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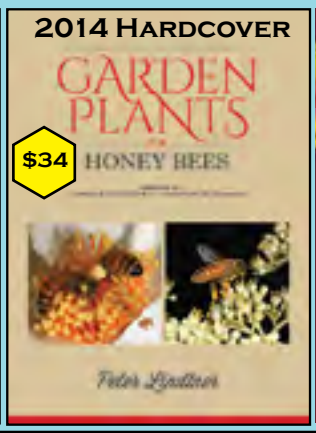

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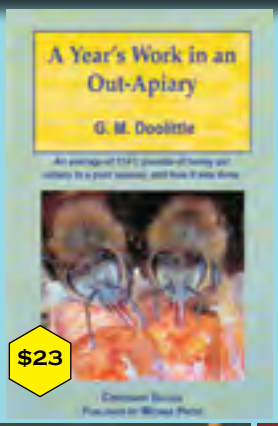

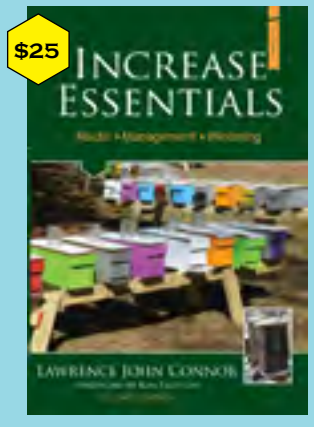

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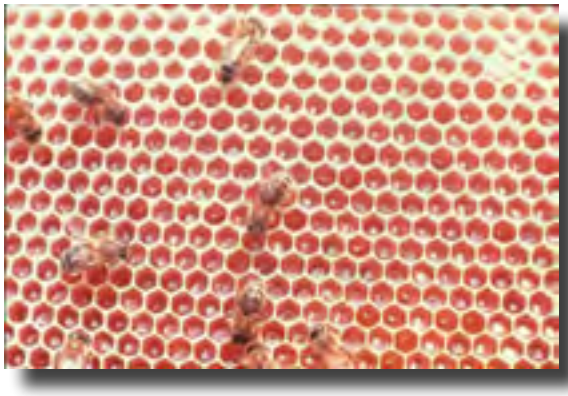

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Executive Publisher – John Root

Associate Publisher, Senior Editor – Kim Flottum, Kim@BeeCulture.com, Ext. 3214
Assistant Editor, Design – Kathy Summers, Kathy@BeeCulture.com, Ext. 3215
Social Media, Event Specialist & Subscription Coordinator – Amanda DeSimone, Amanda@BeeCulture.com, Ext. 3255
Advertising – Jean Newcombe, JNewcombe@BeeCulture.com, Ext. 3216
Publications Assistant – Kelsey Kelly, kkelly@RootCandles.com, Ext. 3220

Contributors

Clarence Collison • James E. Tew • Ann Harman • Kim Lehman • Phil Craft • Larry Connor
Connie Krochmal • Jessica Louque • Toni Burnham • Ross Conrad • Jennifer Berry • Ed Colby

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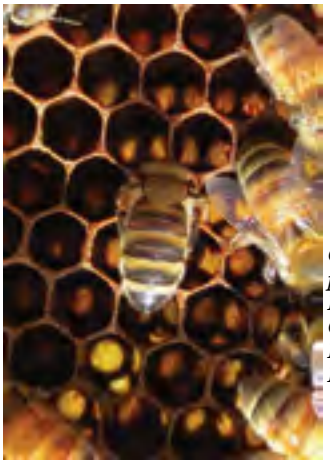

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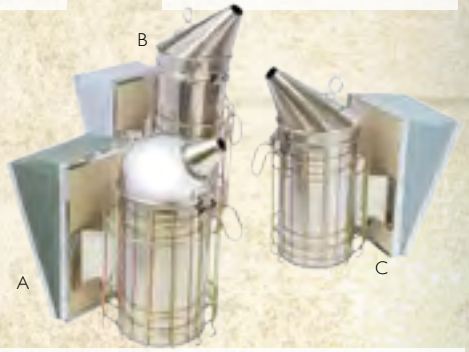

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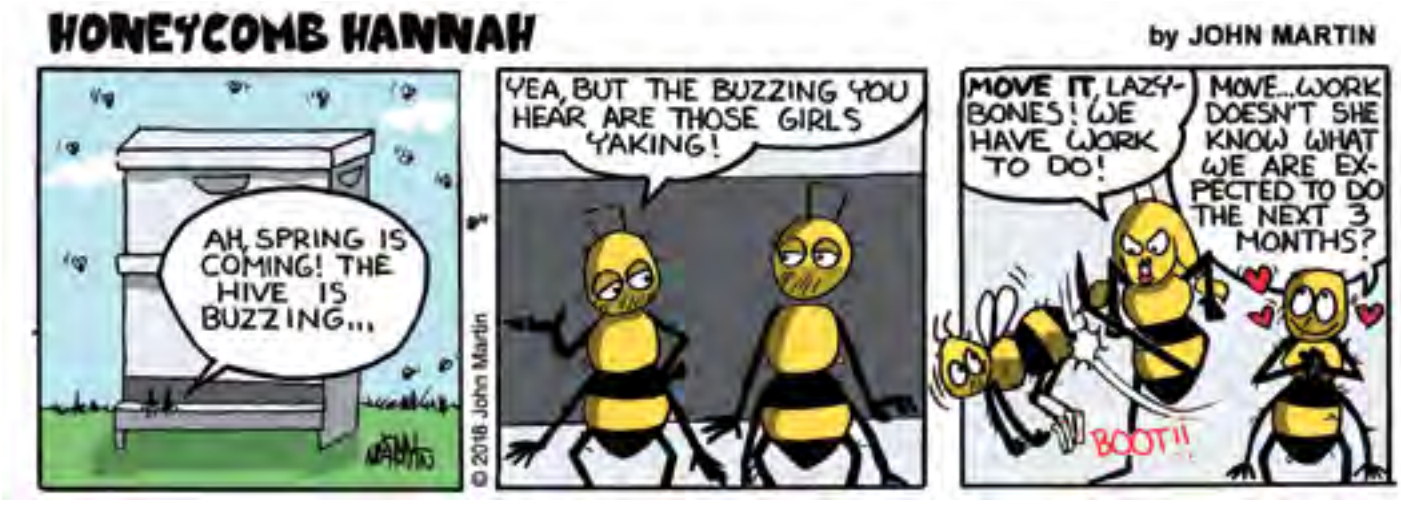

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Improvised Log Bee Gum

A time ago bags of onions were transported to Idaho for the purpose of resale. It became necessary to walk along the Clearwater River.

Since that trip a letter entitled "It's Not So Old" has been printed in the July 2009 issue of *Bee Culture*.

My Dad operated a non-motorized extractor that month when almost 99 years of age. After teaching vocational agriculture, he built a soil lab and was the oldest man to walk at the Bloomsday held at Spokane Washington annually.

I've journeyed at times with a pack and this year had a book printed entitled "Walks on the Kahlotus Road". When hiking along the Clearwater River, some Indians mentioned I could stay at Spalding Park. When doing so for several days, at night tall grass was utilized to form a blanket that would provide for a degree of warmth. The Spaldings built a mission near Lapwai and Lewiston Idaho and traveled west with the Whitmans. It had been Marcus Whitman that was influential at helping develop settlement of the west and mainly the Oregon territory. When Eliza Spalding and Narcissa Whitman also ventured west, the Indians had never seen any European women until then.

The first attempt to transfer hives west was with a covered wagon. This occurrence was during 1846 and severe weather prevented it being successful. Doing so was accomplished in 1854.

Oregon beekeepers began to realize a profit when Italian bees were introduced and hives could be transferred from California in 1846, the Brownings, who were poets, got married in London.

When homesteading was a common practice, Dad's family also homesteaded at Oregon. It's in Harney County and near the Malheur Gomez Refuge. Steens Mountain is at a distance and when visiting its natural environmental wild bees and bumble bees were noticed.

When the family of 10 moved from a shack they did so with a wagon and team of horses. They resettled near Welle-Walk Washington near the Whitman mission.

The August 1962 issue of *Gleanings in Bee Culture* discusses the effectiveness of honey for the treatment of minor injuries. Dad family's mother would apply mud for a remedy.

A photo of an observation hive has been sent. The man who did its construction termed it a log bee gum hive. A bee gum is defined as a colony that lives in a hollow log. Hives used to be found in three types of shelter; straw skeps, bee gums and bee trees.

Forested areas at the North had trees with cavities where bees could nest. Early hives were called gums and were practiced until the Langstroth hive became popular in the twentieth century.

The location of the observation hive is at my property where a 1929 Model A Ford truck is. When situated at the man's property who built it, some eight frame hives were being maintained. He and his wife owned an old dodge car, had a flock of chickens and some pets that would perform and be rewarded. Usually he preferred pancakes instead of bread and ate quite an amount of garlic.

The strain of bees were Caucasian and he claimed they were easy to manage. It's not understood if the observation hive was used the four seasons of the year. It has a large stationary frame at the center that holds five deep frames at each side are four large frames mounted with hinges. They each hold five regular sized

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frames. It has got an inner cover and supers could be added. A large door at each side permits entry and allows for observation and human activity.

Willie Rogers
Kennewick, WA

Comb Honey Hive

Dr. Tew, I may know the answer to your question. Did not know you would give us a test.

To give you my background, I started beekeeping in 1952. My father had bees but he ended up in a wheel chair. He had worked 20 years for Hubbard of Onsted, MI. He taught me from his wheel chair. I got 10 hives and packages from Walter Kelley. Today I question how my parents found the money for this?

I said to my father "Why should I extract honey for 12 cents a pound when I can get 35 cents for comb honey?" Retail on section honey was 50 cents. So we got 30 section comb supers. By 1959 I had 100 hives and got state farmer award in FFA.

Best get back on track here. The reason the section comb super is between the hive bodies is to get the bees to start drawing comb in the CHS. After they get started it can be placed on top of the two-story hive. This is back breaking work for an old man. I still keep bees for section comb honey.

My mother always said "she never knew a beekeeper who did not have a bad back."

My old friend and mentor Baxter Woodman said "It's easier to work the beekeeper than work the bees."

I enjoy reading Gleanings every month.

Jack D. Allen

Fight Against Varroa

I was reading the article about Samuel Ramsey and new hope in the fight against *Varroa.* As we all know the saying is today "There are drugs for everything and nothing but drugs for anything". Nature or rather God has provided us with remedies for every illness on the planet but we have to find them. Just for example some years ago one of the presidents (was it Reagan? I am not sure) declared war on cancer but today America is further behind than ever. However some scientists are proving cancer is as easily cured as athletes foot, but the drug company will not listen because it is natural and they cannot get a patent on it or in other words money in our eyes is standing in our way for these cures.

However I hope it is not standing in our way for bee cures. For the most part bee scientists would be only too glad to find something that would work even if it would prove his past research wrong (I hope I'm right).

Now for a few ideas. Have you ever tried dousing bees with certain honey? That might kill *Varroa;* or even herbal teas or colloidal silver anything for that matter? Maybe we should work harder on building up the bees immune systems.

On another subject If Mr. Torbjorn from Iceland can keep bees over Winter on 25 to 35 pounds of honey are the mites hurting our bees more than we realized? I wonder, so do anything Tonè but keep it simple.

David Swarey
Tyrone, PA

New For This Spring –

bees-at-law. By Noel Sweeney. Published by Alibi, Veritas Chambers. ISBN 978-1-872724-04-1. Available from the author or Northern Bee Books, for $50.00. 6" x 8.25", soft cover, 345 pgs.

The author of this book is an attorney specializing in animal law. He has written about dogs and dog welfare, and animals-in-law and animal welfare in general, so has an all-around understanding of how animals, people, communities, other animals and the law work together, or not.

He appreciates the value of bees to man and the environment, and summarizes that generally the law has a paternalistic view of bees and supports their cause whenever it can. Judges generally hold bees in high esteem, being a positive force for good for our society.

The author states that this work analyses how the background of the judge and the behavior of the beekeeper towards his neighbor can be the crucial factors that determine where the liability of each lies. And, it considers the treatment meted out to bees in many different ways for many different reasons, save for the fact that legally it is often related to a distinct lack of care for their welfare. Laws are the only system that can save bees from their natural enemy:

us, he adds. The author of this book is from the UK, so it has a UK historical slant to it, but only a very little. Much of the recent history comes from the US and the UK, while the historical insights of course are from Roman, Greek and previous ages.

The format of this book is different than you might first suppose. It looks at bees and people, and what can and will happen when they mix. He looks at the value of bees, honey bee history, how dangerous bees can be, he examines in depth and width negligence in both principle and action by bees, beekeepers, farmers, neighbors and the like. He talks of pests, crime against bees, and finally searching for the soul of a bee.

He does all this using case studies, and the decisions of judges for or against plaintiffs and defendants. Citing work all the way back to Plato and further, he analyzes the results of important, precedent setting cases and justifies, defends and explains the resulting decisions. Many of these were found in the US, the UK, and many in other countries. It is a look at bees and people from a global perspective.

And it is one of the best histories of keeping bees I've run across. What happened when and why, and what happened because of it shape much of the legal issues bees, beekeepers and the world we inhabit together enjoy, or endure, depending on which side you are on. If you live in New Jersey right now, or are curious about this historically legal look at bees and people, this should be on your shelf.

Kim Flottum

The Book Of Bees. Written and illustrated by Piotr Socha. Published by Thames and Hudson, Ltd., London. ISBN 978-0-500-65095-0. 13.5" 11". 72 pgs., all color, hard cover. $20 on Amazon,

This very big children's book, translated from the original Polish is an absolute wonder. Each two page spread is essentially a chapter covering a topic, including Bees and dinosaurs, the honey bee's body, the queen bee, swarms, dancing, sev-

eral pages on pollination, fruit and vegetables, and the plants bees like, bees in history from Egypt, Greece, Rome, St. Ambrose, Napoleon, forest beekeepers, the modern hive and equipment, different kinds of honey bees, how bees make honey and even a bit about present day almond pollination. The art, so briefly shown here, is amazing and so easy to use. In a couple of places the two page spread is more like a newspaper with short articles on a variety of topics. One is shown here.

This would be a week's worth of study with a child, with the words at the bottom describing the marvelous art on each page, and then all the detail on each spread. Share this book with a child this year.

Kim Flottum

Mead and Honey Wines. A Comprehensive Guide. By Michael Badger, MBE. Published by Brown Dog Books, **www.selfpublishingpartnership.co.uk**. ISBN 978-1-78545-195-9. Available in paperback, hardcover and e-book. 378 pgs. Color throughout. 6.25" x 9.25". Paper is $43.00 U.S.

I've had some experience with this book because the author asked me some months ago to write the Epilogue, so I had to be in on the ground floor as it was being produced. Plus, I got to share some of this with Ken Schramm, who was asked to write the Foreword. This is good company to be in.

The part of the title that is most useful is A Comprehensive Guide. It is just that. Michael talks about mead in general which is a good overview of the product and the process, but then details methods and practices for mead production that is excellent, and from my point of view, stresses record keeping to its fullest, a habit not to be taken lightly with this craft. The equipment needed and how to use it are part of this, and a fundamental look at handling honey.

Problems happen, and fixing them is next, followed by bottling, corks, equipment, aging and serving. Things I wouldn't have considered but are as necessary as the honey itself. He has recipes for meads, and honey wines, along with Pyments, Melomels, Cyser, Hippocras, Metheglin and honey vinegars. Advanced mead techniques is followed by the flavors of honey, a subject I've had some experience with and finally exhibiting and judging mead at shows.

Ken Schramm said it best. This isn't a book to read. It's a reference book to use. If mead is part of what you do, you'll do better. If it isn't, you'll start out right.

Kim Flottum

Lannie Ballard of Natural Bridge proudly displays his recently issued patent. The patent is for a one-person hive lifting tool he designed to aid young beekeepers, female beekeepers and older beekeepers who have lost strength in their hands to lift beehives often weighing up to 70 pounds.

Available at Dadant & Sons.

The redesigned Honey Squeeze is more eloquent, efficient, and affordable. The stainless steel construction comes with a lifetime warranty and is 100% made in the USA. The machine dispenses honey, maple syrup, chocolate syrup, agave, and simple syrup without mess or contamination. It weighs only three pounds 11 ounces and measures 14 inches high, 7 inches wide and 6 inches deep. It will display nicely on any kitchen countertop. For pricing and more information visit **www.thehoneysqueeze.com**.

The Bee Corp

The Bee Corp., an IU-based agriculture tech startup, receives NSF grant of almost $225,000

The Bee Corp., an agriculture technology startup founded by Indiana University alumni, has received federal funding to conduct research to improve its beehive monitoring system.

The National Science Foundation awarded The Bee Corp a one-year SBIR Phase I grant of almost $225,000. The company is pursuing an additional $50,000 in matching funds offered by Elevate Ventures, a private venture development organization that nurtures and develops emerging and existing high-potential businesses into high-performing, Indiana-based companies.

The funding will allow The Bee Corp. to build upon the baseline statistical model of a healthy hive developed by the company in 2017. The new model will look for anomalies in hive data that correspond to common threats to hive health, including pest- and disease-related problems. The findings will be used to improve existing monitoring products for beekeepers.

Ellie Symes, CEO of The Bee Corp., said the NSF grant represents a significant milestone.

"The National Science Foundation award will allow us to discover new insights about honeybee health through hive data," she said. "We will be able to build better models of hive activity and develop new applications for internet of things technology within the beekeeping industry."

Ting Gootee, chief investment officer of Elevate Ventures, said the matching grant encourages small businesses to explore their technological potential.

"Originally an Indiana University student-led venture, The Bee Corp. shows how young entrepreneurs can find success if matched with the right resources. Their innovative approach combining tech and agriculture first attracted Elevate Ventures to invest in June 2017,"

she said. "We are thrilled The Bee Corp. has earned an SBIR Phase I award so we can continue our support."

The Bee Corp. has hired Gretchen Riggs, its first non-founder employee, as a data scientist. She will spend the majority of her time working on the grant project.

"Gretchen will analyze data collected during the project," Symes said. "She will lead a three-person team of IU graduate students to build and test algorithms and make recommendations on product creation."

For more information, contact The Bee Corp. at **info@thebeecorp.com**.

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Innovate Indiana engages strategic partners to advance Indiana University's intellectual resources and expertise, enhance Indiana's economy, and improve Hoosiers' quality of life.

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When woodworkers Kyle Lagendyk and Bill Ryan founded Bespoke Bee Supply in 2017, they set out to craft the most environmentally responsible hives and beekeeping accessories available on the market. The sweet payoff of their efforts: Langstroth and Top Bar Hives that waste 30-60% less lumber than conventionally made hives and are made with only Forest Stewardship Council-certified wood.

These sustainable hives also eliminate non-natural (and unnecessary) design elements, such as metal roofs or plastic windows, which ensures a healthier environment for the bees (and the rest of us). And the company has a pending Benefit Corporation status, which shows its commitment to social and environmental advocacy, public transparency and accountability to the beekeeping supply industry.

Each hive is made by hand in Bespoke's Portland, Oregon workshop with wood sourced from nearby Pacific Northwest forests. No aspect of hive production is outsourced, ensuring the quality of each one.

By ensuring every practice and process sticks to a strict set of environmental and bee-first standards, Bespoke truly lives its motto – beekeeping for good.

Hives and other beekeeping products can be found at bespokebeesupply.com and are shipped nationwide. You can follow Bespoke on Instagram for tips and behind-the-scenes peeks at **instagram.com/bespokebeesupply**.

Hives: from $169.99; use the code **BEECULTURE10** at checkout for 10% off hives on your first order.

INNER COVER

I have several interests in life that aren't directly involved with bees, beekeeping and beekeepers, but most of them have a tie somewhere that you could point to and say, sure, that affects what you do every day with bees. And you'd be mostly right.

Jess, my daughter, would be one of those things. Twenty some years ago she moved to Oregon because she loved the forests and water falls and weather. She banged around for a while but eventually married a local and settled in. Hiking and exploring and nature in general became a way of life, and working a variety of jobs was what made that possible. One job was in a small town grocery store, interestingly. Since I grew up in that environment we had something in common to talk about when we visited or phoned because hiking and water falls aren't part of my life at all. She knew some local beekeepers, and because of the magazine and me, knew enough to talk to them intelligently, which made that part of her life interesting too, though she didn't have bees or hang out much with those folks.

Oregon kind of fell apart for her last year, and moving to Medina seemed like a good choice so she showed up in June last summer with her cat and dog and stuff. Not long after arriving Kath and I were headed out to the beeyard one day and Jess asked if she could come along. Well, sure I said, a bit surprised because I don't think she'd ever worked bees, but why not. So we got her suited up (though not quite perfectly because the bees found an opening in the veil zipper, and her fuzzy socks that I hadn't checked), and out we went. The veil and ankle thing took some of the shine off that day, but with essentially no experience, she did just fine and seemed to enjoy the time with the bees and just being outside. Though not happy about being stung she wasn't put off and we did this several times last Summer when time permitted. So now she enjoys the bees, and beekeeping and just being outside, which was her life in Oregon. Of course good protective gear helps a lot. So now sometimes we have help, and she has another outside adventure to chase, and something that wasn't a bee part of my life is now a bee part of my life. And that's a good thing.

•

Another tie to bees that I don't get to do enough is to enjoy honey tasting adventures. The book that Marina and I did a bit ago, *The Honey Connoisseur*, is all about honey plants and how to taste the very different honeys those plants make. From that beginning Marina developed The American Honey Tasting Society. Much like wine tasting, there are specialized classes and techniques and even equipment to use for this. She took tasting a lot further than the book though, and, like those professional wine tasters, called sommeliers, has attended several very specialized classes in Italy specifically aimed at learning the sensory experiences, and the aroma and flavor experiences needed to be a Honey Taster. These classes she took are taught at the Italian National Beekeeping Institute in Bologna. So now she teaches people this art and science, and every year hosts classes you can attend to learn this skill yourself. Chefs, food professionals, brewers, mead makers and beekeepers are standing in line to take these classes in order to make educated selections of the best varietal honey for specific recipes and cheese, beer and mead pairings. For reasons only the honey bee gods are aware of, her classes have always been scheduled at the same time I'm in another state doing something else, so I haven't been able to attend one yet. This past Summer she had short introduction classes at the EAS conference and we did a FaceBook live event at one of them that you can see on *Bee Culture's* FaceBook page. Over 2,000 folks have tuned in so far. They initially scheduled just one class, but demand was so great they had to do several to accommodate all that wanted to participate. This is not a fad, but a growing body of dedicated people who want to learn this fine art.

And she did it again. She's having two courses this Spring, a two hour class in March and a two-day event in April and I can't make either one. But if you're interested, check out the American Honey Tasting Society web page at www.americanhoneytastingsociety.com for more info and registration. I can't be there, but you can, and there's only so many seats at the table.

•

Two other things in my world that I find fascinating are anything about water (simply, there isn't enough of it and how we use what we have), and land use. There isn't enough of that either, and there's getting less every day. The USDA does a pretty good job of keeping track of how much land is used, and what it is used for. Over the years they've changed some of the definitions of land use, so it's kind of hard to track some uses over time, but it's pretty good.

Selling Honey.
Land Use.
Local.

They just came out with updated information on land use and it's sorted by states, regions and the total of all land in the US. They have specific use categories assigned to urban, crop land, non-crop land, forests, pastures, and others. I've always found the urban use data the most interesting because it shows how much land we cover with asphalt. John Miller once said the last crop was always concrete and he was right. Here's some of the data.

They started keeping this information at the end of the Second World War, 1945. What I like to look at is essentially growth of urban areas over time. Let's see . . .

Over all, urban land use in the US, between 1945 and 2012 increased 78%. It went from 15,012,000 acres to 69,441,000 acres. You can see below those regions that grew faster, about the same, and slower than over all growth in the country.

The Northeast - +70%. ME, NH, VT, MA, RI, CT, NY, NJ, PA, DE, MD, Dist. Of Co;

Lake States - +68%. MI, WI, MN

The Corn Belt - +71%. OH, IN, IL, IA, MS

Northern Plains – 66%. ND, SD, NE, KS

Appalachian - +86%. VA, WV, NC, KY, TN

Southeast - +89%. SC, GA, FL, AL

Delta States - +76%. MS, AR, LA

Southern Plains - +86%. OK, TX

Mountain - +87%. MT, ID, WY, CO, NM, AZ, UT, NV

Pacific - +98%. WA, OR, CA

So I knew you'd ask, the population in 1945 was 139.9 million people, and in 2012 it was 314 million people, only a 54% increase. We have more people now than then, but each of us is taking up a lot more room. Move over.

•

Did you look at the Honey Report page this month? It tells not only honey and honey bee product prices across all regions, but it looks at where they sell them. There's an old saying about being in the beekeeping business, and that's to stay ahead of the game, you have to get everything but the buzz out of your bees. Every beekeeper, or nearly every beekeeper has honey to sell. Often, too, beeswax, but the most oft asked question is – where do I sell this stuff?

A honey for sale sign in the front yard is a starter. More serious? Get a sign a mile, a half mile and 50 yards down the road in both directions, and have an easy place to pull over. And those signs have to be big enough to read at 65 mph. If you live in the country that is. That's tough to do if you live in town. But nearly 90% or our reporters are selling on average 30% of their honey from home (actually half of these folks sell 40% or more of their crop this way, and 10% sell all of it this way). Either as a pay as you go stand in the driveway, or inside the front porch, or just on a table out front. It works. And it works because everybody who stops and buys knows the person selling the honey is the beekeeper that made that honey. It's local, don't you know. And local honey is almost as good a medicine as Manuka honey, don't you know.

It's the same at work. Nearly 50% of our reporters sell honey at work, or at least to people they work with. And almost as popular is selling honey to local Mom and Pop grocery stores. Local is the name of the game today, and has been for some time. But with foreign honey, and all the bad press foreign honey is getting, so much of the game anymore, local is what people want. LOCAL. You can have a label made that says local. I know, my name and address are already on the label, somewhere. But a top label that screams LOCAL works better. A hang tag that says not only local, but what kind is better.

Farm markets, too, sell a lot of honey for not quite as many beekeepers. Farm markets are local. That's LOCAL again. Farm markets, for the most part, only sell stuff that vendors make. The season long markets are less fussy because it's tough to get local tomatoes in Ohio in December, unless they come from a green house, or aquaponics operation, and we happen to have both here in Medina, so, yes, those tomatoes actually are local. And they are better than the Florida tomatoes in the grocery store. Much better. LOCAL. Use it. It works.

•

Catalogs. Have you looked at all the catalogs this year. They continue to get better, on average anyway, every year. I listen to small operations complain about the cost of catalog production. The layout and design, printing, mailing. It is expensive. We know because we do something similar every month with this magazine and every three months with BEEKeeping. Layout and design, printing and postage. We don't mail as many as some bee supply companies do in a single mailing, but over the course of year I'll be we mail many, many more. One thing I tell these folks about catalogs is to consider them an employee. They go to work every day for you, they don't complain, they don't call in sick, they don't need health insurance, and they don't goof off. And you don't have to feed them, clothe them or babysit them. They just do what they are supposed to do, all year long. I have a stack of them at home I keep close all year long. I don't buy anything from a bee supply catalog, but I use them for reference when I'm doing something like this. They come in handy, and if you don't use them for that you should. How do I do this? What size do I need? Where can I get one? It's all there, in that catalog. I have to tell you though, Amazon is all those things but one – Amazon has never answered a question I had about honey bee biology. Not once.

•

It's March, finally. That woodchuck in PA was right about more winter. It's been, well, less friendly than the past few years this year. I'll be glad when I can get the smoker going again. I'm cold.

