powdered sugar
1 tsp — almond extract
4 tsp — water

Knead well into a log. To make bees, kneed color into a golf ball-size piece of marzipan. Divide into small balls and shape into bees. For wings, use white marzipan or slivered almonds.

# The Curious Beekeeper

by Rusty Burlew

## Food from Bugs: Insects that Feed Humans

Countless bee organizations have lists of "honey bee facts" that are entertaining, if not exactly factual. Many such lists claim that honey bees are the only insects that produce food that's eaten by humans.

That might seem true if you're looking only as far as your local grocery store, but lots of insects collect nectar or other plant exudates that humans are happy to eat. In addition, some insects produce insects that are, in turn, used for food. For example, if a mama wax moth lays eggs that grow into larvae that you fry in butter and serve over rice, certainly that mama moth was producing food for humans. It's all how you think about it.

### The honey makers

Technically, a honey bee belongs in the genus *Apis*. Eight species comprise the genus, all of which produce honey that humans can eat. While the western hemisphere is home to the imported *Apis mellifera*, the rest of the world has a wider selection of honey bees, including the Asian honey bee (*A. cerana*), the giant honey bee (*A. dorsata*), the red dwarf honey bee (*A. florea*), and others.

Aside from *Apis* bees, lots of other bees produce honey, notably stingless bees in the tribe Meliponini. Although the tribe comprises roughly 500 species, not all produce enough honey to make commercial harvesting worthwhile. Still, many species have been raised or raided for human consumption for thousands of years. Meliponiculture has a long history wherever stingless bees live, including Central and South America, Australia, Africa, and Southeast Asia.

Today, the major honey producers among the stingless bees include *Melipona beecheii* and *M. yucatanica*, and sometimes *Trigona fulviventris* and *Scaptotrigona mexicana*. The honey of other stingless species is sometimes harvested by individuals for family or personal use.

And don't overlook the bumble bees (*Bombus spp*). Bumble bee honey is stored in waxen pots within the brood nest and eaten by the queen, so she needn't leave the nest to find food. They store it in small quantities — not enough to harvest commercially — but the tiny pots have been treasured by brave children for countless generations. Since children are human — at least mostly — we can conclude that bumble bees do indeed produce food that is eaten by humans.

*Honeypot ants,* Myrmecocystus mimicus*, store large amounts of honey in their abdomens. Here, three repletes hang off the right side of their own swollen abdomens.* Public Doman photo by Derrick Coetzee

*The Mexican honey wasp,* Brachygastra mellifica*, ranges from Texas to Nicaragua.* Photo courtesy of Francisco Farriols Sarabia

*Wax moth larvae*, like this Galleria mellonella*, make a high-protein snack.* Public domain photo by Sam Droege

### Honeypot ants

Let's not forget the ants. Honeypot ants are another group of insects that produce food that humans eat. The honeypot ants are grouped into seven genera, two of which are found in North America.

Instead of building cells or pots in which to store food, specialized workers in each colony act as living food barrels. These workers, known as repletes or rotunds, eat vast amounts of nectar, plant secretions, and honeydew until their abdomens expand like overfilled balloons, ready to burst. The repletes become so unwieldy they remain stationary, often hanging from the ceilings of their underground nests.

A replete remains motionless until a hungry ant begs for food by stroking her antennae. In response, she feeds it by trophallaxis — mouth-to-mouth transfer. Once full, this ant distributes the food to other colony members just as a honey bee does.

Unfortunately for the replete, she usually dies after her food supply disappears. After having reached the diameter of a small grape, her body simply cannot shrink to its previous proportions. Other workers soon replace her.

Various human populations in parts of Australia have enjoyed the delicious honeypots. Traditionally, they were harvested and eaten fresh, ant and all. Of course, digging for honeypots could foster a voracious appetite, considering the repletes could be six feet deep in the soil, usually in hot and dry climates.

### Honey wasps

The wasp genus *Brachygastra* contains sixteen species of honey wasps which collect nectar and store honey in their large paper nests commonly built in treetops. Only one species, the Mexican honey wasp (*B. mellifica*), lives in North America, while the rest live farther south. Historically, small quantities of wasp honey, which is similar to *Apis* honey, have been enjoyed by native people in and around Los Reyes Metzontla, Mexico.[1]

### Honeydew

The bees, wasps, and ants mentioned above are all closely related members of the order Hymenoptera. But let's look at the bugs that produce honeydew. Although honeydew does not meet the definition of honey, it's certainly tasty and sweet enough to be enjoyed by humans.[2]

Although honeydew is collected by honey bees and stored in honeycombs like nectar, it is not nectar. Instead, honeydew is sap that is secreted by plants and eaten in impressive quantities by certain sap-sucking insects such as aphids and white flies. The sapsucking insects wound the surface of the plant, causing the sap to flow, then eat so much, so fast that the sap goes in one end and out the other essentially unchanged.

The end product — pun intended — is sticky and sweet and highly admired by honey bees. Being opportunists, the bees collect the preprocessed sap from the surface of the plants, then provide a bit more spit along with transportation and storage in honeycombs. Later, we harvest it, often unaware we are eating not plant secretions but insect excretions.[3]

*The resin produced by lac bugs is purified and sold as dry flakes in different colors.*
Public domain photo by Nuberger13

Without these intermediary insects, nothing would be available for the bee to collect, so you can add aphids, whiteflies, and similar sapsuckers to the list of insects that provide food for humans.

### Confectioner's glaze

Another widely consumed product is produced by the scale insect *Kerria lacca*. Like the honeydew producers, these insects ingest sap from plants and excrete a substance from the back end of the digestive tract. The substance, known as lac, is the source of shellac, lacquer, and natural varnish.

Although most sources list lac as a secretion, an article in the Journal of Zoology clarifies by saying, "The lac of commerce originates as an excretion (in the sense of excreta) exuded by the scale from the anal orifice."[4] This substance dries and forms a protective cocoon-like covering for the young, which can later be scraped from the branches where it collects.

Traditionally, the lac was harvested and used in varnish, cosmetics, and even perfume. However, modern techniques of filtering and refining have produced a purified product known as confectioner's glaze or pharmaceutical glaze that is used to coat candies and pills. It is also used to polish raw fruit to keep it shiny and attractive for the consumer. If you're squeamish, don't over-think this. Just chase your daily vitamin with lots of water.

### Insects as food

So far, we've looked at many different insects that accumulate syrups and saps which mankind has a history of eating. Just for fun, I'd like to

also mention some of the bugs we eat every day.

What's that? You don't eat bugs? Let's march into your kitchen for a closer look.

### Cochineal

The scale bug, *Dactylopius coccus*, is a parasite of the prickly pear cactus. After the female bug eats large quantities of the crimson cactus flowers, the fluffy white insect turns blood red on the inside — a trait not so great for her personal safety.

Historically, these insects were simply collected, dried, and powdered into the bright red dye called cochineal. Later, an enhanced purification process was designed that yielded the dye known as carmine. The rich red color was highly prized by European royalty who were famously short on stable red colorants. Once the Europeans learned of the dyes, cochineal became profitable for traders in Mexico and Central America.

### Inexpensive alternatives

However, as time passed, cochineal was replaced with cheaper dyes made from petroleum distillates. As a result, the cochineal trade — which is labor intensive — all but disappeared.

In the United States, cochineal was replaced by Red Dye #2. But in the 1970s Red Dye #2 made headlines after Soviet scientists claimed it caused cancer,[5] so Red #2 was quickly replaced with another petroleum product, Red Dye #40, which is still widely used in the US.[6]

By then, however, many modern consumers were suspicious of petroleum as a food item. In a flash, cochineal made an unsuspected comeback as a natural red dye, and soon began tinting yogurt, candy, cake mix, pie filling, seafood, cosmetics, and drugs.

### Not a perfect solution

Although many consumers preferred cochineal over petroleum, not everyone was happy about the switch. In 2012, Starbuck's yielded to pressure from special interest groups — especially People for the Ethical Treatment of Animals — and removed cochineal from a number of its offerings, including the Strawberries & Crème Frappuccino. However, other companies continued to use it, mostly because it is natural, stable, and non-fading.

If you think you don't eat insects, you may need to reconsider. You can start by reading your food labels. The powdered scale insects may be listed as cochineal extract, carmine, or carminic acid. In any case, because cochineal is naturally sourced, it is an exempt additive, meaning it doesn't need batch certification.[7] However, according to the FDA website, "Because of potential allergic reactions in some people, carmine/cochineal extracts are required to be identified by name on food labels."[8]

*The scale bug,* Dactylopius coccus*, eats the flowers of the prickly pear cactus, turning it red on the inside.* Pixabay image by JamesDeMers

### The hidden meal

Here in North America, most of the bugs we eat are hidden in plain sight, taking up space on our plates without our knowledge. If you are in the midst of a Covid-19 lockdown with insufficient entertainment, go to the FDA website and peruse the Food Defect Levels Handbook. The list contains "levels of natural or unavoidable defects in foods that present no health hazards for humans."

The list has three columns that describe the product, the defect, and the action levels. Keep in mind that nothing happens if the product is below the action level — those foods get a passing grade.

To illustrate, let's look at "cinnamon, ground." The defects measured in the product are insect filth and rodent filth. The action level for insect filth is an average of 400 or more insect fragments per 50 gram (1.7 ounce) sample. Luckily, only something less than 11 rodent hairs are allowed in each sample — say, for instance, ten.

My mom, who never ate broccoli, claimed it "has bugs." According to the FDA, she's right. Insects and mites in "broccoli, frozen" don't trip the alarm until they reach "an average of 60 or more aphids and/or thrips and/or mites per 100 grams (3.5 ounces)."

### Apple cider

Due to my backwoods upbringing, I'm philosophical about bugs in food. I once asked my grandmother about the squirmy black specks in the flour canister, and she explained that since they don't eat much, they don't cause economic loss. My grandfather always joked about wormy apples, forever asking, "What's worse than finding a worm in your apple?" He would then declare, "Half a worm!" and roar with laughter.

Aside from being careful about where I bit, I didn't worry about wormy apples until I watched a lo-

*No matter how wormy the apples, they all go into the cider press.*
Pixabay image by ski4fd

cal farmer loading his cider press. The apples, including windfalls, were all thrown together into the hopper. They were all wormy — today we might call them "organically grown"— and no one ever explained where the worm juice went. We drank the cider straight from the catch jugs, no questions asked, and yet here I am, alive to tell about it.

That said, I admit to a certain queasiness about canned mushrooms. The Defect Levels Handbook says the action level of "mushrooms, canned and dried" is an "average of over 20 or more maggots of any size per 100 grams of drained mushrooms and proportionate liquid or 15 grams of dried mushrooms." To this day, if I need a can of mushrooms for a recipe, I open it, rinse them, and bury them among the other ingredients without looking. I would rather eat something that walks rather than something that slithers, so the whole maggot image is off-putting. Once they're buried in the sauce, though, I forget about them.

### Eating Insects on Purpose

So far, I haven't included any insects we eat on purpose, knowingly and eagerly. But plenty are available. Remember those wax moth larvae I mentioned earlier? It turns out they are something of a delicacy, having an almond-like flavor when fried and a pork-like flavor when baked. Aficionados like to toss them in a wok or make waxworm tacos.[9]

WebMD.com lists many edible insects including ants, bees, beetles, caterpillars, crickets, flies, grasshoppers, mealworms, termites, and water bugs, but emphasizes that proper species selection and cooking techniques should be followed.[10] Some forward-thinking individuals believe that insects may one day play a major role in the human diet, especially as our population continues to rise.

I list these insect foods not to flip your lunch but to dispel the notion that we humans, especially in western societies, can somehow distance ourselves from things we find objectionable. We should be more open-minded and realistic about how far the economics of modern food processing can separate us from things, like bugs, that are natural and commonly found in our environment. Perhaps we should worry less about a wing here and a leg there, and just enjoy our food without freaking over the small stuff.

### Notes and References


1 **Keck M.** (undated) Mexican Honey Wasps. Retrieved from **https://agrilifeextension.tamu.edu/library/landscaping/mexican-honey-wasps/**

2 **FDA (February 2018) Proper Labeling of Honey and Honey Products. Retrieved from https://www.fda.gov/files/food/published/PDF---Guidance-for-Industry--Proper-Labeling-of-Honey-and-Honey-Products.pdf**

3 In biology, the word **secretion** refers to substances released by glands or other tissues, including enzymes, hormones, and lubricants. The word **excretion** refers to biological wastes such as urine and feces. In the case of honeydew, the sticky substance is secreted by the plant but excreted by the sucking insects that ate it.

4 **Misra A. (April 1931).** On the Internal Anatomy of the Female Lac Insect, *Laccifer lacca*. Retrieved from **https://zslpublications.onlinelibrary.wiley.com/doi/epdf/10.1111/j.1469-7998.1931.tb06194.x**

5 **Yoquinto L. (2013, May 30).** The Truth about Red Dye #2. Retrieved from **https://www.livescience.com/35905-red-dye-no-2-truth.html**

6 **Van de Walle, G. (2020, April 29).** Red Dye 40: Safety, Side Effects, and Food List. Retrieved from **https://www.healthline.com/nutrition/red-dye-40**

7 Each new batch of a non-exempt color additive needs to be tested by the FDA for composition and purity.

8 **FDA (2018, January 4)** Color Additives Questions and Answers for Consumers. Retrieved from **https://www.fda.gov/food/food-additives-petitions/color-additives-questions-and-answers-consumers**

9 **Bugs for Beginners (May 12, 2019).** Edible Insects Recipe: Crunchy Waxworm Ramen. Retrieved from **https://www.bugs4beginners.com/blog/recipe-waxworm-ramen/**

10 WebMD. (undated). Bugs You Can Eat. Retrieved from **https://www.webmd.com/food-recipes/ss/slideshow-bugs-you-can-eat**


*In some countries, deep-fried crickets are a popular food item.*
Pixabay image by SadiaK123


**Rusty Burlew** has studied agriculture, honey bees, and environmental science for over 30 years. She is a passionate advocate of native bee conservation and founded the Native Bee Conservancy in Washington State. **https://honeybeesuite.com** or email her at **rusty@honeybeesuite.com.**

# MITE CONTROL WHILE HONEY IS ON THE HIVE

## Part 2

### Beekeeper-funded Research

by RANDY OLIVER
ScientificBeekeeping.com

***Last month I covered the setup of my field trial of summertime mite treatments, including experimental extended-release oxalic acid in glycerin. I'll now share the results.***

Due to space limitations, it's going to take me at least two articles to share the results of this and related field trials, so I'll combine the results and discussion sections, eventually with a final wrap up of what I've learned to date.

I'm going to show you at least two graphs of the results for each treatment group. Initial mite counts were taken on June 16-17; due to climbing temperatures we delayed applying the treatments, but once a week had passed, I decided that we needed to treat on June 23 despite the heat. Midpoint counts were taken on July 12-13 (19 days after application of the first treatment, 26 days after the initial counts). We took end point counts 23 days later on August 4-5 (49 days after taking the initial mite counts, 42 days after application of the treatments).

For the midpoint assessment, I didn't want to take mite washes of all 260+ hives, so I selected what I considered to be "representative" hives from each treatment group at each of the seven test apiaries ("representative' hives being those with bees in both brood chambers, as well as moderate to high starting mite counts).

**Notes:** For each treatment group I will first show a line graph of the mite counts for only those hives chosen for midpoint assessments, followed by a column graph of the final results for all hives in the treatment group. Explanations for each graph type are at Figures 1 & 2. For this entire series of articles, all "counts" are for the number of mites washed from a sample of a half cup of bees (roughly 315 workers) shaken from a frame adjacent to brood (generally from the upper chamber).

#### The untreated control group

The Control hives were intentionally colonies with starting mite counts in the 10-20 range.

**Side note:** Mite counts can go to shocking levels if a treatment fails — our highest ending count in this field trial was a staggering 274 mites on a half cup sample of bees (not shown, and not in the Control group).

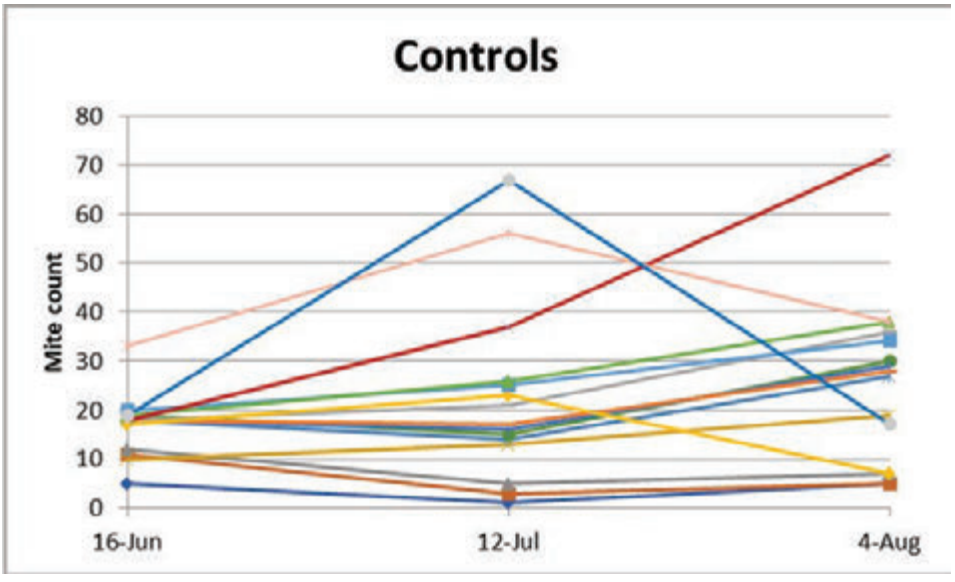



**Fig. 1** *Instead of more-appropriate step graphs, I'm showing line graphs (all to the same scale), since they make it easier to visualize the changes in mite counts for a number of individual hives. So keep in mind that the lines represent only the overall change in mite infestation rate* ***from one data point to the next****, not what happened in between. In most of the chosen Control hives, the mite infestation rates did not change much during the first half of the trial, but then climbed higher during the last half. Remember that the counts for these graphs are from only a few of the hives receiving each treatment, not the entire treatment group (which is shown below).*

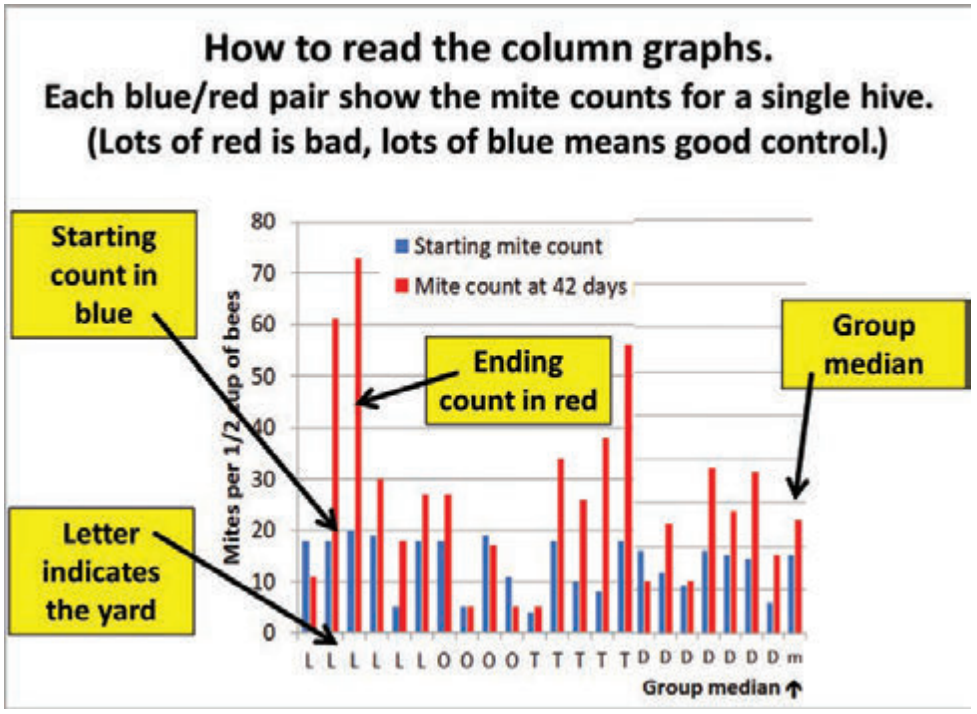



**Fig. 2** *Rather than throwing a bunch of box-plots, ranges, statistics, and error bars at you, I'll give you the straight results for every colony, which allows you to visually pick out patterns for yourself — such as the degree of variability, outliers, and yard effect. All the graphs are to the same scale for easy comparison.*

