STUDYING HONEY WITH POLLEN

ROOT PUBLICATIONS

NOV 2018

Catch The Buzz™

Bee Culture®

The Magazine Of American Beekeeping

www.BeeCulture.com

The Legacy Of CCD

Plan Ahead

Glyphosate?

ROOT PUBLICATIONS $4.99

CRAFT THE PERFECT HOLIDAY GIFT

Soap Making

Candle Making

Lip Balm

Melt & Pour Soap Making

Order your kit **TODAY** and **start crafting**

FREE SHIPPING ON MOST ORDERS **OVER $150*** SOME RESTRICITONS APPLY

BRUSHY MOUNTAIN BEE FARM

Brushy Mountain Bee Farm

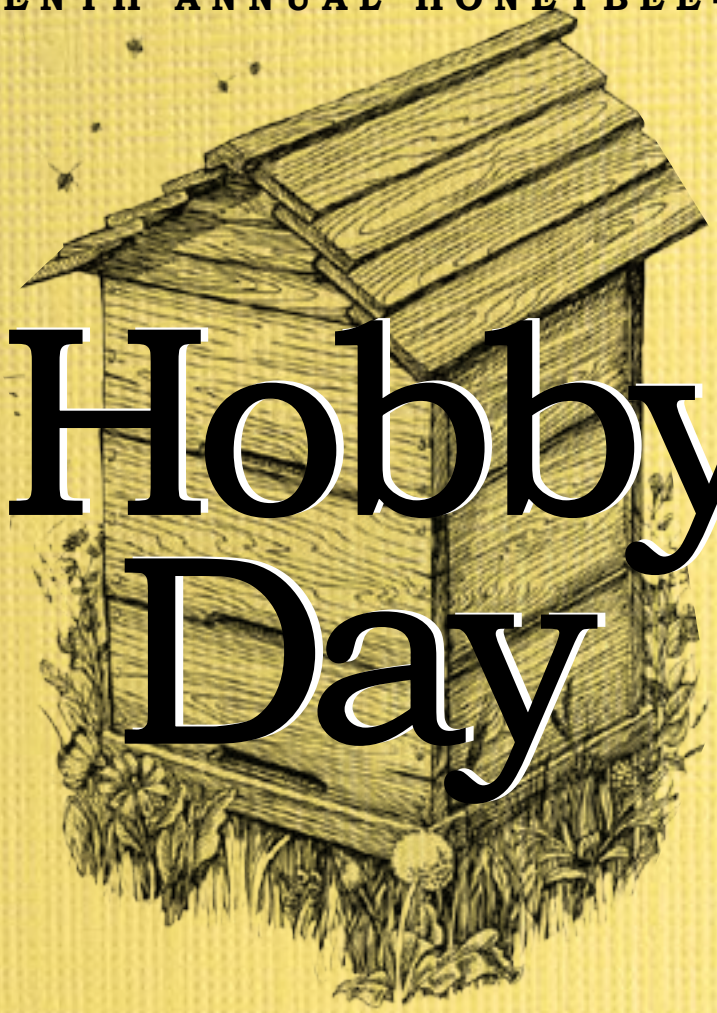
*Serving Beekeepers the Best **SINCE 1977***

BEST QUALITY | BEST SERVICE | BEST SUPPORT

www.BrushyMountainBeeFarm.com | **1-800-233-7929**


We write over 88% of the Beekeepers in the program Nationwide.
BEEKEEPING
INSURANCE SERVICES
APICULTURE INSURANCE PROGRAM
A Specialized Program for Beekeepers
Available Nationwide
Offering All Forms of Insurance Including:
✳ USDA Apiculture
✳ Property
✳ General Liability
✳ Automobile
✳ Life Insurance
✳ Home & Farm Insurance
We are Proud Members & Sponsors of:
✳ American Beekeeping Federation
✳ California State Beekeepers Association
✳ Minnesota Honey Producers Association
✳ North Dakota Beekeepers Association
✳ American Honey Producers Association
✳ Florida State Beekeepers Association
✳ Montana State Beekeepers Association
✳ Texas Beekeepers Association
Kevin Rader: Buzzus@beekeepingins.com
www.beekeepingins.com
888-537-7088

ELEVENTH ANNUAL HONEYBEE-FEST



Hobby Day

PRE-ORDER
PACKAGE BEES
$150

FOR PICK UP AT HOBBY DAY ONLY
LIMITED QUANTITIES AVAILABLE

SATURDAY, APRIL 6TH
OLIVAREZ RANCH
ROAD 20, ORLAND CALIFORNIA
ADULTS $5
KIDS UNDER 11 FREE

9:00AM—3:00PM
RAIN OR SHINE
EARLY BEE BREAKFAST
HOMETOWN MUSIC
& FOOD TRUCKS

LIVE BEEKEEPING DEMONSTRATIONS • MEAD MAKING
COOKING DEMONSTRATIONS • LOCAL CRAFT & VENDOR BOOTHS
LOCAL HONEY • KIDS "BUSY BEE" ACTIVITIES • HONEY TASTING • GUEST SPEAKERS

CALIFORNIA
MONTANA
HAWAII

OHB
NEXT GENERATION BEEKEEPING

CALIFORNIA
530. 865. 0298
6398 COUNTY ROAD 20
ORLAND, CA

VISIT OHBEES.COM FOR TICKETS & DETAILS
*PROCEEDS BENEFIT LOCAL ORGANIZATIONS: LAWS AND PAWS AND ORLAND TOWN AND COUNTRY HUMANE SOCIETY

CAN'T ATTEND HOBBY DAY? ORDER BEE PACKAGES WITH YOUR LOCAL DISTRIBUTOR!

WISCONSIN
Dadant & Sons
Brian Lox
blox@dadant.com
(920) 261-5363
W2763 East Gate Dr.
Watertown, WI 53094

MINNESOTA
Nature's Nectar
Jim Kloek
(651) 439-8793
11108 Manning Trail N.
Stillwater, MN 55082

OHIO
Queen Right Colonies
Denzil & Sheila St. Clair
(440) 647-2602
43655 State Route 162
Spencer, OH 44275
www.queenrightcolonies.com

MICHIGAN
A.W.S. Bees
David Anthony
(810) 621-4371
Leo Stevens
(810) 639-3640
1268 Nichols Rd.
Swartz Creek, MI 48473

Dadant & Sons
Chris Barnes
(877) 932-3268
1009 Industrial Avenue
Albion, MI 49224

UTAH
Knight Family Honey
Lee & April Knight
(801) 706-0984
lee@knightfamilyhoney.com
1761 South 970 West
Lehi, UT 84043
www.knightfamilyhoney.com

PENNSYLVANIA
Mann Lake Ltd.
(877) 829-4077
458 Stewart Road
Wilkes-Barre, PA 18706

WASHINGTON
BEEMANIACS
7619 W Woolard Rd
Deer Park, WA 99006
livebees@beemaniacs.com
www.beemaniacs.com

Betterbee®

Gear up for the Holidays!