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It's Summers Time –

Upcoming Bee Culture Events, Chickens and Winter

A lot is going on right now in the land of *Bee Culture* and it's all good. I think 2018 is going to be a very exciting year for us. For starters Kim and I leave a week from tomorrow (February 17) for New Zealand. This is exciting and not something that was ever on my radar. We are flying to Auckland and then travelling south with different beekeepers and Kim is giving seven or eight talks along the way. I'm going to try and do a good job of journaling our travels this time.

Here at home we are excited to welcome two new ladies to our *Bee Culture* team. Kelsey started with us just before Christmas and is learning the ropes. We've got her answering the phone and handling a lot of our customer service. She's helping with subscriptions, mailing, organizing the honey report and whatever we throw at her. She is very resilient and not afraid to tackle any job.

Brenda is just now joining our team and will be taking over the layout and design of *BEEKeeping, Your First Three Years* – our quarterly publication for beginners. She'll also be helping me out with creating ads and promotional material for *Bee Culture.* This will help to free up some of my time so I can concentrate on several book projects that we have waiting on my desk.

The big one for this year is the next edition of *ABC and XYZ.* Kim and the team of editors have just about finished their part of gathering all of the content and photos and it's just about to land on my desk. We did the last one over 10 years ago. This will be the 42nd edition. It will most likely be over 1,000 pages. So watch for it. I'll keep you posted, but we're hoping for Summer 2018.

July 21 *Bee Culture* will host our Annual Pollinator Day. Over the past four or five years we have planted several gardens on Root property and it has become quite impressive. We also have other groups that are managing gardens here. The Pollinator Partnership people have three plots and the Master Gardener's have a plot. We have pollinator plots with seeds from Ernst Seeds, from Tractor Supply, and from a local co-op, Town & Country.

This year on Pollinator Day we will also have people from Project Apis m, the local Soil and Water people, Monarch Watch, a local bakery that makes their goods with local honey, local produce for sale, face painting, food and honey for sale. We put up tents and tables and we talk bees, bats, butterflies and pollination all day. So if you're passing through Medina that day stop and say hello and enjoy the day with us. It's free and we'd love to see you.

Bee Culture's other annual event will be held October 19-21 right here in our *Bee Culture* Conference Center. This year we are bringing in four speakers that are going to tell their stories. They are very successful beekeepers from different areas of the U.S. with different stories to tell. Ray Olivarez who produces queens and bees in Hawaii and California will be here. Ray ships semi loads of package bees all over the U.S. We actually get our packages from Queen Right Colonies locally, who get them from Olivarez. Ray's been here before to speak to our Medina group, and he and his wife Tammy and others came and visited our store. They were in the process of getting their store open and they liked what they saw here. They sell Root candles now.

John Miller has been here before too. He has two homes – northern California and Gackle, North Dakota. He makes honey, nucs and bees, pollinates and moves all over creation.

Bret Adee and his family are the biggest beekeepers in the "Universe." They manage for pollination somewhere around 100,000 colonies. We've known Bret, his dad Richard and brother Kelvin for years and have visited their South Dakota operation a couple of times. but they've expanded and Bret runs the California operation now.

Mike Palmer's operation is small by comparison to the rest, but he makes it work, and is in the best comb honey location in the world. He makes up nucs in the Spring, and extracts some honey in the Fall. He is, in our opinion, the perfect example of the independent beekeeper.

My Story from January to January – that's what these four will tell you in October.

It will be a great weekend you don't want to miss. These four will keep you entertained and we'll feed you and even show you around the Root factory and warehouse if you come in early on Friday. Watch these pages and our web page for all of the details, but go ahead and mark your calendars now.

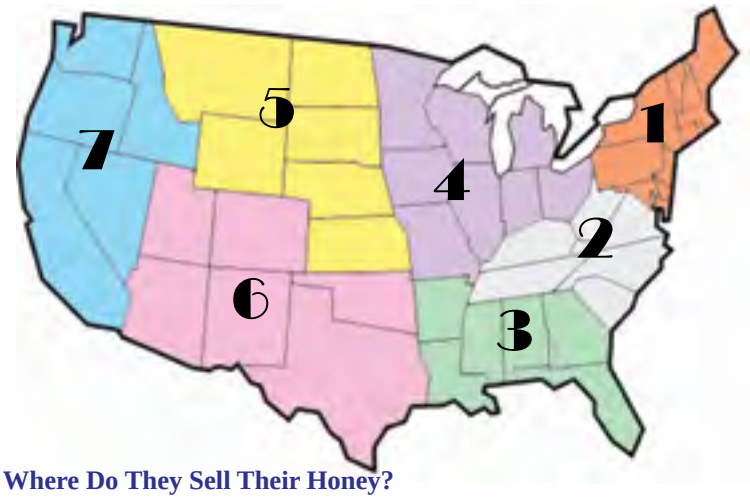
So far – it's early February as I write this – all of the girls (hens) have made it through Winter. In a month four of them will be six years old. So right now we're holding at 20. I don't think we'll be adding to the flock this year. I want to wait until I'm not so busy so I can do a better job at managing them while they're babies. The last bunch we got are doing well, but they're still very skittish. I think that's because I didn't spend enough time holding them and bonding with them.

And we will try ducks again, but not this year for the same reason – too busy. I think I've found a local guy though that can get me the Call ducks that we want. So maybe next Spring. After *ABC* is done.

I've lived in Ohio for about 40 years now and still have not really gotten used to Winter. I grew up in Texas and California – not places where you have to deal with a lot of snow, unless you want to. I'm a sissy when it comes to driving in snow and sleet. I just stay home. The cold I can handle. I just don't do well with the driving. We had a major storm this week and woke up to flashing red and blue lights outside our house. There had been an accident. Two cars driving too fast and not paying attention on our very nasty curve. No one was hurt, but cars pretty much done. And rescue workers and police officers spending an hour plus in the snow and the cold.

So now we're off to New Zealand, where I'm told it will be Summer. By the time we get back we'll be very close to Spring in Northeast Ohio.

MARCH – REGIONAL HONEY PRICE REPORT



Below is the past seven years data on where our reporters sell their honey. We have 17 outlets listed, and, yes, there are more. We asked where else, and several additional outlets were mentioned – Feedstores, coffee shops, hardware stores, church fairs, to their family, annual holiday fairs, restaurants, and orchard stores where they pollinated. 25 places to sell honey. You shouldn't have any left this year.

Sales from home took a leap this year, rising more than 20% over last year, and about 15% above the average. Gift store sales are increasing, as are sales to customers at work. Both of these are refreshing and if you don't already, take a look locally. We think it's the local in local farm markets that's driving those sales increases with more people selling there, but selling about the same amount of their crop. We also think that local small packers are taking advantage of the local honey for the same reasons and buying from more local beekeepers, who aren't, incidentally, selling more but rather keeping it home. Local honey is selling well at fairs and internet sales continue to grow in terms of amount of honey sold there.

Where Do They Sell Their Honey?

% of Reporters Selling at these locations							% of Their Honey Sales at these locations							Locations Honey Sold at
2012	2013	2014	2015	2016	2017	2018	2012	2013	2014	2015	2016	2017	2018	
77	77	72	83	61	67	87	36	73	31	39	46	38	31	Home (inside or roadside stand)
16	19	14	24	14	20	13	19	34	43	32	42	34	37	Local community - sponsored farm market (i.e. Sat. & Sun. sales)
29	28	26	22	24	20	31	40	31	29	20	44	30	29	Local Farm Market business that's seasonal (Fall only, for instance)
29	26	25	28	27	19	26	33	35	26	30	37	38	42	Local Farm Market business that's year-round
4	5	6	6	3	7	5	33	19	10	15	25	19	15	Flea Market
39	35	83	22	22	35	31	24	20	22	19	27	22	18	Health Food/Organic store
10	7	11	13	3	9	18	8	6	10	14	25	13	9	Gift Store
16	17	13	11	2	14	16	21	17	12	19	80	22	34	Bakeries/Food Establishments
14	5	10	9	10	16	16	28	5	16	34	38	18	9	Local High-End Retail Outlets (gourmet stores)
31	27	32	35	15	33	35	16	27	25	20	37	24	23	Local, Small 'Mom & Pop' Retail Outlets (grocery & gas)
17	4	7	11	7	14	18	35	13	28	45	44	43	24	Local Small Packer or Producer/Packer
2	3	3	4	2	3	3	100	67	78	83	45	55	35	Huge Packer, they pick up
11	9	8	11	9	7	10	41	51	37	45	45	48	43	Wholesale only to larger stores, you deliver to warehouse
11	5	13	7	2	14	11	9	5	5	9	30	12	5	Breweries/Beer or Mead makers
10	6	8	6	3	7	6	10	5	8	4	10	10	17	Internet, direct retail, mail order
41	41	33	19	27	36	47	21	18	13	12	34	24	25	Work, direct retail
6	16	10	7	2	16	6	6	16	13	7	27	5	17	Local/State Fair, with club

*Total percentage of sales does not come out to 100% because of multiple outlets.

REPORTING REGIONS								SUMMARY			History	
	1	2	3	4	5	6	7				Last Month	Last Year
EXTRACTED HONEY PRICES SOLD BULK TO PACKERS OR PROCESSORS								**Range**	**Avg.**	**$/lb**		
55 Gal. Drum, Light	1.90	2.19	2.35	2.60	2.23	2.35	3.00	1.80 -3.00	2.34	2.34	2.27	2.30
55 Gal. Drum, Ambr	1.68	2.16	2.10	2.43	2.07	2.03	2.50	1.35-2.65	2.14	2.14	2.11	2.21
60# Light (retail)	214.50	182.80	201.67	217.40	159.00	192.14	220.00	155.71-280.00	203.57	3.39	193.95	197.81
60# Amber (retail)	217.78	191.71	200.00	206.40	210.60	206.25	226.67	162.00-265.00	207.71	3.46	196.89	203.17
WHOLESALE PRICES SOLD TO STORES OR DISTRIBUTORS IN CASE LOTS												
1/2# 24/case	85.44	75.50	90.80	61.67	57.84	90.00	85.15	57.60-121.20	80.90	6.74	81.76	81.16
1# 24/case	126.69	107.95	130.15	117.07	106.32	136.88	128.40	84.00-180.00	124.39	5.18	120.98	120.90
2# 12/case	111.46	96.47	109.35	106.24	97.44	110.40	114.00	78.00-159.24	108.45	4.52	107.68	112.82
12.oz. Plas. 24/cs	104.90	85.44	93.50	84.17	74.40	112.40	97.20	66.00-168.00	96.59	5.37	97.69	95.40
5# 6/case	131.95	109.75	132.90	132.80	102.30	132.00	133.06	90.00-186.00	128.11	4.27	124.21	125.29
Quarts 12/case	168.89	133.05	144.61	180.00	125.64	142.79	132.00	119.00-204.00	146.90	4.08	140.58	145.41
Pints 12/case	117.95	82.75	86.00	132.00	111.34	82.65	84.00	65.00-186.00	97.17	5.40	90.93	89.61
RETAIL SHELF PRICES												
1/2#	5.46	4.29	4.70	4.65	3.26	4.75	6.50	2.92-8.00	4.94	9.89	4.65	4.59
12 oz. Plastic	5.98	5.00	5.29	5.08	4.71	6.49	6.30	3.65-9.00	5.64	7.52	5.87	5.97
1# Glass/Plastic	7.62	6.85	7.49	6.81	5.84	7.26	9.20	4.79-12.00	7.42	7.42	7.33	7.57
2# Glass/Plastic	13.51	11.04	12.53	11.58	11.36	12.00	15.00	8.00-23.00	12.69	6.35	12.28	12.13
Pint	12.89	9.12	9.14	12.95	9.00	9.94	10.13	6.00-16.00	10.16	6.77	9.89	9.33
Quart	17.09	16.38	16.22	19.63	16.80	17.90	19.37	11.00-28.00	17.43	5.81	16.91	17.29
5# Glass/Plastic	27.79	25.30	35.31	24.86	24.79	27.63	35.00	17.99-43.25	27.73	5.55	27.54	25.92
1# Cream	9.15	8.62	11.25	5.95	6.92	5.60	10.25	5.50-18.00	8.68	8.68	9.96	8.89
1# Cut Comb	12.86	9.42	9.00	8.89	15.00	6.50	14.25	5.00-22.00	11.26	11.26	10.46	10.71
Ross Round	10.03	6.73	9.42	9.00	9.42	10.25	12.49	6.00-12.50	9.60	12.80	9.94	9.15
Wholesale Wax (Lt)	7.23	4.98	5.60	6.13	6.00	4.56	7.75	3.00-12.00	6.36	-	6.45	6.30
Wholesale Wax (Dk)	6.65	4.64	4.18	5.97	6.24	3.17	6.24	2.00-12.00	5.49	-	5.32	5.49
Pollination Fee/Col.	87.50	80.00	78.33	75.00	80.00	90.00	63.75	50.00-120.00	79.81	-	80.86	86.14

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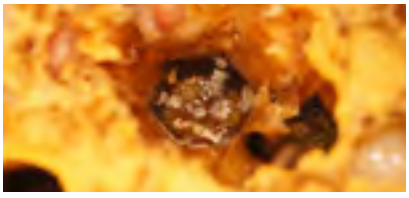

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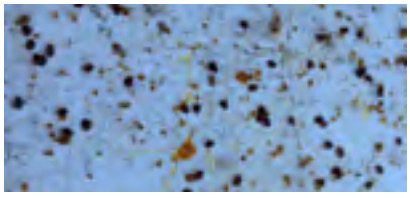

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Let The Sonenshine In: New Ways To Control Mites

Jay **Evans**, USDA Beltsville Bee Lab

Efforts to control *Varroa* mites are expanding at the USDA-ARS Bee Research Lab, in part due to a lucky break. Many students follow their Professors to new places when jobs change but it is rare for a Professor to tag along with his student. Professor Daniel Sonenshine's excellent PhD. student Noble Egekwu was recruited by the Bee Lab's Dr. Steven Cook to begin postdoctoral studies on the impacts of pesticides and mites on honey bees. While the paperwork unfolded for that move, Sonenshine had plenty of time to consider a move at the same time. Following his retirement from Old Dominion University in 2002 after 40+ years, Sonenshine maintained a very active research program as an emeritus professor there. He has, in fact, received more grants after retiring than while a full-time professor and has continued to make great advances in tick biology and control. Tempted by the chance to make an impact on an entirely different problem, he let go of his University and active tick work to join the hunt for controls against bee mites. It did not hurt that Dr. Sonenshine had strong ties in Maryland and that he and his wife were open to a new venture closer to grandkids and family. As Sonenshine says, he did not plan this, but when doors open and you see new ways to be of service you go through.

Prior to his recent arrival at the BRL, Sonenshine had never worked with *Varroa* mites although he does remember the name and story of these mites from his studies alongside tick and mite systematist George Wharton at Ohio State University. While he was late to the *Varroa* bandwagon, Sonenshine has had many noteworthy accomplishments studying the related ticks for over 50 years. For one, he collected the world's knowledge of ticks into a key two-volume textbook ("The Biology of Ticks", 1991 and 1993) and followed this with an expanded second addition co-edited with his friend and colleague Michael Roe. Sonenshine's research on dog ticks, deer ticks, and 'soft' ticks helped lay down many of the fundamentals of tick biology. He and his students described the key tick protein vitellogenin and then discovered the receptor for this protein, a 'guide' that helps the protein do it's thing in the right places (eggs, for one). He then focused on the various ways amorous ticks meet up, leading to seven patents useful for controlling tick populations. In one success that only a scientist could brag about, he developed and attached a tick lure meant for the South end of cows headed North (**https://link.springer.com/article/10.1007/BF00051475**). This lure contains an aggregation pheromone for male ticks alongside an acaricide. Once attached (careful now!), this patch is successful in leading 95% of a cow's ticks to their death under the cow's tail. The location is key since it is one place not reachable by a grooming cow (unlike bees, cows rarely groom each other). More recently, he and his students designed and validated a 'Tickbot', a remote-controlled car designed to collect and kill ticks in nature (**https://doi.org/10.1016/j.ttbdis.2014.11.004**). After navigating with the help of an embedded wire for 60 minutes, the Tikbot effectively cleared mites from a public trail. Take that, Roomba! He continues to keep abreast of tick research and has helped lead efforts to sequence and understand the deer tick genome and to determine how these and other ticks recognize their animal hosts. In many ways, his breakthroughs in tick biology helped set the stage for some of the most promising new *Varroa* controls.

Daniel Sonenshine

So what does Sonenshine have in mind for *Varroa*? A true scientists' scientist, he arrives at the lab on most days of the week, dons his white lab coat and quietly gets to work. With Drs. Cook and Egekwu, along with University colleagues, he has been pursuing new ways to raise *Varroa* in the lab. This will enable better testing of control methods for mites, some of which are hard to work out in colonies. He has also focused on *Varroa* feeding behaviors, shedding light on how mites scrape and chew their bee hosts, feeding and transmitting deadly viruses. He continues to build on his past insights into mite love-talk and is complementing the lab skills of Egekwu and Cook by identifying key chemicals used by passionate or hungry mites. The plan is to use this knowledge to distract mites and lure them to their deaths. His former student Noble will leave soon to continue studies in the lab of Professor Jamie Ellis in Florida, but we are anticipating Dan will stay behind this time to help keep the local mite efforts going. Regardless, we should all be thankful for Sonenshine's longtime dedication to the art of science and for continuing to try to make a difference, even as a volunteer. BC

BIGGER PICTURE

Jessica **Louque**

The Business of Bees, Part III

To fuel the side addictions of birds and bees, most people do have to have a real job. I'm still waiting to win the lottery so I can start a farm of pygmy goats and mini-attack donkeys and emus, but since I don't play it might be awhile. In the meantime, I feed the hobby with some fairly intense honey bee research. It can be a lot, but there's no denying the education that comes with full immersion into something different, whether it be a foreign language or bees. As of last year, Bobby and I together reached the threshold of completing Colony Condition Assessments (CCAs) on over 10,000 colonies. This is where we go through each hive and record the percent coverage of adult bees on both sides of the frame, then record the percent coverage of honey, nectar, bee bread, capped brood, open brood, eggs, and empty cells. This goes down to percentages of five, and must be done for every frame in the colony, whether it be 20 frame sides for a single deep, or 80 frame sides for a quad. You can learn a lot about bees with that sort of in-your-face work, but what it doesn't tell you is the background noise of running a business.

Bobby and Mike putting up doors on the old stable.

We have a pretty small industry in our group, but it's similar to other types of research. As I've mentioned before, honey bee testing is the last in a long line of efforts to put out a product. Similar companies have existed for years at a "Mom and Pop" level where they only do RAC trials that determine the level of residues left from pesticides in various plant matrices, but typically the fruit of the plant or whatever part of that agricultural commodity will come into contact with people. All these smaller companies know they're never going to get rich, but you can make a good living if you have good people and high expectations for quality work. Getting off the ground can be tricky though.

You probably noticed that in the past, I didn't mention a lot of what was happening, leaving many people to wonder what in the world were we doing over here. I have a bit more freedom now with my own business, but in the end, there's only so much even I can say. For everything we do, each contact, client, lab, or field team has to have a Non-Disclosure Agreement. A lot of the information is either still in the nascent stages, or the studies aren't complete. In particular, the pesticide or chemical being tested is not allowed to be discussed until the final report is released. Some of you may have seen my pesticide presentation, either through a bee club or if I taught your applicator's licensing update, and it has a lot more information on how to find what's been released by the EPA. Sometimes that can be difficult to find if you don't know where to look. Aside from the compound itself, a lot of companies jealously guard methodology on how the studies are conducted because you don't want to show your competitors something that might give them an edge over your work. The biggest part of that comes from how we extract nectar and pollen samples from different types of flowers. Having the correct methodology can mean the difference in hours to days of work to have a sample large enough to use, or you may have just wasted several thousand dollars.

Each business doing contract work also has to have a pretty big policy for liability insurance. Depending on the work you do, it's likely going to be well above the $1M mark. When we do the work, we develop an expertise that only experience teaches. However, our end product is literally data. It's thousands and thousands of sheets of data, usually collected by hand, writing down all of the observations and output and everything relevant to the study. It's not unusual to turn in over 30,000 sheets of bound data, divided by type of data, to be archived in case the study comes up for review. All of that data is compressed into a final report that can be as small as a few hundred pages or as large as a few thousand pages. Everything we record in the data is about reproducibility. We want to know that if we had to go back and do the study again, we could exactly replicate all of the completed actions that went into conducting the study. In theory, this should give you the same results, although bees oftentimes have a mind of their own and can react differently from year to year just based on weather differences or other uncontrollable variables. In reality, you'll usually get a similar data comparison, even if the numbers aren't the same. The liability insurance covers the amount it would take to reproduce a study in the event that all of the data was lost. We've had everything from hurricanes to tornadoes, but we've yet to have a major crisis where we've lost our raw data.

We also have fairly strict guidelines following the Good Laboratory Practices, which at some

point I will write about in the most boring (but informative) article I've ever written. To even be considered as a company open for bidding, you have to have job descriptions in place to explain who does what and how it's covered and what the minimum educational and experience requirements would be for each level, you have to have a master schedule that outlines the expected timing of events for each study on the books, and you have to have your Standard Operating Procedures (SOPs) in place. These are the overview of the basic practices and procedures used by your employees, some of which are mandated, and some are created to fit the needs of the type of studies conducted at the facility. We have SOPs on everything from how we move bees to how we make sugar syrup. This is the method that should be followed every time and how you teach your people to do each process so everything is always as similar as possible. Creating these SOPs aren't cheap though, because they need to be edited/audited by a Quality Assurance person, and can run you a good few thousand dollars, depending on the extent of your paperwork.

There's also the equipment needed to run a study. Just starting out, you'll need temperature monitors, freezers, freezer monitors, fireproof archiving, chemical storage, and a fair amount of other necessities just to pass your facility inspection to be allowed to bid. You also have to be prepared to do the work. In our case, doing Tier II tunnel studies requires rolls of mesh that will cost another ten thousand dollars or more once shipping is paid, and has to be ordered several months in advance for delivery only once per year. Hive equipment needs to be ready to go, and bee packages need to be ordered before you even possibly have a study that will need them. We usually use at least 100 colonies per year in studies, all of which is an up-front investment for the business. This is not including supplies like microcapillary tubes, amber vials, or more permanent lab equipment, like analytical scales that easily weigh to milligrams or lower, and weather stations that are mounted in a field. All of this has to be kept in secured areas, and you have to have everything from a lab/office space to barns with tractor trailer access.

Our office door with the first graphics.

You may have seen photos of our sugar rampages, but we go through around 40,000 pounds of sugar a year sometimes. Sugar has to be ordered by the full truckload, which is 18 pallets at a time. These need to be stored in a climate-controlled area that is also kept in a low humidity state. Preferably, this is near your sugar syrup tank with an excessive hot water heater. We ended up having to build a 30,000 square foot ag barn that has a separate section for cold storage with tractor trailer access, a platform for a 500-gallon mixing tank for sugar syrup, and hot water access on the outside of the building. That doesn't include shelter space for trailers and other equipment. We ended up having to "remodel" two of our old tobacco barns where we can store the hundreds of hive bodies and frames and feeders so they aren't out in the weather. It's a good excuse for one of them to be repaired though, as it was built by my family well over a hundred years ago and needed some attention. The other also could use the repair, but it was just a silly 60 years old or so, practically an infant.

This is just the basic outline of what it takes to run headfirst into a bee research business, not counting health insurance, employees, training, meetings, and the terrifying thought of no guaranteed paycheck and having to take care of your people and family. I think we're off to a good start, but time will tell. In the meantime, if you terribly miss the turkeys, you can stalk pictures on my non-private Instagram account of queenofthebees2016, and you can find Louque Ag on Facebook and see our cool old barn being fixed by our agronomist and Bobby, or pictures of our trailers and other things we think are fun to post. BC

Maggie petting Scooter.

Princess and Devin Jr. in for a photo op.

Jessica Louque is a Research Scientist - Apiologist. She and her husband, Bobby, run Louque Ag, a Contract Research Organization (CRO) in North Carolina.

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Communication Among The Bees

Peter **Borst**

Like a lot of beekeepers, I have a pretty extensive collection of books about bees. They range all the way from the *ABC of Bee Culture* to *Zoosemiotics* – what the heck is that? Semiotics is the study of signs and their meaning; "*Zoo-*" refers to animals. So, it is animal communication through signs. The root *sema* is found in the word semaphore, which is a method of signaling with flags. Root states this about bees in his *ABC of Bee Culture*:

Of course, they have particular notes, as of joy, sorrow, anger, despair, etc., which are produced by the wings, usually when on the wing, but I am quite sure they are unable to communicate to each other more than a single idea (Root, 1882).

But signaling with flags can hardly convey much more than one idea at a time, so we can see that even the use of very basic symbols is a form of communication.

Most students of biology are familiar with the honey bee dance, and how it encodes quite a bit of information about the location of nectar sources. In this article I will only touch upon it; for more in depth discussion I shall defer to the excellent books on the topic, especially those by Karl von Frisch. He won a Nobel Prize for his discoveries related to the exquisite method honey bees use to indicate the distance, direction and value of a nectar source. Later researchers learned that the honey bee scouts also use this dance to tell their nest mates information about potential nest sites.

Briefly, Karl von Frisch observed that honey bees have a peculiar sort of dance that they perform at certain times of the year. It is especially noticeable during nectar flows, which gave a clue to its meaning. Spending countless hours watching the bees in glass sided hives, he began to see more clues emerge. Simply described, the dancing consists of a figure eight pattern, and von Frisch realized the orientation gradually shifted every day from morning to dusk. That is how he came to understand that the honey bees were giving a direction by referencing the sun. If the patch of flowers is toward the sun's position, they point *upward.* As the sun moves across the sky they include the angle of deviation from "towards the sun." As the sun moves east to west, the angle gradually shifts, because the sun is moving to the west of the destination.

Many volumes have been written about this. Are bees actually communicating, or is this just an instinctive mechanism of system control, like some sort of GPS device? Does it really matter if the honey bee is aware of what it is doing, when it dances? We are not continually aware of ourselves when we are communicating, especially in the middle of an intense discussion. When the message is urgent, only one thing matters: communicating clearly and directly. It also doesn't matter whether the receivers "understand" the message. What matters is that they are able to get the information and act appropriately. So from this standpoint, the honey bee dance certainly

von Frisch watching his bees.

Measuring the angle of the dance run.

Timing the dances.

qualifies as a means of gathering information, packaging it into symbols, and generating an appropriate response in the recipients. The foragers tell their mates where the nectar is, and they go there. This symbolic communication among animals is zoosemiotics. Dario Martinelli states:

The dance of the honey bee is a sign of something that the other bees cannot see, but do know as an entity, and this entity is abstractly, yet clearly, represented in their minds.

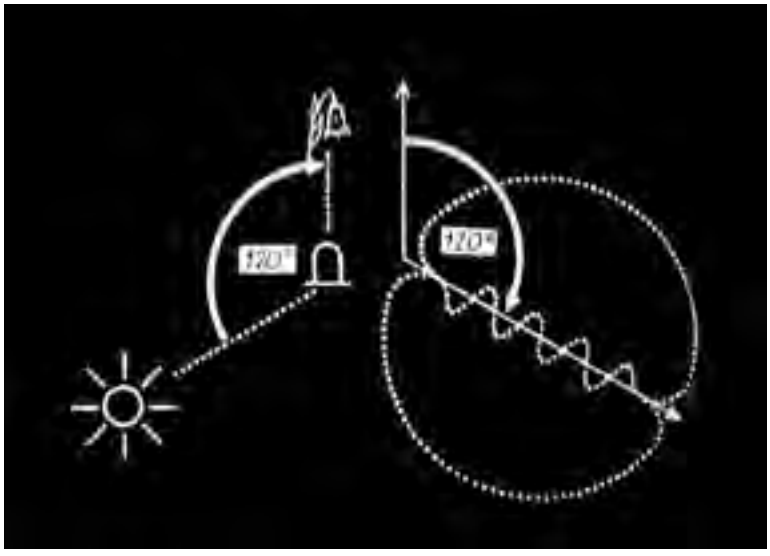
Communication, signification, representation are all zoological phenomena, rather than simply anthropological ones. Therefore: what is really communication? What is signification? Where do they come from? What are the behavioural processes implied in their production? All these questions (and attempts to answer them) are good. (Martinelli, 2010).