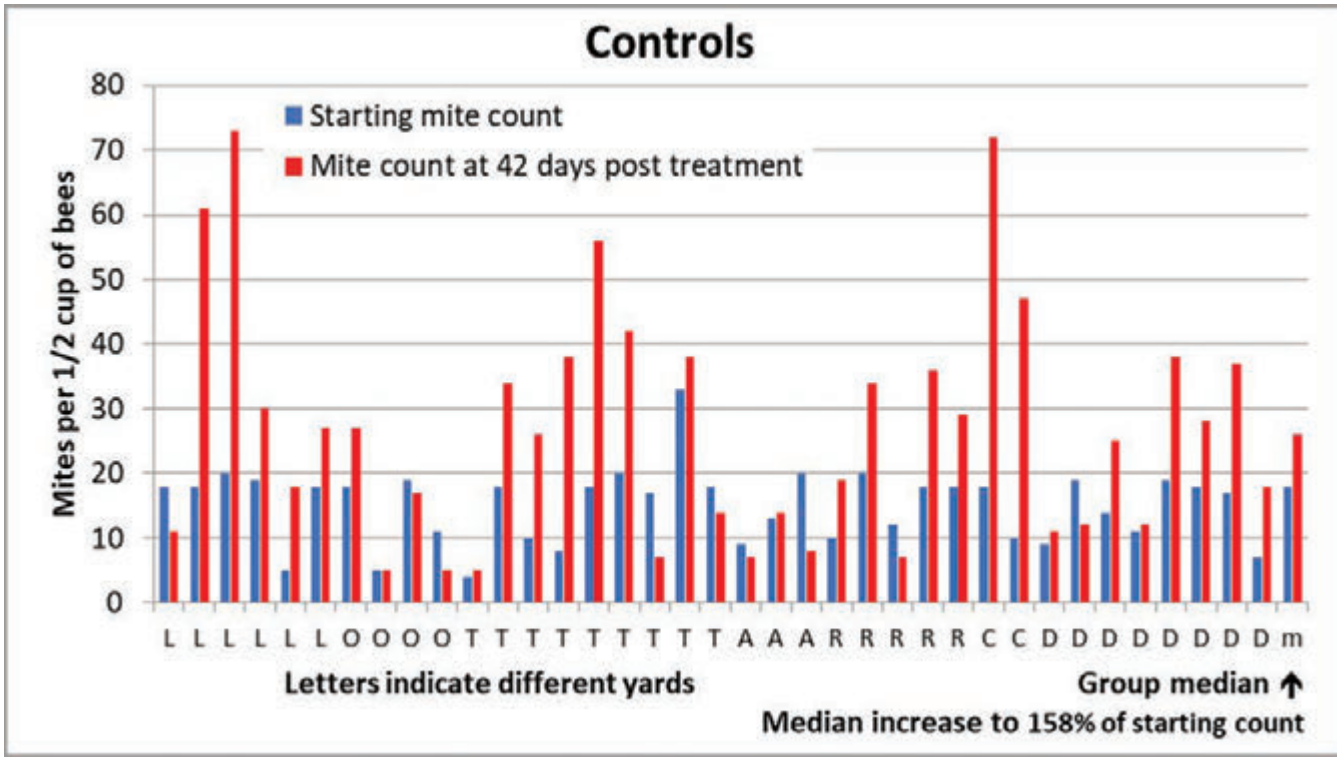



**Fig. 3** *As you can see, there's a lot of* **red** *in the Control group —* ***indicating that mite counts went up*** *— to slightly over 1½ times their starting counts. The group median value means that half the counts went up more, half less (as opposed to means, which get skewed by outliers). You can see why I limited the Control group to fairly low starting counts, since several of them really shot up over the course of 49 days (although just to confuse things, a few went down).*

**Practical application: Since the mite counts in the Control group went up by a median 58%, this expected increase allows us to later estimate the efficacy of each treatment by comparing its group's change to that of the Control group.**

### Formic Pro — 1 strip, repeated after 10 days

There are two options for application of this formic acid vapor treatment: (1) placing two strips at once, or (2) applying only one strip, then another after 10 days. We tested both methods. Unfortunately, the weather heated up after taking our initial mite counts, but as with many beekeepers suffering from a warming climate, we still had to deal with mites despite the weather. The daytime temperatures on the day of application were in the 90s F — well above the

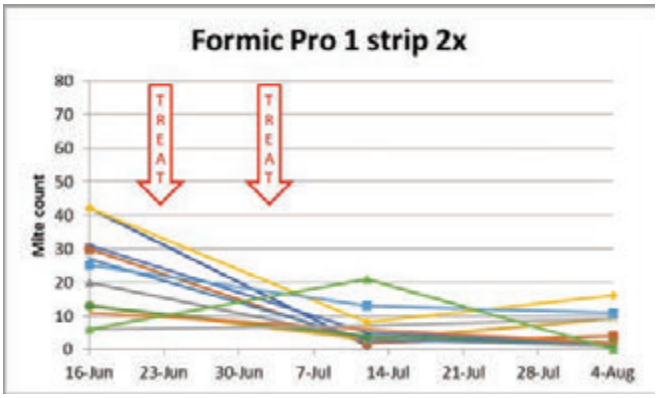



**Fig. 4** *The repeated single-strip treatment with Formic Pro greatly reduced most of the mite counts. Encouragingly, there was little mite increase after treatment.*

*Again, the lines do not reflect the immediate impacts of treatment, only the results at two time points well afterwards.*

manufacturer's recommended temperature range. So this was a good opportunity to see what would happen if we applied Formic Pro under hot, low-humidity conditions.

**Practical application: The rationale for repeating the treatment at 10 days is that it kills mites that have emerged from the brood.**

**Scientific note:** You can see why it's important to replicate any trial in various yards and under different conditions. What I've learned from field trials is to expect the unexpected, that there will be anomalies and outliers, location and weather can be important, stuff happens (including screw ups), and that there is always large colony-to-colony variability that may make it difficult to tease out the signal from the noise.

The poor performance of Formic Pro in yard "L" was clearly an anomaly. I have no explanation, but suspect that it may be related to the fact that it was the first yard to which treatments were applied, and I had conscripted a small group of visiting beekeepers as helpers to apply them — could it have been some detail during their learning curve?

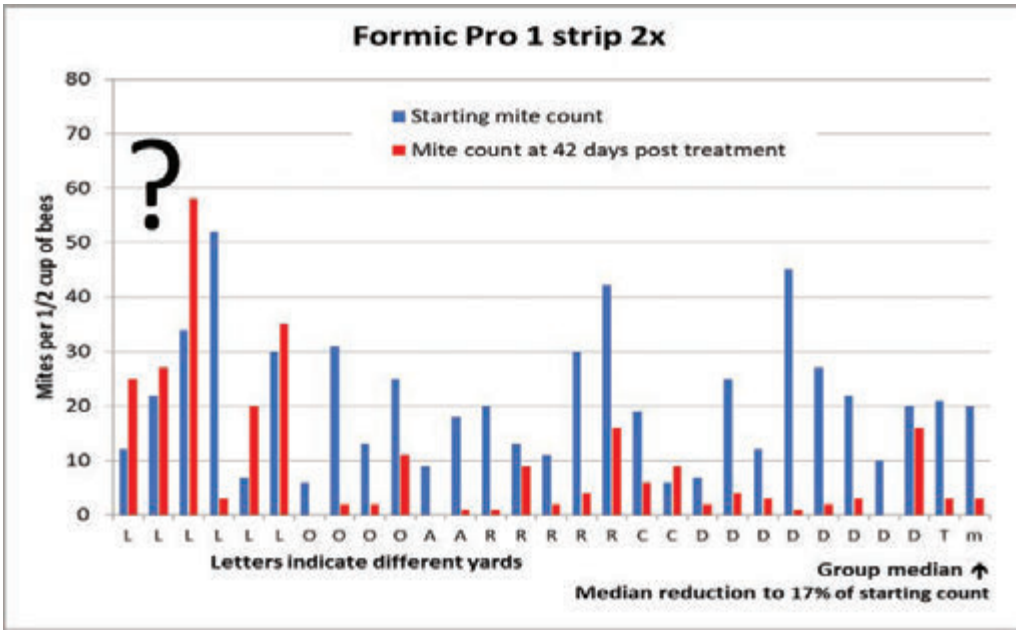



**Fig. 5** *Mite control for the repeated single strip option was quite good, except for in the "L" yard, in which the lack of reduction was in stark contrast to that in the rest of the yards (and in contrast to the excellent control in the same yard when two strips were applied on the same day at the same time — Fig. 7). Even including those hives in which the mite count went up, the overall median reduction in mite counts for all hives in the test group was to only 17% of the starting count — very impressive!*

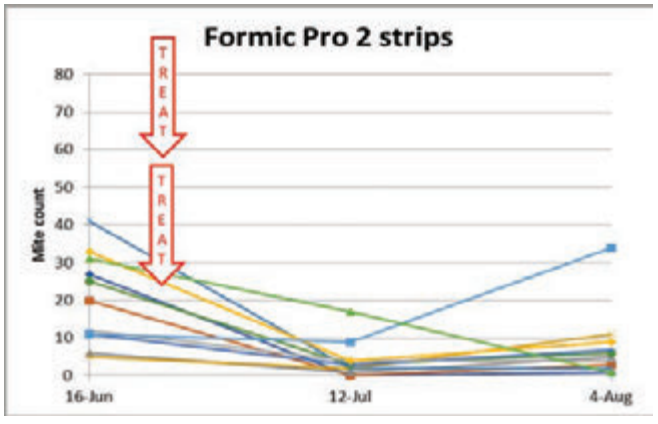



**Fig. 6** *I expected that the intense two-strip application would result in greater mite kill or sterilization under the cappings, and thus better efficacy. That did not appear to be the case, since mite counts rose during the second time period.*

**Practical application: It's all in the details. Why would a treatment work poorly in the first yard, but so well in the next six? I wouldn't blame it on the product, but perhaps upon some detail of how the strips were handled prior to placement, or perhaps since they were applied early in the day (I suspect that Formic Pro would be best applied late in the day). I clearly need to repeat this particular application method to figure it out.**

FORMIC PRO — 2 STRIPS APPLIED AT ONCE, *DURING HOT WEATHER*

**Note:** In these column graphs, if there is no red visible immediately to the right of a blue starting count column, that means that the ending mite count was zero. The median reduction figures may be misleading, since for both Formic Pro treatment groups the median starting and ending mite counts happened to be the same — 20 mites to start, 3 mites at the end.

I had two questions about Formic Pro besides its efficacy:

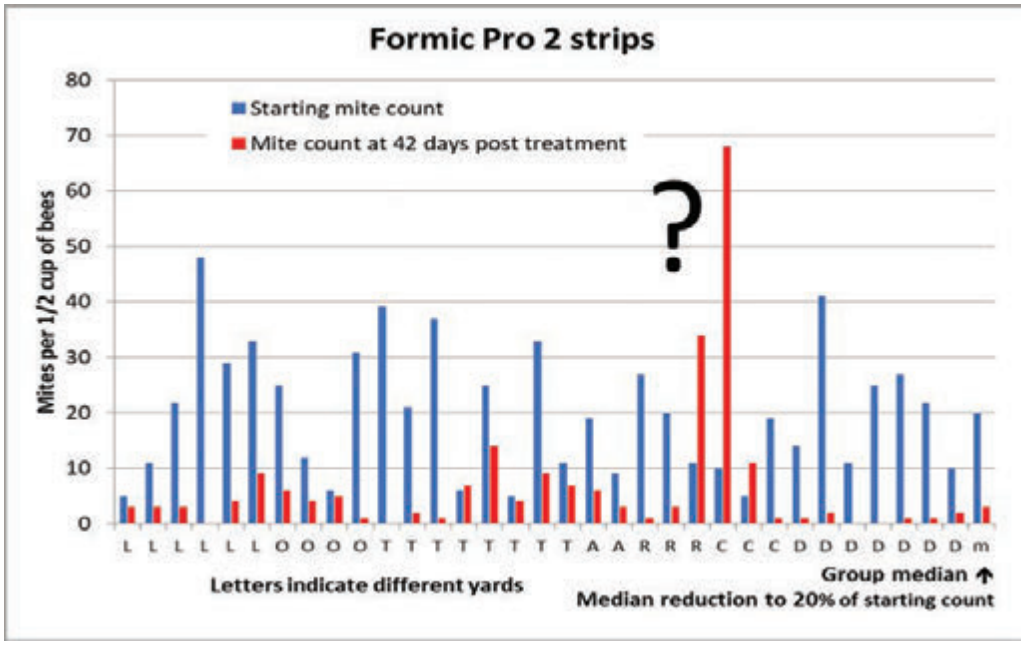



**Fig. 7** *Two strips of Formic Pro gave very good mite control in all but 2 hives out of 33 — for a median reduction to only 20% of the starting count. Why the failure in those two hives I have no idea.*

(1) Do colonies recover more quickly from the 2-strip treatment, since it causes only a single brood break, and (2) is the repeated 1-strip application easier on the queens? Due to space limitations, I'll need to leave the answers 'til my next article.

### Those danged outliers

In Figure 7 there are two outliers — colonies in which mite counts after treatment went way *up*, instead of *down*. This occurs, regardless of treatment type (including synthetic miticides), in nearly every large apiary or experiment, for unknown reasons. We just need to deal with that fact.

### Hopguard 3

Despite the impressive mite knockdown shown in Fig. 8, it was clear by the end of the trial that a single application of Hopguard 3 was inadequate for mite control during summer. I've since spoken at length with Fabiana Ahumada at BetaTec in order to clear up my understanding of the label, and plan to repeat the test next season, but with repeated treatment. There is no need to show the results of this test, since because I did not apply retreatments I did not give Hopguard a fair shot.

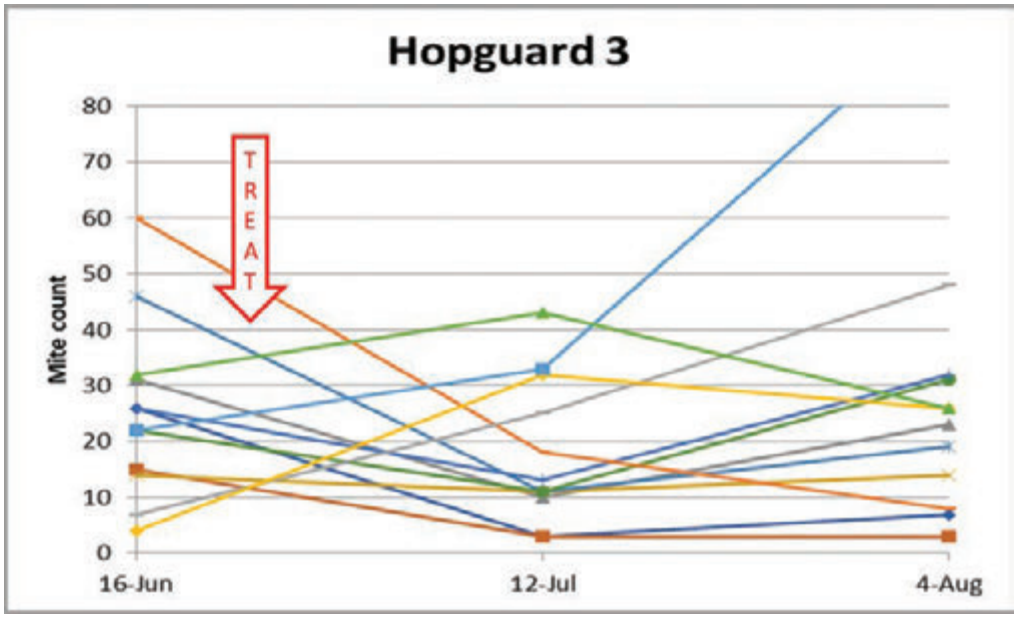



**Fig. 8** *Hopguard 3 gave a quick, but inconsistent, knockdown of the mites. Unfortunately, I found the label to be unclear as to whether it was recommended or permissible to repeat the application during the honey flow (as specified for fall treatment). I've since confirmed that it's OK to do so. Since the midpoint results indicated substantial effect from treatment, I didn't reapply Hopguard 3 strips to any hives. In retrospect, I wish that I had done so.*

**Practical application: Due to the Hopguard's rapid knockdown of mites, non-contamination of honey, and lack of adverse effects on queens (to be shown later), I feel that it can be a viable tool for varroa control (and used it myself later in two other field trials this season). I look forward to testing it again next season.**

### Extended-release Oxalic Acid in Glycerin

The main purpose for this large field trial was to compare the efficacy of extended-release OA to that of the two treatments currently registered for varroa control while honey is on the hive — Formic Pro and Hopguard. I tested three different application methods of OA/gly — let's see how they performed.