Beginner Candle Making Kit

Looking to get into candle making?

This kit is perfect for learning to make candles. It includes all the tools, molds and the supplies to make 30 tealight candles and 12 votive candles. Also included is a book that is a complete guide on how to make and even decorate candles!

Also, take a look at our growing selection of silicone candle molds from Lyson!

Price: $125.95

Lip Balm Kit

Along with candle making supplies, we also offer a lip balm kit! The kit makes it simple to create your very own lip balm. It includes everything you need for 25 tubes of lip balm in your choice of three different flavors.

Price: $27.76

Largest Selection of *Custom* Hive Kits!

Increase Kit

Essential Kit

Basic Beginners Kit

For all kits get YOUR CHOICE of

- **Frame style**
- **Box type & size**
- **Bottom board**
- **Cover**
- **and more!**

We offer all kits in wooden 10 or 8 frame, Lyson or Beemax®!

**offered assembled or unassembled*

Beekeepers Serving Beekeepers®

WWW.BETTERBEE.COM · 1-800-632-3379 · 8 MEADER ROAD · GREENWICH, NY 12834

Dadant

Here at Dadant we pride ourselves on producing top of the line honey bee feeds to fortify colony health and build resistance to the problems prevalent in today's apiaries.

AP23®

Artificial Pollen 23

WINTER PATTIES

WITH HONEY-B-HEALTHY

AP23 Winter Patties are a high carbohydrate feed for honeybee colonies light on stores during the winter months. Contains Sugar, AP23, and Honey-B-Healthy.

M0016010PHW – Ctn/ 10 patties $22.95

M0016040PHW – Ctn/ 40 lbs.

1 - 9	$59.95
10 - 35	$49.95
36 +	Call

- Can be used in winter and early spring i in place of Candy Boards
- Readily accepted by the bees
- Convenient for all beekeepers

AP23® Pollen Substitute

AP23® is a high protein feed developed for all levels of beekeepers. It helps maintain colony strength by boosting populations, which result in better crop pollination and honey crops.

PATTIES

M0016010PH – Ctn/ 10 patties

1 - 3	$34.95
4 - 10	$32.95
11 +	$30.95

M0016040PH – Ctn/ 40 pounds

1 - 20	$79.95
21 - 39	$69.95
40 - 159	$66.95
160 +	CALL

M001601500 – 1 tote $2,100.00

DRY FEED

M0016005 – 5 lb bag

1 - 10	$19.95 ea.
11 +	$19.50 ea.

M0016040 – 40 lb bag

1 - 3	$77.95 ea.
4 - 10	$76.50 ea.
11 - 39	$70.95 ea.
40 - 159	$68.35 ea.
160 +	$65.50 ea.

Brood Builder Pollen Substitute

PATTIES

M0014610H – with Honey-B-Healthy
$20.95 / 10 pack

M0014640H– with Honey-B-Healthy
40 lb. box

1 - 20 ctns	$63.95
21 - 39 ctns	$54.95
40 - 159 ctns	$52.95
160 +	CALL

M0014640HHN –
with Honey-B-Healthy & Nozevit
$83.95 / 40 lb. box

DRY FEED –

M0014625 – 25 lb bag

1 - 5	$39.95 ea.
6 - 10	$37.95 ea.
11 +	$33.95 ea.

Above prices for Illinois only.
Check your local branch for pricing.

www.dadant.com

AP23 FOR HEALTHY BEES!

51 S. SECOND STREET, HAMILTON IL 62341 • PHONE (217) 847-3324 • FAX (217) 847-3660 • TOLL FREE 1-888-922-1293
• CHICO, CA (877) 332-3268 • FRESNO, CA (877) 432-3268 • PARIS, TX (877) 632-3268 • SIOUX CITY, IA (877) 732-3268 •
• WATERTOWN, WI (877) 232-3268 • ALBION, MI (877) 932-3268 • WAVERLY, NY (877) 532-3268 •
• CHATHAM, VA (800) 220-8325 • FRANKFORT, KY (888) 932-3268 • HIGH SPRINGS, FL (877) 832-3268 •

Bee Culture

November Features . . .

Page26

Page 68

800.289.7668
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
Connie Krochmal • Jessica Louque • Toni Burnham • Ross Conrad • Jennifer Berry • Ed Colby

POSTMASTER: Send address changes to
BEE CULTURE, The A.I. Root Co., 623 W. Liberty St., Medina, OH 44256

Subscription Information
U.S., one year, $25; two years, $48. Newsstand price: $4.99. All other countries, (U.S. Currency only), $20.00 per year additional for postage. Digital Edition $15. Send remittance by money order, bank draft, express money order, or check or credit card. Bee Culture (ISSN 1071-3190), November 2018, Volume 146, Issue 11, is published monthly by The A.I. Root Co., 623 W. Liberty Street, Medina, OH 44256. Periodicals Postage Paid at Medina, OH and additional mailing offices.

Subscriptions, Book Orders – 800.289.7668, Ext. 3220 • www.BeeCulture.com • subscriptions@BeeCulture.com

Advertising – 800.289.7668, Ext. 3216; JNewcombe@BeeCulture.com

Asters in the Root Pollinator garden.
Photo by Kim Flottum.




Beekeepers!

Join us for Beekeeping 101 & 201

Beekeeping 101 will help you successfully navigate your first year as a beekeeper.

BEEKEEPING 101 UPCOMING CLASSES

Nov 3, 2018	Jan 5, 2019	Mar 2, 2019
Dec 1, 2018	Feb 2, 2019	

Beekeeping 201 is designed for beekeepers in their second year and beyond. More advanced topics and in-depth discussions on bee health and nutrition.