Since the discovery that the honey bee dance encodes navigational information, there have been attempts to refute the idea that bees use this dance to locate food sources. Some claimed that bees use only the scent of nectar on scouts to locate floral sources. Nevertheless, honey bees also perform this dance on the surface of bee swarms that have not yet moved to a permanent home, and these dances indicate the location of potential home sites.

Good Vibrations

I will not be discussing chemical communication in this article. For recent information, I recommend the exemplary article on pheromones by Dr. Christina Grozinger, in the recent edition of *The Hive and The Honey Bee*. And, chemical communication is more like a regulatory system and does not make use of symbols, or overt behaviors.

Instead, I will focus on messaging where an individual bee communicates an idea to one or more other bees by the use of physical behavior; body language, if you will. One of the interesting features of social insect groups is the dominance hierarchy. Investigators have learned that wasps are able to physically assert dominance over their nest mates. This is an example of a *single idea*: "I am the boss here, you are not." The dominant wasp behaves aggressively toward her nest mates: moving in a "menacing" fashion, tapping them vigorously on the eyes with their antennae, even biting them on the eyes, face and legs (Pardi, 1948).



In the honey bee colony, a simple and direct method of communication is the vibration or "shaking" signal.

An example of a modulatory signal is the vibration signal of the honey bee, which consists of a worker rapidly vibrating her body dorso-ventrally for one to two seconds, usually while grasping a recipient with her forelegs. Vibrating bees typically roam over large areas of the nest and produce a series of signals (up to 20 or more per min) that last from several minutes to over an hour (Schneider, 2004).

According to Schneider, shaking is a frequently used method of communicating in bee colonies, and is used in various ways and on many different types of bees including all ages of workers, virgin or laying queens and even on developing queens in their cells. Even so, he found that only about 13% of the hive bees ever use this means of communicating during their lifetime. The primary function of the vibration signal seems to be to motivate the receiving bees to increased activity, whatever they happen to be doing.

The Buzz Run

The social hymenoptera include certain bees, wasps and all of the ants. These insects live in colonies made up of hundreds or thousands of individuals. Many of their methods of communication are similar. For instance, wasps use what is called the "buzz run."

Reproductive swarming occurs when a portion of a colony leaves to produce a new colony – buzzing run activity may begin occurring at least a week prior to swarming. The scouts run excitedly with wings buzzing through groups of queens and younger wasps who are seen clustering in immobile, tight groups with their wings folded beneath their abdomens on the nest. Breaking runs disperse the clusters and often knock wasps from the nest surface (Forsyth, 1981).

This same buzz run takes place in honey bee colonies, prior to swarming. Martin Lindauer wrote about it, using very similar terminology as in the above about wasps:

It turned out that bees actually have their own signal for situations when the whole colony is to be alarmed simultaneously and quickly: it is a characteristic "buzz-running." During this, the relevant bees very excitedly and nervously force themselves through between the other bees that are standing around. In an indirect zigzag-run they vigorously push the other bees aside, while strongly vibrating their abdomen, producing a clearly audible wing-buzzing (Lindauer, 1955).

The buzz run resembles the vibration signal but also incorporates the message that the activity is to take place outside of the nest. The bees are incited to action and ultimately begin to pour out of the hive in a great rush. Soon the air is filled with bees flying back and forth in great circles. The sight does not resemble a highly coordinated flock of starlings but rather, to us it appears quite chaotic. And yet, the teaming swarm soon begins to move, often for a great distance from the hive where they originated. There certainly seems to be some signal being generated which keeps the herd moving in a particular direction.

Streaker Bees

Early observers tended to assume that the queen was the leader of the swarm. The idea that the bees are controlled by the queen persisted among societies that had social hierarchies, usually with so-called royalty that demanded special privilege and power. Eventually, observers realized that the queen does not act as the director of hive activity. However, the discovery of powerful chemicals called *pheromones* led to the idea that the swarm could follow the scent of the queen. Later, Avitabile posited the idea that groups of workers could lead the swarming bees using some sort of odor cue. Christina Grozinger explains how this theory came to be refuted:

The hypothesis that workers produce an olfactory gradient to guide swarms has been rejected because swarms can navigate to their new home even if worker scent glands are sealed, preventing them from releasing such odors. Simulations suggest that knowledgeable house hunters could visually guide the uninformed masses by preferentially traveling in the direction of the new home (with all workers generally moving toward other workers, but avoiding collisions) or by making conspicuous and fast flights through swarms (with which naïve workers preferentially align themselves). Empirical studies of free-flying swarms show that workers do indeed "streak" above an airborne cloud of bees to visually indicate the direction of the new nest site and steer the swarm's travel (Grozinger, 2014).

Martin Lindauer was the first to propose that there were bees guiding swarms by flying swiftly overhead and then circling back slowly along the side of the swarm. Tom Seeley and his colleagues were able to make use of video cameras and computer software to document the streaker bees. The guide bees flew over the swarm cloud creating visual cues pointing in the direction of the new home, the location of which had been already chosen.

They conducted interesting experiments to see if the swarms were actually following the streaker bees. Seeley's work involves prepared swarms, which he then entices with bait hives. Typically, a swarm will fly more or less directly to their destination. He placed a swarm and a bait hive where it would have to cross the flight path of a small apiary. The bees in the apiary were flying back and forth from the hives to the distant flowers in the so called "bee-line." When the swarm passed through the apiary's bee lines, many of the swarming bees became confused, lost track of the streaker bees, and began following the bees going back and forth from the apiary. This essentially proved that the swarming bees were taking their cues from streaking bees.

The Bee's Ears

People have long debated whether honey bees have some sort of ears, with which to hear sounds the way we do. Clearly, they have the other four senses: sight, touch, smell and taste. But do they hear?

In 1925, Kroning tested the auditory sense of bees with a siren. His extensive experiments lead him to the conclusion that, "Die Bienen konnten keine Tone wahrend des Fliegens horen, wohl aber in Marsch oder wahrend des Sitzens"

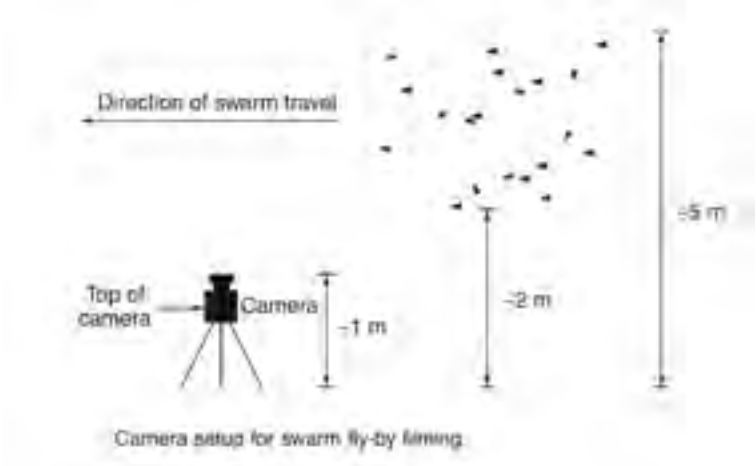
Roughly translated, this means: "The bees could hear no sound while flying, but they could while walking or sitting." Most people are aware that honey bees as well as wasps are keenly sensitive to vibrations. And while our sense of hearing involves the action of vibrations on the eardrum, sensing sound through our hands or feet is not called hearing. Honey bees have no ears at all, if you are looking for something analogous to a mammalian ear. They are acutely sensitive to vibrations transmitted through substrates such as the combs and the hive itself.

The old tradition of banging pans to induce a honey bee swarm to alight is tied to the misconception than honey bees can "hear." The banging of pans is probably linked to the beekeeper's desire to alert the neighborhood to be on the look out for the swarm, and further to establish his or her ownership of it. In any case, Michael Smith showed that the practice of "tanging" simply doesn't work, leaving us to conclude that bees either do not hear airborne sounds, – or they don't pay any attention to them (Smith, 2013).

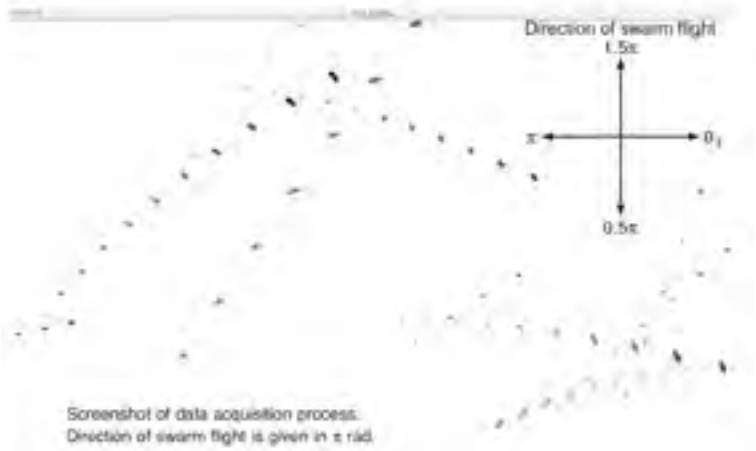
Another interesting vibration or sound produced by honey bees, is called "piping."

It is frequently stated in books that the piping of the queen is "answered" by that of the queen nymphs. Herrod-Hempsall, for instance, in Beekeeping New and Old, describes the queen "stopping every few moments to pipe, the note being answered on each occasion by the imprisoned princess." Was this answer a figure of speech, or did the nymphs definitely pipe each time in reply to the queen's call? The point seems worthy of notice, because … this is the only case I can recall of positive evidence that bees can hear (Wallis, 1940).

In the case of these peculiar piping sounds of the



Camera setup for swarm fly-by filming



Screenshot of data acquisition process.
Direction of swarm flight is given in π rad.

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queen, we really have no way of knowing whether the individuals are trying to communicate something, or if it is reflexive action, nor can we guess if the nest mates gain some meaning from the sounds. To us, it seems like a signal of some sort, but its importance is beyond our grasp. We have to guard against reading to much into the actions of the bees. I offer this example of going to far into the imagination:

Honey bee perception is highly emotional. This emotionality is manifested by characteristic subjective and objective symptoms. Due to this emotionality the primary form of bee consciousness may reflect different primordial affects – anxious, fear, rage, etc. (Lipiński, 2006).

While it is true that beekeepers use these terms to describe their bees, we have no way of knowing whether honey bees feel anything like anger, sorrow or despair. It may appear that they do, but humans are prone to project feelings on to everything from their pets to the weather.

A circle of ants.

Fact or Fantasy?

Theodore Christian Schneirla became the curator of the American Museum of Natural History in New York City in 1947. He was a pioneer in the study of the behavior of ants. Schneirla observed that ants follow programmed behavior which serves them well under a variety of circumstances. Unfortunately, the program fails spectacularly under very particular circumstances.

For example, ants march from place to place, following the scent left by those ahead of them, but if they happen to wander into a complete circle, they can become trapped in a circular *mill.* One such mill was observed that was 1200 feet around; it took an individual ant more than two hours to complete the circuit. The ants kept circling until they dropped dead from exhaustion – there was no program to get out of the infinite loop. Schneirla was doubtful of insects' ability to perform real communication. Insects may be condemned to follow ritualistic patterns.

There is a direct transmission of excitement from individual to individual through antennal (and sometimes also front-leg) stroking, special air-transmitted stridulatory vibrations, and through body vibrations. These effects are not codified in any real sense, do not convey "information," and lack any directive effect in themselves (Schneirla, 1946).

Einstein famously said: "Imagination is more important than knowledge. Knowledge is limited. Imagination encircles the world." But as a scientist, he insisted that theories must be confirmed and backed up with evidence that anyone can test. Otherwise, we may veer off into the realm of science fiction. Some speculative authors have had surprising foresight in their views of the "future," while others have gone deep into the realm of speculation.

An entertaining example is David Blair's unique film "*WAX or the discovery of television among the bees.*" It is the story of a beekeeper who has inherited "Mesopotamian" bees from his grandfather. His job designing flight simulators for the military weighs heavily on him and he seeks solace among his hives. Eventually,

he enters the bees' world and they communicate with him via a form of television. They lead him to the land of the dead where he is able to see both the future and the past. Blair uses a unique combination of archival film and early computer animation to tell his story of honey bee communication.

As fanciful and amusing as this seems, the ancient Greeks also regarded honey bees as oracles and envoys of the soul.

There is a story about a little girl of nine who stood watching the hives. "What are these?" she asked. "Bees, of course," was the impatient reply. "No," she said. "No, we only call them that. If you saw them as I see them, you would not call them insects. I see them as fairies. I see them as souls" (Haarhoff, 1960). BC

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A Closer Look

FORAGING BEHAVIOR

Clarence **Collison**

Individual foraging decisions during nectar collection and colony regulation of nectar intake are distinctly different from pollen foraging.

Honey bees collect distinct nutrient sources in the form of nectar (energy) and pollen (nitrogen). Fewell and Winston (1996) investigated the effect of varying energy stores on nectar and pollen foraging. They found no significant changes in nectar foraging in response to changes in honey storage levels within colonies. Individual foragers did not vary activity rates or nectar load sizes in response to changes in honey stores, and colonies did not increase nectar intake rates when honey stores within the hive were decreased. This result contrasts with pollen foraging behavior, which is extremely sensitive to colony state. Their data show that individual foraging decisions during nectar collection and colony regulation of nectar intake are distinctly different from pollen foraging.

Honey bee foragers specialize on collecting pollen and nectar. Pollen foraging behavior is modulated by at least two stimuli within the nest: the presence of brood pheromone and young larvae and the quantity of stored pollen. Genetic variation in pollen foraging behavior has been demonstrated repeatedly. Tsuruda and Page (2009) used selected high and low pollen-hoarding strains of bees that differ dramatically in the quantity of pollen collected to determine if the observed differences in foraging could be explained by differential responses to brood stimuli. Workers from the high and low pollen-hoarding strains and wild-type bees were co-fostered in colonies with either brood or no brood. As expected based on previous studies, returning high pollen-hoarding foragers' collected heavier pollen loads and lighter nectar loads than low pollen-hoarding bees. Effects of brood treatment were also observed; bees exposed to brood collected heavier pollen loads and initiated foraging earlier than those from broodless colonies. More specifically, brood treatment resulted in increased pollen foraging in high pollen-hoarding bees but did not affect pollen foraging in low pollen-hoarding bees, suggesting that high pollen-hoarding bees are more sensitive to the presence of brood. However, response to brood stimuli does not sufficiently explain the differences in foraging behavior between the strains since these differences persisted even in the absence of brood.

Honey bee workers from small colonies collected more syrup in cages and more nectar in the open when a caged queen was present in the hive than when no queen was present. Free-flying colonies containing larvae but no queens collected more nectar than similar colonies provided with an alcoholic extract of larvae and their food. When nectar was available, free-flying colonies with queens had more incoming bees per four minutes and more pollen carriers per four minutes than colonies without queens but with larvae or brood extracts. When nectar was not available, queenless colonies with larvae had the greatest number and percent of pollen foragers of all treatments. Extracts of larvae and their food appeared to increase both nectar and pollen foraging in the presence of a queen. However, the response was not always clearly evident, and the pheromone responsible was not identified. When nectar was freely available, foraging bees apparently collected pollen incidentally to nectar collection, thereby creating the appearance of a direct influence by the queen on pollen collection. However, in the absence of available nectar, when pollen was also less readily available, larvae exerted more influence on pollen collection than did the queen (Jaycox 1970).

Brood pheromone stimulates pollen collection.

Eckert et al. (1994) experimentally examined the relationship between colony state and the behavior of individual pollen and nectar foragers. In the first experiment they tested the prediction that individual pollen foragers from colonies with higher brood quantities should exhibit a greater work effort for pollen resources than individual pollen foragers from colonies with low brood quantities. Eight colonies were assigned into two treatment groups; HIGH brood colonies were manipulated to contain 9600 ± 480 cm^2 brood area; LOW brood colonies were manipulated to contain 1600 ± 80 cm^2 brood area. They measured colony brood levels over the course of the experiment and collected individual pollen loads from returning pollen foragers. They found that, while colonies remained significantly different in brood levels, individual pollen foragers from HIGH brood colonies collected larger loads than individuals from LOW brood colonies. In the second experiment they investigated the influence of colony size on the behavior of individual nectar foragers. They assigned eight colonies to two treatment groups; LARGE colonies were manipulated to contain 35,000 ± 1700 adult workers with 3500 ± 175 cm^2 brood area, and SMALL colonies were manipulated to contain 10,000 ± 500 adult workers with 1000 ± 50 cm^2 brood area. They observed foraging trips of individually marked workers and found that individuals from LARGE colonies made longer foraging trips than those from SMALL colonies (LARGE 1666.7 ± 126.4 seconds, SMALL: 1210.8 ± 157.6 seconds), and collected larger nectar loads (LARGE 19.2 ± 1.0 µl, SMALL: 14.6 ± 0.8 µl). These results indicate that individual nectar foragers from LARGE colonies tend to work harder than individuals from SMALL colonies. Both experiments indicate that the values of nectar and pollen resources to a colony change depending on colony state, and that individual foragers modify their behavior accordingly.

Forager honey bees function not only as gatherers of food for their colonies, but also as sensory units shaped by natural selection to gather information regarding the location and profitability of forage sites. They transmit this information to colony members by means of waggle dances. To investigate the way bees transduce the stimulus of nectar-source profitability into the response of number of waggle runs, Seeley (1994) performed experiments in which bees were stimulated with a sucrose solution feeder of known profitability and their dance responses were video recorded. The results suggest that several attributes of this transduction process are adaptations to enhance a bee's effectiveness in reporting on a forage site. 1)Bees register the profitability of a nectar source not by sensing the energy gain per foraging trip or the rate of energy gain per trip, but evidently by sensing the energetic efficiency of their foraging. Perhaps this criterion of nectar-source profitability has been favored by natural selection because the foraging gains of honey bees are typically limited by energy expenditures rather than time availability. 2)There is a linear relationship between the stimulus of energetic efficiency of foraging and the response of number of waggle runs per dance. Such a simple stimulus-response function appears adequate because the range of suprathreshold stimuli (max/min ratio of about 10) is far smaller than the range of responses (max/min ratio of about 100). Although all bees show a linear stimulus-response function, there are large differences among individuals in both the response threshold and the slope of the stimulus-response function. This variation gives the colony a broader dynamic range in responding to food sources than if all bees had identical thresholds of dance response. 3)There is little or no adaptation in the dance response to a strong stimulus (tonic response). Thus each dancing bee reports on the current level of profitability of her forage site rather than the changes in its profitability. This seems appropriate since presumably it is the current profitability of a forage site, not the change in its profitability, which determines a site's attractiveness to other bees. 4)The level of forage-site quality that is the threshold for dancing is tuned by the bees in relation to forage availability. Bees operate with a lower dance threshold when forage is sparse than when it is abundant. Thus a colony utilizes input about a wide range of forage sites when food is scarce, but filters out input about low-reward sites when food is plentiful. 5) A dancing bee does not present her information in one spot within the hive but instead distributes it over much of the dance floor. Consequently, the dances for different forage sites are mixed together on the dance floor. This helps each bee following the dances to take a random sample of the dance information, which is appropriate for the foraging strategy of a honey bee colony since it is evidently designed to allocate foragers among forage sites in proportion to their profitability.

Older larva need more food.

Hydrocarbons emitted by waggle-dancing honey bees are known to reactivate experienced foragers to visit known food sources. Gilley (2014) investigated whether these hydrocarbons also increase waggle-dance recruitment by observing recruitment and dancing behavior when the dance compounds are introduced into the hive. If the hydrocarbons emitted by waggle-dancing bees affect the recruitment of foragers to a food source, then the number of recruits arriving at a food source should be greater after introduction of dance compounds versus a pure-solvent control. This prediction was supported by the results of experiments in which recruits were captured at a feeder following introduction of dance compounds into a hive. This study also tested two nonexclusive behavioral mechanism(s) by which the compounds might stimulate recruitment; 1) increased recruitment could occur by means of increasing the recruitment effectiveness of each dance and/or 2) increased recruitment could occur by increasing the

intensity of waggle-dancing. These hypotheses were tested by examining video records of the dancing and recruitment behavior of individually marked bees following dance compound introduction. Comparisons of numbers of dance followers and numbers of recruits per dance and waggle run showed no significant differences between dance-compound and solvent-control introduction, thus providing no support for the first hypothesis. Comparison of the number of waggle-dance bouts and the number of waggle runs revealed significantly more dancing during morning dance-compound introduction than morning solvent-control introduction, supporting the second hypothesis. These results suggest that the waggle-dance hydrocarbons play an important role in honey bee foraging recruitment by stimulating foragers to perform waggle dances following periods of inactivity.

To investigate the distances at which honey bee foragers collect nectar and pollen, Couvillon et al. (2015) analysed 5,484 decoded waggle dances made to natural forage sites to determine monthly foraging distance for each forage type. Firstly, they found significantly fewer overall dances made for pollen (16.8%) than for non-pollen, presumably nectar (83.2%). When they analyzed distance against month and forage type, there was a significant interaction between the two factors, which demonstrates that in some months, one forage type is collected at farther distances, but this would reverse in other months. Overall, these data suggest that distance, as a proxy for forage availability is not significantly and consistently driven by need for one type of forage over the other.

Beekman et al. (2004) compared the foraging behavior of two small (approximately 6,000 bees) and two large (approximately 20,000 bees) honey-bee colonies over six days. They determined where the bees of each colony foraged, whether they collected nectar or pollen, the number of patches foraged at, the number of bees engaged in foraging, and the concentration of the nectar collected. Even though the colonies were located in the same environment and had the same genetic background, foragers from different colonies used different forage patches. Small and large colonies foraged at a similar distance in July when forage was abundant (mean foraging distance for small and large colonies was 0.67 and 0.62 km, respectively) whereas the large colonies foraged significantly further in August when forage was scarce (mean foraging distance for small and large colonies was 1.43 and 2.85 km, respectively). Small colonies foraged at approximately the same number of patches as large colonies. The total number of foragers returning to the small colonies per minute was significantly lower than the number of foragers returning to large colonies. This means that, relative to their size, small colonies foraged at more patches than large colonies. The quality of the nectar collected by foragers of the small and large colonies did not differ. However, small colonies did collect more pollen than large colonies.

The honey bee time memory enables foragers to return to a profitable food source in anticipation of the time of day at which they previously collected food from that source. The time memory thus allows the costs associated with having to rediscover it. A portion of a foraging group (the persistent foragers) will explore a previously profitable source and may do so for several

Pollen loads vary by colony need.

days. The remaining bees (the reticent foragers) await confirmation of availability before revisiting the source. Recent work has shown that both persistent and reticent bees make extracurricular flights to alternative sources when one food source ceases being productive. Little else, however, is known about reticent foragers. Van Nest et al. (2016) determined that reticent bees congregate near the hive entrance in anticipation of the learned foraging time as do persistent foragers. They also confirmed that the food-anticipatory clustering takes place on the waggle dance floor, as suspected, but also found differences in the number of days that persistent and reticent foragers continue clustering. Finally, they found that persistent foragers had significantly more rewards per day at the source than did reticent foragers, supporting the hypothesis that experience at a food source influences a forager's decision to become either persistent or reticent. Their findings demonstrate that persistence and reticence are not immutable characteristics of foragers themselves but rather strategies they employ toward different food sources.

Honey bees are important pollinators, requiring floral pollen and nectar for nutrition. Nectar is rich in sugars, but contains additional nutrients, including amino acids. Hendriksma et al. (2014) tested the preferences of free-flying foragers between 20 amino acids at 0.1% w/w in sucrose solutions in an artificial meadow. They found consistent preferences amongst amino acids with essential amino acids preferred over nonessential amino acids. The preference of foragers correlated negatively with amino acids induced deviations in pH values, as compared to the control. Next they quantified tradeoffs between attractive and deterrent amino acids at the expense of carbohydrates in nectar. Bees were attracted by phenylalanine, willing to give up 84 units sucrose for one unit of amino acid. They were deterred by glycine, and adding 100 or more units of sucrose could resolve

Colonies with higher brood quantities should exhibit a greater work effort for pollen resources than individual pollen foragers from colonies with low brood quantities.

to offset 1 unit amino acid. In addition, they tested physiological effects of amino acid nutrition on forager homing performance. In a no-choice context, caged bees showed indifference to 0.1% proline, leucine, glycine or phenylalanine in sucrose solutions.

Furthermore, flight tests gave no indication that amino acid nutrition affected flight capacity directly. In contrast, low carbohydrate nutrition reduced the performance of bees, with important methodological implications for homing studies that evaluate the effect of substances that may affect imbibitions (assimilation) of sugar solution. In conclusion, low amino acid concentrations in nectar relative to pollen suggest a limited role in bee nutrition. Most of the 20 amino acids evoked a neutral to a mild deterrent response in bees, thus it seems unlikely that bees respond to amino acids in nectar as a cue to assess nutritional quality. Nonetheless, free choice behavior of foraging bees is influenced, for instance by phenylalanine and glycine. Thus, amino acids in nectar may affect plant-pollinator interactions and thereby exhibit a selective pressure on the flora in the honey bee habitat. BC

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

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Frank **Linton**

We do know some things about beehive ventilation, we know bees ventilate their hives to control three factors, temperature, humidity, and carbon dioxide (Southwick & Moritz, 1987). We know that by 'ventilation' we mean both interior air circulation and an exchange of interior and exterior air. We know that brood rearing, nectar processing, and winter clustering have different ventilation needs. We know that bees control ventilation by fanning, they increase in-hive airflow by sending bees outside the hive where they beard, and when necessary, they bring in water to cool the interior by evaporation (Mandl Stabentheiner, & Kovac, 2004).

We know that, outside the hive, air temperature, humidity, sunlight, rain, and wind vary a lot over the course of a day, a season, and a year. And yet, in spite of these changes outside the hive, bees maintain a stable nest environment for their brood, process nectar into honey, and maintain a viable winter cluster.

What we do not know is how much energy bees devote to ventilation and, if ventilation were to be automatically adjusted so as to require minimal effort on the bees' part, how much surplus energy the bees would have and what they would do with it. What if there are times when half the colony is working at hive ventilation and we could reduce that to almost nothing by providing some shade and a screened inner cover? Might they become healthier and more productive? These questions would seem to be worth investigating.

What Existing Research Tells Us

Research tells us that workers who perform nest ventilation are two to three weeks old, which means that the time and effort they spend ventilating is time away from brood rearing and nectar processing (Cook, Brent, & Breed, 2017). Research also tells us about optimal in-hive levels of carbon dioxide, temperature, and humidity, and how bees control them.

Carbon Dioxide

Honey bees have carbon dioxide (CO_2) receptors on their antennae (Stange, & Diesendorf, 1973). The normal atmospheric level of carbon dioxide is 0.04%, i.e., 4/100 of 1%. Bees respond to CO_2 levels by fanning when the level reaches 1%. (Seeley, 1974). Bees cannot sense oxygen levels. The ability to sense CO_2 must offer bees some survival advantage, yet the frequency that bees initiate fanning owing to elevated levels of CO_2 would seem to be rare, with the possible exception of times when hives are sealed, or nearly sealed, by winter snows, and the actual frequency of CO_2-activated fanning is unknown.