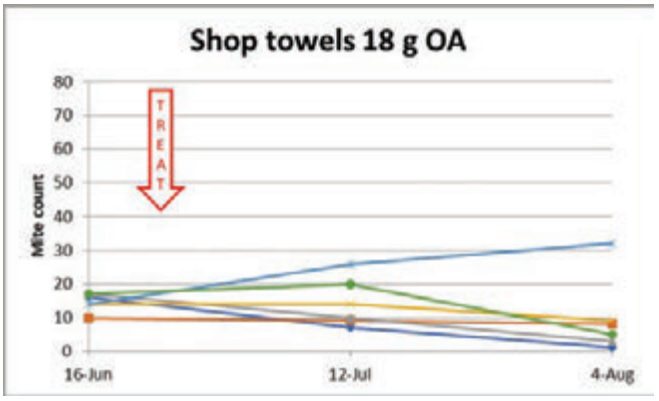



**Fig. 9** *Similar to my findings in previous trials, there is little reduction in the mite infestation rate from OA/gly towel application during the first few weeks of treatment (despite an increased mite drop, not shown). Extended-release OA takes several weeks to attain full efficacy.*

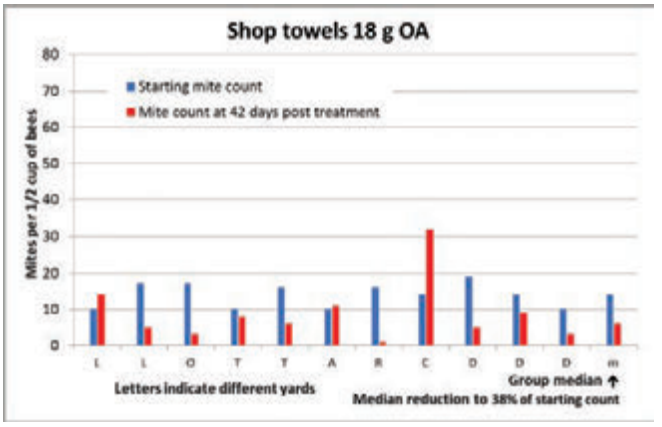



**Fig. 10** *For the shop towel application method I intentionally picked colonies with starting counts similar to that of the Controls for comparison in the efficacy calculation. At 42 days post application, mite counts had dropped to lackluster 38% of starting, but from previous experience I would expect them to continue to decline if given more time.*

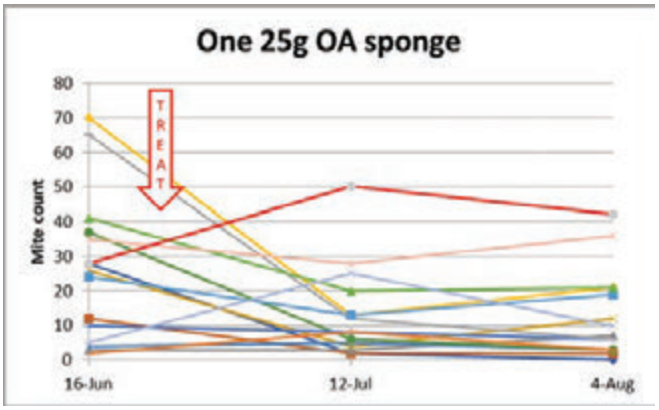



**Fig. 11** *The single-OA/gly sponge treatment exhibited notably greater initial reductions in the hives with high starting mite counts than in those with low counts (which may help to explain the apparent poor performance of the shop towels). But the overall reductions in mite counts above were not impressive.*

### OA/gly — 2 half Shop Towels 1:1 ratio (18 g OA in total)

### OA/gly — one 3½" x 8" cellulose sponge (25g OA in total)

What I was hoping for is that using cellulose sponges as the delivery matrix for OA/gly might deliver a more consistent dose over time than do shop towels.

At this point, OA/gly may not seem impressive. But we still have one more application method:

### OA/gly — Two 3½" x 8" cellulose sponges (50g OA in total)

So what happens if we double the number of sponges applied?

**Practical application: it's not about how much OA is applied in the delivery matrix; it's only the amount of OA that gets to the mites that makes any difference. Although the two sponges held 50 g of OA between them, only a fraction of that actually got released into the hives**

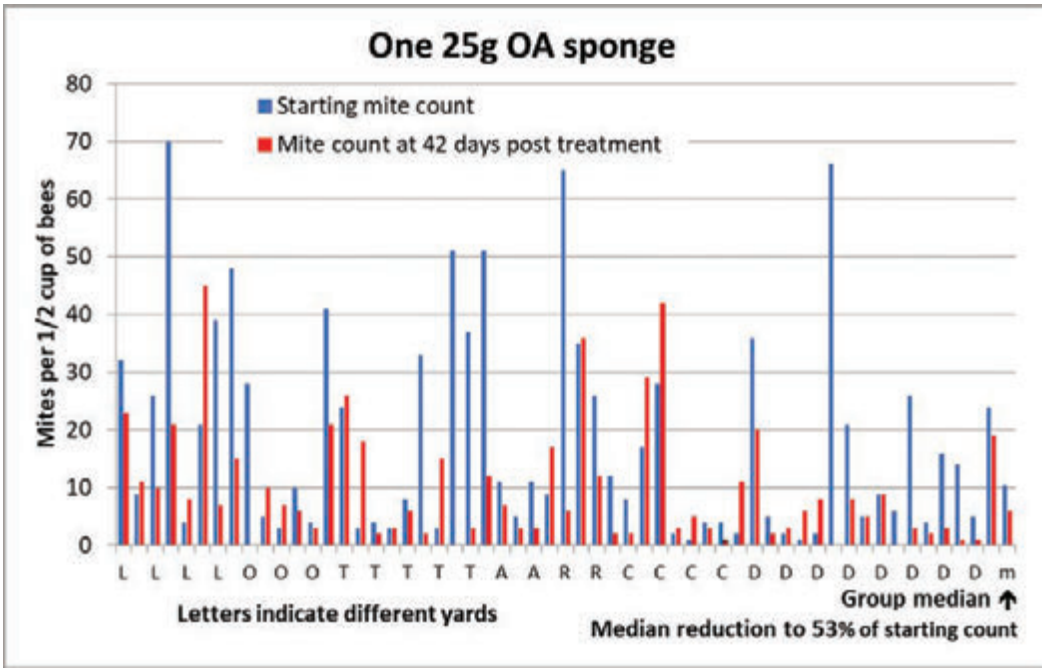



**Fig. 12** *The most striking observation is that the one-sponge application really brought down most of the extremely high mite counts. But for the low-mite hives, the results were not as impressive. Overall, the single sponge treatment dropped the mite counts to roughly half their starting number.*

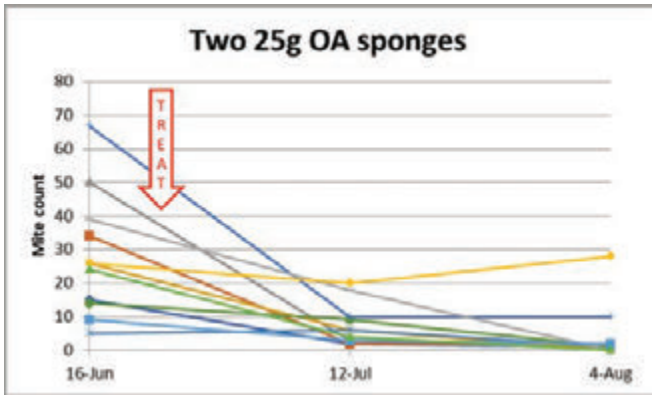



**Fig. 13** *Now we're talking. Look at those ending counts! I'll discuss why the difference later (it wasn't due to the amount of OA).*

**(to be covered next month) — at the end of the treatment period, most of the OA still remained in the sponges, never having gotten distributed to a bee or mite. So don't get hung up on the 50-g dose, since it doesn't take much OA, properly delivered, to control varroa. Bottom line: The better efficacy of the 2-sponge treatment was due to the amount of surface area of the delivery system, rather than the amount of OA held in the sponges.**

### Extending the treatment

The results from two OA sponges look really good – but had they yet achieved full efficacy? I left the sponges in a number of the hives that still exhibited appreciable mite counts (some from which I'd taken midpoint counts) until the treatment had been in the hives for 72 days, and then took mite counts again (Figure 15).

**Practical application: Although the 2-sponge treatment gave decent initial mite knock down, it's really a long-term treatment, taking some time to reach full efficacy.**

Next month I'll show more exciting data. These results are yet another step in my quest to find the best delivery method for extended-release oxalic acid — I can already tell that it's not going to be shop towels or the sponges that I used in this trial, nor a 50-gram dose.

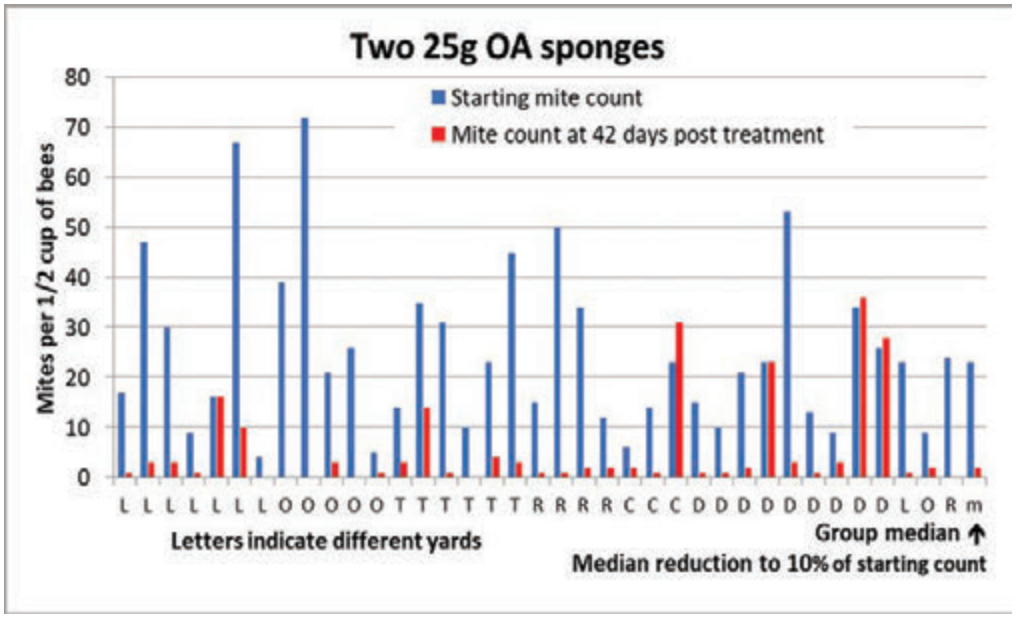



**Fig. 14** *Bingo — that's a lot of* **blue***! Other than the few outliers, the two-sponge treatment was the best treatment of all, with the median ending counts being only a tenth of the start. Despite the average (mean) starting count for this test group being 25 mites, half the ending counts were of 2 or less — not bad.*

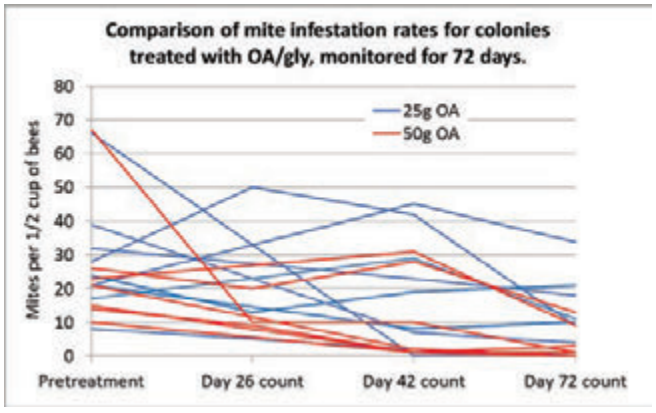



**Fig. 15** *Oxalic acid in glycerin is a long-term treatment, which just keeps on working when applied in two sponges (***red***) — note the downward trend of the red lines over the last 30 days.*

### Efficacy calculations

As always, a researcher can pick and choose methods for calculating efficacy of treatments. I prefer to use the Henderson-Tilton formula, since it compares the ***change*** in pest prevalence in a Treatment group to the ***increase*** in the Control group, setting the Control efficacy at zero. That said, there are different metrics that I can input into the formula. So I calculated efficacy in two ways (Table 1):

**Sum of mite counts:** I added up the totals for each Treatment group's starting and ending mite counts to compare overall reduction in mites for each entire group.

**Median mite counts:** I calculated the median starting and ending mite counts for each Treatment group in order to get a feel for the yard "average" (the median being the midpoint).

**Note: Technically, since the Control colonies started with lower mite counts than many of the Test colonies, we must take the efficacy calculations with a grain of salt (other**

Table 1. Efficacy of treatments by the Henderson-Tilton formula, calculated by either total or median mite counts.

| Efficacy for all tested hives<br>Treatment | Number of hives tested | Range of starting mite counts | Calculated by total mites: Sum of starting mite counts | Calculated by total mites: Sum of ending mite counts | Calculated by total mites: **Efficacy** (based on sums of mite counts) | Calculated from the medians: Median starting mite count | Calculated from the medians: Median ending mite count | Calculated from the medians: **Efficacy** (based on median values) |
|---|---|---|---|---|---|---|---|---|
| No treatment Controls | 37 | 4-33 | 559 | 988 | **0%** | 18 | 26 | **0%** |
| Hopguard 3, single application | 38 | 1-60 | 880 | 1216 | **omitted** | 22 | 22 | **omitted** |
| OA/gly, one 25 g sponge | 55 | 1-70 | 1039 | 546 | **60%** | 10.5 | 6 | **70%** |
| OA/gly, two 9 g shop towels | 11 | 10-19 | 153 | 97 | **70%** | 14 | 6 | **64%** |
| Formic Pro 1 strip 2x | 28 | 1-52 | 589 | 265 | **90%** | 20 | 3 | **75%** |
| Formic Pro 2 strips | 33 | 5-48 | 669 | 216 | **90%** | 20 | 3 | **82%** |
| OA/gly, two 25 g sponges | 36 | 4-72 | 925 | 204 | **94%** | 23 | 2 | **88%** |

**than for the shop towels). However, it's not the *absolute* values that are important, but rather the *comparison* of the efficacy values of the various treatments to each other. Both calculated efficacy values are shown Table 1.**

**Practical application: The OA/gly two-sponge application method clearly kicks butt! But it gets even better, as you'll see next month.**

**Cautionary notes: Due to poor weather earlier in the season, the colonies in this trial were not strong — starting at about 8-10 frames of bees. So the *absolute values for efficacy* of treatment below may not apply to strong colonies**

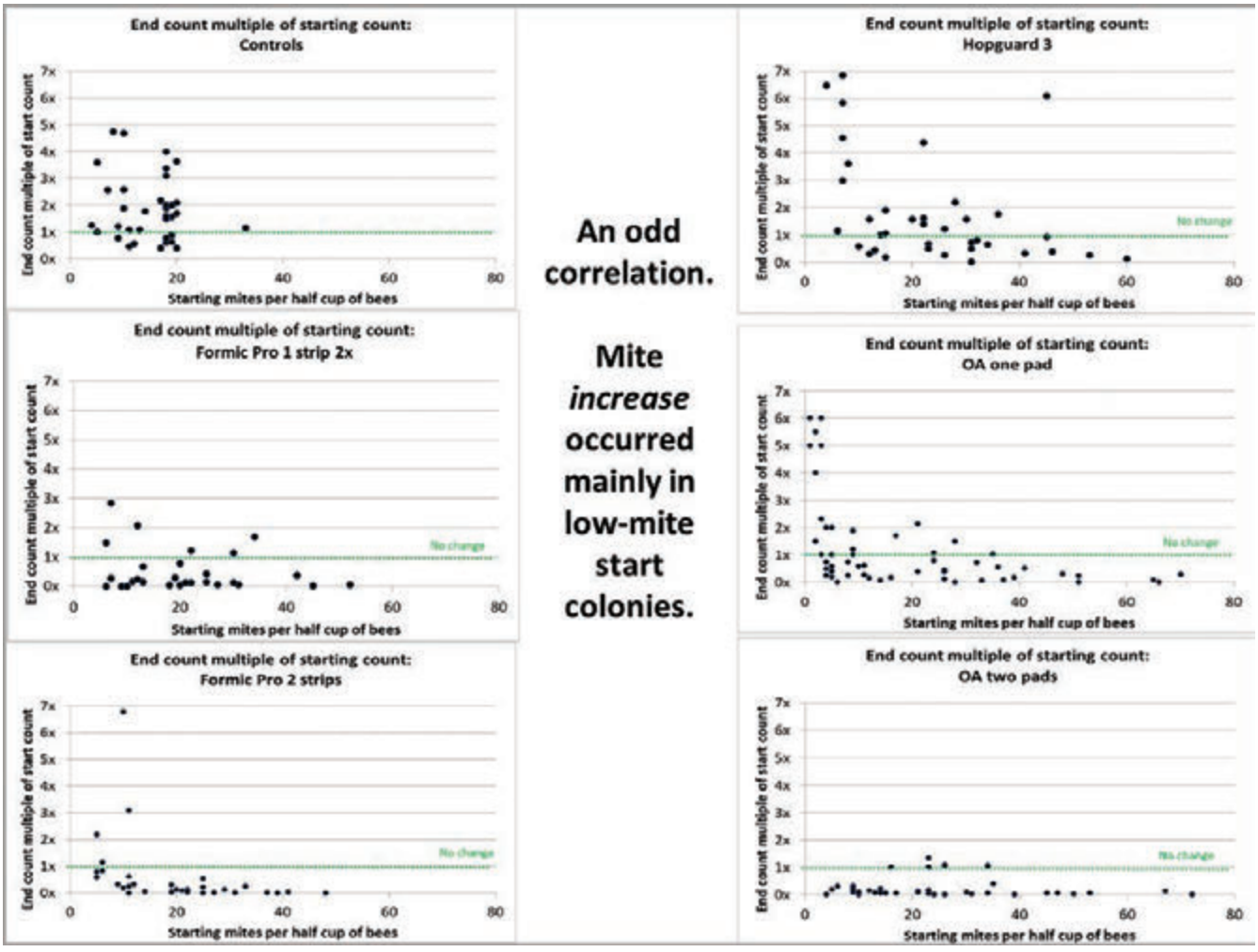



**Fig. 16** *I compared the increase in infestation rate over the 49 days by its multiple value ("2x" meaning that the mite count doubled), against the starting mite count for each hive. The green dotted line (at a multiple of 1x) indicates no change, so data points below it mean that the count dropped, often to zero. Note that for all groups other than the Controls and two OA pads, that mite counts skyrocketed pretty much only in the less-than-10 count hives, despite treatment.*

**stacked with honey supers. That said, what I was interested in was the *comparative* efficacy of the various treatments and application methods.**

### The odd effect of starting count

Just to be sure, I also calculated efficacy values for each group to see whether there was a difference between the half of the hives in each test group with higher starting counts vs. those with the lower starting counts. There was no appreciable difference (not shown).

But then I noticed that there appeared to be a relationship between colonies in which the mite counts went ***up*** after treatment and their starting mite level. So I plotted out scattergrams of the amount of mite increase or reduction vs. the starting mite count (Figure 16).

The above pattern seems counterintuitive — that the treatments were not only ineffective in some of the colonies with the lowest starting mite counts, but actually caused the counts to skyrocket. I have no explanation — but I'll bet that there's something important to learn!

**Practical application: The above scattergrams validate the efficacy estimates for the hives with starting counts above 10. But they still leave me scratching my head!**

### The label is the law

Hold your horses! The extended-release application method is not yet approved by the EPA. Until then, it is not legal to apply OA by this method for mite control, and I do not in any way promote beekeepers doing so. In my next article, Dr. Jay Evans will report upon USDA's progress toward registration of the application method.

### To be continued

Next month I'll cover the effects of treatment upon colony performance and queenrightness (notably the effect of formic treatment in hot weather), as well as more results from this and other trials of OA/gly sponges that we ran this summer, plus some previous-yet-unpublished research of mine on extended-release OA. Stay tuned …

### This is beekeeper-funded research

This field trial was tedious (we took and counted 589 mite washes in all, many with counts well above 50 mites), costly in materials and labor, and involved the loss of many colonies due to failure of treatment. My work is supported entirely by donations from beekeepers, which allows me independence from any company or restrictions by administrators — I work for the benefit of beekeepers alone. You can support our research by donating at **ScientificBeekeeping.com**. Thanks!

**Randy** sees beekeeping through the eyes of a biologist. He's kept bees for over 50 years, and with his sons runs around 1500 hives in the California foothills. He closely follows bee research, engages in some himself, and enjoys sharing what he's learned with others.


## *Honey bees recognize their sisters because their gut microbes make them smell similar*

Serious question: If you close your eyes, can you imagine the smell of your brother, sister, mother or father? My guess is you probably can, even if it's been a few years since you've thought about it. That's because each of us has a characteristic smell, some of which may come from perfume or deodorant, but some of which definitely comes from us.