BEEKEEPING 201 UPCOMING CLASSES

Jan 19, 2019	Feb 16, 2019	Mar 16, 2019

To learn more or sign up

Call us at 800-233-2899 or visit us online at kelleybees.com

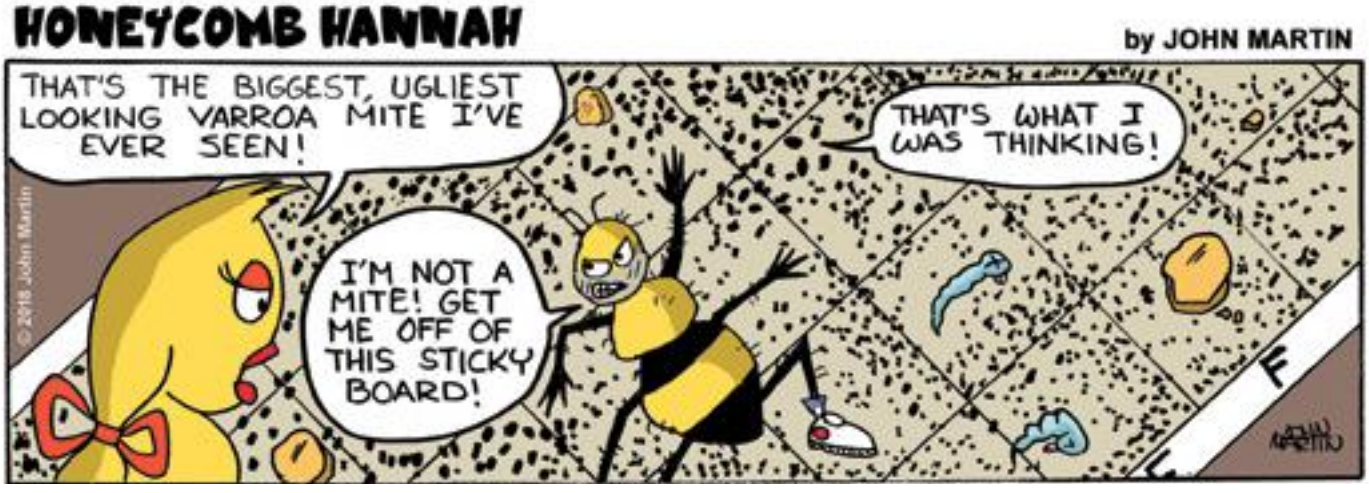
Kelley Beekeeping

SERVING THE BEEKEEPER SINCE 1924

Bee Culture's Best . . .

Page 87

In Every Month –



Frames - Plastic

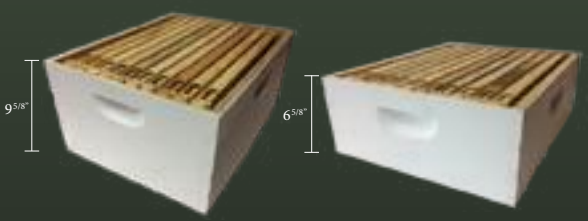
- Super Strong and Durable
- Safe - FDA food grade plastic
- Easy to use - No Assembly Required

Frames - Wood

- Stronger than Industry Standard
- New 1/2" thick end bars - 3/4" top bars
- Assembled, Glued, and Stapled

Snap-in Foundations

- Impervious to wax moths, rodents, and hive beetles
- Preferred by Professional Beekeepers
- Precision molded, perfect cells
- Easy to use - Snaps into wood frames



Commercial Grade Boxes

- Honey Supers & Hive Bodies
- Added Strength 1 – 5/8" Top Joint
- Pacific Northwest Ponderosa Pine
- Assembled, Primed, & Painted

Pierco®

Genuine Beekeeping Equipment

EST. 1977

Buy Pierco - Buy Quality
Factory Direct Store
New Lower Prices - Buy Now and Save!

FREE SHIPPING * See website for details

Check us out at: www.Pierco.com

FOR ALL YOUR BEEKEEPING NEEDS

HOBBYISTS / SIDELINERS / COMMERCIAL BEEKEEPERS

We Offer DOUBLE & TRIPLE WAX

SUPERDFM

PROTEIN SUPPLEMENTS

BEEKEEPING KITS

EXTRACTING & BOTTLING

PROTECTIVE WEAR

FEEDERS

Call or Visit us at:

Factory/Store Address: 680 Main St. | Riverside, CA | 92501

Get Connected | (909) 575-2013 Made in the USA

Some Got It . . .

This a.m. my husband handed me your magazine open to "Bad Spouse Day". I got to the area about Langstroth's 'friendly word to wives.' *Good Housekeeping* I believe had very similar points in an article in the 50s that makes its round on social media. I was surprised the wife in Peter's article did not pick up the bread she was kneading and throw it at him. But, oh how she hit home on her points! Gorilla Glue has nothing on propolis! I once sat down on our garage floor and couldn't get up because my pants were stuck to the floor. Bee supplies have taken over our garage. There is honey on door handles. In the spring, I was given a list of bee favorite flowers to look for. My birdbaths have become watering oasis for bees. As Summer turns to fall, we stock up on granulated sugar to feed the bees. Sugar becomes the #1 item on the grocery list.

I suspect, that if Mr. Sieling starts leaving articles on his wife's favorite chair marked "good advice!" He may find himself with more "good advice!" points from his wife. I like that woman!

Joan Miller
Montpelier, OH

. . . Some Didn't

I had to reread this article (Bad Spouse Day, October 2018, page 24) as I was sure I missed a lead-in that stated that this article was written for the magazine back in 1955. I'm not sure what the message is – that women are so stupid they need to be read to, or that they need advice from their husband from the year 1878? Either way, this article is a complete and utter insult to all women beekeepers (myself) and all married women, if not all women. Whoever thought this article was appropriate for your magazine seriously needs to move into the 21st century, get a new job out of the editorial business, or take a class on the accomplishments of women. As a woman who spent 20 years on active duty in the U.S. military, I am appalled at this mysoginistic and sexist article. Do you have any women under the age of 85 on your editorial board? Your response will determine whether I continue to get your magazine. You should apologize to ALL your readers. I await your response.

Debra LaRiccia
Spencer, OH

Editor's Note *– All of us at BC, those of us over and under 85, were pretty sure the title said it all – BAD SPOUSE!*

Top-Bar Hive & Oxalic

Can I use Oxalic Treatment on a TBH? I want to do the vaporizer method. I would also like info on where to purchase the correct equipment and products for the process. Thanks in advance!!