Temperature

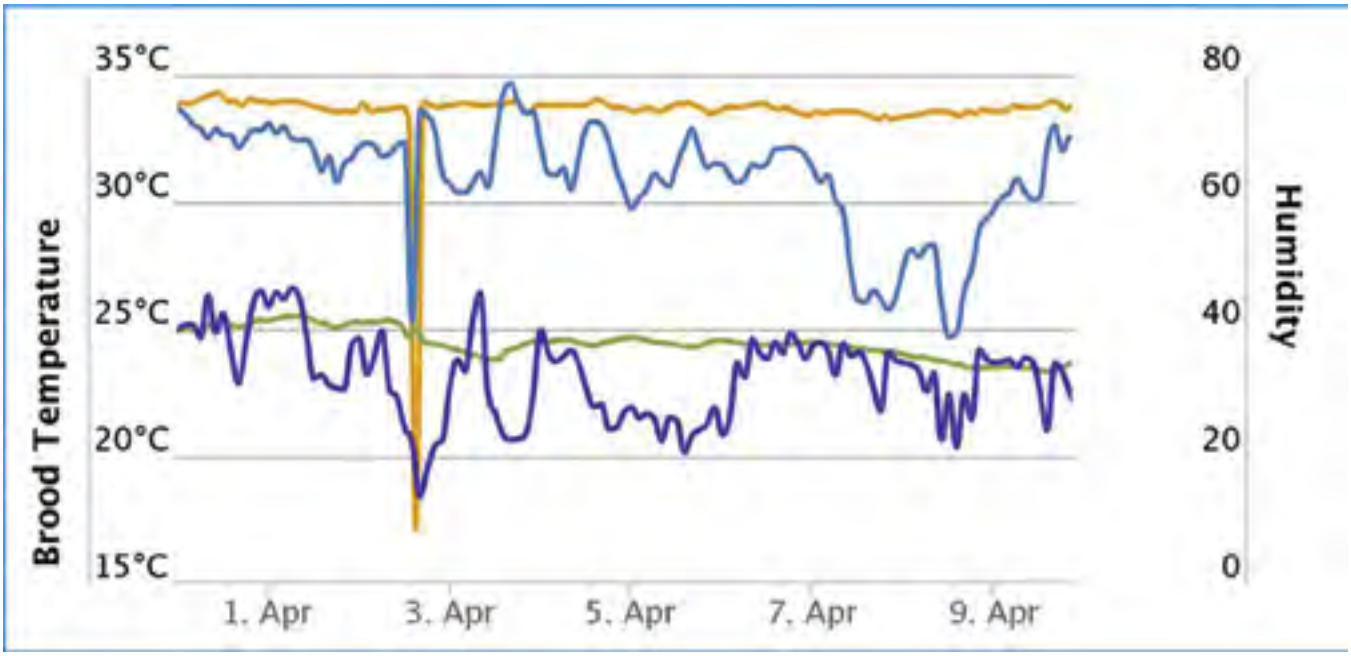
Honey bees detect temperature with thermoreceptors on their antennae. Considering brood, brood chamber, honey super, and Winter cluster spaces, it appears that brood temperature has received a lot of attention, and the other spaces almost none.

It is well-known that bees maintain their brood at temperatures of 33-35°C. We need not discuss that point further here. It is also the case that foragers must warm up their flight muscles to at least that temperature to begin foraging (Seeley, 2010). To warm the brood, and themselves, bees consume honey and flex their flight muscles. When it is necessary to cool the brood, bees first fan and then bring in and evaporate water. Both warming and cooling the brood take an effort. It seems reasonable then, to take as a first assumption that optimal brood chamber temperature would be near, yet slightly lower than, brood temperature.

When bees are processing nectar into honey by evaporating water from it, lower relative humidity and higher vapor pressure deficits are desirable, and warming the air enhances these effects. Yet wax begins to soften at brood temperatures and melts at 144°F, so it seems reasonable that maximum honey super temperature would be a few degrees warmer than brood chamber temperature, but not so high that the weight of the stored honey would begin to collapse the softened comb.

In Winter, bees begin to cluster at 58°F and become too stiff to move around 45°F. To warm the cluster bees consume honey and isometrically contract their thoracic muscles to generate heat. A Winter cluster of bees can keep itself warm at very low temperatures, but if it is so cold that the cluster cannot move to access its honey stores, it risks starvation. When overwintering bees indoors, the optimal temperature range is said to be 40-45°F (Sammataro & Avitabile, 2011), so that would seem to be a good guess for optimal hive temperature when the bees are clustered in outdoor hives.

Eggs need 90-95% humidity to do best.

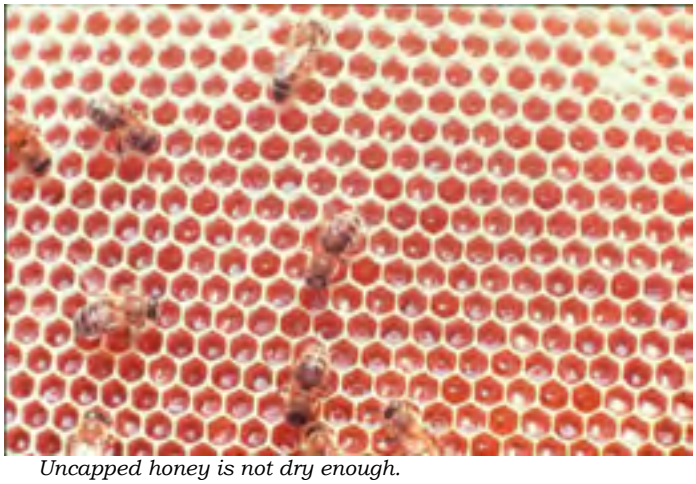


Humidity

Honey bees have hygroreceptors on their antennae that detect relative humidity and vapor pressure deficit (*vapor pressure deficit* is a measure of how much more water the atmosphere can hold, when saturated, than it currently holds) (Ellis, 2008). Within the hive, optimal humidity may vary depending on the bees' activity. Brood cells, brood nest, honey super, and winter cluster area, each need to be considered.

Honey bee eggs require high humidity, a minimum of 55% even to hatch, and do best at 90-95%. (Doull, 1976). Also, the reproductive success of *Varroa* parasitic mites decreases with increasing humidity (Kraus and Velthuis, 1997). And larvae lose moisture both by respiration and by desiccation owing to the permeability of the larval cuticle (Ellis, 2008). The jelly fed to larvae has a high amount of water which may serve to replenish the water lost.

In contrast to the high humidity levels within the honeycomb cells containing eggs and larvae, bees fan to reduce the humidity in the brood chamber, maintaining it at 40%-60%, (Ellis), 60%-70% (Huang). Besides the humidity from the jelly and nectar fed to the larvae, nurse bee respiration and cuticular loss also introduce moisture to the local environment. It appears that low humidity is not a problem in the brood area. Also, as mentioned in the Temperature section above, bees will cool the brood, if necessary, by distributing water around the brood chamber and evaporating it by fanning.



Uncapped honey is not dry enough.

Above the brood nest in the honey super, nectar is processed into honey by reducing the water in the nectar by evaporation. Bees evaporate the water in nectar by fanning and tongue lashing (see Tongue Lashing Sidebar). To reduce the approximately 50% water content of nectar to the 18% water content of honey, bees must evaporate about one-third of the nectar they forage. (To put this effort into perspective, suppose the bees bring in three kg of nectar in a day, then one kg of water must be evaporated, a task approximately equivalent to boiling away a quart of water. Picture the energy required for that!) It would appear that low relative humidity, and high vapor pressure deficit in the honey super would enable this energy-intensive process, yet the bees seem to make no effort to control these factors (see Figure 1). Furthermore, there seems to be no research on how beekeepers might optimize the honey super environment for nectar processing.

Liquid water is a critical issue for bees in Winter. Bees, like all living things, need a continuous supply of water, even in Winter, when most water is found in the form of ice or snow. I have seen bees taking up icy water on warmish Winter afternoons from the edges of sun-melted snow. Some miscalculate and cool down so much they cannot take flight to return to their hive. It would seem helpful to overwintering bees to have a source of fresh water inside their hive. And, as it turns out, they do.

In fact, they may have too much water. The bees create the water themselves, in the form of vapor, by metabolizing honey. How does this happen? To start with, honey has some water in it. For example, if we assume a super holds 40 pounds of honey, and 18% of it is water, that's 7.2 pounds of water. Then, and more importantly, bees metabolize the sugars in the honey to obtain energy, producing carbon dioxide and water in the process, which bees emit by respiration. Some of that water vapor is removed from the hive by ventilation, the remainder

Table 1.Potential seasonal indicators of sub-optimal ventilation.

		Respiration		Thermoregulation		Humidity control	
Internal Situation (HBHC, 2017)	Season: Weather assumption	Too much ventilation	Too little ventilation	Too much ventilation	Too little ventilation	Too much ventilation	Too little ventilation
Dormant (broodless clustered, consuming stores)	Winter: Cold, dry, snow	CO_2 levels are the same as outside air (0.04%).	CO_2 levels are higher than outside air.	Temperatures just outside the brood area, or winter cluster are close to exterior temperature.	N/A	Brood chamber and honey super humidity levels are the same as exterior humidity.	Ice or condensate inside inner cover or on walls of the hive.
Population increase (lots of brood, no nectar)	Spring: Warm, rainy, some sunshine						Condensate inside inner cover or on walls of the hive.
Population peak (lots of brood, lots of nectar)	Summer: Hot, sunny, some rain				Honey super temperatures and brood chamber temperatures just outside of brood area are at, or above, brood temperature, close to exterior temperatures.		Brood chamber and honey super humidity levels are higher than exterior humidity.
Population decrease (little brood, feeding)	Fall: Cool, dry				N/A		

condenses on the cold interior surfaces of the hive. How much water are we talking about? I did the math in a previous article for *Bee Culture* (Linton, 2015). It turns out that 40 pounds of honey, when metabolized, produces a total of 26.9 pounds of water, over three gallons!

Proper ventilation may help ensure that this water plays a positive role in the bees surviving the winter. Just enough ventilation will remove both carbon dioxide and water vapor from the hive. Too much ventilation will require that the bees make an extra effort to warm themselves and may increase their need for water by speeding their desiccation. Too little ventilation will reduce the available oxygen, allow carbon dioxide to build up, and encourage condensation, possibly in undesirable locations.

Depending on the temperature, the condensate may freeze where it forms or drip or dribble to a lower position before freezing. Later, it will melt and continue its downward route. Water on the inner cover may drip down onto the winter cluster, wetting and killing the bees, so having a well-insulated hive top is important. Water on the walls of the hive will run down the sides of the hive and out. You may see it on the mite board.

What You Could Try

In the tropics some species of honey bee build their nests in the open air where their combs are directly exposed to the weather. In contrast, our bees, *Apis mellifera* build their nests in hollow trees or hives. These have an interior weather (temperature, humidity, and breeze/ventilation) that both the bees and the beekeeper can influence to improve the bees' health and productivity.

Factors under beekeeper control are the number, location, orientation, and size of hive openings, the amount of direct sunlight hitting the hive, the extent of wind protection, the level of insulation on the hive top and sides, and the effect of snow. Hive openings and wind together produce a chimney effect that draws air out of the hive.

Factors that arise from the colony going about its business are warm air from the broodnest and cluster, carbon dioxide and humidity from metabolic processes, and humidity from evaporating nectar and brood rearing.

Colony activities to control the hive environment include fanning – both at openings and within the hive itself, providing and evaporating water, bearding to increase airways, propolizing openings, and possibly, modifying comb structure.

With these things in mind, and considering how the tasks and needs of the bees vary with the seasons, as noted in Table 1, it does not seem farfetched that perceptive beekeepers could, by observing their colonies closely, discern when they were engaging in these environmental control activities and supplement the colony's efforts with actions of their own. Specifically, enlarging or reducing hive openings, exposing or sheltering the hive from sun and wind, and adding or removing insulation.

The second stage for beekeepers, after a few seasons' experience manually optimizing ventilation controls and observing – the assumed – positive effects on their colonies health and productivity would be to automate them. An automated system would have sensors that noticed when the bees were adjusting the hive's internal conditions and would manipulate openings and flaps to minimize their efforts.

An illustrative example of this second stage is Bee Cool Ventilators (**http://www.beecoolventilators.com**). It is a thermostatically controlled exhaust fan powered

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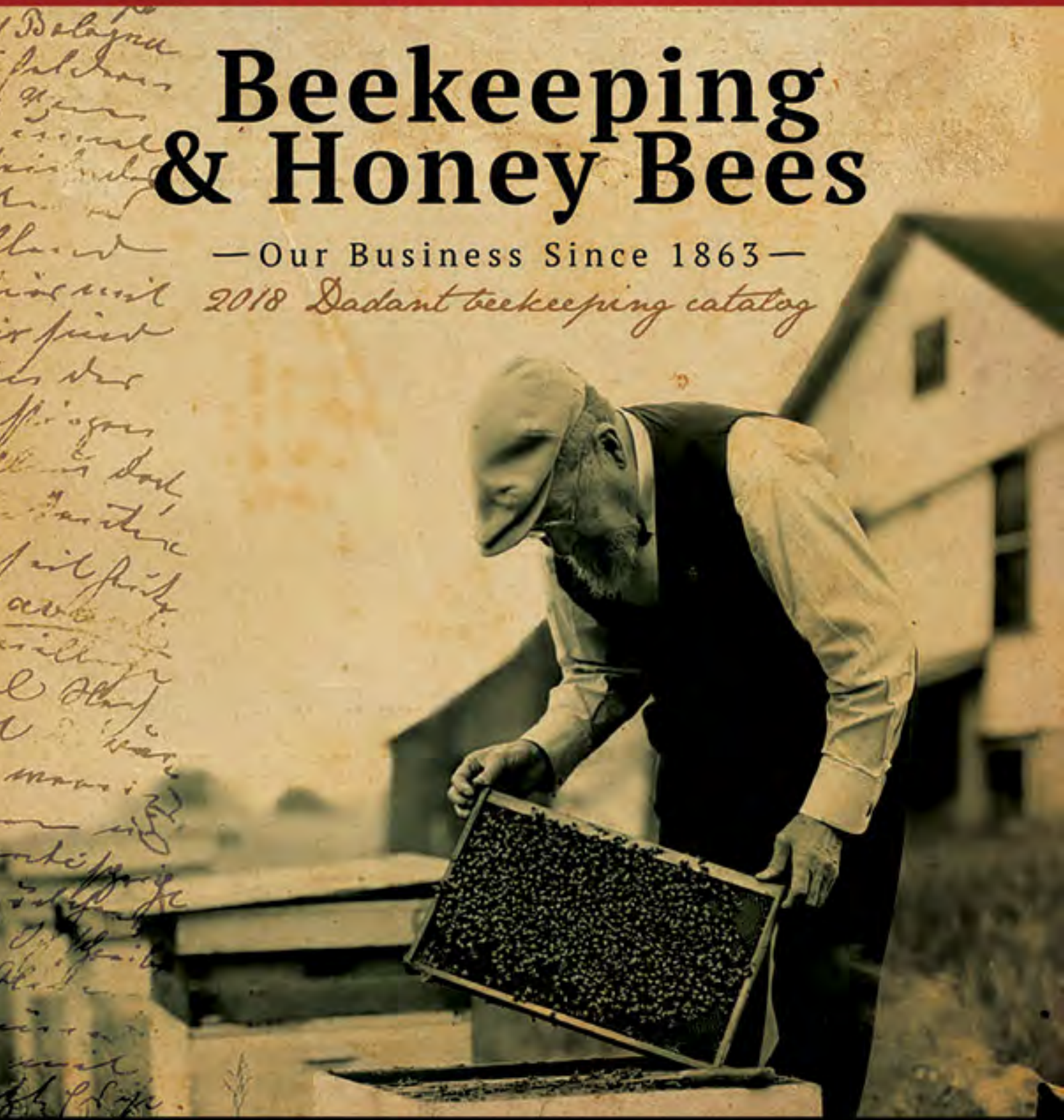

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by a solar cell. I have no idea whether the product does what it claims; for my taste, there is far too little evidence presented on the website. It is, however, a good example of the concept of a gadget that assists in hive ventilation.

Avoid Excessive Ventilation

When ventilating hives, whether manually or automatically, one must also be aware of the dangers of providing too much ventilation. Four scenarios come to mind. First, too much airflow through the brood box may result in bees being unable to maintain temperature and humidity within their optimal ranges, thereby reducing the amount of brood the colony can raise. Second, bees communicate with pheromones. Too much airflow may interrupt colony communication by removing pheromones from the hive before they have spread throughout it and had the desired effects. Third, when converting nectar to honey, bees remove a lot of water by the process of evaporation. Both a low relative humidity and a high vapor pressure deficit aid this process, and a warmer hive increases these (Ellis, 2008). Thus, depending on exterior conditions, either increasing airflow or decreasing it may improve the process, it all depends . . . Fourth, a Winter cluster keeps itself warm by consuming honey and vibrating its flight muscles. A proper airflow will remove the products of respiration, including water vapor, which might otherwise condense on the hive ceiling and drip down on the bees, wetting and killing them. Too much ventilation, in contrast, may prevent the bees from breaking cluster to reach their supply of honey and doom them to starvation inches from their stores.

"Female Allodapula variegata concentrating the dilute (14%) nectar of Aloe arborescens by evaporation. The regurgitated droplet, held under the tongue, is repeatedly sucked in and out and may be very large in relation to the size of the bee (body length 7 mm). Photo, Michael Ellis."

Tongue Lashing

Honey bee tongue lashing dramatically increases evaporation (Louw and Hadley, 1985).

Images of bees tongue lashing nectar are rare. This photo of tongue lashing is the only one I could find on the internet. The photo is by Michael Ellis; the photo and the explanatory caption appeared in an article by Susan Nicolson (2009).

How to Investigate Ventilation

Earlier we mentioned using sensors to detect when bees were adjusting the hive's ventilation. There are numerous observables that might be monitored, including fanning, bearding, temperature, humidity, carbon dioxide, condensate, airflow, and hive weight change.

To monitor fanning, for example, you might measure the sound of fanning, the heat from the fanners' thoraxes, the presence of fanners at openings, or changes in temperature, airflow, or humidity. To anticipate the need for fanning, the increase in hive weight during a day of nectar flow would be the basis for an estimate of the amount of water to be evaporated from it. Other indicators of a need for fanning include excess temperatures, humidity, or moisture inside the hive. In contrast, direct evidence of too much ventilation when bees are not fanning may be harder to come by. Hypothetically, an active system might reduce ventilation until the bees started fanning, then increase ventilation slightly.

Some tools to monitor fanning are available today, though they may need to be modified for this role. For example, Wyatt Mangum (2017) reported using an infrared camera to detect the heat generated in bees' thoraxes when they were fanning at the hive entrance, as well as to detect temperature differences inside the hive indicating the airflow. Infrared cameras provide new and valuable information to beekeepers, but they require a skilled operator and the images must be captured when no other factors, such as sunlight, affect the temperature of the hive's outer surface. Still, inspired by Mangum's images, one can imagine using a conventional video camera such as Keltronix EyesOnHives, pointed at the hive entrance, together with software to analyze the imagery, to detect fanning effort.

The Arnia colony monitoring system (**http://www.arnia.co.uk**) measures fanning noise (and flight noise) with a microphone embedded in the unit's electronics box, which is placed just inside the hive entrance.

To monitor hive weight changes, estimate nectar collection, and predict fanning to support evaporation requires a hive scale. There are numerous hive scales on the market. I have posted a partial list here: **http://colonymonitoring.com/cmwp/five-components/sensing/hive-weight**.

The examples just given are some of the ways to, potentially, measure fanning, which is just one of the several ways of monitoring ventilation. To summarize, sensors available in today's colony monitoring technologies, that could be used to monitor ventilation processes or activities include:

- Temperature sensors
- Humidity sensors
- Microphones
- Hive scales
- Intelligent video cameras

Sensors that could also be used in beehives include

- CO_2 sensors
- Moisture sensors (inside inner cover to measure liquid condensate)
- Airflow sensors (at hive orifices) BC

Neonicotinoid Pesticides: A Major Problem For Bees, Part VI

Ross **Conrad**

If you still think pesticides are not as big a concern as other issues like Varroa mites, you haven't been paying attention.

Last month we explored some of the evidence indicating pesticide regulation in the U.S. is fraught with fake science, corruption and manipulation. Unfortunately, this is not new and attempts to reform our regulatory agencies have occurred over and over, always with failed results. In this last installment of this series, we look at why has this been the case.

Regulated Industries Take Over

It turns out that once the constitutional separation of powers is ignored and legislative, executive and judicial authority are all concentrated in one regulatory agency, it makes it easier for it to be corrupted by the industry it regulates – all industry has to do is exert its influence upon it and take it over. This is the experience of William Sanjour, a 30-year veteran of the U.S. EPA who wrote the Independent Science News article titled: *Designed to Fail: Why Regulatory Agencies Don't Work*.

In the case of neonicotinoids for example, EPA writes the regulations (legislative - laws), the President appoints the administrators who are then beholden to the president, not congress, if they want to keep their jobs (executive), and the EPA has the power to declare findings of guilt and issue fines and punishment (judicial). According to Sanjour the root of the corruption and inefficiency at EPA and other regulatory bodies in the U.S. government is due to the fact that their functions span all three branches of government.

In the article, Sanjour describes not only how industry representatives get appointed to executive positions within agencies, but how gifts, bribery, flattery, meals, trips, hints of future employment, and even drugs and sexual relationships are used to capture regulatory agencies on behalf of industry. (Smith, 2008) This is part of the reason why as wealth becomes concentrated, there is a tendency for political power to follow which leads to government policies that move the cycle forward. Government employees quickly learn that they make enemies with powerful and influential people when they draft and implement rules governing big corporations. Folks who like to get things done and see results don't last long. While they may not necessarily be fired, they are often transferred to meaningless jobs with no opportunity for advancement. These employees typically quit in disgust. Those that last learn to be team players, procrastinating, obfuscating, and creating superficially plausible reasons for accomplishing nothing. According to Sanjour, the primary reason regulations are so complex (and often written by industry) is so that they can easily hide loopholes. Regulatory capture is also the reason that beekeepers, whistleblowers, environmental groups and concerned citizens are the primary source of publically expressed issues and concerns about neonicotinoid pesticides. Such worries are not typically expressed by EPA, USDA, or any other government regulatory body.

Regulatory agencies being gradually taken over by the parties they regulate is not new and has been the subject of much academic study. Economist George Stigler won the Nobel Prize in 1982 "for his seminal studies of industrial structures, functioning of markets and causes and effects of public regulation." Regulatory agencies once captured by regulated businesses provide the industry with the power of government and this is arguably worse than no regulation at all. We end up in a country with a government of industry, by industry, for industry.

Escaping Industries Grip

Reforms that tweak the current system while basically maintaining a business-as-usual approach are not going to prevent the dramatic declines in wild pollinators or improve the health of our honey bees.

Although the evidence was not conclusive, the EU, acting on the precautionary principle, took action in 2013 by imposing restrictions on the use of three neonicotinoids – clothianidin, imidacloprid and thiamethoxam. Although these controls are often spoken of as a ban, the neonicotinoids may still be used under certain conditions and so it is more accurate to describe them as restrictions. Utilizing the latest studies and research, the European Food Safety Authority (EFSA) is expected to finalize an

updated risk assessment on the potential harm to bees from neonicotinoid pesticides early in 2018, as part of the EU's process of deciding whether to continue restrictions on these neonicotinoids.

In July 2015, the Canadian province of Ontario enacted regulations designed to track the sale, use of neonic-treated seed and reduce the number of acres planted with them by 80 percent. In 2017, Ontario farmers were only allowed to plant neonic-coated seeds when they could provide evidence of pest problems. Meanwhile Health Canada's Pest Management Regulatory Agency has made a timid proposal to limit the use of a couple neonicotinoids and add more warning labels to the packaging.

While some cities in the U.S. have taken steps to ban neonicotinoid use, only a few state regulatory bodies have managed to avoid enough of the corrupting influence of industry to have retained some level of independence from Federal authorities and act where federal action is lacking. For example, there have been recommendations to protect pollinators from states such as Oregon, Minnesota and Vermont that have the potential to actually help protect pollinators and reduce pollinator decline provided state legislatures takes steps to adopt and implement them. Such recommendations include:

- Banning prophylactic use of neonicotinoid pesticides
- Decreasing pesticide toxicity and application rates
- Eliminating household use of neonicotinoid pesticides
- Banning neonicotinoid use on State lands and forests
- Developing goals to gradually reduce and eliminate the use of all pesticide use over time.

The reality is that a majority of today's farmers have come to rely heavily upon pesticides. Their farming equipment, systems and operations are all designed around the pesticides they use. However, farmers are not to blame here. Most of them don't even know what is on the seed they are planting. All the farmer knows is that the seed treatments are legal, are said to have been scientifically vetted, and when planted they grow like crazy. The crux of the problem lies in a pesticide regulatory process corrupted by industry and government incompetence, conflict of interests, dishonesty, and a financial industry that funnels farmers into long-term loans for expensive machinery required for chemical intensive agriculture. Once heavily indebted, it becomes even more difficult for farmers to step off the pesticide treadmill.

Thanks to the Citizen's United decision by SCOTUS that legalized unlimited political bribery, banning all pesticides outright is politically difficult. Meanwhile farmers are fed misinformation that suggests they would suffer economically without access to such toxic "tools" even though EU crop yield reports are up since neonicotinoids were restricted there and there is strong scientific evidence that indicates crop yields do not necessarily decline when neonicotinoid use is abandoned. (Sgolastra, 2017; Lechenet, 2017, Moore 2015, Budge 2015, Lechenet 2014)

A Suggested Approach

As much as an immediate ban on neonics would be best for pollinators and our damaged ecosystem, a more realistic approach that may actually have a chance of succeeding is to tackle the pesticide issue like we are tackling the climate destabilization issue: just as we are working to phase out the use of fossil fuels and replace them with renewable energy sources, we should also work to phase out the use of pesticides over time and replace them with non-toxic pest management techniques and compounds with extremely low toxicity. (Brown 2016, State of Nature Report) With the support of government and extension programs designed to provide technical and financial assistance, farmers can transition from chemically intensive agriculture to farming that is more in line with conservation and regenerative farming principles which will not only help protect pollinators but will help us bring stability to our climate by sequestering carbon in the soil at the same time. (see *Bee Culture January and February 2016)*

Other Challenges to Overcome

Honey bees deal with a complex system of stresses on their health. While wonderfully resilient, bees cannot cope with exposure to wave after wave of the toxic chemical exposures permitted and promoted by our dysfunctional political, regulatory and economic system. The underlying problem is that the majority of people (especially those in leadership and decision making positions) have come to identify with corporations and businesses for their ability to survive. It makes sense therefore that these same folks will fight to the death for the ability of corporations and businesses to continue to thrive. It is not that most people are failing to live up to their values. The problem, rather, is that our values themselves are counter to our survival. What we really require for survival are healthy rivers, streams, oceans, mountains, forests, meadows and lakes. Not enough of us are fighting to the death for these things to survive. Even more astounding when you think about it is the fact that corporations and businesses are not even real things. What is real about them are the people they employ and serve and the products and services they provide. The corporation is simply an idea around which real things are organized. The corporation itself only exists on paper, and yet we act to keep the concept of the business alive and healthy even when doing so is detrimental to the things that are real. We even give the corporation some of the same rights as people. It is as if the majority of our culture (or at least those in positions of power) have literally lost touch with reality.