What does this have to do with bees? Well, it turns out bees also have a characteristic smell, or more specifically, characteristic cuticular hydrocarbons (CHCs). In addition to protecting bees from drying out, CHCs serve as pheromones that help bees recognize their nestmates. Indeed, guard bees at a colony's entrance can recognize the similar CHCs of nestmates and accept them into the colony, or they can recognize the different CHCs of intruders and drive them away.

But how do CHCs become similar among nestmates? Are they genetically determined, or are they physically transferred and mixed among all bees in the colony environment? And what about all those microbes that live in and on bees — do they play a role in determining a bee's CHC profile? These are the topics for our thirty-sixth Notes from the Lab, where we summarize **"The gut microbiome defines social group membership in honey bee colonies,"** written by Cassondra Vernier and colleagues and published in ***Science Advances*** **[6:eabd3431].**

For their study, Vernier and colleagues first created colonies using queens from three different sources — Georgia, California and New York. To assess whether CHC profiles were different among workers from each of the three colonies, they collected numerous foragers from each colony (Photo 1), then extracted and quantified 19 common CHCs using gas chromatography. This allowed the researchers to create a CHC "fingerprint" for each individual bee based on the relative proportion of each CHC.

Similarly, to assess whether the gut microbiota were different among workers from each colony, the authors collected numerous foragers from each colony, extracted DNA from their guts (Photo 2), then amplified and sequenced the bacterial DNA. This allowed the researchers to create a bacterial "fingerprint" of each worker based on the relative proportions of each species of bacteria.

**Photo 1** *Lead author Cassondra Vernier collecting forager bees at the entrance to an experimental colony.* Photo: Katelyn Marcus

**Photo 2** *A dissected honey bee gut. Crop (left), mid-gut, hind-gut, stinger (right).*
Photo: Cassondra Vernier

Next, Vernier and colleagues tested whether a causal relationship existed between worker gut microbiota and CHCs. To do this, they first established whether colony-specific microbiota were acquired by newly emerged worker bees that were placed in a different colony. In other words, they took newly emerged workers from a colony, placed half of them in a new colony while allowing the other half to remain in the original colony, then compared the gut microbiota in bees that were transferred to those that stayed (Photo 3).

The authors then tested whether changes in microbiota led to predictable changes in CHC profiles by experimentally altering the microbiota in two ways — via antibiotics or microbe inoculations. For the inoculations, they compared the microbiota and CHCs of sister bees that either did or didn't receive inoculations of live vs. heat-killed microbes, or microbes from one of two potential colonies.

Finally, Vernier and colleagues tested whether microbiota-mediated changes in CHCs led to changes in acceptance of intruders. To do this, they first showed that inoculating workers with two culturable gut bacteria — *Gilliamella apicola* or *Lonsdalea quercina* (Photo 4) — resulted in different gut microbiota and associated CHCs in sister bees. Next, they tested whether *G. apicola*-inoculated bees discriminated against *L. quercina*-inoculated bees, and vice versa, via intruder assays. Finally, they tested whether *unrelated* bees could develop similar nestmate recognition cues and be accepted when inoculated with the same microbe. To do this, they inoculated resident bees with *G. apicola*, then tested whether they accepted workers from that colony or a different colony that were inoculated with either *G. apicola* or *L. quercina*.

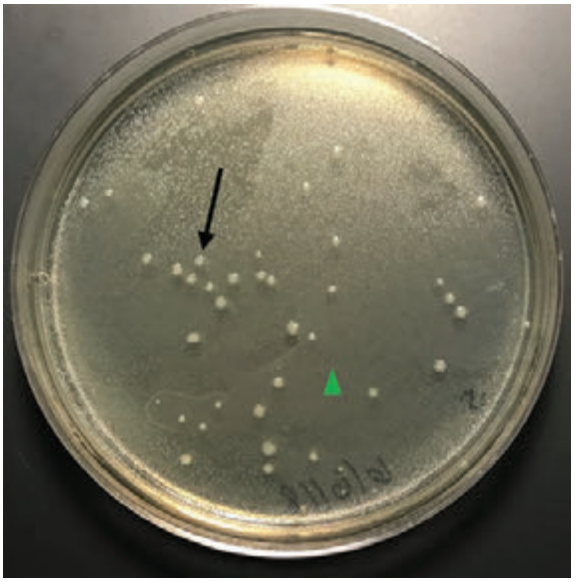
**Photo 3** *A frame showing paint-marked bees used in the cross-fostering experiments. Workers from the resident colony are painted green or blue while workers from a different colony that were reared in the resident colony are painted pink.*
Photo: Cassondra Vernier

**So, what did they find? Are gut microbes different among bees from different colonies?** Yes. Among the three colonies tested, the gut microbes of sister bees were similar, but the gut microbes of bees from different colonies were different.

**Are gut microbes fixed in a worker bee, or can they change according to the colony in which she's raised?** The gut microbes could change. Specifically, if a worker was raised in her own colony, she acquired the same microbiota as other workers in that colony. But if her sister was raised in a different colony, that sister acquired similar microbiota to workers in the other colony. In other words, a worker's gut microbiota depend on the colony in which she's raised, though they're also influenced by her source colony/genetics.

**What about cuticular hydrocarbons (CHCs)? Do gut microbes alter CHCs?** Yes. And here's where this paper really breaks ground in our understanding of honey bee and microbe biology. It didn't matter whether Vernier and colleagues treated newly emerged worker bees with antibiotics, inoculations of live microbe inoculum vs. heat-killed inoculum, inoculum from older bees from two different colonies, or inoculum containing *G. apicola* vs. *L. quercina*; each of these treatments changed worker microbiota and led to corresponding changes in CHCs. In short, changing a worker bee's microbiota always changed its CHCs.

**Well that's neat, but why is this important? Do microbiota-mediated changes in CHCs alter recognition between nestmates?** Yes. And here Vernier and colleagues' study breaks ground again. In their intruder assays (Photo 5) the authors found that *G. apicola*-inoculated bees discriminated against *L. quercina*-inoculated bees, but not vice-versa. Since *G. apicola* is a symbiotic gut microbe while *L. quercina* is an opportunistic microbe (in other words, *G. apicola* contrib-



**(L) Photo 4** *A Petri dish culture of* Gilliamella apicola *(black arrow) and* Lonsdalea quercina *(green arrow), two bacteria that are naturally present in worker honey bee guts.* Photo credit: Science Advances **(R) Photo 5** *The laboratory behavioral dish assays used to assess discrimination among workers with different gut microbiota.* Photo: Cassondra Vernier

utes positively to gut function, while *L. quercina* simply exists in the gut when it's there), these results suggest that symbiotic but not opportunistic microbes may allow workers to generate and perceive nestmate recognition cues.

Furthermore, when they tested whether *unrelated* bees could develop similar nestmate recognition cues and be accepted when inoculated with the same microbe, the results were very clear: First, workers inoculated with *G. apicola* had different CHCs than workers inoculated with *L. quercina*. Second, guard bees that were inoculated with *G. apicola* accepted workers from their own colony or workers from the different colony if they were also inoculated with *G. apicola*, but they rejected workers inoculated with *L. quercina* (Photo 6). Wow, that is just neat; changing a worker's microbiota caused her to be accepted by bees from a different colony because she produced similar CHCs and they therefore mistakenly thought she was their sister.

Overall, Vernier and colleagues' study shows that gut microbes play a surprisingly influential role in a major behavior exhibited by eusocial honey bees — nestmate recognition. In fact, you might ask who's in charge of this behavior, the bee or its microbes? Bees certainly benefit from being able to recognize intruders and avoid being robbed. But it shouldn't go without notice that microbes may also benefit, since keeping novel microbes out of a colony could reduce competition with unrelated microbe strains.

On reflection, if I were a bee, I think I'd be happy to help out my gut microbes, regardless of whether they were making me help them or not.

Until next time, bee well and do good work.

Scott McArt

**Photo 6** *Guard bees inspect a possible intruder at the entrance of their hive.* Photo: Nathan Beach


**Reference:**

**Vernier, C. L., I. M. Chin, B. Adu-Oppong, J. J. Krupp, J. Levine, G. Dantas and Y. Ben-Shahar,** The gut microbiome defines social group membership in honey bee colonies. 2020. *Science Advances* 6:eabd3431. **https://doi.org/10.1126/sciadv.abd3431**



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# Ellen Tupper, The Iowa Bee Queen

by PETER L BORST

*Editor's note: This is a continuation of a series, begun in April as "Coming to America: Beekeeping in the New World."*

PORTRAIT OF MRS. E. S. TUPPER—Drawn by Aug. Will.—*Engraved for the Bee-Keepers' Journal and National Agriculturist.*

When I first read about Ellen Tupper, right away I wanted to write about her. It seemed like no one had done a full treatment of her life, her career, and the impact she had on people's lives. Then, this January, a book-length article appeared with a long title: Beehives, Booze and Suffragettes: The "Sad Case" of Ellen S. Tupper (1822–1888), the "Bee Woman" and "Iowa Queen Bee" (Mielewczik 2019).

The authors left no stones unturned in their quest to tell everything about this woman's life and times. Much of it had to do with her involvement in gaining equality for women, and fighting the demon rum. I will focus on her connection to the beekeeping world of the 1800s. She went from having a few hives to supplement the family income, to being an editor of the American Bee Journal. As the above title suggests, there is much sadness in the story, but inspiration too.

### Early years

Ellen Smith was born in Providence, Rhode Island in 1822. Her family claimed to be descended from famous "founding fathers" of New England, including Captain John Smith and Robert Wheaton on her mother's side. At twelve years old, she and her family relocated to Calais, Maine. Her father was involved with the city's first newspaper as an investor and contributor. Early on, Ellen showed a talent for writing although it got her into trouble when she began writing essays for other students (Harrison 1870).

In 1843, Ellen married Allen Tupper. Ellen's father Noah Smith and Allen Tupper worked in the lumber and shipping business. The wealthy Tupper family had expected Allen to fall in with their extensive business, but he was leaning toward involvement in ministry, as well as the Temperance Movement and the Women's Rights and Anti-Slavery movements. In 1844 the couple moved to the northern border between Maine and Canada. Ellen had several pregnancies in the ensuing years and lost three of the four children. Only Eliza survived this bout with tragedy, one of many the Tuppers would have to endure.

The Tuppers relocated to Newtonville, a town on the outskirts of Boston, Massachusetts. Ellen recounted many times being told by her doctor, "one of Boston's best," of a heart condition and the likelihood that her "stay on earth would be very short." Of those times in Newtonville, Ellen recalled: "Ah! The weary days and nights of that last year in New England, when nothing seemed to hold me to earth but the clinging hands and loving hearts of my little ones!" (Mielewczik 2019; Tupper 1867)

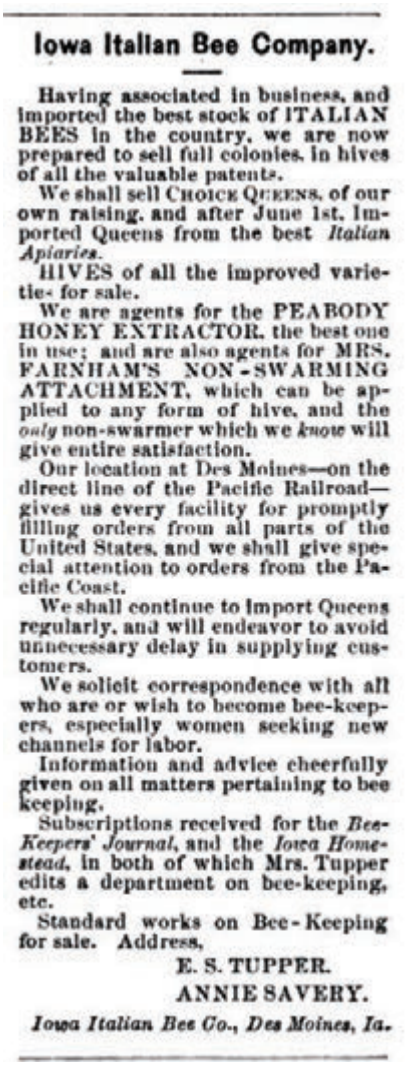
Like so many people living in the Eastern United States, Ellen was advised to go west to a healthier climate. In one of her many autobiographical essays, she told the story like this:

> I found courage to join my husband in preparations, and before my friends had recovered from the astonishment our crazy plan caused, we were on the way to find a new home beyond the Mississippi. "Gone away from her friends to die among strangers" sighed all who were acquainted with the circumstances. (Tupper 1867)

### Out west

The growing Tupper family moved to Brighton, Iowa in 1851, where they purchased 400 acres of land of which some 80 acres were used for farming and raising livestock. Her husband invested in timber land and sawmills. Mrs. Tupper continued:

> In the second summer of our western life came the time that tried men's souls, both East and West. Our little village was not



**Iowa Italian Bee Company.**

Having associated in business, and imported the best stock of ITALIAN BEES in the country, we are now prepared to sell full colonies, in hives of all the valuable patents.

We shall sell CHOICE QUEENS, of our own raising, and after June 1st, Imported Queens from the best *Italian Apiaries*.

HIVES of all the improved varieties for sale.

We are agents for the PEABODY HONEY EXTRACTOR, the best one in use; and are also agents for MRS. FARNHAM'S NON-SWARMING ATTACHMENT, which can be applied to any form of hive, and the *only* non-swarmer which we *know* will give entire satisfaction.

Our location at Des Moines—on the direct line of the Pacific Railroad—gives us every facility for promptly filling orders from all parts of the United States, and we shall give special attention to orders from the Pacific Coast.

We shall continue to import Queens regularly, and will endeavor to avoid unnecessary delay in supplying customers.

We solicit correspondence with all who are or wish to become bee-keepers, especially women seeking new channels for labor.

Information and advice cheerfully given on all matters pertaining to bee keeping.

Subscriptions received for the *Bee-Keepers' Journal*, and the *Iowa Homestead*, in both of which Mrs. Tupper edits a department on bee-keeping, etc.

Standard works on Bee-Keeping for sale. Address,

E. S. TUPPER.
ANNIE SAVERY.

*Iowa Italian Bee Co., Des Moines, Ia.*

exempt from the scourge. Cholera in its most fatal form visited us and for weeks terror reigned on every hand. When neighbors and friends were hourly summoned; when he, who to-day assisted at the burial of a neighbor, to-morrow, himself filled the plain coffin, hurriedly and without ceremony borne past our door to the grave. When weeping and lamentation were in every house, when any hour might make our remaining children orphans, we could little realize the greatness of our loss. (Tupper 1867)

In the late 1850s, her husband's health became poor and his business began to fail. According to an 1872 newspaper story, the Tuppers had to sell much of their land and their "wealth melted away like dew before the sun." Mrs. Tupper, children to raise, took a job as a school teacher. Following this same newspaper account, she and the kids all went daily on horseback three miles to the school (Anon. 1872). About this time, Mrs. Tupper decided to get into beekeeping:

> At an expense of twenty dollars I purchased in the Spring of 1859 four hives of bees, of medium strength, and from them secured by fall, fifteen good swarms, and 150 pounds honey in glass boxes, besides some inferior honey. Such honey sold *here* readily for 15 cents per pound, and each swarm of bees was worth $5, making a gain of $77.50 from an investment of $20. This was an unusually good year. The succeeding year, 1860, was unusually dry, and many bees did not swarm at all, yet mine doubled in number, and I had a quantity of surplus honey. I have no doubt that I can double my number of swarms every year, and realize from 20 to 75 pounds spare honey from each hive besides. (Tupper 1861)

### Bees for women

But beyond the boon of making money for the family, she immediately saw this as something women could take advantage of. Beekeeping in those days was primarily a backyard craft. To be sure, people like Quinby, Harbison, Hetherington, etc. would turn it into an extensive business, but beekeeping has also kept its role as a supplement to income, like chickens or fruit trees. In 1863, The Iowa State Agricultural Society awarded Mrs. Tupper a first prize for her essay on bees. This was an extensive treatise, running over ten thousand words. She clearly connected with the current sources of information. The American Bee Journal had just commenced in 1861, but articles about beekeeping had been appearing in the magazines of the times for more than ten years. It is remarkable to me how well informed people were in the mid-1800s. Information was widely available, and Tupper made clear it should be used:

> The time is now, however, long past when ignorance in the matter is excusable, for by the labors of Wagner, Quinby, Langstroth and a host of others in our country, information is now disseminated and the whole business so simplified that only study, perseverance and energy, such as are necessary for success in anything, are needed to make this one of the most pleasant and profitable branches of rural employment; while the ease with which all parts of the labor are performed, peculiarly adapt it to females. Since the invention of the sewing machine, many a woman should be emancipated from the necessary thralldom of the [sewing] needle which has proved so ruinous to the health of the sex. (Tupper 1863)

Her articles on beekeeping in the Burlington Hawk Eye caught the attention of editor William Wilson, and he hired her to write on a regular basis on the topic of beekeeping. On his advice, she was enlisted to write for the "United States Agricultural Report for 1865" of which 180,000 copies were printed and distributed. Then The Prairie Farmer magazine hired her as the "special contributor on bee subjects" which she did from 1865 to 1869. Tupper began to exploit the exposure she was receiving through her articles by advertising Italian bees for sale.

> In retrospect, some of the advertisements placed by Ellen S. Tupper at that time are, even though very short, quite telling. They show for example that she had no inhibitions about making grand claims that misled the audience if she thought them helpful. For instance, as early as in 1866 she advertised her Italian bee queens as "fully tested" and warranted as "pure" even though there was no reliable method at the time to do so. (Mielewczik 2019)

### Straying from the path

By the early 1860s, Ellen Tupper was widely known and highly respected as an authority on bee culture. A later writer would look back and declare her "one of the foremost entomologists of the world." She was a proficient writer, skilled at propagating honey bees, and an advocate for the newly introduced Italian variety. However, the question of the purity of Italian bees in the United States took her down a rocky trail. The Italian bee had been imported into the country and various people were selling them at a high price. The only way to tell the Italian from the common honey bee of the time was the fact that the former had orange bands and the latter was black. When the two were crossed the result was

variable, and the assumption was that pure crosses should yield golden bees only.

It was known at the time that honey bees mate high in the air, so there were few ways that the crosses could be controlled. One way would be to have the Italian hives isolated; placing them on islands in the Great Lakes was tried. Another plan was to confine the bees until late in the day, when black bees had carried out any mating flights, and then release the Italians to breed — if they were so inclined. The competition was so fierce to advertise pure mated bees, that Mrs. Tupper began to claim that she had achieved what no one else had done: getting the drones and a queen to couple underneath a wire cloth dish cover.

To beekeepers today, who understand bee biology, the idea is preposterous. It took many decades to finally perfect the controlled breeding of bees, using anesthesia and micropipettes. It remains a costly procedure, generally used only for research purposes. But Tupper and some of her supporters maintained that they had been successful using cages of various sorts. How they could have been so misled is a mystery, but eventually the claims died out. The question was discussed endlessly in the journals. One writer averred:

> The discovery was made by Mrs. Ellen S. Tupper, of Brighton, Iowa, who, in a letter to me, dated May 23, 1868, was kind enough to inform me of it, and who then stated that she had made the discovery some time previously. (Anon. 1870)

But after some years passed, clearer heads prevailed:

> 1885 – Cook, Hiller, Heddon, Dadant, Pond, Doolittle, Tinker, and Demaree unanimously agreed that mating in confinement is impossible. (Harbo 1971)

### The Iowa Italian Bee Company

In November 1871 Ellen S. Tupper and Annie Savery together started "The Iowa Italian Bee Company." They saw beekeeping as a way of empowering women, and went to great lengths to promote it. Annie Savery was born in London, and her husband James Savery in New York. In 1862, they moved to Des Moines, Iowa, where they built up a successful hotel and eventually made a fortune in the real estate business. Annie Savery is best known, however, for her role in the Women's Rights movement, especially in Iowa.