Michelle Moseley

Bee Culture
623 West Liberty St.
Medina, OH 44256
mailbox@beeculture.com

Response from Shane Gebauer, Brushy Mountain *– Kim Flottum at* Bee Culture *forwarded your email to me do to Brushy Mountain holds the registration on the Oxalic Acid (OA). There are a few issues/challenges with vapor method of OA, some unique to TBH some not. Let's go through those (in no particular order) so we can be sure you are getting an effective treatment.*

1) You have to be careful that the vaporizer does not contact the comb. The heating element of vaporizer can exceed the combustion point of beeswax. Without a bottom bar to protect and "insulate" the beeswax you need to be careful.

2) The vapors are not going to traverse the frames very well. As such, when you vaporize the OA try to get it under the frames which have the clustered bees. This will increase the efficacy of the treatment.

3) Assuming you have a wooden bottom to your TBH, you will have to protect the wood from the heat of the element. You can use just about anything metal.

As for the supplies, here are links to the items which you will need. vaporizer: ***https://www.brushymountainbeefarm.com/Varrocleaner***
OA: ***https://www.brushymountainbeefarm.com/Oxalic-Acid_3***

Please follow the instructions with the products.

I hope that helps and let me know if you need anything else.

Stuff Happens!

Received my new October edition of *BC*. Great articles, always.

I always keep my mags for reference. Keep them together in nice neat stacks, chronologically. This issue was in Poor shape.

All the pages, except a few, were coming unglued from the binding. Pages were falling as I was turning pages to read. Don't know what the problem was, but thought you may want to know, in case something needs attention.

I am 72 and have been a beekeeper only for three years. Wish I had an interest earlier in my life. Instructors said it was best if we subscribe to a bee mag and yours is the way to go.

My wife is not involved in the beekeeping, but she loves to read all the articles.

Thank you for what you do and who you are!

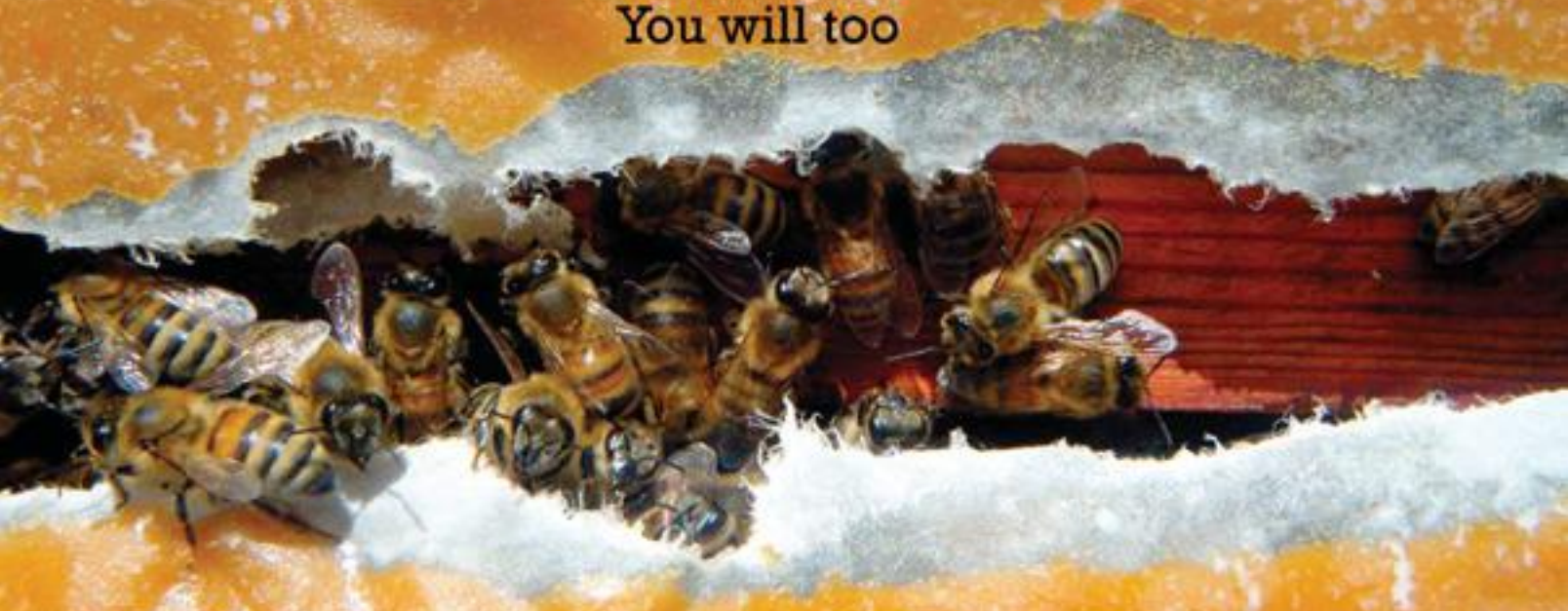
Dick Kuhn
Scotland, PA

Yes, there was an issue with the binding on a batch of magazines at the printer. We'll replace yours if it fell apart. Let us know, and please be patient.

Bees Love

Global Patties

You will too



Keep your hives strong and healthy with less effort and low cost
Reduce winter loss and see faster spring build-up
Help your bees thrive despite drought and stress from mites and disease

Two North American Factory Locations

Plus depots across the U.S. and Canada to Serve You Best

BAY 2 - 8 East Lake Way NE, Airdrie Alberta T4A 2J3
Phone: 1-403-948-6084 - Fax: 1-403-948-6901

150 Parkmont West, Butte Montana 59701
Ph: 1-406-494-4488 - Fax: 1-406-494-3511

Call Us Toll Free in North America at 1-866-948-6084

We make protein and pollen patties to your specifications
using only fresh, high quality, proven ingredients. Satisfaction guaranteed.

Be sure to visit our website

www.globalpatties.com

For our locations, news, ideas, specials, and much more...

Your bees will thank you

Time To Think About Holiday Gifts –

Clothing for a cause. That is what **Bloom Clothing Company** is all about. With a portion of profits going to the Honeybee Conservancy, we are making an effort to spread the word that honey bees are friendly little creatures that the world needs.

The company started in 2017 to try something new and to make a difference in the world. It started with only three colors of t-shirts and now has around 100 products from shirts, to sweatshirts, bath bombs, lotions, bracelets, and more.