I hate to have to point this out but losing touch with reality is one of the definitions of mental illness. This helps to explain the reality that our landscape, whether rural, urban, or domestic, along with crops, soil, water and air – is becoming increasingly toxic and dangerous to pollinators and is threatening life as we know it. We are witnessing the collapse of all the species that we grew up with in the countryside. Most Americans don't appear to grasp the enormity of this unfolding ecological disaster and environmental crisis. What we are experiencing first hand is Ecocide – the poisoning of our entire ecosystem.

Meanwhile proponents and defenders of pesticides stay firmly on message: "There are many factors contributing to bee deaths. It's wrong to just focus on neonicotinoids and take away tools farmer's use. We must rely on sound science. We must plant more flowers. It's *Varroa*, *Varroa*, *Varroa*!". . . All of this has the effect

of deflecting and delaying taking meaningful action on a major problem for bees: Neonicotinoid pesticides. BC

Ross Conrad is the Author of Natural Beekeeping: Organic Approaches To Modern Apiculture, 2nd Edition.

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THE SPIRIT OF THE BEEHIVE

Ryan **McDearmont**

The Most Beautiful Film Ever Shot Involving Bees, And Certainly One Of The Most Positive Depictions Of Pollinators

Human society is reflected largely through the monsters we create. Since the dawn of storytelling itself, humanity has passed down tale and tale again of that which goes bump in the night – the werewolf, the vampire, the being which serves to disrupt that which society has created. These legends embody our culture's anxieties, such as the fear of the unnatural, the fear of outsiders, or the fear of something evil lurking close to home.

Arguably, these myths didn't fully grip the public until the 1930s and onwards. With the release of Bela Lugosi's iconic *Dracula* in 1931, monsters took the world by storm, and suddenly the boogeymen which once existed as cautionary tales became bankable stars. The Wolf Man, the Mummy, and the Gill-man all crept out of the dark and into the spotlight to become icons as ubiquitous as Bugs Bunny or Mickey Mouse. Those beasts who were once the stuff of nightmares transformed into pushers of toys, shirts, breakfast cereals, and even Pepsi products in the 1990s.

The biggest proponent of Universal's stable of scares these days is Mexican director Guillermo del Toro, who late last year released *The Shape of Water* (2017) to critical acclaim. The film is a more romantic take on *The Creature from the Black Lagoon* (1954), in which the leading lady falls in love with the creature as opposed to seeking its death. This wasn't del Toro's first foray into the world of monsters, however. His 2006 dark fantasy film *Pan's Labyrinth* was chock full of beasts, poised as both fairytale critters and twisted reflections of the film's subject matter. The movie deals with adolescence in Francoist Spain; an allegorical tale of men and fantastical beings about how innocence is extinguished in the grip of a fascist regime. While certainly unique, *Pan's Labyrinth* is not the first film to deal with the aftermath of Spain's Civil War through the lens of childhood and monsters. That honor goes to one of its implicit inspirations: Victor Erice's 1973 debut *The Spirit of the Beehive*.

While previously mentioned by name in this column (see our January issue), *The Spirit of the Beehive* has yet to be covered thanks to the unusual circumstances of its existence. Far from the lurid sensationalism of *The Deadly Bees* (1966) and *The Swarm* (1978), *The Spirit of the Beehive* is perhaps one of the most tempered and realistic depictions of bees outside of that found in nature documentaries. In addition, it comes some 20 years prior to *Candyman* (1992) and *The X-Files* (1998), but subverts expectations regardless by remaining one of the few bee-focused films which is a drama as opposed to a science-fiction, horror, or disaster yarn. Its status as a foreign arthouse film has done little to help its viewership in the United States, and as such it will likely remain the most obscure, yet most compelling drama covered in this feature.

Even as a drama, however, *The Spirit of the Beehive* might not be to everyone's taste. The languid film features meager dialogue, and those who speak converse in Spanish, their words related through subtitles. It holds little regard for traditional narrative, and instead focuses on the hypnotic power of images and symbolism. Those familiar with the output of arthouse distributor Criterion Collection, known for releasing films such as *Rashomon* (1950), *Videodrome* (1983), and countless others, will likely know what to expect from *The Spirit of the Beehive*.

What plot *Spirit* retains is mysterious, yet compelling. The year is 1940: a young girl named Ana lives with her family in rural Spain, shortly after the installation of Franco's fascist regime. One afternoon, she and her sister attend a screening of Universal's *Frankenstein* (1931), which deeply affects Ana. Spurred on by her sister, Ana becomes obsessed with the eponymous monster, going so far as to search for his "spirit" in desolate places around her hometown. As her preoccupation grows, Ana hurtles towards both a greater understanding of the world and further within the fantasy she has constructed for herself. It's a coming-of-age story told on curious terms: one which provides precious few answers or details, but

instead leaves each viewer with their own interpretation as to what is being said.

But what of the bees? If Frankenstein's monster provides the enigmatic "spirit" portion of the film's title, then what of the "beehive"? In *The Spirit of the Beehive*, apiculture originates with Ana's scholarly, beekeeper father Fernando, but quickly permeates every aspect of the film. The opening credits begin with a child's drawing of a beekeeper and their swarm, but this image soon transfers to reality as Ana's father tends to his hives. Shot, framed, and edited without flair (aside from *Spirit's* general painterly style), these sequences of beekeeping are played straight and sympathetic. Presented as neither hero nor villain, it's this plain view of beekeeping which defines Fernando, and soon dominates the film as a whole.

Unhindered by sensational urgency or creeping dread, the well-kept bees of *The Spirit of the Beehive* are allowed to flourish and fill a narrative space which lacks the negative connotation often inherent to other bee-centric films. With so much interpretation left to the audience, the swarms of *Spirit* become a reflection of the film's central themes, more so than any other movie discussed here thus far. Within the honey-tinted halls of *Spirit*, bees appear relatively infrequently, but their behaviors and aesthetics inform the entire film.

It becomes apparent soon after the film's opening that its title goes far beyond the concept of an explicit physical beehive. Once the camera moves within Ana's home, the film takes on an amber hue, related by light filtered through golden windows cut into repetitive hexagon patterns. Not only do these windows convey a connection to bees as a larger theme, but they also provide physical context for the house itself. Within this home, Ana's family "becomes" a collection of bees, serving a purpose larger than themselves. In *The Spirit of the Beehive*, this purpose could be virtually anything, but the film's ending moments lend credence to a particular interpretation.

As *The Spirit of the Beehive* draws to a conclusion, Ana flees the home and her father, fearing reprisal for aiding a runaway soldier. It's in this action that she escapes the insular "hive" of her home. This massive, yet near-empty dwelling is defined by the people within it: her cold mother, her distant father, and her capricious sister Isabel. Once Ana has escaped into the woods in search of the green, bolt-necked monster she is convinced lives there, her family follows her into the night, hoping to save her before the worst occurs. It's in this search that the family is brought together, with her mother and father reconnecting and her mischievous sister warming up to Ana with genuine concern.

It could be stated, then, that *The Spirit of the Beehive* is in fact a spirit of unity, of kinship, and of greater purpose. While not spelled out in the film through explicit terms, the use of bees as symbolism provides an argument that the central family of the film, and therefore honey bees as a whole, are a unit which utilizes their connection for betterment as opposed to destruction. While the main characters of *Spirit* certainly aren't producing honey, it's the restoration of the family which proves important.

In fact, this incident provides a template for *The Spirit of the Beehive's* worldview as a whole. In one of the film's central sequences, Fernando writes a diary entry about the glass beehive which he keeps inside his study. As he discusses the intricacies of the hive, "the teeming bridges and stairways of wax," and "the varied and repetitive labors of the swarm," it becomes clear that these bees are meant to Fernando's perception of the world as a whole: a collective which toils endlessly, unaware of their greater purpose. While perhaps not the most positive view of mankind, *Spirit* does describe Fernando as a "misanthrope."

Regardless of the views of its characters, *The Spirit of the Beehive's* portrayal of the eponymous insect is positive, or neutral at the very least. There's no explicit negativity in the vein of other bee-centric films released at the same time, but this is likely because of *Spirit's* radically different nature. Even if *Spirit* draws connections between bee's industrious nature and the toil and ideologies of mankind, there's no denying that the pollinators themselves are given a more favorable treatment than American bee movies released at the same time. This time around, the only monster is the one created by Dr. Frankenstein and let loose on a silver screen.

In *The Spirit of the Beehive*, bees as presented simply as they are – as insects, as producers, as another element of nature. There are no deadly swarms, no bee-themed killers, no pollen-based pathogens, and not even so much as a sting. While the movie doesn't go as far as to espouse the environmental benefit of bees, this sort of non-aggressive framing goes a long way in acclimating audiences to our humble honey producers. They might hold a deeper, more symbolic meaning for the film as a whole, but in their actions and presentation, *Spirit's* bees are tame as a lamb - as they should be. As a piece of fiction, *Spirit* is a consummate champion of the honey bee, but the circumstances of its creation and distribution have kept the film from a wider audience.

The distance of its release some 45 years ago, its status as a foreign art film, and its limited release through the Criterion Collection have rendered *The Spirit of the Beehive* an almost unknown title outside of those well-versed in film. From both an artistic and apicultural standpoint, this is a shame. It's perhaps the most beautiful film ever shot involving bees, and certainly one of the most positive depictions of pollinators prior to more sympathetic documentaries and other educational features. For those interested in a viewing experience outside the beaten track, *Spirit* is a must. It might not have made a splash in the apicultural community, but *Spirit's* amber tones prove to be secret gold. BC

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Taming Killer Bees

W.S. **Robinson**

Three separate times during this adventure in the mountains of Tabasco I think well, that's that. We're not going to get to do this after all.

The first is when we discover we have forgotten the beeswax foundation, left way down the mountain in the little *pueblo* of Redención del Campesino. But no, says our *brujo*. It's only 20 miles. You all just relax here and I'll be back with the wax shortly.

The sun beats down on this village of 200 souls. For the next two hours we sit in plastic chairs in scant shade, eating juicy mandarins from a tree in the packed-clay yard of a tiny whitewashed adobe house. Chickens, ducks and turkeys forage around us. We walk down to an emerald pond and watch a couple of kids swimming and fishing with a long net strung between two poles. A family of pigs cavorts in the water on the opposite shore. Oropendolas give their musical, loopy, water-drop calls.

Luis Manuel Godínez García – who I am genuinely beginning to think of as a sorcerer of the bees – returns with the wooden frames of foundation wax. The legendary "killer bees" that we intend to gather from a hole in the ground will need them in order to start their new life in a wooden hive.

Off we drive toward the farm where the nest has been reported. We stop when we see the *dueño* of the property flagging us down. He stands waiting by a muddy path with his two sons and a rickety wheelbarrow full of excavation equipment: sledge hammers, mallets, shovels, pry bars, machetes, even a chainsaw with gasoline and bar oil. "It's about two kilometers in," he explains. I look at the rough, uneven, sodden path, pocked with the prints of cattle. I look at the wheelbarrow full of equipment, contemplate the two kilometers, and think, well that's that.

Luis just smiles and begins to pile bee boxes and smokers, spray bottles and enough bee veils for a small army on top of all the tools. His team of devoted students and ex-students helps out. For the past 10 days, my wife Maria and I have been accompanying Luis through rural Tabasco, particularly to small villages grandfathered in to the Usumacinta Canyon Ecological Reserve, on a tour of all-things-apicultural. I should know by now that nothing is going to daunt this *brujo* of the bees.

Miguel Ángel Corzo Romero, Luis's stout right-hand man, lifts the handles of the wheelbarrow to push it, and one of the *dueño*'s sons is roped into a harness made from a lariat to pull (yes, *pull*) it. Our group slogs single-file through the mud. I'm happy that my advanced age and status as "visiting expert" leaves me blithely traipsing the trail, swinging just my insect net and a small mallet, swabbing streams of sweat from my forehead with my baseball cap.

In half an hour we arrive at the site of the bees' nest, only to find that the bees are ensconced about 10 feet up on the side of an arroyo. They are barely accessible by a tough, vertical, slippery climb. A thick cover of vines and other vegetation conceals a tiny entrance leading deep down into the limestone.

Well, that's that, I think. No way on earth are we going to be able to remove all that plant cover, open a hole into solid rock large enough for us reach in and pull out five to 10

Luis Manuel Godinez's assistant, Miguel Corzo, and the son of the landowner wrestle the wheelbarrow to the site of the bees' nest.

Luís Manuel Godínez puffs smoke at a cluster of bees while assistants stand at the top of the arroyo.

Miguel Corzo uses a machete to cut a vine holding the gathered bees.

Miguel Ángel Corzo digs away at the cave with a pry bar.

Student Ana Laura Trinidad Sánchez sheds her veil and digs into the cave barehanded to harvest combs.

Smoke drifts over exposed combs hanging in the limestone cave.

combs of bees, larvae, pupae, pollen and honey, and escape without a horrible stinging incident. Aren't these the fabled killer bees?

The people of Tabasco are poor – in money, in land, in a culture hammered by foreign economic interests – says Luis, and a hive of bees costs a thousand pesos. The bees will produce delicious honey that brings another 120 pesos per quart. So it's well worth the risk, and the hard labor, to pick up a hive free of charge.

Professor Godínez, a 56-year-old biologist at the Universidad Politécnica Mesoamericana in the municipality of Tenosique, smack on the Guatemalan border, has been a bee lover since his childhood. "I think I am an addicted to bees," he tells me. "I am never as happy as when I am working with them." He is a master at the manipulation of these Africanized bees. Even in the potentially hazardous situation in which we now find ourselves, he wears only a white tee shirt and blue jeans, no protective suit, veil or gloves. He spritzes the guard bees with lemon-juice-laced water to wet their wings and hinder their flight. From a smoker he puffs dense clouds of smoke to calm them, mask their alarm chemicals, and induce them to engorge on honey, which calms them further. As his students work with him, he is constantly chanting to them "*agua y humo, agua y humo.*" Water and smoke.

The team uses machetes to hack away the quilt of vegetation, and now sweat-drenched Miguel Corzo wails away at the limestone around the nest entrance with the sledgehammer, exchanging it for a smaller mallet at one point when the head goes flying off the old sledge. "*Peligroso*," he murmurs. Students chip away with pry bars, and I find myself dodging big hunks of rock tumbling down into the arroyo. My nostrils and lungs fill with acrid smoke. The air around us buzzes with thousands of alarmed, confused bees.

The students, even the first-year ones, are fearless. Ana Laura Trinidad Sánchez, who has never before this week worked with bees, sits at the cave entrance pawing bare-handed at dirt and limestone fragments and trying to reach in with a knife to cut out the combs. She becomes exasperated with the awkwardness of her veil and asks the *brujo*, "*Me quito esto*?" Can I take this off? Of course, says Luis.

Billows of smoke drive the bees completely from the cavity, and the cut combs are placed in wired wooden frames and then into a wooden bee hive. A large swarm of suddenly homeless bees has gathered on a nearby dangling vine. A student uses a machete carefully to sever the vine they have clustered on, and – after *agua y humo* – shakes and brushes them gently into the box of frames.

And there sits the new hive, loaded with bees and comb, atop the limestone outcrop and just at the entrance of the old nest. During this entire operation, *not a soul* has received a sting from these so-called killers.

I look back down the long mud path, sweating profusely. I'm thinking of the return journey, which will have to be after dark when all the bees are home, with the hive and its notorious inhabitants clattering and bouncing in the wheelbarrow.

Agua y humo, agua y humo. And the b*rujo*. All will be well.

And that's that. BC

W.S. Robinson teaches biology at Casper College in WY. His most recent bee research has been on Apis dorsata *and* Apis cerana *in Thailand. He was in Tenosique, Tabasco, at the Universidad Politécnica Mesoamericana in December and January, 2017-18 as a Fulbright Specialist in apiculture.*

Assistants press combs cut from the cave into a wired frame.

A student prepares to spray, brush and shake the swarm into the hive as Luis looks on.

The newly hived "killer" bees sit atop the arroyo.

HONEY BEE

Darryl **Gabritsch**

The balancing act of managing the needs of honey bees while managing the needs of horses is challenging. It's difficult to find an article addressing the coexistence needs of both. Honey bees need suitable locations to live, water and nectar and pollen producing food sources. Horses need suitable locations to live, water for drinking, and food source areas free of toxic plants. The challenge for the beekeeper is how to provide support for the needs of the honey bees without harming the horses and still meeting the horse's needs.

The first challenge is a good location to live. Horses need large fields with lots of sun with patches of shade, ample room to run, a water source and, in a perfect world, some sort of overhead shelter. Honey bees need to have their hives facing South, an area that is preferably in full sun. The hive also needs to be relatively near water and not in low areas where night temperatures drop too low. Hives should not be located in the horse paddocks since horses are naturally curious and might knock over hives.

One scenario is that a horse knocks over the hive, the honey bees become defensive and sting the horse. The honey bees are at a loss until a beekeeper puts hive back in order. The horse is at a loss because it gets stung, and possibly gets more severely injured by slipping and injuring a leg, possibly running into a fence and getting a laceration, etc (let your "what if" imagination run wild) as the horse runs away from the threat. Calling a veterinarian out to suture a laceration is an expensive lesson that's best not learned the hard way. A farm call for a veterinarian to suture a minor laceration could cost well over $200 in initial costs plus follow-up visit costs if needed.

The second challenge is balancing water needs of the honey bees and the horses. The honey bees need water to dilute honey and to cool the hive during hot weather. The horse needs gallons of water to survive. If the hive is too close to horse troughs the bees can intimidate the horse as numerous honey bees fly around the watering troughs as they forage for water.

I recently observed this firsthand when my wife, a veterinarian, came inside our house and told me that I needed to "do something with the honey bees". I went out to investigate the problem, and sure enough there were more than two dozen honey bees buzzing on and around the water trough as the horse repeatedly tried to get water. There stood the poor horse desperately trying to get to the water while swatting at the honey bees with its tail as the bees buzzed the horse. Honey bees might fly as far as six miles to get water, but they prefer closer distances. In a perfect world the apiary would be located within 300 feet of a natural water source such as a pond or creek that is located outside of a horse paddock and located between the horse paddock and the hive since honey bees make an average of 50 to 100 trips a day for water during hot weather. Most people don't live in the perfect world. Things you could try to help solve the water challenge:

- Put a smaller water trough near the bees. You can make it more inviting by adding a capful of bleach to scent the water as long as the trough is fairly large, and by adding floats to the water such as yellow dog bone sponges or a PVC pipe float with window screen zip tied to it. The bleach scent, as well as the sponges and /or PVC float, makes it easier for the honey bees to find the water trough as they forage for water. I usually add several sponges to the top of the window screen covered float. The PVC float and window screen will keep the sponges from getting saturated and sinking to the bottom of the trough. You should change out the water in the troughs about once a week to keep mosquitoes out. You will also need to scrub the tubs (brush only, no soap) and rinse sponges to keep algae to a minimum.

- Put a division board feeder with a cap and ladder system filled with water inside the hive.
- Put a slatted rack on the hive. The slatted rack is normally used with solid bottom boards, but can be used with screened bottom boards. It normally isn't needed if you are using a screened bottom board with the Integrated Pest Management sticky board removed. The slatted rack fits between the bottom board and the bottom brood chamber hive body. The slatted rack has the same outside measurements as the hive bodies above it. The rack is normally about two inches deep, with a solid piece of wood horizontally across the front of the rack and parallel slats at the back of the rack that align with the brood frames in the brood chamber above it. The slatted rack provides an air space between

the bottom board and the brood chamber which helps keep the bees cooler in the Summer.

- Active ventilation measure: Install a solar powered ventilation system on top of the hive. This is an expensive endeavor, but may be necessary if you want to keep both horses and honey bees in close proximity to each other. A solar powered ventilation system replaces an inner cover. The ventilation system goes under the telescoping top cover. Solar powered ventilators use a solar panel to power a small DC powered fan, have a screen under the fan to prevent honey bees from touching the fan, and have vents normally facing the front of the hive. Typical costs can be around $130 or more for each solar powered ventilator system.

- Passive ventilation measure: Install a screened ventilation shim in place of an inner cover. There are numerous plans on the internet on how to construct them. They are simply a frame (converted honey super, 1"x4" boards or similar size boards) with holes drilled on all sides with screen stapled to the inside of the frame covering the holes. Some versions even put screens horizontally on the top and bottom to serve as a screen barrier to keep honey bees from coming out of the hive as you pour sugar syrup through the top of the ventilation shim into hive top feeders if the ventilation shim is placed on top of a hive top feeder. Passive ventilation shims aren't as effective as the active solar powered ventilation systems, but they are a cheap option for the budget conscious beekeeper. Typical costs can be around $10 or less for each ventilation shim if you make it yourself.
- Temporarily put shade over the hives. Construct a removable shed type covering that could be placed over the hive that provides air space between the shed and hive while leaving room for the bees to fly into and out of the front of the hive.

The third challenge is balancing food needs of the honey bee while avoiding plants that are toxic to horses. There are many great nectar and pollen producing plants available to the beekeeper, but you must do extensive research to ensure the plant isn't toxic to the horses. I read several books and articles on good nectar producing plants and selected the black locust tree, *Robinia pseudoacacia* and Wild cherry tree, *Prunus serotina.* My wife quickly pointed out that they are both toxic to horses. She then handed a copy of her toxic plants bulletin to me and told me to do some research before I ordered any plants. Lesson learned: What's good for the honey bees might not be good for any nearby animals. You can research plant toxicity to animals from numerous sources. You should cross reference multiple research sources for information since a single source may not list your particular plant; whereas another source might have it listed as being toxic. You need to closely verify both the common name and the scientific name of the selected plant to ensure the plant you are researching is correct. For example if you search Lily of the valley (common name) without cross referencing the scientific name you would find that Lily of the valley, *Pieris japonica* (a four to eight foot tall bush) is toxic; whereas Lily of the valley (also known as Sourwood), *Oxydendrum arboreum* (a 20-30 foot tall tree) is not toxic and produces a nectar that honey bees convert into a sought after honey. The starting point locations to research toxicity that this author used are:

- **https://plants.ces.ncsu.edu/plants/category/poisonous-plants/**
- **https://www.aspca.org/pet-care/animal-poison-control/toxic-and-non-toxic-plants**
- **https://www.accessdata.fda.gov/scripts/plantox/detail.cfm?id=4677**
- Plants Poisonous to Livestock and Pets in North Carolina, Revised Edition (North Carolina Agricultural Research Service Bulletin, No. 414) Paperback – 1994 by **James W. Hardin** (Author), **Cecil F. Brownie** (Author). ASIN: B007FCS6HU . The book is a bulletin produced by the NC Agricultural Research Service, North Carolina State University, Raleigh, NC

In the end I decided to order several Tulip Poplar, *Liriodendron tulipifera* trees and Sourwood, *Oxydendrum arboreum* trees to plant near my honey bees. The bees will get a good nectar source and the horses will get a natural shade source. You CAN have happy, healthy honey bees and horses coexisting in close proximity if you simply do a little planning and research. BC

Darryl Gabritsch lives and keeps bees in North Carolina with his family.

The ULTIMATE Swarm Box

Frank **Mortimer**

Swarm, swarm everywhere a swarm
Flyin' outta my hives, breakin' my mind
Do this, don't do that, can't you stop the swarm?

Last Spring in New Jersey was a roller coaster of weather, which you know is never a good thing for a beekeeper. In February, we had temperatures in the 70s, it felt like Winter was over and sunny days were here to stay. It seemed like Spring was coming two to three months early and I was already dreaming of having honey supers on before St. Patty's day. But Mother Nature had other plans and in March, we had a blizzard, with some areas getting well over a foot of snow. The snow melted, but the colder than usual temperatures stayed around through April, which was then followed by an unseasonable amount of rain. I imagined that my hives were like drag racers at the starting line, revving their engines, ready to get to work and start bringing in the nectar to make lots of honey. But instead, the bees were stuck inside the hives, cramped, until the weather finally cooperated. Just after tax day, I knew Spring was finally here. I didn't have to look outside to see the sun shining, or hear the birds singing. I knew Spring was finally here because our club's Facebook page was filled with posts about swarms. Here a swarm, there a swarm, everywhere a swarming swarm. It had been about six years since I'd seen this many swarms in our area. Back in 2011, we had a similar start to our season, with weeks filled with rainy days. When you visited your hives during the few non-rainy hours you would just see how grumpy bees get when they're stuck inside for too long. It's like having a bunch of six-year olds hopped-up on sugar, standing at the door trying to make the rain go away.

Swarming is caused when the bees feel they are too crowded inside the hive, and prolonged rain keeps more bees inside their hive, which only exacerbates the problem. Also, for new beekeepers, it is also important to remember that bees do not count foundation as more space, only drawn comb counts as space. So, if you are just starting out, it's important to go into your hives to see where your bees are, feed to encourage comb building – especially when it's raining, and add your next box *before* it is too late.

For established hives it's always important to remember that when bees are at the top of the hive, with only the inner cover above them, they feel like they have run out of room and this, too, can cause swarming. The best way to prevent the bees from feeling they have run out of room is to reverse your boxes in March to prevent swarming in May. However, remember that you should always check where the brood nest is *before* reversing your boxes. If your brood nest is completely in the top box, go ahead and reverse your boxes. But, if you have brood in both boxes, you should keep the brood nest intact, as the bees may not be able to keep two separate brood areas warm if the temperature drops.

I also think that putting honey supers with drawn comb on early can prevent swarming, as you have given the bees lots of extra space. One point of debate when you put honey supers on is whether or not to use a queen excluder. If you're using your supers to also prevent swarms, then the answer is, **NO**. Using a queen excluder can also create the "this is too crowded" feeling because you are limiting where the queen can go. But, if you don't use the excluder, you will have to deal with brood in your honey supers. Personally, I'd rather deal with the brood than my hives swarming. Especially when the queen lays early in the season as I have found that as soon as the brood hatches out, the bees will go back and fill those cells with nectar, so I end up with honey supers filled 100% with honey and 0% brood.

I've been keeping bees for about 10 years. During my first couple of years, I was so focused on limiting the mistakes I made to my own hives that I never went after any swarms. Starting in 2011, I added my name to the New Jersey Swarm page, as I felt I was ready to make mistakes beyond my own hives. The New Jersey Swarm page is set up so that if someone sees a swarm, they can search for a beekeeper by town or county, who will

Then, like they were on the backs of angels, my swarm glided smoothly into the box. I closed it up, used the Gorilla tape to keep it shut, and I was waving good-bye to the homeowners less than 15 minutes after arriving.

come and remove it. The good news about living in such a populated area is that if a hive swarms, someone is going to see it. Having thousands of beekeepers throughout one of the most densely populated states means you tend to get a lot of swarm calls. The bad news is that someone is going to see it, before you do. When I first decided to start catching swarms back in 2011, I wasn't really prepared to catch them, so when I got a call, I had to scramble to get everything I needed to go catch one. Usually, I also forgot something or wished I had packed one more item to make my swarm catching go more smoothly.

In the Winter of 2012, while thinking of what bee stuff I could do, I decided to create the ultimate swarm box. I used a nice-sized cardboard box, and I cut out ventilation windows on all four sides, then covered the "windows" with screen, so the bees had plenty of air, and I wouldn't have to worry about them overheating or getting out. I also reinforced the box with tape to keep it sturdy because I planned on using it to catch a lot of swarms. I then filled the box with everything I might need: garden sheers to cut branches; Gorilla tape to seal the box once the bees where inside; a bottle of sugar syrup to spray the swarm; an old bed sheet to wrap around a tree; some old comb to make the bees feel at home; and even a stack of New Jersey Beekeepers Association educational flyers about swarms to give to anyone who wanted to understand what was happening. It was a busy, creative Winter.