*Mrs. Tupper claimed, quite controversially, that she was able to mate a queen under a wire cloth dish cover such as this.*

Savery was an invited speaker at a beekeeping convention in December 1871. She thought she would be speaking to beginners, sharing her new passion with them, but found herself facing a room full of experienced "bee men." Sharp witted, she changed the topic to beekeeping for women:

> I bought 23 hives of bees, and went to work to learn something about them. It would be uninteresting to you old bee keepers, to state how I proceeded, suffice it to say that I found that every pleasure had its sting. I think I now know the meaning of that phrase, "obtaining knowledge under difficulties." … As society is now organized, there is nothing for girls outside of marriage, and for this the majority of them are totally unfitted. … Nothing will contribute so much, and to develop her into such a woman as every sensible man must admire, as engaging in an employment which will make her his equal. (Savery 1871)

Advertisements began to appear in all the trade papers for "Pure Italian Bees" sold by Tupper and Savery. Ellen's star was rising. According to Mielewczik:

> In 1869, she became one of the editors of the "Bee-Keepers' Journal." She thus was, to our best knowledge, the very first woman to ever hold an editorial position in an entomological magazine and perhaps even more generally, any magazine on a biological topic. (Mielewczik 2019)

In the National Bee Journal issue of January 1, 1872, was this passionate description:

> Mrs. Ellen S. Tupper, also, honored us with her presence. All were glad to see her; every hand was put forth to meet the friendly, cordial grasp of her hand; every one being anxious to have her speak upon her favorite topic — apiculture. To this lady, the bee keepers are under lasting obligations for the numerous instructive articles she has written upon apiculture. Go where you will, Mrs. Tupper's name among bee keepers is a household word. Long may she live. (Anon. 1872)

Her ability to write and edit, and her renown, propelled her to the po-

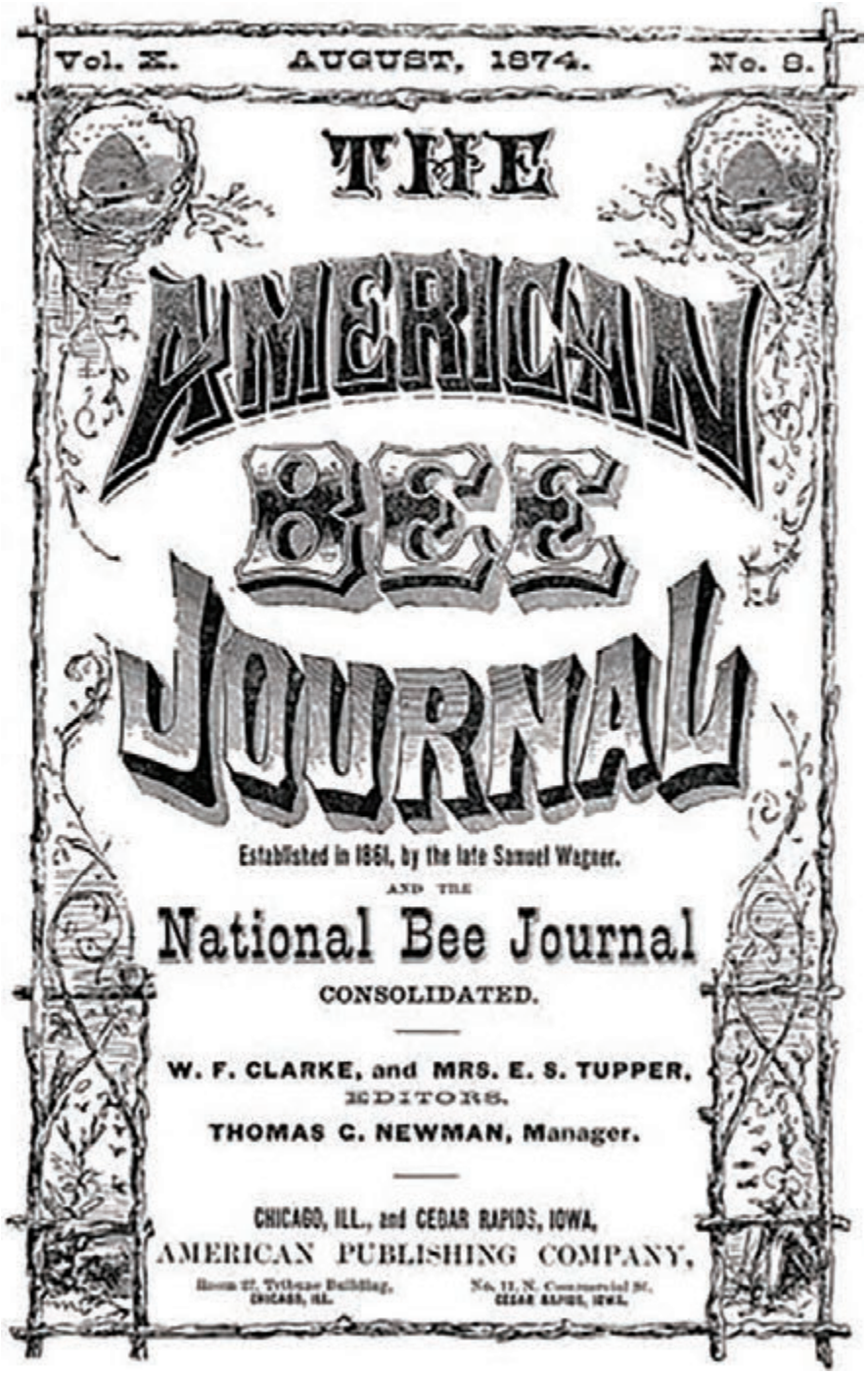
sition of editor at the American Bee Journal, which she held jointly with W. F. Clarke from August 1874 to February 1876. (Her own National Bee Journal had previously merged with ABJ.) In April of 1875, she was appointed to take charge of Iowa's honey producers exhibit at the celebration of the "One Hundredth Anniversary of the Nation," to be held at Philadelphia, Pennsylvania, 1876. She began by soliciting contributions from the beekeepers of her state via the American Bee Journal. Yet, less than a year later, the Journal was to report:

**The Bee Queen's Temptation**. Since our last issue, Mrs. Ellen S. Tupper, long known as a writer on bee culture, has "fallen like a star from heaven." On the 28th of January Mrs. Tupper was arrested for forgery. It appears that she has freely used the names of her relatives and friends, and in addition, forged the names of leading citizens of various cities of Iowa, from the name of the governor of the State, down; as well as the names of leading men in the Eastern States. Her forgeries will foot up somewhere from fifteen to twenty thousand dollars, and perhaps more. (Anon. 1876)

This was followed by comments such as these :

> "Mrs. Tupper's proverbial philosophy was to forge ahead till she gained $11,000. And now comes emotional insanity with its uplifted umbrella." A prominent bee-keeper in New England, well known to our readers, remarks in a letter of recent date: "I don't wish to say much against Mrs. T—, but if swindling, fraud, and forgery, is any indication of insanity, she has been insane, to my knowledge, for ten years, at least." (Anon. 1876)

Needless to say, her plans for the Centenary evaporated. She was arrested in 1877. The American Bee Journal printed a very short note: "Mrs. Tupper was tried for forgery in Davenport, and upon the plea of insanity, she was acquitted and is now in Dakota on a farm." Irate customers and creditors showered the Journal with requests for money they had sent her for queens which had arrived dead; and for hives, bee equipment and even subscriptions which were never delivered. The publisher, Thomas Newman, was compelled to make it plain that Mrs. Tupper was engaged only as a writer and editor; her debts were her own.


Vol. X. AUGUST, 1874. No. 8.

THE AMERICAN BEE JOURNAL

Established in 1861, by the late Samuel Wagner.

AND THE

National Bee Journal

CONSOLIDATED.

W. F. CLARKE, and MRS. E. S. TUPPER, EDITORS.

THOMAS C. NEWMAN, Manager.

CHICAGO, ILL., and CEDAR RAPIDS, IOWA,

AMERICAN PUBLISHING COMPANY,

Room 27, Tribune Building, CHICAGO, ILL. No. 11, N. Commercial St. CEDAR RAPIDS, IOWA.

#### Later years and passing

Ellen Tupper disappeared from public view after the debacle. She lived at her husband's farm in the Dakota territory, but he died soon thereafter, in 1879. According to the newspapers, Mrs. Tupper and her daughter Kate moved to Portland, Oregon. She continued writing, contributing to the periodical "Pacific Rural Press" under the pen name "Pioneer." She traveled extensively in California and reported to her friend A.J. King on beekeeping in that state. In 1887, she traveled by ship to Alaska and was there for some time and wrote about it, though nothing remains of her record. Her travels had taken her from the farthest eastern portion of the USA to the far west. In the end, it was while she was visiting one of her daughters in El Paso, Texas, that she had a sudden heart attack and died, in 1888.

Largely forgotten are her contributions to the advancement of beekeep-

ing and especially bee culture as an occupation to increase the self-reliance of women. Many years would pass before women would rise again to prominence in the field of bee culture. However, the cause of women's rights was taken up by her four daughters. They appeared together as lecturers at the 1894 Woman's Congress in San Francisco. One of the topics was how woman's plight "is much attributable to her clothes. We can't breathe comfortably or sit down comfortably or walk easily. Woman is not physically free."

To be fair, Mrs. Tupper's path was strewn with obstacles and it is amazing that she advanced so far. She overcame ill health; bore 11 children of whom 6 died; she lost to a house fire 200 hives which were being wintered in the cellar. Everyone in the business of shipping bees around the country was negatively affected by the Post Office's outright hostility to the idea of live bees in the mail. Countless Italian queen bees were lost and had to be replaced due to neglect or deliberate mistreatment by mail handlers. It's hard not to draw a lesson from this story, but in the end my view is Ellen Tupper greatly overextended herself. She aimed very high, perhaps beyond the realm of what was possible to do at the time. And yet, seeing the success of those around her, who would blame her for trying?

### Bee Queen References


**Anonymous. (1870).** *The Illustrated Bee Journal*. Vol. 1, No. 7. Indianapolis, Indiana.

**Anonymous. (1872).** *National Bee Journal*. Vol. 3, No. 1. Des Moines, Iowa.

**Anonymous. (1872).** What an Iowa Woman Has Done. Letter from Des Moines. In: St. Louis Globe.

**Anonymous. (1876).** *American Bee Journal*. Vol. 12, No. 3. Chicago, Illinois.

**Cook, A. J. (1875).** American Bee Journal. *American Bee Journal*, Vol. 11, No. 4. Cedar Rapids, Iowa.

**Harbo, J. R. (1971).** Behavioral and physiological aspects of honey bee (*Apis mellifera* L.) mating. PhD Thesis, Cornell University. Ithaca, NY.

**Harrison, E. (1870).** Biographical Sketch. *The Bee-Keepers' Journal and National Agriculturist* 11(1): 1.

**Mielewczik, M., Jowett, K., & Moll, J. (2019).** Beehives, Booze and Suffragettes: The "Sad Case" of Ellen S. Tupper (1822–1888), the "Bee Woman" and "Iowa Queen Bee." Entomologie Heute [Entomology Today]. 31: 113-227. Aquazoo Löbbecke Museum.

**Savery, A. (1872).** Transactions of the North American Beekeepers' Society. Cleveland, O., December 6, 1871. Indianapolis Printing and Publishing House.

**Tupper, E. S. (1861).** Hints on beekeeping. Hints on Bee keeping. 30th March 1861. The Burlington Weekly Hawk-Eye. Burlington, Iowa.

**Tupper, E. S. (1863).** Essay on bees. in: SHAFFER, J.M. (ed.): Ninth Report of the Secretary of the State Agricultural Society to the Governor of the State for the Year 1863. F.W. Palmer; Des Moines.

**Tupper, E. S. (1867).** Why I became a beekeeper. Letter I. *The Prairie Farmer* 9(7): 100–101.



**Peter L Borst** has published over 60 articles on topics as diverse as beekeeping technique, honey bee genetics, and the history of beekeeping. He has presented on these for beekeeping organizations in many states. He is retired from Cornell University, and lives in the woods near Ithaca, NY.


# Does Locally Sourced Honey Alleviate Seasonal Allergies?

## The research is inconclusive

**by ANDREW BAUER**

It starts every spring with the melting of the snow, like an unseen enemy swiftly attacking your sensory organs. If you have never suffered from seasonal allergies you may consider yourself blessed. With over 19 million people diagnosed with allergic rhinitis (more commonly known as hay fever) in the United States each year (CDC Summary Health Statistics 2018), and approximately 10-30% of the global population suffering from seasonal allergies (WAO World Allergy Organization White Book on Allergy 2011), it is easy to understand why people may be looking for the miracle cure.

There are several proven pharmaceutical treatments for hay fever approved for use in the United States, but there are common drawbacks and side effects associated with taking them, most notably drowsiness. So is there a better option? Some believe there is, in the form of local raw honey. But is there legitimacy in these claims? It does make sense after all; bees collect pollen and that is the trigger to most forms of rhinitis, so eating a small amount of pollen-laden honey each day would act like a mini allergy shot, right? Let's take a deeper look at this question.

### The information will guide you

A quick Google search on this topic will leave you bewildered. Some articles state that local raw honey is the golden cure for your seasonal allergies; yet in the same search you will find articles stating just the opposite. Both camps cite several different scientific studies to prove their claims, so let's start there and see if we can find the truth; here is a quick summary of these studies:

Our first study (Asha'ari, Z.A., et al. 2013), seems to be one of the main sources of information for the "honey as a cure" group. In this paper they used a double blind study with forty participants. Half of them were given one gram of honey per kg of bodyweight while the other half were given a placebo of honey-flavored corn syrup at the same dose. That would be approximately two and a half tablespoons a day for someone weighing about 150 lbs. This was an eight week study and for the first four weeks the participants were taking an antihistamine (Loratadine) to relieve their allergy symptoms while also taking the honey or placebo. After week four the participants were evaluated on their symptom score, and both groups showed marked improvement. At this point the Loratadine was removed from the test and the participants were scored once again at week eight. It appears that the control group did not maintain their improved symptom status and quickly went in a decline after the removal of Loratadine. In contrast, the case group showed continued improved symptoms after week four until the end of the study at week eight, with significant improvement in sneezing, nasal congestion and itchiness.

Another scientific study that has often been cited by the "honey as a cure" group and has also been criticized by the "it has not been scientifically proven" group for adding pollen is Saarinen, K et al. (2011), birch pollen honey for birch pollen allergy, a randomized controlled pilot study. This was a study conducted in Lappeenranta, Finland, in which 61 participants took part, with fifty completing it. This study split participants into three groups, those receiving birch pollen honey (BPH), those receiving regular honey (RH), and the control group which continued their normal allergy relief medication. The RH was locally sourced raw honey, while BPH was local raw honey enriched with bee-collected pollen. This study had participants take the honey orally and allow it to dissolve on their tongue — starting in November with a small droplet (<1 g) and gradually increasing dosage every three weeks to the maximum daily dose of one teaspoon a day (8 g) ending in March. Then, during the birch pollen season (April-May) the participants filled out symptom diaries to track their allergy symptoms and need for any medication. Participants who took BPH had a significantly lower total symptom score during pollen season in comparison to the control group. Although it appears that there was not a significant difference in BPH and RH in the end findings, the BPH did score higher on all marks.

Now for the study most commonly cited stating that honey has no effect on rhinitis (Rajan, T.V et al. (2002): If you have heard someone say that science has not proved honey works on allergies it was most likely this study that was used. This study was conducted at the University of Connecticut Health Center. It involved 36 participants, of which only 23 completed the study, so that is over a one-third dropout rate. Participants were split into three groups. One group was

given locally sourced raw honey; the second group nationally produced, filtered and pasteurized honey; and the third group a corn syrup imitation honey as a placebo. Participants received a five-pound jar of their honey or placebo and started taking one tablespoon a day on March 15, continuing for 195 days until the end of the test. Study patients were required to fill out a weekly diary, tracking all symptoms and symptom-free days and whether or not medication was needed. According to their findings, there was not a clear correlation between the ingestion of either raw unprocessed honey or the national brand in alleviating rhinoconjunctivitis. In this study the control group experienced approximately the same results as the case groups.

So there we have three scientific papers all finding somewhat different results — two state that there is benefit from taking honey and one comes to the opposite conclusion. So how does an average allergy sufferer know which study they can trust? At this point you don't, there just has not been enough research with different methods and large enough study groups to give a definitive answer.

So what about anecdotal information? Granted, none of this can be proven, and is more pseudoscience than any sort of a clinical trial, but there may be something to all these personal claims that honey helps *them* relieve *their* personal allergies. Out of curiosity I wanted to get an idea just how widespread the use of honey for allergies is, so I asked this question to people on several different social media platforms: "Have you ever used local, raw honey to relieve your allergy symptoms?" There were 467 responses to my question and 34.68% of the respondents stated they have never taken honey for their allergies, while 8.77% stated that they have taken honey to relieve their allergy symptoms and it did not work. Surprisingly, 56.53% of respondents stated they have used honey for their allergies and it did indeed work for them (Figure 1).

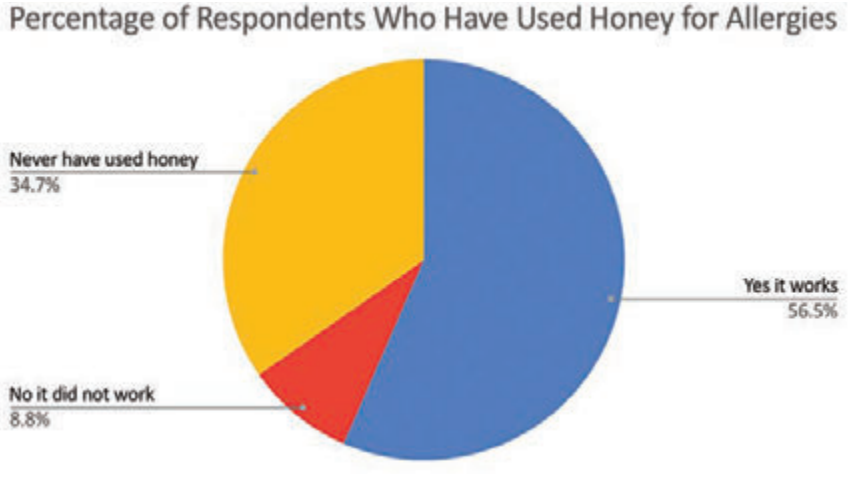



**Fig. 1**

### Placebo or secret weapon?

Though there is not a known number on how many allergy sufferers are using more nontraditional ways of treating their allergies, nontraditional medicine is widely being used to support conventional treatments (Kłak et al (2016): 251-57). There are thousands of people using non-traditional treatments like honey so it is hard to believe so many people can be finding relief in something that does not work. But walking down this pathway is like following the white rabbit down his hole in "Alice in Wonderland." The farther you go the more confused and bewildered you will become. Does it work on the brain and not the body? Is it possible that all these people that are taking raw honey are finding relief from their allergies due to the placebo effect (Finniss et al. 2010)? If this is the case, is it enough to make the patients feel as if their symptoms were less severe than they had previously been? Or is this really mind over matter, where the subconscious mind is tricked into making the body believe it is no longer under attack (by pollen in this case)? Another possible scenario is that allergy sufferers are taking their honey for the month or so while the plant they are having a reaction to is blooming, and then that plant's life cycle will complete, therefore not releasing any more allergens into the air, and the patients' symptoms disappear and honey receives the recognition for a cure. There is no way to definitively tell whether an allergy sufferer's symptoms were relieved by the raw honey with anecdotal information as there are just too many variables.