With the help of amazing communities like the *Bee Culture* family, the company has seen so much growth in the past year. With all of this support we were able to win a competition at SouthPark Mall in Strongsville, Ohio for free rent in a retail space for six months. It was a competitive and tough experience, but the management team for SouthPark saw the potential.

The first brick and mortar space will be opening at SouthPark Mall on November 1st of this year and we're hoping to spread the word to shoppers from all over who visit the mall. With the growth we've seen of the past year locally, we are attempting to spread it nationally and internationally by announcing that we are now shipping to over 240 countries. Heart and soul have gone into this business with support from so many lovely individuals who love the cause, products, transparent business practices, holistic strategy, and so much more.

Can't wait to see where the business is next year and how we've helped the amazing creatures that support us every day.

You can learn more about **Bloom Clothing** at **www.bloomclothingcompany.com** or visit us at Southpart Mall, 500 Southpark Center, Strongsville, OH 44136.

www.queencage.com

Almost 1½ years ago we were approached by a major queen and honey bee breeder with the question, "Why don't you make a new, easy to use version of the standard wooden cage most people are familiar with?" Had this not been asked, I would never had given much thought to Building the Better Mousetrap".

So after several missteps, mistakes, and at times misguided notions, the product is ready for the U.S. market.

Mike Gardner, of Gardners Apiaries/SpellBee, pushed to get the queen cage built to his specification – it was Mike who had planted the idea. The first 20 some thousand went to the local landfill. They worked, but they didn't work to Mike's satisfaction.

So after promising to show the world a new queen cage, and failing to produce, we now have the Shamrock Queen Cage, a Patent Pending unit that comes completely assembled, saves time & materials and makes for easy intro and release.

Imagine if you will, having 200,000+ wooden cages that are filled with paper, after which fondant is added, then a small screen carefully stapled in place, plus the balancing act of keeping up with two corks. And if they are to be used for packages the strap is cut and stapled in place. All that's done before you add the queen.

With the Shamrock Queen Cage you still have to install the fondant. Then . . . well, you put in the bees.

If the cages are not to be used for packages, simply order them without a strap (that costs one penny more) or just cut the standard strap with scissors.

Shamrock Queen Cage samples are available in boxes of 50 for $39 (that includes the freight). They scale downward as the quantity rises.

To order samples email **johnsullivan@triad.rr.com**.

Easy-On Hive Covers

These covers were developed five years ago. They are manufactured and field tested in Northwest Ohio. Last Winter many lost most of their hives to the cold. Our bees were medicated and fed. Old man Winter didn't get a single hive during the 2017/18 Winter.

The covers are made from heavy tear resistant material that cleans easily and lasts for years.

Effective Efficient Easy!

- Seconds to put on
- Windproof
- Waterproof
- Foam Board insulation
- Holds tight to the hive
- Stands up to Winter wind
- Does not block ventilation
- Fits just under the hive lid
- Fits the Langstroth 10 or eight frame two deep hive
- Folds flat for storage
- Lasts for years
- Looks Good!

Bee Child, written by Wyatt A. Mangum. Published by Stinging Drone Publications, ISBN 978-0-9851284-1-8. Paperback, 560 pages. $17 + tax and shipping. To order go to **www.beechildthebook.com**.

In his first novel, honey bee scientist Dr. Wyatt Mangum weaves the intricacies of bee biology into a spellbinding story about the power of love, motherhood, and of course bees.

This book takes place in the 1840s, during a crucial time in this history of America and beekeeping.

The main character of the book is a boy named Amaron, who is orphaned as an infant by his mother. But before she died his mother filled him with words of wisdom regarding the bees. She had a very special relationship with them.

The boy's mother had already lost her husband and twin daughters to the rough wilderness they lived in. She did not want the boy to grow up afraid of the bees, as her husband and daughters had been. So she talked to him all of the time from the day he was born, about the bees.

Some would call her a 'bee tamer' because of her relationship with the bees. The bees protected her and her children after the loss of her husband. They provided food in the form of the honeycomb for them when Winter came along.

The book starts out very dark and forboding as it describes the harsh circumstances of the mother's life. But it is intriguing also as she has the bees to protect her.

At one point the bees keep her from harm while she tries to get her and her infant son out of the wilderness and into civilization. Three wolves start tracking the boy and his mother and one by one the bees kill off the wolves.

Even with the help of the bees the mother still ends up orphaning her young son. But hopefully she has filled him with the knowledge of the bees and the promise of a magnificent girl who will search for him.

It is a long book, but if you are a fan of fiction it is well worth the time and Dr. Mangum does a great job of weaving bee biology into the story.

Kathy Summers

Vanishing Bees: Science, Politics, and Honeybee Health (Nature, Society, and Culture) by Sainath Suryanarayanan and Daniel Lee Kleinman. Published by Rutgers University Press. ISBN 978-0-8135-7458-5. I60 pgs., 6" x 9". Paperback, no color, soft cover. $26.95.

Interestingly, this book is written by two professors from my alma mater, the University of Wisconsin, Madison. The project began some 8 years ago, with the goal of looking into the whys of vanishing bees. It does just that with extraordinary success with one tiny exception, which, it turns out has little to do with the value of the book. It is, to a small degree, somewhat dated – by two to three years or so, and when looking at the history of what has happened to bees in the past decades, it matters very little. Besides the time needed to complete this work.

There are only five chapters. One on beekeepers, one on researchers, one on growers, one on Bayer and one on the EPA. This covers, without doubt, all of the players in the plight of bees and beekeeping.

It took me a couple of chapters to realize the technique of each of these chapters. The authors would argue one side of a question, then argue the other side, and only then reach a conclusion. It was frustrating at first, but the value is that you have laid before you both, or more, sides of a question and the logical deduction of what actually is correct. The Cutler/Scott-Dupree experiment is a good example of examining data from more than one perspective and reaching the correct conclusion.

They have sections on knowledge and ignorance that have given me new meaning in some of the discussions I have had over the years about this subject with clients on both sides of this coin.

If vanishing bees has meaning in your world, this book should be part of it. – *Kim Flottum*

Memory Lane

Beekeepers, RNAi, Monsanto and Gerry Hayes

Well Sherman, set the WABAC machine to Florida, 2006.

OK, Mr. Peabody!

I was the Chief of the Apiary Section of the Florida Department of Agriculture and Consumer Services in 2006. I and the 12 Apiary Inspectors stationed throughout Florida to assist beekeepers were always getting calls about honey bee health issues of one kind or another.