Once I had my ultimate swarm box, complete with all the swarm supplies you'd ever need, I put it in the trunk of my car, so I would be ready for that next call. And man was I ready! When I started hearing about swarms in other parts of the U.S., I'd get even more excited, thinking that soon it would be my turn. But days turned to weeks, weeks turned into months without receiving even one call. So, I put my ultimate swarm box, complete with all the swarm supplies you'd ever need, away for the season. The following Spring, I pulled out the ultimate swarm box, complete with all the swarm supplies you'd ever need, and put it back in the trunk of my car, and waited. And, I waited. I waited for three more seasons, and still, I was never able to use my ultimate swarm box, complete with all the swarm supplies you'd ever need. Four years in a row, I had put everything in my car so I'd be ready for that swarm call and nothing, not even one swarm call. Yes, there had been swarms in my area, but other people always seemed to get the call, not me. Several beekeeping friends would call to tell me all about catching the 'biggest swarm you've ever seen". I would listen to their stories, imagining it was me who was catching the swarm, and thinking how I'd use all the swarm supplies I'd ever need to make the job go as smoothly as possible. There were a few times when I debated, (with myself,) about skipping family vacations, just so I could be ready for when that swarm call finally came in. If there were a sunny day after a few rainy days, I'd tell my boss, I needed to "work from home," just so I'd be ready.

Throughout those four long years, I was contacted only twice about honey bees, and both times it was a feral colony living inside a concrete wall of a building that would require a jackhammer or some small explosives to get the bees out. Every Fall, I'd get lots of calls for which I asked two questions: 1) Does the hive look like it's made of paper?" and 2) Do they look shiny like they're made of plastic? I would then say, "Those are yellow jackets, not honey bees."

As this year began, I saw my ultimate swarm box, complete with all the swarm supplies you'd ever need, sitting in my garage mocking me. As it was sitting there, all cozy on its shelf, I could tell it was thinking, "When does my Summer long ride around in your car begin?" So right then and there I decided, not this year swarm box! This year you're going to stay right where you are. This year, I'm not wasting a bunch of my trunk space just so you can go joyriding around, enjoying the Summer sun. This year is going to be different!

Boy was it different. Starting in early April, I began hearing about swarms in New Jersey. But I wasn't going to budge, swarm box stayed in the garage.

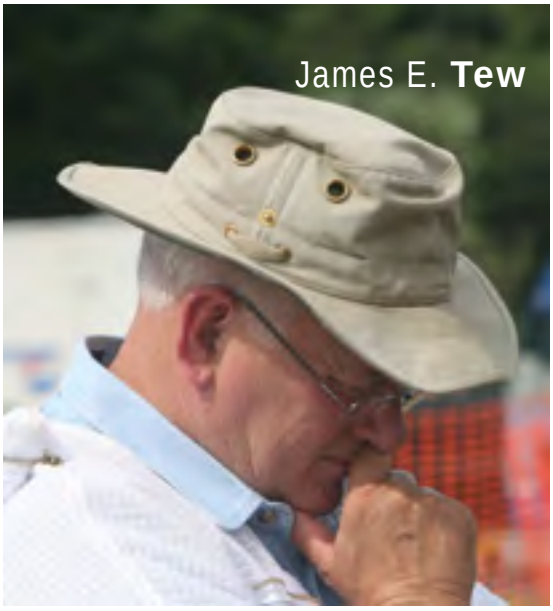
But finally on Mother's Day, I got the call! It's was five years after its creation, but I was finally going to use my ultimate swarm box, complete with all the swarm supplies you'd ever need! I arrived at the home where the swarm was taking up temporary residence. I handed the homeowners several copies of the pamphlets I'd been hauling around for five years. I positioned the ultimate swarm box underneath the swarm. And man oh man, it was a beautiful swarm. It was teardrop shaped, which I'm convinced represented tears of joy because the bees were *that* happy they would get to bee inside the ultimate swarm box. I used the garden sheers to cut the few branches the swarm was attached to. Then, like they were on the backs of angels, my swarm glided smoothly into the box. I closed it up, used the Gorilla tape to keep it shut, and I was waving good-bye to the homeowners less than 15 minutes after arriving. If I just caught the swarm and left, it would have been taken me less than five minutes, but I spent several minutes explaining to the family what a swarm was, why bees do it, and how gentle the bees are when they swarm. Then after I caught the swarm, I also spent nearly 10 minutes just admiring the bees in my ultimate swarm box. I felt like a proud papa admiring his newborn child.

I drove back to my hives with my ultimate swarm box finally fulfilling its destiny by transporting a newly caught swarm. During the drive, instead of buzzing, I could have sworn I heard them humming because they were so happy to be enjoying the pure luxuries of the ultimate swarm box. Once I arrived at my apiary, I set up a nuc box and finally poured the bees into their waiting new home. As the swarm slid out of the box, many of the bees looked over at me and gave me tiny bee thumbs-ups to let me know how wonderful it was to experience the ultimate swarm box.

If I live to be 115, I'm not sure if catching a swarm will ever again go that perfect for me. I'm back to keeping the ultimate swarm box, complete with all the swarm supplies you'd ever need, in my car.

So one thing I know for sure is: With that swarm box back in my car, there is no way I'll be getting another swarm for the next five years. BC

Beeyard Thoughts, Observations, and Updates



Frozen honey and how bees eat it – possibly.

Winter stores for the wintering colony.

Consuming frozen honey

Honey bee colonies – anywhere in the world – require some way to store food products for lean times. Such foodless periods occur in all climates. While stores are required anytime there is a dearth, the Queen Mother of all dearths is a long, hard cold Winter.

After reading the simplest of bee books, beekeepers, new and old, know that bees require honey as a Winter food source. No doubt, pollen is just as important, but my discussion here pertains to eating frozen honey during Winter months. To my knowledge, pollen plays no integral part in bees' consumption of Winter honey. Bees require winter stores. We all repeat it. We all know it, but what I personally don't fully understand is exactly how bees eat frozen honey food stores.

Much of this country just experienced a very cold Winter. In northeast Ohio, where I and my bees reside, it was very cold only a few weeks ago. I know, I know that U.S. states father north and all of Canada chuckle at Ohio's opinion of cold, but -10°F is cold anywhere that temperature occurs. *(At this point, I begin to wander away from apicultural science and amble more toward conjecture. Be warned.)*

Right now, it is about 8°F outside. The wind is still, so the wind chill temperature is also about the same. In my hives that I can see in my backyard apiary, honey stores would be about that same temperature. That's cold honey.

Yes, I know – the healthy wintering colony gives off a bit of heat – about the amount of heat from a 60W incandescent lightbulb. Would that byproduct heat not warm the honey (some)? I'm sure it would, but would that bit of heat be enough to liquefy a significant part of colony's honey stores to the point that it could be drunk using bees' lapping-sucking mouthparts. I don't think so. That frigid honey is going to be very, very thick. Sticking the (very) rough equivalent of a plastic soda straw in that thick honey would not be a practical way to eat cold honey. You try giving a pull on that straw stuck in that frigid honey.

Having no teeth or chewing structures, honey bees do seemingly have a way of returning the honey, in small amounts, into a liquid form at those low temperatures; indeed, at any temperature.[1] I think bees' cold honey consumption procedure must be like my grandkids licking a lollypop. Water (saliva?) is used to liquefy small amounts of frozen honey. Now liquid water in a wintering colony, at such low temperatures, is a hypothetical can-of-worms. Where do bees get a store of liquid water when the temperature is so low?

Do wintering bees lick ice to generate liquid water? I don't know, but if I'm allowed a guess, I would suspect they do not routinely do this.

My reasoning for this answer is that an individual bee would need to be very near the ice source that is to be licked. I suppose that could happen, but for a bee searching for ice or frost (which has little odor in the dark hive) in a frigid hive, the wandered distance would have to be very nearby or the bee will quickly chill, sit immobile for a while, and then die from cell lysis that causes compromised cellular membranes. If bees were holding any thin liquid in their crops, I suggest that it also would freeze. That's not good (if my guess is correct). An individual bee within a wintering hive getting only a short distance from the warmth of the cluster is quickly in serious trouble.

Though I have personally said many times that internal frost and ice can be sources of Winter water for a colony, I now second-guess that comment. Gathering water from internal hive sources when the temperature is below freezing does not seem to be practical.

Honey on left is at 10°F while honey on the right is at 70°F. For this photo, I laid the left jar on its side to show the honey thickness. Even the honey on the right could not be consumed by bees without dilution.

[1]It would seem that honey bees dilute honey – at any temperature – with water before being able to lap-suck it into the crop. A bee's crop is essentially a cargo bay for product transfer. This structure is also instrumental in absorbing water from the central body cavity. When full, the crop is about 10x the size of the empty crop. The crop generally has a capacity of about 40mg or 3/5s of a single drop.

Wintering colony water use

To the best of my ability, the pictured bee is 9/16" (0.563 in). I mean seriously – considering everything else that is within that little bee, how much water can she physiologically hold – a full drop? I don't know, but it simply can't be much. Humans are accustomed to full glasses of water, but I don't think that individual bees consume huge amounts of water per bee.

Like water on Mars

Apparently, there is abundant water on Mars. Whether or not ice or liquid water is readily available on that planet is still being reviewed. As on Mars, in the wintering colony with ample honey stores, there is an abundant water source in the honey reserves. The frozen honey is probably about 16.5 – 18.6 percent water.

If any of my guessing is in any ball park, that little bee pictured above has access to abundant water that is a component of honey – if it can be thawed or at least warmed. Using her own miniscule amount of internal liquid water, I think she can consume cold honey. To do this, (1) she must be warm at the outset; (2) she has to lick/dilute the thick, cold honey, and (3) she must acquire a saliva/honey mix held in her crop that subsequently passes to her true stomach (ventriculus) where digestion occurs. Digestion processes provide energy to power her flight muscles which are used to generate heat within the wintering colony – ergo – colony warmth during cold periods.

But now I'm stuck

To put some general estimations on this frozen honey water reserve, see if this works. In Ohio, it is commonly recommended that a wintering two-story colony have about 68 pounds of honey reserves going into Winter. If the honey is 18.6% water, that will result in the production of about 1½ gallon of water over the Winter months.

Now I'm stuck. I have gone from, *"Where do bees get liquid water within the wintering colony to how – over the course of the winter – do bees get rid of 1½ gallons of by-product winter water?"* Do wintering bees in the center of the cluster need the same water quantities that bees at cluster edges need? I don't know. Do all bees within the wintering cluster, if possible, eat Winter stores or is it given to them by other bees nearer the food gathering site. Year round, bees routinely transfer food stuffs (Trophalaxis) between themselves. This transfer *could* happen. In fact, I would guess that it does happen.

One bee feeding another. This process works during Winter, too.

Yet another guess...

Surely, any bee, anywhere within the colony, and at any time, would use whatever means necessary to get food when energy was required. Yes, some bees have their food stuffs delivered to them, while other bees are literally foraging within the hive for honey that may be very thick and cold. Such cold honey needs processing before it can be consumed. Ultimately, all bees would appear to eat diluted honey as their primary carbohydrate source. That dilution would seem to be from a saliva/water mix and thick honey that is licked in order to consume it. In this way, all bees within the colony are given both carbohydrates and a drink of water when they get their diluted honey meal.

But then there's the rectum and other beloved internal organs . . .

I am going to speculate that water can only enter the bee through the bee's mouth. I have not found any absorption or humidity procedures that allows water to enter a bee in other ways.

The water that the earlier bee got from her diluted honey meal passes through all the digestive system, along with other materials and waste products, until it enters the rectum. Other things happen to other products, but staying with the water theme here, water is reclaimed via rectal pads that are in the rectum. That reclaimed water is released into the hemolymph where it roams around through the bee until the bee becomes *"water logged"* with byproduct water.

To maintain osmotic and salt balance, the Malpighian tubules begin to reabsorb water from the bee's hemolymph and dump it (and other products not discussed here) into the rectum again. I am unable to explain how the rectal pads in the rectum and the Malpighian tubules in the hemolymph of the body cavity come to an agreement about water levels. Excess water stays in the rectum (sometimes for months) until cleansing flights can be taken. The amount of excess water in a particular bee determines the *"liquid splat"* content of bee feces on your car. Watery spots are released by bees that are nearly water logged. Firmer fecal spots are released by bees that had little excess water. There are also possible diarrhea issues that are beyond my scope here.

Not all colonies are the same

But you already knew that. Feral nests are commonly much smaller than intensely managed colonies. Small populations and smaller amounts of honey stores mean that these small colonies can nearly stay in a small, confined area of honey stores throughout the Winter. I

A watery fecal spot on my car. This spot was not the only one.

Frost on the inner surfaces of both lids. I don't sense that this is a suitable water source for wintering bees.

speculate that *"moving upward"* as managed colonies do as the Winter advances does not always occur in small colonies that are essentially always on their honey stores.

But a smaller managed colony in a single deep would have a similar wintering scheme to a larger colony. It seems logical, but I have no data to support this concept of smaller colonies not moving far from their honey stores.

Venting the outer cover during Winter months

As wintering bees flex their flight muscles at a high rpm without moving their wings, they generate heat within the cluster. The outer insulatory layer of older bees try to hold that heat in, but it's simply not possible to retain all of it. Heat rises and water condenses on the inner surface of the hive top. (Is this a bit like water accumulating on the ceiling caused by an unvented propane heater?) As they burn their honey fuel, they generate water as a byproduct (So you recall the 1.5 gallons from earlier?). Beekeepers need to provide a vent at the top, but then later in the season, the humidity needs to be raised to allow brood production.

Water in and water out...

This entire cold honey thread came to my mind because my wife and I were to present a short wintering discussion to my grandkids elementary school bee class. *(Ironically it was so cold and snowy that school was cancelled that day.)* As my wife *(Grandma)* and I (Pop-Pop) were trying to come up with a plan to explain how bees survive a Winter, the wind was howling outside my living room window. It was a good Winter storm.

Part of our plan was to use honey straws to give the kids a sample of the food which that bees consume to survive the Winter. I briefly had the thought, *"Wow, we should freeze these honey straws to give them a real understanding of bees' winter food."* To which I thought, *"Well, how do the bees do it?"* I realized that I wasn't sure; hence, your torture here today.

This is my *colony winter water* story, but I am not necessarily sticking to it. I could be wrong in oh-so-many places. I'm confident someone will point them out – as they should.

As the Winter weather temperature begins to drop and stored honey thickens, internal hive foragers, only require the tiniest amount of water (or saliva) to liquefy the surface of their cold honey stores – thereby collecting a honey/water mix. I suspect all bees can do this, but I also would guess that much of the task falls to bees that are nearest the stored honey. In "eating" this honey, the bee gets both a sugar meal and some water to go with it. Therefore, all wintering bees should have similar food quantities. Yes, there are cluster mechanics failure at times resulting in the colony being damaged or even killed. As bees consume diluted honey, water levels accumulate in the wintering bee. Cleansing flights are required on warm days during the Winter. Bees also lose moisture via respiring and around their cuticular membranes.

It's complicated . . .

Wintering bees need water, but only just enough. Bee brood requires controlled humidity levels – but not too little and not too much. What's a beekeeper to do? Only the best they can.

I suspect this discussion could have been painful for some of you. It's much ado about very little. But when I hear generalized statements given as information for general hive management such as this one, "Provide a dependable water source for your bees.", there is so much more to that simple recommendation. Here I have offered my guesses with some occasional facts.

At this point, I am reminded of H.L. Mencke's well known quote:

> *For every complex problem, there is a solution that is simple, neat, and wrong.*

That quote could describe my efforts at understanding bees beyond my ability.

Thank you.

If you made it through this piece, thank you. BC

I used these sources for some of my information.

http://honeybee.drawwing.org/book/crop

The Hive and the Honey Bee, 2015 edition, Joe Graham, editor

Understanding Honey Bee Anatomy: A full color guide, 2012, Ian Stell, author

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Dr. James E. Tew, State Specialist, Beekeeping, The AL Cooperative Extension System, Auburn Univ; Emeritus Faculty, The OH State Univ. ***Tewbee2@gmail.com; http://www.onetew.com; One Tew Bee*** *RSS Feed (****www.onetew.com/feed/****);* ***http://www.facebook.com/tewbee2; @onetewbee*** *Youtube:* ***www.youtube.com/user/onetewbee/videos***

Sales & Marketing In The SE U.S.

It's all in the timing, and the price.

David **MacFawn**

Beekeeping, while a lot of hard physical work, is one of the enjoyable endeavors that may make some money. Often the beekeeper's focus is on the bees and management of their colonies. However, if one is to turn their hobby into a financially sustainable venture attention must be given to learning to market their products.

A sales and marketing plan addresses what you are going to produce based on customer demand, how you are going to package and label the product, and how you are going to sell the product. This impacts what production and processing equipment you will purchase, assemble, and use. It will also impact how much money you will need for the coming year for equipment, labor, and other expenses. A sales and marketing plan should address how much product you will produce and be able to sell via various sales channels.

Chunk honey. Photo by Larry Coble.

Extracted pint jar of honey. Photo by David MacFawn

Ross Round comb honey. Photo by David MacFawn

Sales and marketing plans need to be developed by late Winter in the Southeast United States. The main Spring nectar flow is March through the end of May in much of this region. Hence, honey is typically extracted in the May to June time frame. Things to consider are where the beekeeper will sell his or her honey, pollen, candles, and other products of the hive. Also, the beekeeper should consider the type and size of container, and appropriate labels which meet legal guidelines. Sales represent a different skill set than product production and tending the colonies.

The sales and marketing plan, whether written or just thought out, will also drive and impact your equipment decisions. If you are going to produce extracted honey, the extracting supers will need to be procured and assembled. If you are going to produce extracted honey with comb in it, then some supers and frames with thin surplus foundation will need to be assembled. Pollen production will require a pollen trap, cleaning equipment, and drying equipment. Beeswax production for candles and other beeswax products will need beeswax rendering equipment such as a solar wax melter, double boiler, or other methods to clean the wax.

One advantage the local beekeeper has over other retailers is the ability to capitalize on locally produced products. The beekeeper can inform the customer that the honey was produced at a certain bee yard and regional location, can state when it was produced, and identify the predominant flora in the area during that time period. Local honey sells for a premium over "imported" honey from other regions or countries. The beekeeper can also say when the honey was extracted and describe the honey's taste.

The number of containers needed to bottle the product should be identified during the latter part of the nectar flow. The honey yield can be estimated from USDA data of each state. If honey will be the primary product, the seller can then decide on the appropriate jar type for the selling venue, and the corresponding packaging. In the south pints and quart jars are popular and common in the mass market. Other options include "bears" and "upside down" dripless jars. The seller also needs to determine if they will sell honey with beeswax comb in the jar. Many customers are interested in liquid honey with comb since they believe it is more likely to be pure honey. If selling liquid extracted honey with comb in it, the beekeeper will need to produce comb honey in addition to extracted honey.

If producing pollen, the beekeeper needs to locate a pollen source that is free of pesticides, determine the time of year it will be produced, and how long the pollen flow will last. All of the pollen being brought in by the bees

PURE HONEY

Distributed by or Produced for: (*if not the producer*)
New Product Enterprises
1212 Street Avenue
Columbia, SC 29555

NET WT 22 OZ (622g)

✦Conversion Factors: 1 ounce = 28.35 grams

✦Nutritional Fact Panel is required for firms with 100 + employees and over 100,000 unit sales.

The Four Basic Label Requirements (Fair Packaging & Labeling Act)

1. Statement of Identity (Product Name) *shall* be in **BOLD** print, type size *must* be comparable to the most prominent printed matter (larger than other type). Must be placed on **Principle Display Panel.**
2. ***Ingredients not needed if using pure honey.***
3. Name and address of the manufacturer, packer, or distributor *shall* be added. Address *shall* include a **street address** (if not in a local directory), **city or town, state, and zip code**. Use the phrases "manufactured by", "manufactured for"(if company is not the original manufacturer), or "distributed by".
4. Net Weight *shall* be placed at **the bottom 1/3** of the **Principle Display Panel**, *shall* be in **both customary** (**pound, ounce**, fluid ounce, etc.), and *shall* be **in metric** (**kilogram, gram**, milliliter, etc.) weights, and have a minimum type size of (see below) based on the area of the principle display panel.

Minimum type size (inches)	Area of display panel (sq. inches)
1/16	5 sq. inches or less
(Usually) **1/8**	5 sq. inches – 25 sq. inches
(Larger jars) **3/16**	25 sq. inches – 100 sq. inches
1/4	100 sq. inches – 400 sq. inches

*The following is a list of weight measurements and conversions commonly used for honey
8 OZ. (226g)
12 OZ. (340g)
16 OZ. (453g)
18 OZ. (510g)
22 OZ. (623g)
32 OZ. (907g)
44 OZ. (1.24kg)

Links to FPLA can be found at *https://agriculture.sc.gov*

South Carolina Labeling Requirements.

Extracted chunk honey, Hogg Half Comb honey, and beeswax at a State Fair. Photo by David MacFawn

should not be collected to avoid disrupting the colony's brood rearing. In addition, equipment to collect and clean the pollen needs to be purchased or built. Appropriate drying and bottling facilities need to be assembled also. The market for dried pollen differs from honey. Pollen retail markets include health food stores, nutrition stores, drug stores, and other upscale stores and markets. Pollen labels should address allergies.

Local varietal honey can be sold at a higher price. Nectar flows are typically composed of several sub-flows from various flora sources. In many areas the main nectar sources are often from trees and shrubs, or large fields of farmer planted crops. Honey super management, putting on and taking off supers at the correct time, is critical to collect varietal honey. Local honey with pollen from nearby areas frequently benefits from antidotal reports indicating it helps with allergies.

All honeys produced in the south should be extracted quickly to avoid Small Hive Beetle issues. If a room with moisture and temperature control is available, supers with honey may be stored for a few days but extraction should be completed in a timely manner to help minimize the possibility of Small Hive Beetles. This can be achieved with the use of a dehumidifier and climate control.

Pricing

Determining pricing, with the resulting profit margins, are important in estimating cash flow. The beekeeper typically incurs expenses, or money outflows, when procuring equipment and producing the bee products. Income typically will come in when selling, which is typically in the Summer and Autumn in the Southeast.

Records should be kept for production costs such as labor, fuel, transportation, equipment, medication, feed protein and carbohydrates, jars, and labels. Market based pricing is recommended where the product is priced competitively in the market place. The production cost can then be subtracted to determine the profit margin. If the product is priced via cost + fixed margin/fee, you may be leaving money on the table. The beekeeper needs to determine their cost to make sure they are realizing an acceptable profit margin.

Getting the Word Out and Advertising

When advertising in local traditional media and social media one wants to emphasize the product's qualities first and not the price. Honey qualities, such as local honey, type of honey, where the honey was produced with the resulting pollen content for allergies, color and taste and more factors are important. Discussing price should come after the customer is sold on the product's benefits and qualities.

Entering honey, beeswax, etc. in the local and state fairs is also very beneficial. Being able to say this is "award winning honey" goes a long way. You may also want to consider the "black jar" contest where the honey is judged on taste alone.

Selling Venue

Where you sell will determine your packaging, jars, and labels. If you are going after the local market, such as farmers markets, then pint and quart jars may be appropriate in the south. Larger volume containers are also typically desired by customers. The beekeeper needs to be careful when selling larger margin containers, like 60-pound pails, since they may make more selling smaller quantities. A small producer should typically sell their product directly to the end customer and not sell wholesale to increase their profit margins. Fairs are an excellent place to sell directly to the end customer at full retail prices.

If you are going after the upscale market, like boutiques, hair salons, upscale restaurants, coffee shops, book stores with coffee shops, then the hex jars and unique tailored jars may be suitable. Smaller jars may also be more appropriate.

Labels needs to be attractive, colorful, and eye catching. A combination label and jar type are critical to catching the customers' eye in the split second they look at the honey product. The label should support and enhance the jar. The jar and label should support the venue where the product is sold. A tamper proof seal, such as heat shrink plastic bands or tamper proof labels should be considered.

There are strict state and federal labeling laws that defines label, the font size, and where on the label information should be located. For guidance contact your state's food inspection agency.

https://www.fda.gov/RegulatoryInformation/LawsEnforcedbyFDA/ucm148722.htm

An infant warning statement should also be considered. This statement indicates honey should not be fed to infants younger than one year old. Also, product liability insurance should be considered.

A sales and marketing plan is vital, whether written or planned in your head. All aspects of production from the type of equipment procured and assembled to the packaging and labeling of the finished product drives the sales and marketing plan. Cost and pricing with the resulting profit margins should be determined early in the planning to make sure you will make an acceptable profit. Your sales and marketing plan will vary from year to year depending on consumer demand and the resulting profit margin. Sales, while necessary, are a different skill set than product production or tending the colonies. As stated earlier, beekeeping, while a lot of challenging physical work, is one of the enjoyable hobbies that will make some money. With practice, the marketing and sale of your products can also become an enjoyable aspect of your beekeeping venture. BC

The Good Ole Days Of Beekeeping

David **Hughes**

Ah, the good old days of beekeeping.

Healthy bees, huge flows of honey – life was good for a beekeeper.

Was it really ever this way? If it was, what happened? Why does it seem so hard now to make a good crop of honey?

There are stories from the dim past of hives with huge stacks of supers full of honey. Were those beekeepers really better than we are or was there something else going on?

The reality is, they were not keeping bees in the same world that we live in. The entire environment around those hives was different than today. Most of those stories were from a time before the total dominance of the internal combustion engine. Now, this is not an argument against progress. There will be no urging us to go back to preindustrial times. This is just a description of the environment a hive had to work with compared to today.

Prior to the 1960s, agriculture was what we call "small." Most farmers had less than a couple hundred acres to work with. Most had much less, 20 to 40 acres. These farms were diverse. They raised multiple crops and they had livestock.

Small, Diverse and livestock are the keys. Farm management included a rotation of row crops that included a rotation of Hay and Pasture. This necessitated small fields which made for fencerows that were semi-wild. Small fields and rotations meant that most farms were at least 50% pasture or hay. Throw in a few fruit trees and a woodlot for firewood and farm lumber and you have a very diverse forage environment for a honey bee.

Repeat this farm model over an entire continent and you have a country full, entirely full of forage for beehives. This was a world pre-herbicide. There were weeds in the corn. Pastures and hay fields always includes clovers and alfalfa. Forage grasses in the pastures tended to be clump types which left room for other plants, "weeds," to grow. Horses and cattle ate the "weeds" in season so there was no loss of forage.

Farm work was low tech and there was a lot of manual labor so, cutting the blackberry thickets out of the pastures was done every second or third year. Those fencerows were a jungle of wildflowers and various forms of wild plants. Some pasture lands were just whatever grew there with no manipulation other than a periodic burn or hacking back the bushes. This was honey bee nirvana. Bees had a diverse forage base well within reach.

There were some environmental negatives to this world. Many lands too steep for cultivation were cleared and plowed. The State of IN was once more than 90% deforested. There are more trees in North America now than there were in 1900. But, this is not about that subject.

We are now trying to keep bees in an urban, suburban, industrial and industrial agricultural world. We live in a "clean" world. See a weed, spray it. Lawns with nothing growing in them but turf grass. We have as a society become weed phobic. Hundreds of thousands of acres in agricultural crops with no weeds or anything else for a honey bee to eat. Our roadsides are sprayed regularly for "weeds".

Where a honey bee could once have flown a few hundred feet to all the flowers it could ever want, we now have a world where they cover thousands of acres to collect the same nectar and pollen. The longer the trip the fewer trips per day. The fewer trips per day the less honey can be made.