It is possible that locally sourced raw honey does have a healing effect on allergic rhinitis. This is likely not due to the pollen in the honey acting as an immune booster because the type of pollen that is most common in allergic reactions comes from grass, trees and other wind-pollinated plants that the bees do not intentionally collect, therefore limiting the amount of such pollen in the honey (Rajan, T.V et al. 2002). Honey has been known as a healing agent since ancient times, with antimicrobial, anti-inflammatory and wound healing properties (Mandal, M.D., & Mandal, S. 2011), so it may be possible that honey will relieve your allergy symptoms by an internal mechanism related to its anti-inflammatory properties, but without understanding how those properties work, this is a very difficult topic to study (Hadagali, M.D., Chua, L.S 2014).

With our love of honey dating back thousands of years we will most likely be enjoying and using honey to help alleviate our allergies, coughs, colds, cuts and bruises, and whatever else ails us for years to come. Although on rare occasions eating raw honey can cause allergic reactions, that is very uncommon so if you think it will help, and you really enjoy honey, you will most likely see some benefit from it. But (there always seems to be an unforgiving "but" with the things we love) until we have more rock solid tests to prove the how and why of the matter it will still be an unproven old wives' tale. So keep your trusted antihistamine handy!

> "Our treasure lies in the beehive of our knowledge. We are perpetually on the way thither, being by nature winged insects and honey gatherers of the mind."
>
> — *Friedrich Nietzsche*

### Endnotes


1 **CDC** **Summary Health Statistics Tables for U.S. Adults: National Health Interview Survey, 2018, Tables A-2b, A-2c https://www.cdc.gov/nchs/fastats/allergies.htm**

2 **WAO.** World Allergy Organization White Book on Allergy. Milwaukee, WI:World Allergy Organization (2011). Available: **http://www.worldallergy.org/UserFiles/file/WAO-White-Book-on-Allergy_web.pdf**

3 **Asha'ari, Z. A., Ahmad, M. Z., Jihan, W. S., Che, C. M., & Leman, I. (2013).** Ingestion of honey improves the symptoms of allergic rhinitis: evidence from a randomized placebo-controlled trial in the East coast of Peninsular Malaysia. Retrieved from **https://www.ncbi.nlm.nih.gov/pubmed/24188941**.

4 **Saarinen, K., Jantunen, J., & Haahtela, T. (2011).** Birch pollen honey for birch pollen allergy--a randomized controlled pilot study. *International archives of allergy and immunology*, *155*(2), 160–166. **https://doi.org/10.1159/000319821**

5 **Rajan, T.V, Tennen, Howard, Lindquist, Richard L, Cohen, Leonard, and Clive, J.** "Effect of Ingestion of Honey on Symptoms of Rhinoconjunctivitis." *Annals of Allergy, Asthma & Immunology* 88.2 (2002): 198-203. Web

6 **Kłak, Anna, Raciborski, Filip, Krzych-Fałta, Edyta, Opoczyńska-Świeżewska, Dagmara, Szymański, Jakub, Lipiec, Agnieszka, Piekarska, Barbara, Sybilski, Adam, Tomaszewska, Aneta, and Samoliński, Bolesław.** "Persons with Allergy Symptoms Use Alternative Medicine More Often." *Pneumonologia I Alergologia Polska* 84.5 (2016): 251-57. Web

7 **Finniss, Damien G, Kaptchuk, Ted J, Miller, Franklin, and Benedetti, Fabrizio.** "Biological, Clinical, and Ethical Advances of Placebo Effects." *The Lancet (British Edition)* 375.9715 (2010): 686-95. Web.

8 **Pasupuleti, Visweswara Rao, Sammugam, Lakhsmi, Ramesh, Nagesvari, and Gan, Siew Hua.** "Honey, Propolis, and Royal Jelly: A Comprehensive Review of Their Biological Actions and Health Benefits." *Oxidative Medicine and Cellular Longevity* 2017 (2017): 1-21. Web.

9 **Rajan, T.V, Tennen, Howard, Lindquist, Richard L, Cohen, Leonard, and Clive, J.** "Effect of Ingestion of Honey on Symptoms of Rhinoconjunctivitis." *Annals of Allergy, Asthma & Immunology* 88.2 (2002): 198-203. Web

10 **Mandal, M. D., & Mandal, S. (2011).** Honey: its medicinal property and antibacterial activity. *Asian Pacific journal of tropical biomedicine*, *1*(2), 154–160. **https://doi.org/10.1016/S2221-1691(11)60016-6**

11 **Hadagali, M.D., Chua, L.S.** The anti-inflammatory and wound healing properties of honey. *Eur Food Res Technol* 239, 1003–1014 (2014). https://doi.org/10.1007/s00217-014-2297-6




**Andrew Bauer** is a beekeeping cowboy who lives and works on a ranch in southwestern Montana. Animal husbandry has always been paramount in his life, so in a search for knowledge he completed the Master Beekeeping program through the University of Montana. With his most recent venture, Hazel's Honey LLC, he has built his own queen rearing methodology utilizing management intensive practices to rear locally adapted mite tolerant queens. Using his wife as a reluctant participant and the energy of their 4-year-old daughter, Andrew seeks to further his contributions to the beekeeping community through the development & implementation of research that is applicable to commercial & backyard beekeepers alike. Questions for Andrew can be directed to: **hazelshoneyllc@gmail.com**

# Monitoring Honey Bee Colony Activities with a Temperature Sensor Grid

## Part 3 of 3

by
**Frank Linton, Anna Stumme, Brett Padula, Gail Ifshin, Gregory Behrmann**

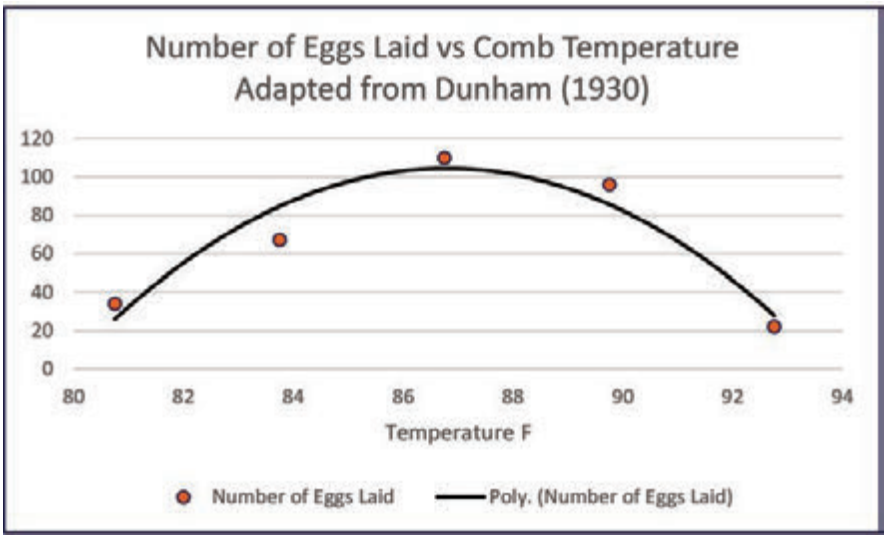



**Fig. 1** *Egg laying temperatures*

**Recap of Parts 1 & 2:**

In the first installment in this series we described the design and construction of our 36-temperature-sensor grid and how we installed it over the honey super. There it monitored the size and location of the winter cluster, and the colony's transition to brood rearing in early spring. We then moved the sensor grid to just above the brood box.

In the second installment we tracked changes in the colony's brood volume as the colony experienced multiple splits and swarms in the late spring. We also reported on the results of our investigation into seemingly anomalous readings. We concluded that even a two-part temperature-based indication of brood, using both temperature and the standard deviation of temperature readings, may result in an over-estimate of brood volume.

In this third and last installment we will describe our efforts to locate where the queen is laying at the moment and swarm detection, both pre- and post-swarm.

**Eggs**

With a dense array of temperature sensors in the brood nest, it may be possible to determine where the queen is actively laying. In general, we might expect to find eggs at the edge of the brood nest, adjacent to brood in later stages of development, or in areas where brood has recently emerged.

According to Dunham (1930), queens prefer to lay eggs at 87ºF, +/- 5ºF. See Figure 1. Assuming this is the case, then areas of the comb adjacent to brood, and cooler than brood temperature, could indicate the presence of eggs. Unfortunately, Dunham did not, apparently, continue to monitor temperatures in the areas where eggs were laid, and he did not report how the temperatures changed over time to reach to the standard brood rearing conditions.

Contradicting Dunham's results, however, Li, Huang, & Sharma et al. (2016), found that for worker brood, average temperatures were higher for eggs than for larvae or brood. They reported these averages: for eggs 35.6 C (96 F), for larvae 35.2 C (95.4 F), and for pupae 35.0 C (95 F).

We examined the sensor locations where the colony initiated or reinitiated brood rearing. We graphed the average daily temperatures for the seven days before brood-rearing temperatures were reached, plus the temperature on the first day of brood rearing (Figure 2). Although there was much variation from day to day and from sensor to sensor, on average, temperatures climbed about 1 F each of the seven days before brood conditions appeared, starting from 88 F and reaching 94 F the day before stabilizing at brood conditions.

While it would be ideal if data from this sensor grid could inform a beekeeper which frame the queen was on and her approximate location, it appears at this point that the best that can be done would be to indicate which sensors were reporting temperature increases of approximately 1 degree Fahrenheit per day. As each sensor covers about 3 percent of the brood box, even limiting the search for the queen to several sensors might greatly ease the task of finding her.

**Splits**

This colony was split twice, first on March 17, when the sensor grid was moved from atop the honey super to atop the brood box, and again on April 6, a few hours after the first swarm departed. This second split was made using some of the swarm cells. Both splits were made with frames from the honey super, so brood reduction due to splitting does not appear in the temperature record, but the splits may have affected overall colony strength.

**Swarm detection**

On April 6, about noon, this colony swarmed. The swarm was then followed by two afterswarms; one on April 20, about 3:50 pm, and another on April 22 at 1:00 pm.

Our working hypothesis (Linton, 2017) was that the swarm event would appear in the temperature data in two ways. First, after the swarm, fewer bees would be in the brood chamber and this would affect the temperatures there. Second, for bees to fly, they must first warm up their flight muscles to 95 F (Seeley, 2003), and this warming-up process would be visible in the data as well.

The first swarm event, Figure 3, shows up plainly in the data: Following the swarm; the temperatures in the brood box decreased and their standard deviations increased. These data confirm that the colony had swarmed.

The first of the afterswarms (April 20) is not visible in the temperature data; it occurred soon after the double peak in the graph below (Figure 4).

A close-up view of the April 20 temperature data also shows no obvious

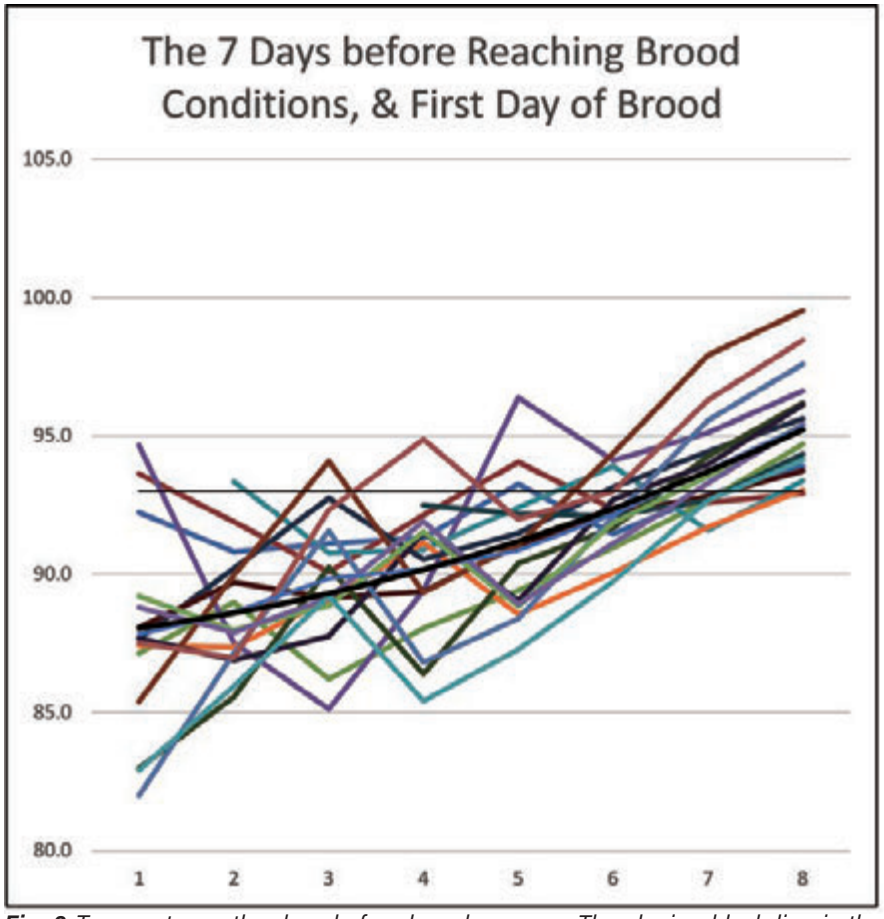



***Fig. 2*** *Temperatures, the days before brood appears. The sloping black line is the average.*

temperature changes around the time of the swarm (Figure 5).

The third swarm occurred in the brief interval between the final exterior temperature peak and before this data set was collected; there is insufficient data to determine whether significant temperature changes took place around the time of this third swarm, but it appears that there were few if any changes.

To summarize, based on the data from these three swarms: This sensor configuration may reveal that a swarm has occurred, especially if multiple sensors indicate the presence of brood, as with the April 6 swarm. If brood temperatures are not being tightly controlled, however, the signals from the temperature sensor grid do not visibly change with swarm events.

### Swarming: pre-swarm indicators

Learning that a colony has swarmed is worth something, but beekeepers would much prefer to know when a colony is about to swarm, so that the swarm could be prevented or captured. Swarm preparation may be visible in the data, as the bees warm up their flight muscles — and the hive's interior — before departing (Seeley, 2003; Zacepins, et.al. 2016). Swarms tend to depart at mid-day, however, when the outside air is also warming, and this outside warming tends to warm the hive's interior as well, which means that data analysis to detect a swarm warmup must distinguish between the normal daily temperature increases and swarm warmups.

Figure 6 makes a swarm event look obvious. This line is the average of six temperature sensors in the center rear of the hive on the day of the first swarm. The colony swarmed when the temperature peaked. Unfortunately, if we plot the three previous days on the same axes (Figure 7), you can see that the temperatures rose at the same time on those days as well. Temperatures on the day of the swarm are different, but not that different, from the temperatures on the non-swarm days.

Plotting individual sensors, rather than their average, yields the same uninformative result. And temperature data from the hours preceding the two afterswarms is even less predictive.

To summarize, the hypothesis that swarm warnings could be issued based on detecting pre-swarm warmups is not supported. This outcome is unexpected for two reasons: first because of reports in the literature that swarms warm up before departing, and second, because the first

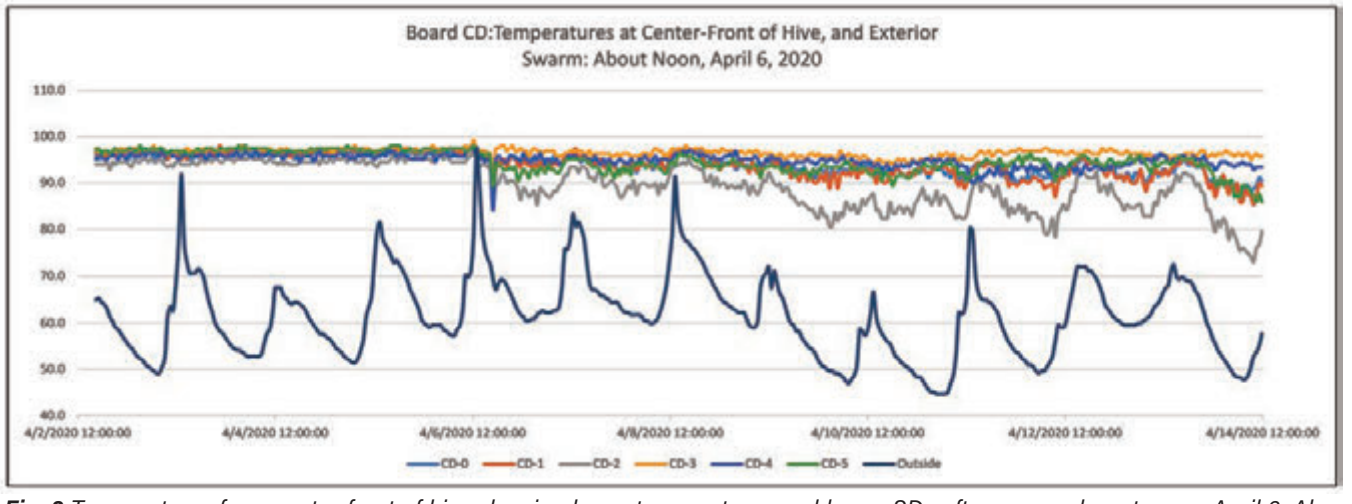



***Fig. 3*** *Temperatures from center-front of hive showing lower temperatures and larger SDs after swarm departure on April 6. Also visible: a brief drop in temperatures immediately after swarm departure; the sensor grid was removed for a colony inspection.*

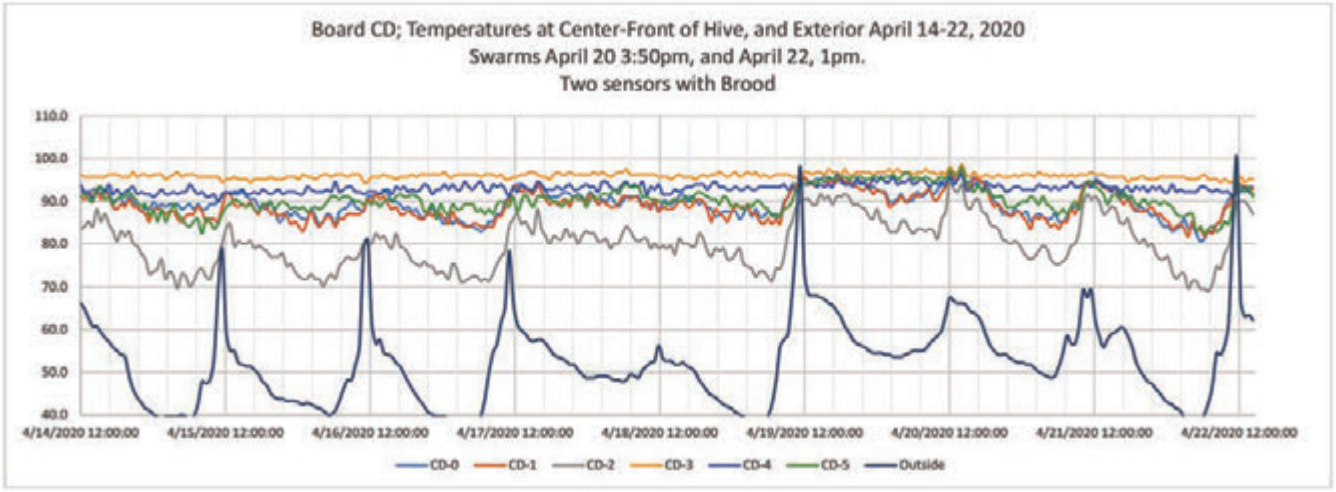



***Fig. 4*** *Temperature conditions during two afterswarms. These temperature data show little or no evidence of their occurrence.*