Dave Hackenberg, a commercial beekeeper, called me that Fall and said his bees were gone. Not dead or stolen, just gone. I listened as I always did to beekeepers with problems, tried to help them solve them. Dave was not just a one call guy. He called several times and kept telling me this weird story about bees being gone. Not dead on the bottom board or dead on the ground in front of the hive but just gone. And it wasn't just one colony it was many.

As you all know now we named this thing that researchers, academics and USDA specialists didn't know what was, **Colony Collapse Disorder or CCD.** We didn't know what it was or what caused it or how to fix it so we called it a **Disorder.**

And we figured like most things in beekeeping it would disappear in a few months and life would go on as it had. Well, it didn't and many of you reading this now are beekeepers because of the focus on honey bees and honey bee health.

In the intervening years, we have come to understand *Varroa's* impact on Honey Bee health and understand that this thing we named CCD is linked to the multiple factors that all tie into this new parasite the *Varroa destructor* mite.

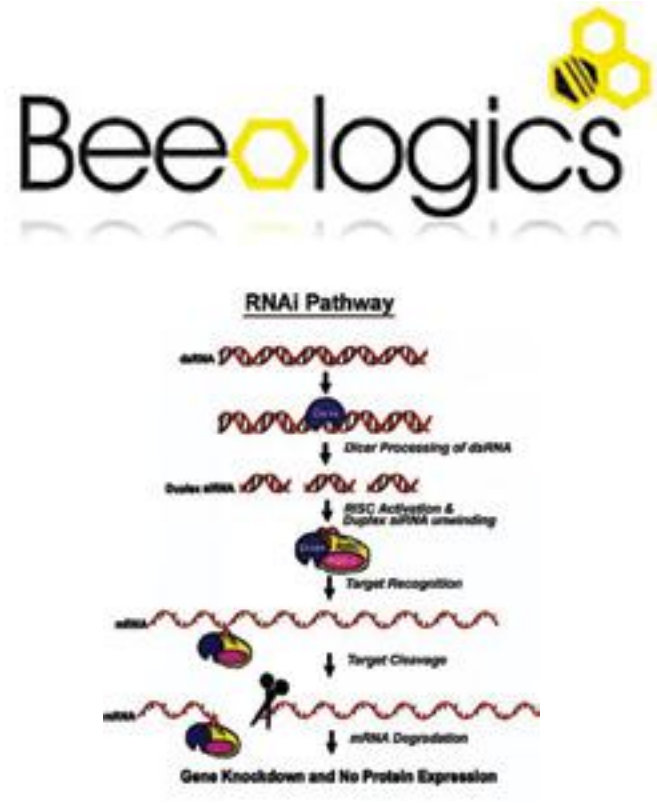
In parallel with the above, there was a USDA CMAVE (Center for Medical, Agricultural and Veterinary Entomology) lab around the corner from my office in Gainesville, Florida. I was invited to a workshop where they were going to control malaria-carrying mosquitos using a brand new technology called RNAi.

I could walk across part of the Univ Florida campus to get there. It was a fascinating presentation of how DNA never leaves the cell nucleus but makes copies of these genetic instructions that cells need to make things for the mosquito or us, or cows, or pigs, plants and most everything to stay alive. These specific instruction copies are taken by a cousin of DNA called RNA to the cell site to turn some protein synthesis on or because you can't have things running all the time turn this down or off with the instruction delivered by RNAi, i stands for interference.

The USDA CMAVE folks were going to use RNAi to turn something off in the malaria-carrying mosquito and kill, hurt or damage it. This DNA to RNA process is going on in you and me right now and Fido and Fluffy and lettuce and apples to regulate how things live and grow. And because it is a fundamental process of biology and in our food supply we eat it and digest it because it is a normal natural component. And because RNAi is focused and specific to those organism's unique genes it has no negative effect on you or I or other plants and animals. Sounded pretty good.

On my walk back to my office I stopped by Dr. Jamie Ellis' office in the Entomology and Nematology Dept. on the UF campus. I told Jamie what I thought I heard and wondered if this technology could be used to safely and efficiently help honey bee health.

Remember this is 2006, very early in this technology. Jamie and I decided that we should move forward and simply try to learn about RNA. We started emailing and asking questions to colleagues globally to gain as much



knowledge as we could to see if this might be a path forward for honey bee health.

A company from Israel, Beeologics, heard we were asking questions and they contacted us. Beeologics had been working with RNAi and had developed a possible control for a virus that early on had been correlated with CCD, the Israeli Acute Paralysis Virus (IAPV). They contacted us and to make a long story short we decided to informally collaborate together to learn about RNAi and honey bees. And we did for several years.

Fast forward to 2011 when Monsanto acquired (bought) Beeologics. Not for the honey bee thing but because RNAi was a possible insect control for production ag. crops. And, bless their hearts they kept the honey bee piece of this as a platform to learn about RNAi and as a PR move, knowing that they would never make money off a honey bee health product but it was a good thing to do.

They looked around their 22,000 employees and nobody knew anything about honey bees. Because of my connection with Beeologics and learning about RNAi and honey bees I was asked by Monsanto if I would come and lead this project to develop an RNAi solution to honey bee health issues.

It took me several weeks to make a decision because like everybody else I had lots of suspicions because we were all taught to hate Monsanto. As I shared this with friends, family and colleagues some said, "have you lost your mind." Others said, "its a big corporation with lots of money to fund research, do it."

My final decision was based on the fact that I wanted to help the industry I love and respect, that honey bee research never had received the resources or attention it deserved and I was 'late career' so all they could do was fire me. I thought I would stick my neck waaaaay outside of my shell and give it a shot.

I knew they were using me for reputational reasons but I was using them as well to get big corporation resources focused on honey bees.

A bunch of things kind of happened together at first. I had been told by the person who hired me that there was an RNAi product all ready to go. I was told I had a budget and I needed to decide on packaging and distribution and marketing/advertising. I was excited to be on the cutting edge of something valuable for the beekeeping world.

About two weeks later I found out that this product had failed its 5th or 6th FDA trial. I was not happy. I could have gone back to Florida as they were either very kind or knew stuff like this happened so kept my job open. I decided that I would stay because we in the beekeeping industry have never had the concentration of smart people, funding and expensive equipment in one organization. I would stay and keep people's feet to the fire and hang on until something could be invented, I was fired or left.