So, what do we do? Go back to the past? Throw up our hands and quit? Most of us have a limited area we have direct control over. Maximize the forage where you can. If you live in a town, encourage the city to plant bee friendly plants in their parks and road medians. Get with the tree board or urban forestry department and urge them to include bee friendly trees and shrubs. Talk to your local Master Gardener groups about including pollinator pastures in large areas they need to plant. Talk to wildlife groups about habitat improvements that benefit honey bees as well as native birds and animals.

Be sure to make up a list of bee friendly plants to give out to these groups. Don't expect them to know. Make it easy for them. Maybe your bee club could work with other groups to put on a pollinator habitat day where you plant together. Donate a tree to the parks department. Be creative. Be proactive. BC

Thymol – Varroa Control

Claudia **Garrido**

Thymol is one of the alternative treatments in late Summer, or even in Spring according to the temperatures of the year or area. European beekeepers use thymol for several years, having three different registered treatments. For having best results by using thymol, some background knowledge is useful.

Like formic acid, thymol acts by its vapors. The bees distribute them in the hive by their activity, like ventilation or removal of the product. In addition, the external temperature is important: the efficacy is highest when the temperature ranges between 15-30°C (59-86°F) and never falls under 12°C (54°F). The ideal range for thymol treatments is 20-25°C (68-77°F). The most widely used and popular products all over Europe with thymol as a main ingredient are: Apiguard, ApiLifeVar and Thymovar. However, these products are not exactly the same: Apiguard is a gel with thymol, while the other two products are strips saturated with it. ApiLifeVar is a blend of thymol with eucalyptol, menthol and camphor, while Apiguard and Thymovar rely on pure thymol.

Comparison of the three products under different environmental conditions

Not many studies are available comparing the three products by means of their efficacy under different environmental conditions. The bee institute in Liebefeld (Switzerland) compared Thymovar and ApiLifeVar, finding high and similar efficacy for both products (around 90%).

A first extensive comparison of all three products was made in Italy: the scientists performed a study at three different locations in Northern, Central and Southern Italy. In the Centre and the South, all three products showed high efficacy, killing more than 90% of the *Varroa* mites in the colonies. In the North, however, Apiguard was less reliable. The efficacy dropped to 66.9%, which is insufficient for protecting bee colonies until the Winter treatment. The researchers attributed this low efficacy to the lower temperatures and low activity of the bees: under these circumstances, the workers did not "work" on the gel to remove it. By this, the gel surface dried, impeding the evaporation. The other two products did not have this problem.

In Germany, the same occurred: all three products were tested in Hesse (with cooler climate) and in the Rhine region (with milder climate). Apiguard in this trial had the lowest efficacy on both sites, with 43.1% in Hesse and 71.5% in the Rhine region. Thymovar worked better, though also this product was less efficient at the cooler site in Hesse. In the Italian study, Thymovar in addition also showed some problems in tolerability: the bees removed brood and honey from beneath the strips. In Northern Italy, the colonies decreased significantly in strength. At one of the two apiaries in this region, the study had to be interrupted because of the severity of the effects. This may have been due to a higher dose of thymol in Thymovar than in the other products and may have been released too fast. ApiLifeVar finally, was equally efficient at all sites and no problem with the safety for the bees happened. In the table below, you can find a summary of the results of these studies.

Product characteristics influence efficacy

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

In this context, it is important to understand the conditions for treatment success with thymol. As already mentioned, this substance acts by its vapors. The

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

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

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

From all three products, ApiLifeVar was the most independent from environmental conditions. The efficacy remained over 90% at all sites. This may be due to the different composition of this product: differently to the other two, it is a blend of thymol with menthol, eucalyptol and camphor. An interesting property of this blend is that it remains liquid at colder temperatures. Pure thymol is solid until a temperature of 49-51°C (105-124°F), therefore also under hive conditions of 35°C (95°F). Mixing thymol with other aromatic substances decreases its melting point (i.e. when it becomes liquid). Both solid and liquid thymol can pass to the gaseous stage, which is necessary to reach the *Varroa* mites on the bees. However, the step from liquid to gaseous (evaporation) is much more constant and reliable than the step from solid to gaseous (sublimation), especially under cooler temperatures. This may be the explanation for the more consistently high efficacy of ApiLifeVar under cooler climatic conditions.

Some practical advice

When it is correctly used, thymol is a highly efficient and safe treatment against the *Varroa* mite. It is important to note that thymol does not reach reproducing *Varroa* mites in the brood and only kill the mites on the adult bees. Therefore, the duration of the treatment and any other indications given on the label are important to get the best results.

The details given above however show that a variety of factors influence the efficacy. Therefore, it is crucial to use registered products for *Varroa* treatments. Only these products were tested under different conditions and provide the data to make informed decisions about the right product to use. Other preparations do not offer this security: they may not have sufficient efficacy or the thymol concentrations in the hive air may get too high and harm the bees. Thymol is a natural substance, but as every medicinal or pesticide product, it has to be handled with care and responsibly. BC

About Dr. Claudia Garrido :

Dr. Claudia Garrido is a biologist and founder of Beesafe, a field studies and bee health consulting company. She has published several scientific publications about Varroa *and pollinators. Her career was entirely dedicated to bees from the first insights in 1993. Claudia worked on bee parasites and diseases at the State Bee Institutes in Hohenheim (with research stages in Thailand and Brazil) and Kirchhain, Germany. Also, she performed several higher tier honeybee studies in Germany and Austria. Claudia works mainly in Germany and Italy, but performed pollinator studies also in Austria, France, UK and Spain. BeeSafe operates in three main areas: agriculture, veterinary medicine and science communication. To know more visit* ***www.bee-safe.eu****.*

Ann **Harman**

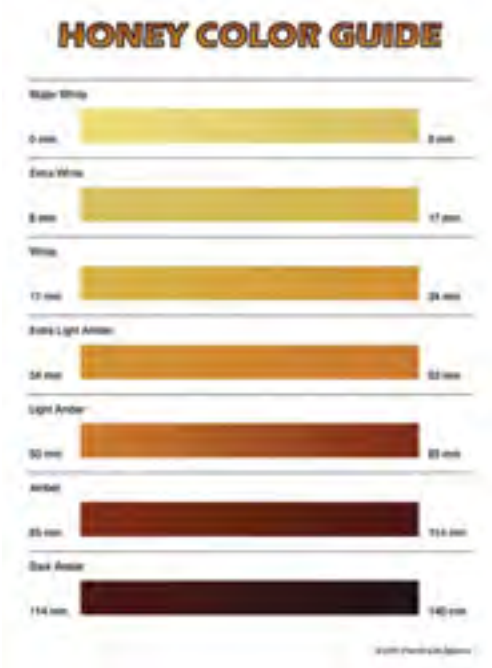
Honey Shows

Oh! A Honey Show is just like a horse race – best one wins. Wrong! It is all about marketing! Honey is a variable agricultural product – just like corn, tomatoes, apples, chickens. Some years the weather is excellent and quality is excellent. Other years, weather is terrible or disease strikes and yield is poor or quality is awful.

Agriculture fairs or shows have a centuries-long history. Today we have newspapers and other printed material, as well as the internet and other electronic communications. Step back in time several centuries and communication was difficult, especially in rural areas. You could walk or go by oxcart – both very slow for transmittal of information. Traveling by horseback or horse-drawn carriage was faster but still had its limits. How could anyone relay information about the magnificent stallion available for breeding or that the cabbage crop was not only plentiful but also the best quality? The answer was to have a fair where people could bring their livestock and samples of crops and have an independent judge to decide the best.

Today the agricultural fairs still exist in counties and in states around the U.S. Some of these are large and some are small but the entries in the various categories are still reviewed by independent judges, experts in their particular field. Honey, hive products and related beekeeping items are a part of many agricultural fairs today. Beekeeping associations – local, state, regional and national also have honey shows.

If your local club or state association does not have a honey show, then make plans to have one. Start small and plan to expand as the need arises. However the purpose – **improvement of a product for market** – needs to be emphasized. Consumers want value for their money. Consumers are looking for a quality product. Keep this in mind the next time you shop for food whether it is at a huge supermarket or at a farmers' market. You, as a consumer spending your money, will walk past the wilted lettuce; ignore the tomato with a sunken black spot; replace on the shelf the jar of sauce with something sticky on it; shove the dented can aside to select one without a dent.



These are the colors used in the U.S.

You are a beekeeper. You know that a bee leg floating on top in a jar of your own honey came from one of your bees. So what. You know the foam on top is because you filled the jar too fast. Doesn't matter. You know that those weird looking crystal clumps are because your bees visited some particular nectar source. Stupid bees.

Now let's consider what the customer thinks. What's that floating thing? Ugh, it looks like some bug part. Bees are good because they pollinate but bugs are icky. All that foam on top? Ewww – it has spoiled! What are those clumpy things in the honey? They don't look edible.

Although some customers may understand, you are not always at their side to explain the mystery items in your honey or why the jar isn't filled correctly or to hand them something to wipe the sticky off their hands. If customers find your honey has consistently good quality they will continue to be customers and also recommend your product to others.

So let's have a honey show and discover ways to improve not only liquid honey but also other hive products such as creamed honey, comb honey, beeswax and even other items related to beekeeping.

Honey shows, in general, will have classes for liquid extracted honey. That is, after all, the most common way honey is sold in this country. Anther honey class can be for creamed honey. Chunk honey, a piece of comb surrounded by liquid honey, is popular in some parts of the country but not in others. Comb honey can be in round sections or as cut-comb. Sometimes you will find a class for a frame of honey suitable for extracting.

Beeswax will be shown as a block, weight usually specified. Other beeswax entries can be candles of various kinds and even artistic beeswax. You occasionally find classes for products made from honey, beeswax and propolis.

Beekeepers love to invent gadgets that are an aid to beekeeping. Some shows will have a class for those. Arts and crafts classes, with a beekeeping theme, are popular. Everyone is taking photographs today so many shows, even small ones, may have several classes. A gift basket class may have a theme specified, such as for a birthday or a specific occasion. Classes for mead and honey beer have become popular.

In the U.S. we have seven different color classifications for liquid honey: water white, extra white, white, extra

Comb honey is a category. All cells filled and cappings even.


Wax blocks should be blemish free – uniform weight.

light amber, light amber, amber and dark. You can purchase two kinds of color graders: one is a simple card fan of colors, the other an expensive electronic color grader. However an experienced honey judge can place the colors separately from experience. It is important to keep in mind that all the seven colors will not be encountered everywhere in shows around the country. In addition bees can and do visit many plants to collect nectar that may be classed as "wildflower" instead of a completely pure source. Entries in a large national show would need all the color categories, but only three or four would be needed in smaller shows. Grouping honey by color is done so that the characteristics are more likely to be the same throughout a class.

Every show needs a set of rules. Why? To have a "level playing field." The rules let entrants know just how to present their entry so that everyone has an equal chance of winning a class. For example, liquid extracted honey may be required to be in one-pound queenline-type jars with no labels. In large shows your single entry may be three or more jars; smaller shows may require only one jar. Rules should be made available as soon before the show as possible. Harvest time varies across the country. If this year's rules have changed from last year's rules, call attention to that so entrants have warning.

One important rule is the one that states: Only one entry in each class may be exhibited by an individual, that individual's family, or that individual's apiary. That eliminates multiple entries of the same item in a class. In other words, it makes a level playing field.

The U.S. is a large country with many beekeeping associations, large and small. Agricultural fairs can be small local ones or large statewide ones. Therefore the rules and classes and judging criteria can be different. It is up to the person entering to know the rules and keep up with any changes.

To put on a honey show it is necessary to have a number of good volunteers. Someone needs to take the entries and keep good records of "who" and "what" and "what class." Someone needs to make certain that the entry is in the correct class. The judges can reassign liquid extracted honey by color if necessary as long as no duplicate entry has been made. Someone has to prepare the room. The judges appreciate stewards to help with the jars – perhaps loosening the caps or putting them back on. It is necessary for someone to check the score sheets for arithmetic errors. Ribbons may need to be attached to entries. If it is the first honey show given by a club then make notes for improvement for the following year. It is much better to have too many helpers than not enough. Be certain to thank them and recognize them during announcements.

The show organizers need to recruit judges. If it is a very small show then one judge may be adequate. If it has the possibility of being larger than expected, more judges may be needed. Sometimes it will be necessary to have specialty judges, such as for artwork and crafts,


Mead entries will be tasted.


Frame surfaces uniform, filled to edges and wood clean as a whistle.

photography, mead, honey beer. If the honey classes are huge having two judges working together can work very well.

Today two different judging criteria are being used. Let us call one the U.S. Method that has been used for very many years throughout the country. Honey judges can learn by being an apprentice judge working with an experienced one or, in some cases, by attending workshops given by a bee club. The second is the Welsh Method, used in the UK. This was introduced in the US at the University of Georgia & Young Harris Beekeeping Institute **(**YHBI**).** To become a Welsh judge, exams must be taken either at the Institute or at the Florida Bee College.

The U.S. Method uses score sheets with numerical values given. In liquid honey classes, instruments, such as refractometer (water content) and polariscope (cleanliness, crystallization) are used. In measuring the water content, listed in score sheets as density, usually any reading above 18.6% disqualifies the entry because fermentation could occur. The polariscope can determine and distinguish lint, air bubbles, miscellaneous dirt, flakes of wax, and crystals. Flavor is judged only on faults due to removal and processing of honey, such as residues from bee repellents and scorching from overheating. The judge's personal dislike of a honey flavor (such as buckwheat) is not to be considered. The U.S. honey plants (over 300, many of which are regional) have a very large range of flavors.

The fill of the jar is important. Queenline-type and round jars have a bead just under the threads. If the jar is filled correctly it will contain the one pound of honey that it should. Honey level below the bead is underfilled. Honey level should be about 3/8 inch, maximum of ½ inch, from the jar top with no visible gap between bead and cap. Cleanliness of jar and cap is also judged. Today perfect glassware does not exist but in the distant past it was also judged.

In the Welsh Method, three color classes are used, graded by using squares of colored glass into light, medium and dark. The density is tested with a tiny glass spoon dipped into the honey and then raised up. Several dippings can be done. With practice, honey with a proper viscosity – not to thin and runny or too viscous – can be determined but it does not receive a numerical score. A flashlight is used to look for crystals, air bubbles and dirt. The flashlight can be moved around, shining from behind and from the bottom of the jar. Cleanliness of jar and cap are judged, as well as correct fill. The flavor is important. If the judge does not like the flavor then that entry will not win a ribbon. The judge's comments on the entry are written on a file card.

The Black Jar Class was introduced into the U.S. when the Welsh method was introduced. A small jar is painted black on the outside so the color (and any impurities) cannot be seen. Usually all the entries in the class will be tasted by one judge. One jar is the winner – the flavor the judge likes the most; therefore judging is highly subjective. It has become a popular class with many entries in some honey shows.

Beekeepers who are seeking to improve their marketing skills can search for honey shows and agricultural fairs in their region and also plan to enter in the national show given each year by the American Beekeeping Federation. Ribbons and trophies won in shows display the excellence of your honey and other hive and beekeeping products. BC

Ann Harman knows all about how to have a successful honey show. She lives in Flint Hill, Virginia.

Button Bush

Depending on the location, button bush can be a large shrub or small tree.

Connie **Krochmal**

Although button bush (*Cephalanthus occidentalis)* may not necessarily be the best known honey plant in North America, it is certainly one of the most widely distributed pollinator species. This native is found in all mainland states except Oregon, Washington, Idaho, Nevada, Utah, Colorado, Montana, Wyoming, and the Dakotas. In addition, the plant also occurs in scattered locations in a few other states. These include Arizona, New Mexico, and California.

The presence of this native typically indicates that the area is a wetland. This lowland species favors wet and damp sites, such as low spots, sinks, swales, bogs, marshes, swamps, and wet flood plains. It is most often found along ditches, canals, rivers, streams, creeks, and lakes. The plant can form dense thickets.

Button bush is known by various other common names. Usually, these refer to the button-like appearance of the flower heads. They include button ball, honey bells, button tree, globe flower, and button wood. It is also called button willow since it generally favors wet or damp places just like the willows. In the West, the plant is often called western button wood.

Description of Button Bush

Worldwide, there are about seven to 17 related species that occur in the New or Old World, particularly in tropical regions. These can be evergreen or deciduous trees or shrubs. Some are native to Asia or Africa.

The genus name is derived from two Greek words meaning head and flower in reference to the flower heads. This group is distantly related to coffee and quinine. Button bush belongs to the madder family, which is also called the bedstraw family. Several relatives of button bush are widely grown as ornamentals, including sweet woodruff, gardenia, and bouvardia. Some native relatives are the partridge berry and bluets.

Depending on the location, button bush can be a large shrub or small tree. Often, it will be the former. This native has reportedly reached 40 to nearly 50 feet in height in certain locations, such as California. On the other hand, in Florida it is typically only half as tall. Elsewhere in colder areas of the country, this woody species generally ranges from three to eight feet or so with about a three to six feet spread.

The bark ranges in color from grayish-green to brownish-gray to nearly black. With age, this becomes scaly and furrowed. The upright, bushy, low branched, very leafy species has a rounded to an irregular spreading shape.

Button bush bears many crooked, twisted, slender, upright branches. The stout, thick, five-sided twigs can be brownish-gray to greenish-gray.

Generally smooth, the foliage can be a source of yellow Fall color although this isn't quite as pronounced in certain regions. With a papery texture, the glossy leaves are either opposite or in whorls of three. Ranging from 2½ to eight inches long and three inches across, the medium green, pointed foliage is pinnately veined. It can be elliptical, oval, or lance-like.

The leaves emerge in late Spring after frost has past. Sometimes, there are slight hints of red along the mid ribs and veins. On the underside, the foliage is sometimes hairy with the color ranging from a slightly lighter green than the upper surface to reddish in some cases. The short, reddish leaf stalks are grooved.

This is a free flowering species. In the southern part of its range, such as California and Florida, this tends to begin flowering in early Summer. Elsewhere, the blooming season is typically somewhat later. In most locations, the flowers will appear for a month or more.

The blossoms are generally creamy white, but occasionally can be reddish or pale pink. For the most part, they're terminal. However, button bush can also bear flowers in the upper leaf axils.

Only one-third inch long, the small blossoms release an intensely sweet scent. They form dense, rounded, globe-like or spherical-shaped heads. One to two inches across, the heads emerge on long peduncles that are generally branched.

These have often been described as spiky cotton balls, pinwheels, or pin cushions. One of the most distinctive features of the flowers is the long styles that protrude far

beyond the end of the corolla. Each funnel-like corolla contains four fused petals.

The stigmas are typically heavily laden with pollen. The calyx is usually hairy at the base. These contain four stamens and one pistil. The dried flowers as well as the leaves smell like new mown hay.

Shaped somewhat like a top, the firm, angular nutlets or fruits can be reddish, pinkish-red, or brownish-red. These form dense, round clusters. The fruits eventually split from the base upwards into two to four, closed, one sided sections.

Ripening in the Fall, these remain on the plant over the Winter and are eaten by various kinds of birds, including shore birds and water fowl. Mallard ducks are particularly fond of the seeds.

According to some botanical experts, several varieties of the native button bush can be found in some areas of the country. *Cephalanthus occidentalis var. californica* is restricted to certain areas of the state of California. It is typically found below 3000 feet elevation.

Reaching up to 30 feet in height and 10 feet across, this variety tends to be slightly less hardy than the species – to 25 degrees Fahrenheit. The much branched, upright, fast growing plant bears foliage with orange to yellow Fall color. The white blossoms emerge from Spring throughout the Summer. It is adapted to alkaline soils.

A variety known as honey bells (*Cephalanthus occidentalis var. pubescens)* is recognized by some botanists. This has been reported in certain states, including Texas, Oklahoma, Indiana, Illinois, Ohio, Louisiana, Georgia, and Virginia.

This variety is also reportedly somewhat less hardy than the species. The fact that the common button bush foliage is typically smooth makes it easy to identify this one because its leaves happen to be hairy on both surfaces.

This variety features flower heads that are two inches across and ovate to lance-shaped or oblong foliage. The branchlets are also hairy as well.

Some horticultural experts recognize an additional variety called *Cephalanthus occidentalis var. angustifolia.* This one can be identified by the slightly narrower leaves.

Although button bush has sometimes been taken internally for medicinal purposes, I would choose to err on the side of caution and not consume any part of this plant. According to *Toxic Plants of North America* by George Burrows and Ronald J. Tyrl, this has been responsible for poisoning some animals.

Bee Value of Button Bush

Bees work each of the individual flowers on the crowded flower heads from about 11 a.m. to dusk. These blossoms produce an abundance of nectar and pollen. The latter is yellow.

When these plants are flowering, they're sure to attract honey bees as well as butterflies and hummingbirds. When the bees are working this plant, the apiary often has a rich aroma at night.

Button bush is a common nectar plant over much of the continental U.S. It is a major nectar and pollen plant in the Northeast, the North Central region, the Plains, the West, and the Southeast. The plant is found in most honey producing states. This is considered to be a particularly important honey plant along the Mississippi River.

One reason that button bush is such a valuable bee plant is that it can bear flowers over an extended period, typically from July to September in some locations. This occurs at a time when there is often a dearth of nectar and pollen.

The pleasant, mild tasting honey is good quality. This is heavy bodied and light colored.

Growing Button Bush

It is indeed a pleasure to recommend button bush for bee gardens because this native is an easy to grow, reliable choice that is suited to most regions and situations. The only limiting factor that I can find for this outstanding species is its ultimate size, which might make it unsuitable for small garden spaces. Full sun is really best for optimal flowering, although the plant does grow reasonably well in partial shade. In sunny sites, it will be more compact.

Both seeds and plants are readily available from nurseries and various sources. Button bush can self sow, and can also spread by producing root sprouts. This native woody plant is fairly easy to grow from seeds and cuttings.

Seeds should be collected from late Summer to Autumn before the nutlets begin to split. Cuttings of button bush can sometimes take up to a month to root.

Preferring a moist, rich, fertile soil high in organic matter, this tolerates a range of pH levels from acidic to neutral. In California, it thrives in alkaline soils.

So far as the soil type is concerned, button bush grows well in a wide range from clay or loam to limestone. A peaty soil is considered ideal.

Even though the plant typically occurs in moist sites, the plant is much more adaptable than previously thought. A three-year study at the University of Connecticut-Storrs found this thrived in a parking lot with a dry, well drained soil. By the end of the study, the plants had reached five feet in height and were almost as wide.

This fast growing plant is fairly long lived, probably 50 years at least. Button bushy is ideal for erosion control and disturbed sites. The plant is suitable for mass plantings, rain gardens, naturalistic settings, mixed borders, retention ponds, drainage swells, the margins of ponds, and poorly drained spots.

Buttonbush is completely Winter hardy in zones six through 11. It is considered marginally hardy in zones four and five where the tops can at times experience significant dieback during very harsh Winters. In such situations, the plant can be treated as a perennial since new sprouts arise from the roots each Spring.

When planted in wet spots, button bush has a tendency to spread. If planting it in such areas, allow the plant to have plenty room. Normally when button bush is cultivated, this will generally grow larger than those plants found in the wild.

Button bush benefits from an annual pruning. This tends to result in a more floriferous, dense, compact plant. Pruning is best done in late Winter to very early Spring before growth begins. It can also be done in the Fall after the plant has finished flowering.

Those plants that receive a light application of fertilizer once a year in the early Spring are generally the most free flowering. In most situations, button bush usually experiences minimal damage from insects and diseases. The few exceptions seem to be deer, which browse on the plant. Chewing insects sometimes feed on the leaves in Florida.

Several improved cultivars of button bush are available. In 2016, a compact, rounded version called Fiber Optics was released. It is usually smaller than the species, typically reaching six feet tall with a matching width.

Fiber Optics button bush is reportedly hardy to zone four. The attractive plant bears flamboyant, 1½ inch wide flower heads. These blooms are covered with very showy stamens that resemble white quills. So far as sources for this newer cultivar are concerned, it is apparently sold by some greenhouses in Minnesota and Chicago. But, as of yet I haven't found it at online or mail order nurseries.

Bee gardeners will also find another lower growing cultivar of button bush called Sugar Shack. This Proven Winners selection should be widely available at the many local nurseries and garden centers that sell this nationally distributed brand of plants. Bluestone Perennials as well as Jung Seed are two sources for Sugar Shack.

With a moderate growth rate, Sugar Shack button bush is even smaller than Fiber Optics – only three to four feet in height. The reddish tips of the foliage add a punch of color to the plant. The name refers to the very sweet scent of the blooms, which open throughout the Summer months. BC

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

Death In The Snow

But Sioux City Bees Will Fly Again

Toni **Burnham**

You could call it the gut shot heard 'round the world: a half million honey bees dead in the Iowa snow, and a small family business destroyed by vandals in the night. And it jangled not just the small universe of beekeepers, but whole communities who surround and (it turns out) stand with us.

You probably heard it on the news, if the outcry from your own friends and colleagues didn't reach you first. On the morning of December 28, 2017, Justin and Tori Engelhardt of Wild Hill Honey in Sioux City, Iowa discovered that vandals had toppled all 50 of their colonies, and had broken into their bee shed, damaging everything they could. The Engelhardts were out of business. Or so they thought.

A torrent of support came to them in a single day through a social-media driven GoFundMe campaign, almost $40,000 in 24 hours, and they will start again. After Sioux City, vandals also attacked an apiary in Prunedale, CA, and the community rallied around Alfonso Perez, too.

But blows like this leave a mark, and while some lessons are learned (and shared), some precious links will have to change.

The story of Wild Hill Honey is a great one: it makes me wish that I was their neighbor. Asked if they thought of themselves as urban beekeepers, Justin said, "It is really interesting to talk about the position of our hives. Sioux City has a population of about 80-90,000 people, the greater Siouxland area has a population of about 140,000 people. So, we are right inside the city: our house is on the north side, but our land is on the west."

Becoming Beekeepers

Justin and Tori Engelhardt have been beekeepers for only six years. They love the place where they live: the prairie and what grows on it. Tori studied Forestry at Iowa State, Justin has a Latin degree from the University of Iowa, and they make their living as carpenters. Considering how deeply they understand and speak about horticulture, apiculture, and habitat, I thought that they held science degrees!

Justin explains, "Probably six years ago I was on my way to do a roof, and I was listening to NPR. They were doing an interview with a professor named Tom Seeley of Cornell University. He wrote this book called *Honeybee Democracy*, and it is all about how honey bees make decisions… I said to myself, 'That sounds like a cool damn bug!' I decided to get some, and I love it."

The scene of the crime

The Engelhardts didn't have any land, but soon had 17 hives with some folks who were willing to host them. Justin started doing some research: he wanted to keep the bees away from row crops, but near some amazing parks.

"We wanted to keep them away from corn and soybeans. Something like 99% of the corn crop here in Iowa has neonicotinoid pesticides and, last I checked, 85% of the soybean crop. We wanted to stay away from that stuff, and in the city."

Justin also did a map study on the Woodbury County Assessors page. He discovered 18½ acres around which you could draw a two-mile ring and find Stone State Park–a nature preserve; the Briar Cliff Prairie Restoration Project; and the Woodbury County Conservation Area. The hitch? It was divided into over a dozen tiny lots, the smallest only 1/6 of an acre.

Justin says, "It took me something like 13 deals to get that property: it was a bunch of little, tiny, worthless lots. They were overgrown."

"It took about three years, and I got it for *cents* on the dollar, because nobody wanted it. Some sold for the back taxes due the county, some for taxes to the IRS–I bought some from a lady who had inherited it but had never been to Iowa. None of them had buildings, but they all conjoined. I stitched them all together, and the last thing we had to do was to buy a road from the city, a one-block stretch: it is a dirt track, was never paved, and there are no utilities, but it connects them all."