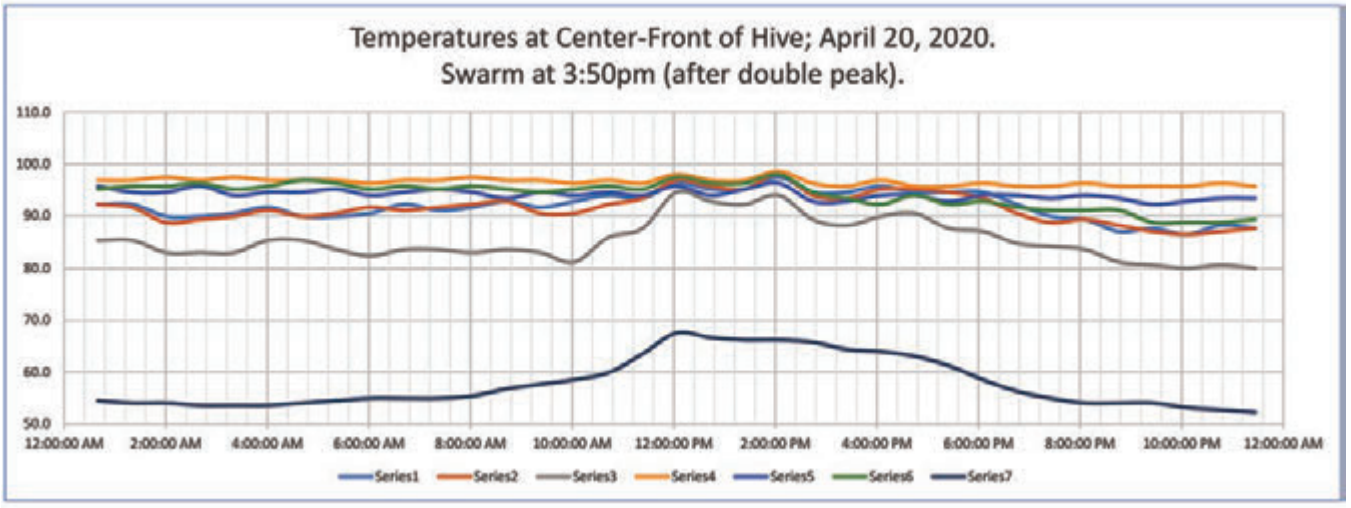



***Fig. 5*** *Swarm on April 20: Neither warmup nor post-departure temperature changes are visible in the data.*

author had previously detected a pre-swarm warmup — in an observation hive. One difference in the latter case is that the observation hive was kept at room temperature, a constant, so that the pre-swarm warmup was not confounded by temperature rises on other days.

## Conclusion

This research has shown that a relatively inexpensive and unobtrusive sensor unit comprised of a dense array of temperature sensors, each measuring temperatures in an area smaller than 3% of the box it is monitoring, can detect the size, movement, and location of the winter cluster; the

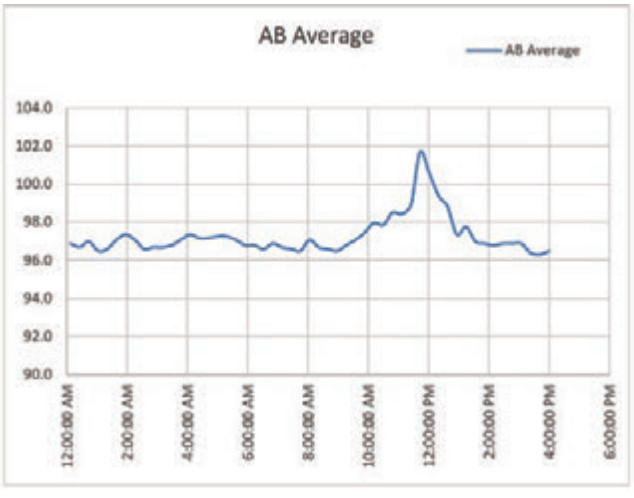



**Fig. 6** *Temperature peak at the time of swarm departure. Average of six mid-hive sensors.*

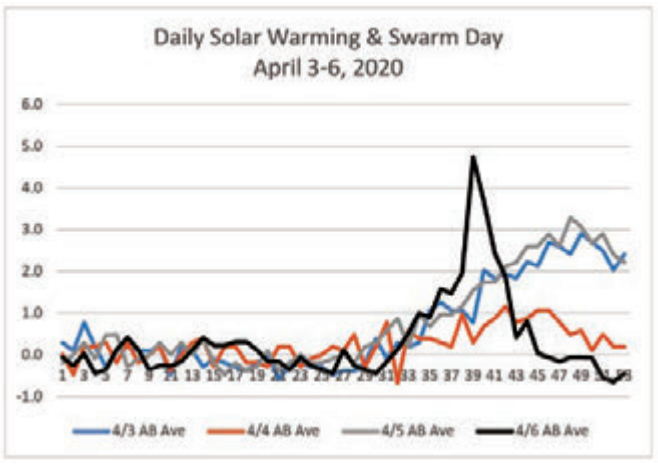



**Fig. 7** *Morning and mid-day temperatures, swarm day and the three previous days; normalized on their average morning temperatures*

start of brood rearing; the quantity of brood; and the departure of some, but not all, swarms. To our knowledge, no other colony monitoring technology system currently in use can monitor these colony characteristics as closely. Although this particular arrangement of temperature sensors cannot indicate exactly where the queen is laying, it can make an informed guess.

This work is a step in the process of developing multi-sensor networks that continuously monitor the health and productivity of honey bee colonies with great precision. With such networks in place, we expect to enable beekeepers to intervene early to address issues while avoiding disturbing their colonies with unnecessary inspections.

## References


**Dunham. W.E. (1930)** Temperature gradient in the egg-laying activities of the queen bee. Ohio J Science 30:403–410. Retrieved from: https://kb.osu.edu.

**Li Z, Huang ZY, Sharma DB, Xue Y, Wang Z, Ren B (2016)** Drone and Worker Brood Microclimates Are Regulated Differentially in Honey Bees, Apis mellifera. PLoS ONE 11(2): e0148740. https://doi.org/10.1371/journal.pone.0148740

**Linton, F. 2017.** Monitoring Colony Activity with Temperature Sensors: a Research Agenda. Apimondia 2017. Istanbul Turkey.

**Seeley T, Kleinhenz M, Bujok B, Tautz J (2003).** Thorough warm-up before take-off in honey bee swarms. Naturwissenschaften 90:256–260

**Zacepins, Kviesis, Stalidzans, Liepniece, and Meitalovs**. Remote detection of the swarming of honey bee colonies by single-point temperature monitoring. http://dx.doi.org/10.1016/j.biosystemseng.2016.05.012.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# Memphis Medical Startup Heals with Honey

## Product bioengineered for chronic or acute wound care

**by JUSTIN STOKES**


Can honey help heal wounds? For students of history, there's evidence answering this question dating back to 3000 B.C.E. According to the peer-reviewed medical journal Wounds,[1] the ancient Egyptians used honey as part of the "Three Healing Gestures" process that included cleaning the site of the wound, applying a plaster dressing made with honey and other materials, and bandaging the area.

There is also an array of more modern examples of honey's usage in wound treatments. Many medical studies published by the National Center for Biotechnology Information address the use of honey in wound care, including an article from 2013. It provides an updated review of published literature addressing the benefits of honey-based wound treatments entitled, "Evidence for Clinical Use of Honey in Wound Healing as an Anti-bacterial, Anti-inflammatory, Anti-oxidant and Anti-viral Agent: A Review."[2]

*Isaac Rodriguez, Chief Science Officer of SweetBio*

Combining what historians and scientists know to be possible, several companies are in the wound care space using honey, specifically manuka honey, in their products. This is exactly what the Memphis, Tennessee-based medical device startup SweetBio is doing. The commercial-ready company currently produces tissue engineering products for the management of wounds. These products help manage nine different wound-types: 1) full and partial thickness wounds; 2) pressure ulcers (stages I-IV); 3) venous stasis ulcers; 4) diabetic ulcers; 5) surface wounds; 6) traumatic wounds (healing by secondary intention); 7) surgical wounds; 8) abrasions; and 9) donor site wounds.

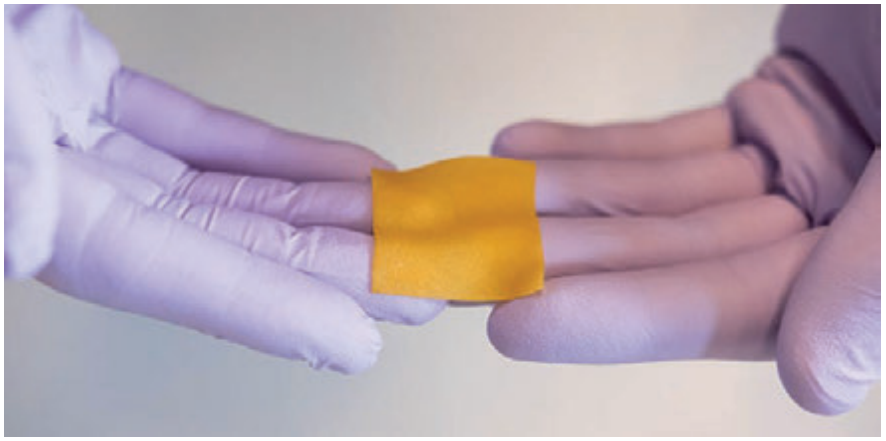
Isaac Rodriguez, PhD, is the co-founder and Chief Science Officer of SweetBio. A quick study of his bio on the company's website reveals some impressive credentials, including 15 years of experience in the biomedical field, over 900 citations attributed to his work in academic journals, and inclusion as a keynote speaker for NASA Langley's 2017 Hispanic Heritage Month Celebration.

"I earned my PhD in 2013," Rodriguez tells American Bee Journal, sharing that his undergraduate work was at the University of Virginia. He later pursued his masters and doctorate degrees at Virginia Commonwealth University. "And I specifically focused on the design and development of biomaterials that go into the body, that biodegrade, and that can regenerate the different types of tissue — whether that's bone, skin, ligament, tendon. I even collaborated on some vascular and ocular tissue engineering projects."

Isaac says that his goal was to design a material that the body recognizes as a part of itself — and not a foreign entity — to promote the healing process, so that damaged or diseased tissue may repair itself faster. While at the University of Memphis as a postdoctoral fellow, Isaac comprehensively researched the mechanical and cellular properties of tissue regeneration. As a result, he co-invented what would become SweetBio's platform technology.

He and his academic mentor, Dr. Gary Bowlin, saw that these "scaffolds" for the advancement of healing had practical potential in everyday use for the medical community, and wanted to turn the platform technology into a business product. However, there was a stumbling block: Isaac realized that while he had the scientific background to create a company like SweetBio, he would need help from someone with business experience. So, he reached out to his sister and told her, "We have this product in the lab that could be something. Can it be a business?"

Isaac's sister, Kayla Rodriguez Graff, provided the initial guidance for the company before signing on as co-founder and CEO of SweetBio. Her resume includes an MBA from Hult International Business School, a front-end developer certification, and six years as a marketing professional for the Target Corporation. After founding the company in 2015, Kayla was able to steer SweetBio into different business accelerator programs — including the Springboard Enterprises Health Innovation Hub 2019 cohort, ZeroTo510, LaunchTN, and Steve



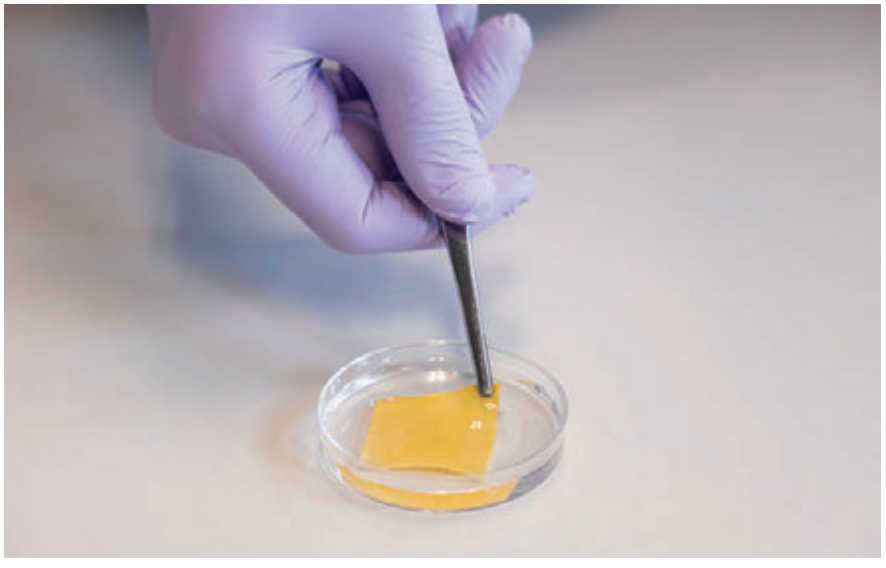
Case's 2018 Rise of the Rest tour — to tap into the skills of experts in the field and move forward strategically.

Isaac says that part of what SweetBio is currently doing is to help with problems related to both surgical and chronic or hard-to-heal wounds. He explains, "Sometimes these chronic wounds, like foot ulcers, are open for months to years and do not heal. Our product provides cues to the microenvironment to help get those wounds from a chronic/stalled state into a progressive state to where the wound can close."

In terms of the tech used by SweetBio, the product — which was cleared by the FDA for use in 2019 — is called "APIS." The website describes APIS as: "An advanced synthesis of proven materials … a bioengineered wound product for the management of chronic and acute wounds. APIS covers and protects the wound, absorbs exudate, and creates a moist wound environment. In vitro data demonstrates that APIS® reduces bacterial load, decreases MMP-9, and triggers the release of growth factors, which has been shown to instill balance in the wound microenvironment and progress the wound towards healing."

Isaac explains the name of the product, saying, "We call it 'APIS' because ... '*Apis mellifera*' is 'honey bee' in Latin … we're paying homage to the bees." APIS is a solid, flexible, biodegradable sheet that is applied to the wound or surgical site to manage that wound. The sheet degrades within two weeks. Over that period, the product provides an environment that supports the healing of that wound.

The sheets are synthesized at the molecular level and are made from gelatin, manuka honey, and hydroxyapatite. They are shelf-stable at room temperature, usable within minutes (some applications call for hydration in sterile saline prior to use), can be cut to fit specific wound shapes, and can be applied in any orientation. Isaac says that while gelatin has been used for other wound care products, the hydroxyapatite added to reinforce the sheets marked the first time that the component had been commercially applied in such a way.



*Depending on the wound, the Apis bandage may be hydrated in sterile saline prior to application.*

It was the manuka honey, however, that brought the whole project together. Isaac says that integrating manuka honey was his "Aha! moment" for APIS. This research leveraged his PhD experience and drew inspiration from history and other means of treating wounds today. He explains, "Even today if you go to the hospital with a burn, you may get treated with a sterilized and filtered manuka honey gel or paste. This specific type of honey has been proven medically for decades. We wanted to see how we could use it outside of its messy, sticky short-term application form. Specifically, how can we incorporate it into a longer-lasting sheet or device that can be potentially implanted into the body and last longer?"

According to Isaac, the wound care market as a whole is crowded. What sets SweetBio's products apart is that they're a comprehensive, advanced wound care treatment that's a balance between cost and quality. In comparison, products released by other companies are either too expensive or are narrowly focused to support either the early or later stages of wound healing. Isaac says, "They each have an important role. The less expensive, lower-end products are known for complementing the early stages of wound healing. They help with blood-clotting and managing inflammation. However, they don't help with the later stages of proliferation and remodeling. If you look at the higher-cost products, they assist with the later stages of healing because they deliver growth factors that tell the cells what to do. What is missing is a product that can treat a wound from beginning to end."

As crowded as the market might be for wound care, Isaac says that SweetBio is one of a few companies that can offer an advanced-yet-affordable option for such treatments. "We're creating a unique category," he states. "Our next body of work is reimbursement so that we can increase the access of our technology to those who need it most, including Medicare patients."

APIS is currently available in two sizes, a 2.5 x 2.5 cm sheet and a 1.6 x 1.6 cm sheet — ideal for smaller wounds such as surgical sites, diabetic foot ulcers, and Mohs surgery (a precision surgical technique used to treat skin cancer). To date, over 100 patients across the country with a variety of wounds have been treated with APIS.

Isaac jokes that even though the APIS sheets are made from gelatin and manuka honey, there's nothing exciting about the way that they taste. This combination of ingredients, however, does have an advantage over non-honey-based treatments. Isaac says that they've observed that the familiarity that consumers have with the APIS components of manuka honey and gelatin makes them more comfortable with the product, even requesting it in a few cases from their physicians.

But if APIS is made from manuka honey, will the current challenges to honey bee health adversely affect the company? "Bees play a critical role in our ecosystem," Isaac shares. "Manuka honey comes from bees pollinating from the wild-growing manuka (*Leptospermum scoparium*) plant in New Zealand. We've partnered with a supplier that is conscious of the bee population and is active with promoting beekeeping. Medical device companies with honey gel and paste products require a significant amount of honey raw material. Since our products uniquely synthesize manuka honey with other materials, we are able to maximize the impact of a smaller amount of honey." Isaac uses the example of a soda can, and says, "If that was honey, we could manufacture several thousands of products out of that one can. While a little bit of honey does go a long way, we are passionate about exploring ways we can give back to the bees and are looking forward to initiatives in 2021."

Every year offers a new challenge with different themes for SweetBio. After navigating FDA regulations, partnering with other entities to help guide the business, and protecting their intellectual property, SweetBio's itinerary for 2021 includes commercialization acceleration, new product development, and continued scientific and clinical data collection. Already making progress on the clinical data collection front, SweetBio's clinical trial with Vanderbilt University[3] using the APIS sheets for Mohs surgery was published in September 2020.

"Having an innovative product and being the first to do something in any industry presents its own challenges," Isaac says. "Our team is uniquely equipped with decades of experience in marketing, operations, research, and more that will contribute to our ability to successfully navigate these potential challenges."

For further information about SweetBio, including the APIS brochure and updates related to the company, visit their website — **http://sweetbio.com/** and social media — **https://www.facebook.com/sweetbioco/**.

**References:**


1 **Treadwell, Terry. (2007, September).** Honey's Healing History. Wounds. **https://www.woundsresearch.com/article/7749#:~:text=The%20ancient%20Egyptians%20used%20honey,been%20found%20in%20Egyptian%20tombs.&text=Although%20it%20was%20said%20to,Gestures%E2%80%9D%20used%20by%20the%20Egyptians**.