But, I was pretty naive and even though being a beekeeper and in the industry and a supporter and cheerleader for it for years, at my first presentation at a beekeepers' meeting, before I even opened my mouth, people got up and walked out saying ugly things as they went. This happened several times for the first year or so until those sensitive beekeepers realized Jerry hadn't changed. He just changed how he thought he could add value in a different way.

I thought coming from State Gov. I would know, kind of, big organization structure so it would be a quick learning curve. I sure was wrong. This was like going to Mars. Nobody was really in charge until you looked up the ladder. You were discouraged from going and visiting one on one with others. You had many, many meetings every day because you were on many Teams for many different topics not at all related to honey bees.

The Teams were not like sports teams working together hand and hand to win the game or solve a problem. They were mostly a way to communicate because usually nobody was available to speak one on one. Very disconnected. But, the people were great and were playing the game because they wanted to take care of their family, had really good working conditions, health insurance, and a salary future.

But they were also not responsible individually and recognized as such in an industry they loved. Keep your head down, do what you are told and don't make eye contact and life is good.

But despite my not fitting in the corporate mold, there were several good people doing their jobs and progress was made in RNAi development for *Varroa* control. The formulation was improved and manufacturing and some of the largest field trials in the history of honey bee research were funded and conducted.

The biggest challenge with RNAi is delivery. This is a natural normal product made up of regular normal natural amino acids. This is a problem because how do you get it into Honey Bees? If you put it in sugar syrup and the syrup is not sterile, bacteria, yeast and fungi eat it as food. It doesn't last very long.

If in syrup the bees eat it and its digested as food. You have to put a lot in to get it past the digestive system. And it is really expensive to make which means it will be expensive to use. A good thing is if it is spilled on the ground it is eaten by organisms on the ground.

It is targeted and directed if the right gene is selected to turn off so won't hurt bees or other organisms. But all these things make it tough to build a product around.

Then the easiest route for regulatory approval is to go through the EPA. EPA doesn't care if it works just that it doesn't impact the environment. FDA is harder because they are looking at materials that are eaten or consumed and what is the outcome. So, I heard several times when I was asking strong questions because I didn't understand how it worked in field trials that were so inconsistent, "Jerry it doesn't matter if it works, it just has to get through EPA." That was the answer for me that I was hoping never to hear. That was the last answer for me. So, my friends, I failed to help the beekeeping industry with a new technology that I had hoped would have been safe, effective and affordable. But, I think I went where others were afraid to go and . . . tried. You never know until you try. BC

Gerry Hayes has moved on to Vito Bee Health, and still writes the Q&A column for American Bee Journal.

A&O FORKLIFT

WWW.HUMMERBEE.COM

THE CLASSIC HUMMERBEE IS BACK!

TUNED HYDRAULICS, A BRAND NEW TRANSFER CASE DESIGN, AND IMPROVED ARTICULATION JOINT MAKE THIS HUMMERBEE EVEN BETTER. ORDER NOW FOR QUICK DELIVERY!

Engine - Kubota Diesel!

Hydraulics - 2 speed!

Drive - 4X4!

Lift - 2,000 lbs!

CALL US TODAY!

800-943-8677

Hummerbee®

Rough Terrain Forklifts

UNITED STATES POSTAL SERVICE®

Statement of Ownership, Management, and Circulation (Requester Publications Only)

1. Publication Title	2. Publication Number	3. Filing Date
Bee Culture	9 2 4 3 – 8 0	10/01/2018
4. Issue Frequency	**5. Number of Issues Published Annually**	**6. Annual Subscription Price (If any)**
Monthly	12	$25

7. Complete Mailing Address of Known Office of Publication *(Not printer) (Street, city, county, state, and ZIP+4®)*
623 West Liberty Street, Medina, OH 44258

Contact Person: Kathy Summers
Telephone *(Include area code)*: 330.725.6677, Ext. 3215

8. Complete Mailing Address of Headquarters or General Business Office of Publisher *(Not printer)*
623 West Liberty Street, Medina, OH 44258

9. Full Names and Complete Mailing Addresses of Publisher, Editor, and Managing Editor *(Do not leave blank)*

Publisher *(Name and complete mailing address)*
John A. Root, 623 W. Liberty St., Medina, OH 44256

Editor *(Name and complete mailing address)*
Kim Flottum, 623 W. Liberty St. Medina, OH 44256

Managing Editor *(Name and complete mailing address)*

10. Owner *(Do not leave blank. If the publication is owned by a corporation, give the name and address of the corporation immediately followed by the names and addresses of all stockholders owning or holding 1 percent or more of the total amount of stock. If not owned by a corporation, give the names and addresses of the individual owners. If owned by a partnership or other unincorporated firm, give its name and address as well as those of each individual owner. If the publication is published by a nonprofit organization, give its name and address.)*

Full Name	Complete Mailing Address
Brad I. Root	4172 Fawn Run, Medina, OH 44256
Elizabeth Judkins	3016 Salem Meadows Drive SW, Rochester, MN 55902-2847
Kenneth Judkins Trust, Elizabeth Judkins trustee	3016 Salem Meadows Drive SW, Rochester, MN 55902-2847
John A. Root	4712 White Tail Lane, Sarasota, FL 34328
Stuart W. Root	2260 Thoroughbred Dr. Medina, OH 44281

11. Known Bondholders, Mortgagees, and Other Security Holders Owning or Holding 1 Percent or More of Total Amount of Bonds, Mortgages, or Other Securities. If none, check box. → ☒ None

Full Name	Complete Mailing Address

12. Tax Status *(For completion by nonprofit organizations authorized to mail at nonprofit rates) (Check one)*
The purpose, function, and nonprofit status of this organization and the exempt status for federal income tax purposes:
☐ Has Not Changed During Preceding 12 Months
☐ Has Changed During Preceding 12 Months *(Publisher must submit explanation of change with this statement.)*

PS Form **3526-R**, July 2014 *[Page 1 of 4 (See instructions page 4)]* PSN: 7530-09-000-8855 **PRIVACY NOTICE:** See our privacy policy on *www.usps.com.*