"Probably a third of it is in cedar trees. You can tell that it used to be pasture: the tallest ones aren't more than 15 feet. The rest of it? About a third of it is in broom grass."

Revitalization, four wings at a time

"We've owned part of the property for about five years, and now a lot of it is in Crown Vetch, because the bees are making a huge impact on the environment. At first there was just a little bit of Crown Vetch in there, but because it gets so thoroughly pollinated, the Crown Vetch now just grows like crazy."

"My wife and I are also really interested in prairie remnant plants: Iowa used to be all Tallgrass Prairie. Something like a fraction of 1% of the tallgrass prairie is left. Of our 18 acres, probably half an acre is all Big Blue Stem, Goldenrod – all tallgrass prairie plants."

"It was just an interesting observation: we didn't have any plans to spread the tallgrass prairie plants, or any of the forbes. We could find only one Lead Plant on the property when we bought it: it's a tallgrass prairie shrub. Those racemes are just packed with pollen, and it comes when there is a lull in our year. Anyway, there was one we bought, and now there are about 50 of them."

"Also, there is a little plant called Prairie Clover: it is different from the yellow or white sweet clover that we have so many of. This prairie clover, though, it is all over now: there are asters in the Fall…it is really remarkable to see how many forbes have popped. It is neat to see the impact of that the bees are having on the environment."

The Wild Hill Honey Method

"We have really good honey flows. It is not always great, but you can't really expect to get more than 100 pounds per hive. *[Note: that is not a typo. He said 100 pounds.]*

"It's a really remarkable spot. I think the average in Iowa last year was 50 lbs.

"The reason is that we have some really early plants, like willows. They start blooming in February, and if you get one really nice day, they are going to start bringing in pollen and kick off. We've got Silver Maple and Sugar Maple. When I was a kid, those did not bloom until the first or second week of April, now they bloom by the end of March, March 25th last year. There's a really potent native, Virginia Waterleaf, that grows in the understory and blooms in mid-Spring. That really gives the bees a kick."

"We have started running one-and-a-half story hives instead of double deeps because we very rarely have bees starve. We do open them up in the Spring and find dead outs, but usually not signs of starvation. We might see moisture or dwindling, frozen, so we wanted the hives to be smaller."

"Most of the hives that were vandalized were made up of a deep and a shallow. There is some evidence that smaller hives handle *Varroa* mites better, so that is part of what we were shooting for."

"We run homemade crown boards on top, not the commercially available ones. Ours are ¾" thick and have holes just big enough for mason jars. When we feed early in the Spring or late in the Fall, we don't have to open up the hives. We take the lid off, stick this jar over that hole, and put a feeder box around it. We don't have to break the seals. Our hives are then three boxes high, and we just take off the lid: there's this box with the feed cans inside of it, and we pack it with wood chips for insulation."

Hindsight is 20:20

"One thing I *thought* was an advantage but which I came to regret is that, when the bees didn't need to be fed, I would just put that mason jar aside in the wood chips for later and put a piece of burlap over the holes. If we got a 60 degree day in January, a I would say to myself, 'I gotta feed 'em!' then just go out there where I already have mason jars stowed. All I have to do is scrape away some wood chips, fill the jar from my jug, pull out that burlap, turn the mason jar upside down, and voila! How smart is that?"

Well, it works unless you have vandals that knock over your hive and smash your mason jars.

"The big loss was the loss of the comb. The bees died, yeah, but we also lost six years' worth of comb, because we could not be sure that this comb was free of glass. If I had taken the jars out, that would not have been a factor and I could have saved more comb."

"Also, we built a shed for beekeeping supplies. These kids had to break a window to get in, so they broke *every* window, and they knocked over our stacks of drawn comb. We use queen excluders, so I have honeycomb in there that is 6 years old and never had an egg laid in it, super strong (I harvest off of it). We put that box in the extractor, spin it out, then put that box on another hive to clean it out, then store it."

"After they broke the windows, they kicked over the stacks of comb into the glass."

"It was really the loss of the comb, and the next year's honey crop, and all the bees…it was such a huge hit."

The vandalism

The vandals came on a cold night, when it snowed about an inch and a half. The snow is the reason why Tori and Justin came out the next morning, to clear entrances.

"We parked on the far side of the property, and were walking through the trail, looking at all the deer tracks, and the rabbit tracks."

"And then everything was knocked over, and there was an inch and a half of snow on it."

"There was an amazing thing. When we got out there, the air temperature was about five degrees, negative 10 degrees with wind chill. We started picking things up, and there were still clumps of bees alive."

"We sort of pulled some frames together, put them in a hive. There's no way they are going to make it, you know, but we can't just leave them. But they survived the night, lying out on the ground like that, which is kind of shocking."

"It got up to 55 degrees the other day, and there were bees flying out of two of them."

Aftermath

"That day was rough. But the response is the surreal part. First by the media, and then by social media."

"When we first saw it, we knew it was going to be bad, but we had to walk through to see how bad. And you know, *every* hive. Tori said, 'we have to call the police.'"

"So, we called them, and they were there in less than 10 minutes. It went over the police scanner, because three news organizations interested in the story contacted us within 30 minutes. We said, 'we're just picking up hive parts out here, you are welcome to come out.' And they did."

"Tori put something on our Facebook page, to ask for information. It's not a huge city, people know stuff. Tori put a picture up, hoping that we could get a lead for the police."

And then they worked all day in the cold, picking up pieces.

According to Justin, "By the time we got home that night, three different people had set up GoFundMe sites: the response was amazing. We shut them down about a day later."

"After we shut down the GoFundMe sites, we left a message saying that this compassion could be used to help other people, pointing at the Houston beekeepers. They lost thousands and thousands of hives to Hurricane Harvey, and they've got a GoFundMe site, but it hasn't really gotten any press."

Who gave?

"There were so many messages, we don't even know who all messaged us. We are doing our best to try and respond – it was overwhelming! We heard from people as different as a large commercial guy who is going to help us out with bees in the Spring but insists on keeping his name out of this, and folks with only one or two hives who say, 'We're only a state away, want us to come help you clean up?' There's a local producer of mead who made a generous contribution, and *hundreds* of beekeepers: it was really nice."

Next?

At first Wild Hill Honey announced that it was shutting down, but now the Engelhardts are going to keep going, though there will probably not be a honey crop before 2019, and the bees will have to live somewhere new.

"We are going to get new hives in the Spring, and a different location because we got burnt there."

The Engelhardts have put the lot that they stitched together so lovingly up for sale.

"We bought it because we were going to put bees on it, but it just feels too risky now. If we could build a house up there, then we would feel ok because they would be in our giant backyard. But we don't have that kind of money. We are years away from being able to build up there."

"The bees were doing great up there, but we will see what happens. We have a new location, even closer to Stone Park, that we are going to try out next year. We are going to install a robust security system."

Justin asked me to point you to beekeepers in need in Houston and Puerto Rico, and I promised. Here's to having each other's backs, and riding on the hope of bees.

Houston: **https://www.gofundme.com/helping-beekeepers-recover**

Puerto Rico: **https://www.gofundme.com/fund-for-puerto-rico039s-pollinators** BC

Cover Evolution

Jim **Thompson**

I have found it interesting to look at the types of different bee hive covers or tops that have been used over the years. I began my search with the first beehive that was patented in the United States but had a problem because the patent office burned in 1836 and many of the early written patents were destroyed. My records show that there were 1,131 beehives patented up to 2009. Some of these hives were the same hive with improvements to keep the patent in effect. The very first beehive patented was developed by J. Sweet, April 11, 1810, in Bethlehem, MA, but that record was destroyed in the fire. I found patent X 5,872 was granted to Ebenezer Beard in 1830 with a flat attached cover. Most of the written part was recovered from the fire and had a flat attached cover.

Sixty-eight patented beehives later, in 1853, Lorenzo L. Langstroth was granted a patent for a hive. Reverend Langstroth had actually developed five different models of beehives and most of his hives had flat tops. However his fifth hive was a glass hive within a hive and the outer top could be tipped forward. So it might be classified as a telescoping cover because it covered an inside hive.

During the 23 years in between the Ebenezer Beard hive and the Lorenzo L. Langstroth hive there were 44 flat topped hives that had covers that were hinged, attached or simply rested on the beehive. There were four beehives that had covers sloping in one direction and two telescoping covers. Eleven hives had unusual shaped covers with projections and seven hives had pitched or gable tops. When you stop and think about it, it isn't really that unusual, as the trend in the early times was to convert a piece of furniture into a beehive and have drawers or a side panel that could be opened.

The lumber in the 1850s was available in wider widths so you could get a single piece that would cover the entire hive. However you would encounter the problem of warping or cupping, allowing the top to have gaps between the top and the super. The gaps could be viewed as being good or bad. The gap would provide upper ventilation and an upper entrance to the hive. However, if you wanted to move the hive there was just another place for the bees to escape from the hive.

To eliminate the warping, the boards could be cut in narrower strips, the grain reversed and cross pieces used to hold the boards together. This style of cover is very much like today's migratory cover.

A problem arose, what do you do with a flat top once it is removed? You can't just lay it on the ground in the same orientation as it would smash bees. Your best choice would be to prop it up against something else. Once a bee is smashed, the alarm pheromone is released and the other bees are now on alert. If you reverse the top and lay it on the ground, you can't use it to stack equipment on it because it may violate bee space and squash bees.

If the top was attached by a hinge to the side of the hive some of this warping might be reduced. The hinging of the top would mean that the hinges may bind in time and you must have a little over 90 degrees movement of the top to allow frames to be removed. The covers that had projections or finials risk damage, if they are reversed and used as temporary bases for supers.

The pitched roof could be set on one side of the roof, but when you go to stack equipment on it, the equipment will be at an angle and limit the number of supers that can be stacked.

By 1895, there were three types of covers offered for sale by the A. I. Root Company. They were the Higginsville cover, the Root Ventilated Gable Cover, and the Dovetailed Chaff Hive. A Dovetailed Winter Cover was available, but it was similar in construction to the outer part of the Dovetailed Chaff Hive.

Langstroth's fifth hive design

The Higginsville cover was the standard cover supplied with the purchase of a hive, unless another type was specified by the purchaser. The Higginsville cover replaced the plain flat cover with two 7¼ x 20-7/8 x 7/8" boards that were tapered to 3/8" along their width to allow water to drain off the roof. There was a filler strip of wood between the two side pieces and the entire top joint was covered with a 2" strip of wood. The top boards would be inset to the end pieces of wood. The end pieces of wood would allow the top to lie flat on the ground and supers could be stacked on it.

The Ventilated Gable Cover was advertised as being a cover that could be used in hot climates and places where shade was not available. It also boasted that the use of the 20 pound stone was not necessary. The intermediate top of the hive was made of ¼" material and cut into the end boards. The top pieces of wood were of 3/8" material and the highest point of the cover was two inches above the top inside board. The special feature about this cover was the ½" ventilation gap along the sides of the roof.

Root Ventilated - Gable Cover

The Dovetailed Chaff Hive was rather unusual as it was a hive that was encased by another box which allowed the beekeeper to stuff leaves or straw into the gap between the hives from the bottom of the super. The top would telescope down over the hive but it had extra long sides. The long sides permitted an additional "box" to be inserted over the hive that could hold leaves or straw to act as insulation. In 1917 the double walled hive became known as the Buckeye Hive, sometimes it had the insulation box, but usually it was omitted.

The Dovetailed Winter case was simply the shell of the chaff hive that one could purchase to put over a single hive to protect the hive during the Winter. It was made of 3/8 " thick lumber.

Dovetailed Chaff Hive showing the chaff tray

In 1897 the Danzy Cover was added to the Root line. This Cover was developed by Mr. Francis Danzenbaker and was similar to the Higginsville cover in that it replaced the slopping side boards with two boards that provided a flat bottom and a slopping top. Rather than a filler board and a cap in the center, the center board was grooved to accept the side boards. The end board had a straight dado so the cover would fit on the hive without any adjusting. The recommendation to prevent warping was to use lots of lead paint. It is interesting to read that the center piece was made of fine quality White Pine. When wood is exposed to the weather the softer woods tend to rot faster than the harder woods, so that may be the real reason of suggesting lots of lead paint. Lead paint is not sold today.

The Danzy Cover

In 1900, the Excelsior Cover replaced the Danzy Cover, because the Excelsior Cover is better suited to warmer climates. It was mentioned that the shrinkage of the wood is less with the Excelsior Cover and that is probably due to the smaller size pieces and the construction that allows less expansion and contraction. It was a much easier cover for the company to machine.

The Excelsior Cover

An improvement to the Root Ventilated Gable cover was to put holes near the gable to allow air to circulate within the cover without any other air entering the hive.

In 1903, a new Danzenbaker Nailless cover was listed in the Root Catalog. It was a cover that consisted of several tongue and grooved boards that were held together by paint, but for additional insurance, staples were used on the ends of the boards. To keep the boards from warping, a metal strip was inserted in the saw kerfs. These covers were perfectly flat on both sides. Further testing on this top was recommended.

New Danzenbaker Nailless Cover

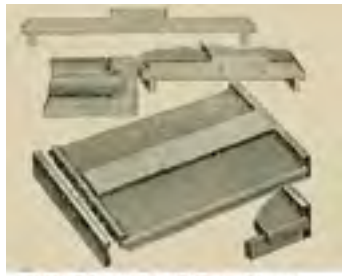
Also announced in the 1903 catalog was the double air spaced cover, which had been in testing for 12 years and was giving favorable results. The cover was made of 3/8" boards which were held together with 3/8" cross boards on both sides. The end cleats were put on for added rigidity. The sides were covered with a special paper and tacked with five large headed tacks. It was recommended that the paper be painted so you would get results similar to what their tests were giving. However for five cents more, you could get metal instead of the paper.

Double Air Spaced Cover

The 1906 catalog stated that many of Root's customers preferred the metal-roofed Double cover. Several beekeepers had expressed concern that the wood in the hive was developing checks and splits so the metal covers were developed to help their situations. An additional inner cover was needed to correct ventilation problems. These tops were available in either eight or 10 frame hives and are very similar to the telescoping covers of today. The inner cover had a relief cut in the edge that provided ventilation in the Summer time when the slot was in the up position. In the Winter, the inner cover was reversed to provide ventilation and an upper entrance for the bees.

Metal-Roofed Cover

1909 saw an improvement in the Excelsior cover in that sides were added to the top. To avoid confusion the new cover was named the Colorado cover.



New Excelsior or Colorado Cover

By 1915, the A.I. Root Company was offering only four types of covers for the hives. The metal-roofed Double cover was the standard cover supplied with their hives, but the Root Ventilated Gable cover, Excelsior cover and a flat hive cover were available. The Flat Cover had been discontinued years before, because clear lumber was hard to obtain, but it is being made again with three top boards instead of one and an option to have redwood as the top board. In later years the flat cover will be known as a migratory cover.

The Flat Cover

The Root Ventilated Gable cover was not available in 1924 from the A.I. Root Company, but other companies are making Gable type covers. Some of the hives using the Gable type covers are the decorator hives and the Garden Hive which have copper coverings.

The Root Company continued making the Buckeye Hive, the Excelsior cover which became known as the inexpensive all-wood hive cover, and the Metal roofed Double cover which became known as the metal cover up to 1933. For three years a metal top flat cover was offered and then dropped from the line. In 1940 the Buckeye Hive was dropped from the A.I. Root line. In 1944, The Root Company went to making 10-frame equipment only. From 1944 to 1955, the A.I. Root Company sold only the metal top and the inexpensive all wood top. Then the all-wood top was discontinued.

It seems ironic that in the beginning of wooden bee hives that the least popular type of cover became the most popular type and the most popular in the beginning became the least popular cover produced today. Perhaps I am just looking at this from the hobbyist beekeeper point of view. The Migratory Hive Cover is primarily used by beekeepers that are hauling bee hives for pollination purposes and by eliminating the two sides of a cover, allows the hives to be stacked closer together on the truck. The numbers of hives operated by commercial beekeepers far outnumber the hives of the small beekeepers.

It is also interesting to see that the problems that were facing beekeepers long ago keep being addressed today, such as the ventilation, insulation, Gable type cover, and shade issue. I remember seeing beehives that had a ½ sheet of plywood sitting on top of the hive and held in place by two concrete blocks. This was done to provide shade for the hives and ended up being more work for the beekeeper in removing blocks and plywood to get to the hive. Covers were designed so that the use of the 20 pound block wasn't needed, but where are we today? Many beekeepers put blocks and bricks on the top of their hives to hold the covers down. However the placement of the bricks might be an indicator as to the condition of the hive. Some people have designed a catch to anchor the top to a bee hive, while others use a banding machine. I have used rocks and sticks to prop up inner covers and covers to provide hives ventilation. When I have used covers with vent slots, I have experienced spiders living in the slots. If a screen is attached over the slots, the bees will fill the screen with propolis.

There is always the search for new materials and sometimes what looks to be a good solution could end up being a disaster. Very wide stable lumber is hard to get and expensive, people have used particle board or plywood in the construction of tops. If you don't have a waterproof glue in those materials, it is just a matter of time until they fall apart. The use of plastic seems ideal, but be careful when you need to move the hive. Plastic tops tend to have many gaps and do not hold up well if you place a hot smoker on them.

It is very hard to beat the telescoping cover as the common practice is to place it on the ground to stack equipment on when you are working the hive. If the honey supers drip honey, the honey will be caught by the cover and returned to the hive when you reassemble it. Sometimes you may wish that you had an additional cover or something else to stack equipment on, as you may want to switch supers around. Also there may be a time that you wish that you didn't have to take a heavy super all the way to the ground but had a higher stacking point, like another short hive close by or the tail gate of a truck. BC

References

A.I. Root, *Various Years of Bee Supply Catalogs*, starting in 1895 to 1996

L.L. Langstroth, *Langstroth on the Hive and the Honey Bee a Bee Keeper's Manual*, 1853.

CALENDAR

♦INTERNATIONAL♦

Beekeeper Tour to Cuba March 3-11 with visits to apiaries, processing plants, research centers and more. .

Contact Transeair Travel for more information, 202.362.6100 or **Blubic@TranseairTravel.com**.

♦ARIZONA♦

The 11th meeting of the Organic Beekeepers will be in Oracle, AZ, March 2 – 4.

Contact Dee A. Lusby 520-748-0542 eve. Registration $240/person due in advance to Dee Lusby, HC 65 Box 7450, Amado, Arizona 85645. Indicate organic beekeepers meeting, with check made out to Dee Lusby. Send self addressed stamped envelope for receipt and information on YMCA ranch/camp in Oracle, plus liability /medical form to be filled out. $240 fee is a straight fee whether sleeping /eating at camp or not. Event is two nights lodging on Friday and Saturday, six meals, and bring blankets for rented cabins and lodge. For additional information contact Keith Malone (Alaska) 907-688-0588.

♦CALIFORNIA♦

UC Davis Bee Symposium March 3 in the UC Davis Conference Room.

Keynote speaker for this day long event is Tom Seeley.

For more information and to register visit **www.entomology.ucdavis.edu**.

♦CONNECTICUT♦

CT Beekeepers Association Package Installation Workshop, March 24 at Massaro Farm, Woodbridge. Bee Talks, March 8, Rockfall Foundation, 27 Washington Street, Middletown. March meeting, March 31, CT Agr Experiment Station, 123 Huntington St., New Haven.

American Honey Tasting Society Honey Tasting Classes – The Language of Flavor in Honey, March 18; Mastering Sensory Skills for Honey Tasting, April 14-15.

For information and registration visit **www.americanhoneytastingsociety.com**.

Back Yard Beekeepers – each month hands on inspection workshops, bee school, mentor program and more.

Speakers include March 27, Christy Hemenway; April 24, Roberta Glatz; May 22, Peter Borst; June 26, Dinner meeting; September 25, Richard Coles; October 30, Dewey Caron; November 27, Bill Hesbach.

For information **visit www.backyardbeekeepers.com**.

♦MICHIGAN♦

Michigan Beekeepers Association Spring Conference March 9-10 at Kellogg Hotel and Conference Center, East Lansing.

For information contact Adam Ingrao, **ingraoad@msu.edu** or visit **www.michiganbees.org**.

♦MISSOURI♦

MO State Beekeepers Association will host their Spring meeting March 2-3 at the Johnson County Fairgrounds in Warrensburg.

Speakers include Jim Tew, Alexandria Payne, Cory Stevens, Charlotte Ekker Wiggins and more. Registration is $60 including Saturday's lunch.

For information and to register visit **www.mostatebeekeepers.org**.

♦NEW YORK♦

Southern Adirondack Bee Association Seminar wil be held March 10 at the Hudson Valley Community College TEC SMART building in Malta.

Speakers include Diana Sammataro, Michael Palmer and Samuel Ramsey.

For information contact Mary Jo Crance, **mjc.river@gmail.com**.

♦OHIO♦

Lorain County Beekeepers Association will hold their 23rd Annual Beginner Class, Fridays March 2, 9, 16, 23 at Life Church, 1033 Elm Street, Grafton.

The cost is $50, includes one year membership for you and family members of same address. Books will be available for purchase.

Visit **www.loraincountybeekeepers.org.**

♦OKLAHOMA♦

The Oklahoma State Beekeepers Association will hold their Spring convention March 3 at the Southern OK Technology Center, 2610 Sam Noble Parkway in Ardemore. Registration begins at 8:30 a.m.

Lunch is provided. Speakers will be from the Noble Research Institute and OK Dept. of Ag.

For information visit **www.OKBEES.ORG**.

♦OHIO♦

Tri-County Beekeepers Association 40th Spring Workshop March 2-3 at OARDC, Wooster.

Register early as space is limited. Watch website for opening of registration. Speakers include Randy Oliver and Jamie Ellis.

For information visit **www.tricountybeekeepers.org/register**.

♦VIRGINIA♦

Principles & Practices of Biodynamic Beekeeping - Part One: Introduction Spikenard's introduction to basic biodynamic/sustainable beekeeping methods - March 16. This one day workshop will offer in-depth advice for those who want to have bees and for those who had bees and want to start again. Classes take place at Spikenard Honeybee Sanctuary in Floyd, VA. **www.spikenardfarm.org contact: info@spikenardfarm.org** or 540-745-2153

Principles & Practices of Biodynamic Beekeeping - Parts One and Two: The Spikenard Method Spikenard's full introduction to basic biodynamic/sustainable beekeeping methods - March 16-17. This two day workshop includes the Introduction class and a more robust introduction to the Spikenard Method. Classes take place at Spikenard Honeybee Sanctuary in Floyd, VA. website: **www.spikenardfarm.org** contact: **info@spikenardfarm.org** or 540-745-2153

♦WEST VIRGINIA♦

WV Beekeepers' Association will hold their Spring Conference March 23-24 at Tamarack Conference Center in Beckley.

Speakers include Debbie Delaney, Parry Kietzman and others.

For information and to register visit **www.raleighcountybeekeepers.com** or contact Mark Lilly at 304.860.9638.

♦WYOMING♦

WY Bee University and Bee College, Cheyenne, March 16-18.

The Bee University has a choice of four all day workshops on Friday, March 16. The Bee College runs, March 17-18 and offers five tracks on day one and four on day two.

For more information and a schedule visit **www.wyomingbeecollege.org**.

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In January the gal Marilyn and I took the overnight Amtrak from Colorado to Reno for the 2018 American Beekeeping Federation conference. But first, our train hit an abandoned automobile outside of Chicago. Then, coming out of the Moffat Tunnel in Colorado, it had to slam on the brakes for a skier on the tracks at the base of the Winter Park ski area.

We boarded six hours late in Grand Junction. Sometimes Amtrak can catch up when they're behind, but not this time. They'd replaced the wrecked Amtrak engine with a slower freight locomotive, so we continued to lose time and arrived in Reno seven hours late on Sunday.

Reno advertises itself as the "Biggest Little City in the World." It's an interesting little town, I'll say that. Our well-appointed downtown Airbnb condo was located next to the Truckee River, across the river from the blinding lights of the casinos. In an odd juxtaposition of Reno architectural styles, tawdry 1950 and 1960s motels sprout like weeds among glittering highrise monoliths. The homeless sleep in vacant lots or wherever they can find shelter.

The place drips with sex. Gambling billboards feature women with big-lipstick smiles, leaning seductively on Hollywood-handsome men at blackjack tables. A sign in the window of the Cal-Neva casino features three very naughty ladies beckoning you to play "beer pong" in the Pleasure Pit. The legal brothels are all out of town.

You can also get married in Reno. Wedding chapels flourish everywhere. At the Chapel of the Bells drive-through, you can get hitched in your car.

I wanted to hear Randy Oliver's talk on his adventures with oxalic acid for *Varroa* mite control on the opening day of the conference. Instead I fell under the sway of Marilyn and Michigan State bee researcher Meghan Milbrath and went skiing. We picked up Dr. Milbrath at the conference venue, where she was staying. She kept her head down as she dragged her ski bag past other conference attendees, hoping no one would catch her playing hooky. Let it go, Girl! This is Reno, land of forbidden pleasure!

On the drive up to Mt. Rose, Meghan gave me ideas for how to structure a beginners' bee class, sorely needed where Marilyn and I live out in the boonies. I don't have time for teaching classes, but somebody has to do it! Then it hit me – I was talking bees with a professional bee researcher. This was a business ski trip! I could write off my lift ticket!

The wind howled at the ski hill. Mt. Rose only had a couple of lifts open. It rained the day before. Icicles dripped from pine boughs. We jumped on the lift and talked bees.

We talked about neonicotinoids, the controversial systemic pesticides now very much in vogue. Meghan explained that the neonics don't all act exactly the same in the environment and as stressors on pollinators. We talked about risk assessment and how we humans make decisions relating to risk. Meghan brought up pumping your own gas. Gasoline contains benzene, a known carcinogen. Every time you pump gasoline, you assume some cancer risk. Exposure to benzene is an enhanced risk for people in poor health. But as a society, in general we agree that pumping your own gas is worth the risk.

We talked about fungicides and neonics as synergistic bad ju-ju and about recent research indicating that fungicides serve as pollinator attractors. In other words, bees may prefer flowers coated with fungicides.

Our lift ride went pretty fast! We followed Marilyn down the ski hill. Marilyn likes to be the leader, and Meghan and I like to follow. Marilyn can be hard to keep up with!

On the lift again, we discussed how difficult it is to prove something scientifically, and how preconceived notions and points of view color our perceptions of reality. We talked about the funding of research by interested parties, i.e. pesticide research conducted and paid for by pesticide manufacturers. "Who else has the money?" Meghan queried.

We agreed that neonic seed treatments violated a principle of Integrated Pest Management. In IPM, you use the lowest dose of insecticide that'll do the job, and then only when you absolutely need it. With neonic seed treatments, you treat the problem when you plant, before you even have a problem. Dr. Milbrath explained that for crops normally coated with neonics, like corn, soybeans and Canola, farmers can't even buy non-treated seed. They're stuck with treated seed, whether they want it or not. When she needed some non-treated corn seed, she had to drive to Indiana to find it.

At the top of the lift, we hiked uphill a few steps to a place where few skiers ventured. We descended through an enchanted forest of wind-battered pines and twisted tree snags. Lake Tahoe shimmered in the distance. Meghan got too far forward on her free-heel skis and augered in face first. She got up laughing, the little darling! We never stopped for lunch.

Back on the lift, we kept congratulating ourselves for ditching the ABF conference. Finally I said, "This has gotta be more fun than Randy Oliver's lecture!"

"I'll tell him you said so," Meghan said. Her smile stretched across the snow-capped Sierras.

Ed **Colby**

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