2 **Yaghoobi, Reza; Kazerouni, Afshin;and Kazerouni, Ory. (2013, July).** Evidence for Clinical Use of Honey in Wound Healing as an Anti-bacterial, Anti-inflammatory Anti-oxidant and Anti-viral Agent: A Review. *Jundishapur Journal of Natural Pharmaceutical Products*. (**https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3941901/#:~:text=Honey%20has%20anti%2Doxidant%2C%20anti,content%20and%20hydrogen%20peroxide%20content**) (**https://sites.kowsarpub.com/jjnpp/articles/18311.html**)

3 **Wallace, Matthew. (2020, September).** Enhanced Secondary Intention Healing vs. Standard Secondary Intention Healing in Mohs Surgical Defects on the Head and Distal Lower Extremities. **ClinicalTrials.gov. https://clinicaltrials.gov/ct2/show/NCT04545476**

# Oregon Master Beekeeper Anna Ashby Brings Honey to Resort's Table


Photo by Sarah Gemmill

by DEWEY M. CARON

Hidden away in the beautiful rolling countryside of Yamhill County, 45 minutes south of Portland, Oregon, is the 5-star Allison Inn & Spa, a 10-year-old destination resort. This 85-room luxury hotel and spa attracts vacationers and wine aficionados from far and wide. Befitting its reputation, the resort offers "the finest in dining" at their Jory restaurant. The menu features farm-to-table dishes from their own on-site Chef's Garden, managed by Oregon Master Beekeeper Anna Ashby.

The 1½ acre garden and 2880 square foot greenhouse seasonally grow a wide variety of vegetables and fruits. They supply the farm-fresh fruits and vegetables, plus honey, served daily to guests and an expanding local clientele. As Garden Manager, Anna coordinates closely with the Executive Chef to supply a wide variety of menu and seasoning items, something that she has perfected over the past seven years.

Anna learned the art of vegetable growing as a youngster in the Willamette Valley of Oregon, helping on her parents' large (half-acre) post-depression-era/World war II garden. She continued her interest as a lifelong vegetable gardener. She began teaching others as an 18-year participant in the Oregon Master Gardener program. She has logged countless hours in the county extension office as a phone volunteer responding to horticultural questions, and giving numerous presentations at MG events. She is the "go to" vegetable garden specialist, teaches the winter vegetable garden session to new students in the current MG training program, was treasurer of the county Master Gardeners for 11 years, and was recognized as Master Gardener of the Year in 2005.

### Learning beekeeping

Producing the honey as Chef's Garden beekeeper initially was a challenge. Her first season, the garden had two honey bee colonies on the north side of a shed in the shade. They provided some honey that fall but did not survive the winter as they were not given any mite treatments. It was her introduction to beekeeping and she loved it, but she knew she needed to learn a lot more in order to become successful. So the next spring she enrolled in the beekeeping short course of the local bee association. Through her extension Master Gardener activity, she heard of the establishment of a new statewide Oregon Master Beekeeper Program and also started in the 2014 Apprentice class.

That next spring the Chef's Garden apiary restarted with two new nucs. But then disaster struck. Anna had an anaphylatic shock from a bee sting on her lip. On her visit to an allergy specialist, it was determined she was allergic to both honey and bumble bees and yellow jackets. So she began bee sting therapy. This required careful avoidance of a sting, and allergy shots every 4 to 6 weeks over the next three years. She is now able to take a sting, and in fact gets her "booster" injection thanks to the bees and occasional yellow jacket stings without an adverse reaction.

In the interim Anna dressed to protect against getting stung and used her growing familiarity with bee care to improve the apiary and management of the bees. The Apprentice program includes a mentor and four seasonal learning opportunities with a guided instructional course. Taking the cue from the information, she improved hive placement by moving the apiary to the corner edge of the Chef's Garden. For mite control she used powdered sugar dusting in keeping with the resort's organic food production dictates. But once again the two nucs, after another small harvest, did not survive the winter.

### Improving success

Rather than become discouraged, she decided to continue her beekeeping education and enrolled in the Journey level of the Oregon program. For this level, the emphasis is self-study and mentoring of others, perfect as a match for Anna who "prefers reading and self-study as a means to learn." And she enjoys helping others, so she mentored a summer intern and a garden assistant. She completed the 2-year program and became one of the first students to tackle the Masters level.

She began to teach a portion of the local association's beginner short course and to work protection of bees and pollinators into the Master Gardener instruction and her

*The entry to the Allison Resort. See grapevines in the background.*

many garden club talks. She helped organize a new local bee group. Anna also upped her game with the garden colonies, switching to Apiguard to control varroa mites. The colony number grew to five, and best of all they all survived the next winter.

Currently, by alternating formic acid (Formic Pro) and essential oil thymol (Apiguard), plus oxalic acid after brood rearing has ceased (all organic treatments), winter survival continues improved as has the honey harvest. The 2019 season was exceptionally good; harvest was 290 pounds, and the Garden purchased a Maxant 2-frame reversible extractor. This past winter 7 colonies and 3 nucs successively overwintered before COVID-19 spring changed everything.

The virus pandemic closed the resort for 10 weeks. Staff was furloughed with essential staff hours cut drastically. The Garden needed attention. The bees were split heavily to stave off swarming and to enable sale of four nucs. Fortunately it was an early spring with March and April weather very favorable for bee colony expansion. Unfortunately this was followed by an extremely heavy swarming season. The early splitting paid off as there were few swarms in the Garden apiary, and 215 pounds of honey was obtained.

### Mastering becoming a Master Beekeeper

Anna has found the Oregon Master Beekeeping Program to be a great beekeeping learning tool and has become a star pupil. The initial Apprentice level helps get beekeepers off to a strong start. The Journey level builds on the first year with independent guided study and the opportunity to progress in bee knowledge hand-in-hand with bee experience and put it to use by teaching others. Last fall Anna was one of the two initial recipients of the final Masters level.

### Alternative hives

As part of her journey toward completing the OR MB Masters, Anna investigated the pros and cons of alternative hives. She outlined the evolution from ceramic, gum and skep hives to wooden hives with 8/10 removable frames, then focused on the development of modern versions of removable frame hive alternatives. She described the Peoples (Warre) hive, the Kenya top bar hive, the AZ Slovenian hive (often kept within a bee house), polystrene hives, and the long (horizontal) hive. She was able to look at many of these hives maintained at the Oregon State University demonstration apiary.

She continues her own personal interest in the types of hives used to house our bees. The Chef's Garden has standard 10-frame Langstroth hives and one polystyrene hive but she "plays" with two horizontal hives in her backyard. She counts as distinct pros (compared to the other hive designs) "the benefit of only lifting individual frames instead of entire boxes, the convenience of using an extractor to harvest honey, and the ability to place the hive at a level that is comfortable to work." She feels that her two horizontal hives attract less negative attention from neighbors. She recommends choosing an alternative hive "if it makes it easy to care for the bees and brings joy, then that is the right style for you."

### Nuc hive proficiency

The Masters students are required to demonstrate proficiency in two areas. All must master diseases and pests, and then a new (to them) second proficiency. Anna elected to have practical nuc management be this second proficiency. She established a goal to make and sell at least two nucs her initial season and then to double that number the next year. Nuc sales would enable her to have funds to purchase additional equipment and an extractor for the Chef's Garden. She was also interested in exploring the possibility of overwintering nucs and utilizing them in spring swarm control.

So following her review of the literature on nuc making, she split the four overwintered Chef's Garden hives to establish four nucs of 3 to 3½ frames of brood plus 1½ to 2 frames of nectar and pollen in early April. Two of the nucs received purchased queens, one had a queen from the previous year, and the last one had a sealed queen cell. The nuc with the queen cell did not succeed but the other three did and were sold in May. Two more nucs were made (with locally sourced purchased queens) in anticipation of overwintering them, but one queen did not take and the other nuc was needed to bolster a weaker hive.

The following spring was hectic in the apiary. Weather delayed hive management but not spring development of the colonies. Swarming was elevated. After observing a swarm leave (and fly to cluster high in a tree), she divided the remaining colonies to establish 5-frame nucs (2-3 brood frames in each). Unfortunately the overwintered colonies continued to swarm, (half were captured); two additional swarms followed the lead of the first and settled high in a fir tree.

Part of the reason for the heightened swarming was the decision to raise queens rather than purchase queens for nucs to be sold. This meant establishment of nucs was delayed, in concern that mating might not be possible. This put the management behind the bees' timetable. But the delay paid off; the nucs developed nicely, and homemade queens were introduced in all five, which were subsequently sold as late spring nucs before the end of May.

### Outreach project

Masters students must do a project to become certified. Projects are either outreach or research. They can be student-designed or be involvement in an ongoing research/extension effort. Anna elected to design her own outreach project which she designated "Ask a Beekeeper." She included the "Ask an Expert" tab of the Oregon Master Beekeeper Program. Note: The "Ask an Expert" program is to change to "Ask eXtension" later this year.

*Fall Bee hive with slatted rack, Vivaldi board and robbing screen*

Anna had been responding to the "Ask" program as a Master Gardener. She added new tabs to her profile to indicate what kinds of questions she wanted to answer such as "beekeeping," "bee health," "pollinators," "bees," and "honey bees." The "Ask an Expert" responses require vetted, research-based information, not personal opinion; Anna researched extension/bee club resources to back up answers. During the first six months she answered 54 queries from beekeepers in seven states and a handful of questions from outside of the U.S. She sought to answer questions the same day or by the next day.

As part of the project Anna prepared a 17-page report giving some analysis of what types of questions were asked, where she was able to find resources to include in her responses, and an analysis of responses. She stated that each question required research on her part. The feedback, from 24% of respondents, was all positive. She continues to service the "Ask an Expert" site.

### Future growth

Anna's journey from neophyte to seasoned veteran, with a detour to become desensitized to bee stings, was step in step with the growing development of this Master Gardener into a Master Beekeeper.

While fulfilling program requirements, she has learned how to care for bees and protect them against deadly varroa mites, and she has reached out to teach others and to try new hives and web platforms. She now supplies income from nuc sales and her last two large harvests have allowed the Allison resort to give out promotional 3 oz. skeps of honey. The gift shop may soon sell their own honey. I wonder if mead is not far behind — it would go well with the resort-produced wines. The spa sources local beauty products but the manager has been inquiring about using honey and beeswax from the Chef's Garden bees for their clientele.

Although bee care suffered in this virus year, they have still exceeded expectations and the garden has had a bounty of produce. Things have picked up now that the resort has reopened and once again they are hosting special events (a wedding in early August for example). The restaurant customers are slowly returning. And the garden and bees now again have her full-time attention. They have an experienced Master in Anna Ashby to ensure continued success.

**Dr. Dewey M. Caron** is Emeritus Professor of Entomology & Wildlife Ecology, Univ. of Delaware, & Affiliate Professor, Dept. Horticulture, Oregon State University. He retired in 2009 and moved to Portland, OR to be closer to grandkids. Dewey remains active in bee education, writing for newsletters, giving Bee Short Courses, assisting in several Master beekeeper programs and giving presentations to local, state and regional bee clubs.

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## *Lactobacillus acidophilus*

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## *Bacillus subtilis*

is a "fungistatic" microbe, meaning it prevents the growth of molds and other undesirable fungi, including *Ascosphaera apis*, which causes chalkbrood disease (Alippi et al. 2000, Reynaldi et al. 2004). Feeding *Bacillus subtilis* has a strong positive effect on honeybee colony health and performance (Sabate et al. 2012).

## *Bacillus licheniformis*

secretes secondary metabolites, which inhibit the growth of pathogens such as *Paenibacillus larvae* (Alippi and Reynaldi 2006).

## *Enterococcus faecium*

can be scarce in honey bee environment because of its high susceptibility to pesticides glyphosate and chlorpyrifos. *Enterococcus* bacteria found in bee bread produce bacteriocin-like inhibitory substances against multiple pathogens (Audisio et al. 2005).

## *Bacillus pumilus*

can survive for long periods of time in harsh environments, then inhibit growth of multiple pathogens (Reynaldi et al. 2004).

## *Lactobacillus plantarum*

helps detoxify pesticides such as neonicotinoid imidacloprid (Daisley et al. 2017).

**By, Dr. Vera Strogolova**

American Bee Journal

# MarketPlace


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**Doubles, singles, brood for sale year round. FOB Jan-April, Oakdale, CA. April-Dec., Milton Freewater, OR. Queens less than 6 months, great equipment. Ryan@sweetbeehoneyco.com (360) 907-0842. $5k min. purchase.**

**WILD SURVIVOR BREEDER QUEENS NW Feral Stock - Hardy - Hygienic Mite Tolerant - Disease Resistant. – OLYMPIC WILDERNESS APIARY Isolated Yards – (360) 928-3125. www.wildernessbees.com**

2020 Early-bird pricing – School House Bees. Italian & Russian Hybrid package bees & queens: P/U – KY ship-Midwest. 5-frame nucs & single hives P/U – KY. Pails of Spille's honey all year. **www.schoolhousebees.com** (859) 356-1350.

PACKAGE BEES AND QUEENS for sale Spring 2020. Double deep 10-frame and 8-frame hives. Powell Apiaries, 4140 Co. Rd. KK , Orland, CA 95963. Phone (530) 865-3346. FAX (530) 865-3043.

JERRY FOSTER QUEENS quality Carniolan and hybrid Italian queens at competitive prices. NUCS and packages also. Jerry Foster Apiaries, 937 9th St., Colusa, CA 95932 Phone (530) 458-4234.

Spring-summer queens @ 20 in 100 quantity orders. Postage paid and insured. Call Steve 239-896-0777 or **7bees7@gmail.com**

ITALIAN PACKAGE BEES, 3# $92.00, cage included. Pick up only. 50 minimum. 10% deposit. Cottonwood, CA. Sam & Joyce Van Vleet, (530) 347-1987.



## NUCS

**NEW! ZipNetBags.com! 36"x26" double layered net bag w/36" zipper to transport NUC of bees. 281-556-6798, info@ZipNetBags.com**

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Honey and Beeswax wanted. All colors and varietals. Send samples or call Smitty Bee Honey (712) 748-4292.

Wanted: Plate filter and 400 boxes of drawn combs, prefer white. Phone 1-620-365-7919 or email **madelinecooper@sbcglobal.net**

## HELP WANTED

Full time position available in Oregon. Beekeeping experience and CDL required. Contact **Ryan@sweetbeehoneyco.com** PO Box 558, Milton Freewater, OR 97862 (360)907-0842.

Seasonal and full-time help needed at our migratory bee operation. We are located in FL and WI. We do pollination, queen rearing and honey production. Some experience preferred, team environment, wages dependent on experience, good opportunity or advancement. Prior work history and references required. Contact Gary at (262) 689-1000.

Olivarez Honey Bees/Big Island Queens is seeking motivated beekeepers to join our Hawaii team! Experience preferred. Self-motivator and ability to work in a team environment a plus. Positions are full time, salary based on experience. Great Benefits Package. Prior work history and references required. Advancement opportunities available. Submit resume to **info@ohbees.com** or Olivarez Honey Bees Inc/Big Island Queens, P O Box 847 Orland Ca 95963, Fax: 530-865-5570, Phone 530-865-0298

Need help unloading & loading hives for 2021 Almond Pollination in CA? We can unload in your holding yards or our holding yards. Hives are also needed for 2021 almonds. Services available in the Central Valley. Call for info. Miguel (559) 313-6038.

Beekeeper/Laborer - Looking for a member of our beekeeping team. Must reside on the South-West side of Hawai'i Island. Full job description at **www.hawaiianqueen.com/careers**. Send resume and cover letter to **hiqueen@hialoha.net**.

Kona Queen Hawaii seeks MAINLAND migratory beekeeper to lead Stock Testing department based in FLORDIA. Full time, benefits, competitive salary. Management experience preferred. Contact **hiring@konaqueen.com**.

## MISCELLANEOUS

The AMERICAN BEEKEEPING FEDERATION has many benefits to offer its members. ABF also offers a free Beginning Beekeeping Packet to individuals starting or looking into beekeeping. Contact AMERICAN BEEKEEPING FEDERATION, 500 Discovery Parkway, Suite 125, Superior, CO 80027, 720-616-4145, email **info@abfnet.org**. You can also find out more info about ABF at **www.abfnet.org**

## PERIODICALS

L'ABEILLE DE FRANCE—The most important of the monthly publications in France - for all beekeepers, from the amateurs to the professional. Each month: an article for beginners, reports from specialists, a review of the latest information all over the world. Ask for a sample Annual subscription: 40$ US. ABEILLE DE FRANCE- 5, rue du Copenhague-F 75008 PARIS.

THE AUSTRALASIAN BEEKEEPER—Senior Beekeeping Journal of the Southern Hemisphere. Complete coverage of all beekeeping topics in one of the world's largest beekeeping countries. Published by Pender Beekeeping Supplies Pty. Ltd., "Bilga" 79 Naylor Road, Urila, N.S.W. 2620, Australia. Annual subscription paid in advance $160 AUD.

THE AUSTRALIAN BEE JOURNAL—Caters to both amateur and commercial apiarists. Subscription $120.00 Australian currently for all overseas subscribers per annum. Published monthly. Victorian Apiarists' Association, Inc., P.O. Box 40, California Gully, Vic. Australia 3556 Ph: 03 5446 1543, Email: **vaa@vicbeekeepers.com.au**.

BEECRAFT The UK's leading monthly beekeeping magazine. View a digital copy and subscribe on line at **www.bee-craft.com**.

BIENEN & NATUR, Still being the bee magazine with the highest circulation in Germany, bienen&natur greeted readers in 2020 with a new look und structure. Each issue focuses with a special section on a particular topic to give deeper insight and understanding to what keeps bees alive and healthy. It`s a practical guide for beginners, advanced and experienced beekeepers that brings traditional and alternative methods to the table. Monthly publication of 80 pages. Subscription per year: € 53.00 print edition/€ 34.99 ePaper **www.dlv-shop.de, www.bienenundnatur.de**

HIVELIGHTS, National magazine of the Canadian Honey Council. Published quarterly. Free sample on request, write to Canadian Honey Council, Suite 236, 234-5149 Country Hills Blvd. NW, Calgary AB T3A 5K8, CANADA. Subscription information available at WWW**www.honeycouncil.ca**

HONEYBEE NEWS, The Journal of the New South Wales Apiarists' Association, Inc., International Subscription AUS$50.00 (Airmail) Bank Draft, Visa or MasterCard payable to NSW AA. Published bi-monthly—For more information contact: The Editor, PO Box 352, Leichhardt NSW 2040 Australia. E-mail: **honeybee@accsoft.com.au**

IBRA (the International Bee Research Association) is a unique organization established in 1949 for the advancement of bee science and beekeeping. It publishes two magazines: JAR – the Journal of Apiculture Research, for scientists, and BW - Bee World, for beekeepers who want broaden their horizons by learning about other beekeeping traditions, other bees, other ideas. Members chose which magazine(s) to include in their membership. IBRA is a vital bridge between the local (hive) and global concerns. IBRA is registered under UK charity law (Office: 91 Brinsea Road, Congresbury, Bristol, BS49 5JJ, UK) **www.ibrabee.org.uk**

IRISH BEEKEEPING—Read An Beachaire (The Irish Beekeeper). Published monthly. Subscription $50.00 per annum post free. Dermot O'Flaherty, Journal Manager, Rosbeg, Westport, Co. Mayo, Ireland

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SOUTH AFRICAN BEE JOURNAL – The official magazine of the South African Bee Industry Organization (SABIO). Published quarterly in English, with Afrikaans articles, on the South African Honeybee sub-species of Cape Bees and African bees. For enquiries send to **info@sabio.org.za** or refer **www.sabio.org.za**

ULADAG BEE JOURNAL - Publication of Uludag Beekeeping Association, published quarterly in Turkish (with English titles and summaries of all articles) and English in all aspects of beekeeping; beekeeping news, practical beekeeping, and research articles, and considered a link between Turkish beekeeping and the world. Gazcilar Cad. No. 9/2 16220 Bursa-TURKEY Fax:+90 224 224 3964 **http://www.uludagaricilik.org.tr**

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