13. Publication Title	14. Issue Date for Circulation Data Below
Bee Culture	10/01/2018

15. Extent and Nature of Circulation — Worldwide Beekeepers			Average No. Copies Each Issue During Preceding 12 Months	No. Copies of Single Issue Published Nearest to Filing Date
a. Total Number of Copies *(Net press run)*			19,148	17847
b. Paid Circulation *(By Mail and Outside the Mail)*	(1)	Mailed Outside-County Paid Subscriptions Stated on PS Form 3541 (Include paid distribution above nominal rate, advertiser's proof copies, and exchange copies)	12650	11944
	(2)	Mailed In-County Paid Subscriptions Stated on PS Form 3541 *(Include paid distribution above nominal rate, advertiser's proof copies, and exchange copies)*	0	0
	(3)	Paid Distribution Outside the Mails Including Sales Through Dealers and Carriers, Street Vendors, Counter Sales, and Other Paid Distribution Outside USPS®	1401	1346
	(4)	Paid Distribution by Other Classes of Mail Through the USPS (e.g., First-Class Mail®)	0	0
c. Total Paid Distribution *[Sum of 15b (1), (2), (3), and (4)]* ▶			14051	13290
d. Free or Nominal Rate Distribution *(By Mail and Outside the Mail)*	(1)	Free or Nominal Rate Outside-County Copies included on PS Form 3541	0	0
	(2)	Free or Nominal Rate In-County Copies Included on PS Form 3541	0	0
	(3)	Free or Nominal Rate Copies Mailed at Other Classes Through the USPS (e.g., First-Class Mail)	268	266
	(4)	Free or Nominal Rate Distribution Outside the Mail *(Carriers or other means)*	300	275
e. Total Free or Nominal Rate Distribution *(Sum of 15d (1), (2), (3) and (4))*			568	541
f. Total Distribution *(Sum of 15c and 15e)* ▶			14619	13831
g. Copies not Distributed *(See Instructions to Publishers #4 (page #3))* ▶			1995	2018
h. Total *(Sum of 15f and g)*			16614	15849
i. Percent Paid *(15c divided by 15f times 100)* ▶			96%	96%

* If you are claiming electronic copies, go to line 16 on page 3. If you are not claiming electronic copies, skip to line 17 on page 3.

UNITED STATES POSTAL SERVICE®

Statement of Ownership, Management, and Circulation (All Periodicals Publications Except Requester Publications)

16. Electronic Copy Circulation	Average No. Copies Each Issue During Preceding 12 Months	No. Copies of Single Issue Published Nearest to Filing Date
a. Paid Electronic Copies ▶	400	383
b. Total Paid Print Copies (Line 15c) + Paid Electronic Copies (Line 16a) ▶	14451	13673
c. Total Print Distribution (Line 15f) + Paid Electronic Copies (Line 16a) ▶	15019	14214
d. Percent Paid (Both Print & Electronic Copies) (16b divided by 16c × 100) ▶	96%	96%

☒ **I certify that 50% of all my distributed copies (electronic and print) are paid above a nominal price.**

17. Publication of Statement of Ownership

☒ If the publication is a general publication, publication of this statement is required. Will be printed in the November 2018 issue of this publication. ☐ Publication not required.

18. Signature and Title of Editor, Publisher, Business Manager, or Owner	Date
Kim Flottum	October 1, 2018

I certify that all information furnished on this form is true and complete. I understand that anyone who furnishes false or misleading information on this form or who omits material or information requested on the form may be subject to criminal sanctions (including fines and imprisonment) and/or civil sanctions (including civil penalties).

INNER COVER

It was, if I recall, right before Thanksgiving during my first year on the job that I got a call from somebody who wanted to put an ad in our magazine for the January 1987 issue and how would they go about it. They were selling Expeller Processed Soy Flour and Brewers Yeast for feeding bees in the early spring. They were new to me so there were forms to fill out and such, but in the January, 1987 issue, Mann Lake Bee Supply placed their first quarter page display ad with us.

Their business actually began back to 1984, when, because they were tinkering around as hobby beekeepers, needed to buy some supplies. Jack Thomas headed to one of the major suppliers and was met with a series of experiences so frustrating that it made him decide that it could be done better, and he was the guy to do it. So they opened a business in their garage attached to their home on Mann Lake, Minnesota, very near the town of Hackensack.

They ran that Brewers Yeast ad for a few months, then backed off a bit after getting a feel for how this was going to work. They put a smaller ad in ABJ for menthol crystals during the Summer for tracheal mite control and ran that for a bit too.

Over the next few months I talked occasionally with Jack Thomas about the beekeeping industry, beekeeping, advertising, who his competitors were and the like and got to know him fairly well.

Right off he got some pretty sharp business people working for him to keep the place up and running. Jack was an engineer so the technical part of the business worked well for him, but he knew the business side as well.

Over the years I got to know Jack, his wife and partner Betty and many of their employees fairly well. I've visited his operation in Hackensack, Minnesota several times for stories and for events they support for beekeepers. Each time the operation was more diverse, bigger, with more people and more business. They were definitely giving the other manufacturers (The A.I. Root Bee Supply business included) a run for their money.

The one thing that was absolutely in their favor was that they didn't have a hundred-year legacy behind them that they could comfortably rest their laurels on that all their competitors had. All three of them, Dadant, Kelley and Root were established names in the industry, with decades of experience and tons of recognition, and complacency to match. That, and equipment that for the most part was as old and inefficient as the companies that ran them.

Since he had retired shortly before he opened his business he and Betty had both the time and financial grounding to take a long hard look at the industry they had now become a part of. And from that outside perspective looking in could see that their one big advantage was that they didn't take a lot for granted, and could bring in new technology and new ideas without the burden of 'this is how we've always done it'. This is still a not uncommon approach in many businesses.

This opportunity paid off over the years and the company grew faster than most realized. Today they have facilities in four different states, and are selling far more than simply beekeeping equipment supplies. They have captured a large share of the hobby, sideline and especially commercial business, both internationally and online, along with producing, or managing other products beekeepers need and use.

I think the best time I had with Jack and Betty was a whole day of just driving around their part of northern Minnesota. This is where, in case you didn't know, the head waters of the Mississippi are located. We drove to the very outlet from a small lake, and I actually stepped over the Mighty Mississippi without getting my feet wet.

Over the years Jack had several joints replaced. Shoulders, hips, I forget all that he had replaced. It came to the point that when you met Jack at a meeting you got a fist bump rather than a hand shake. Every morning I have similar issues with hands and hips, so I can relate exactly to what he must have gone through, and all the time with a smile.

Five or six years ago they decided that their love of animals needed a place to be, so they built an animal shelter in Hackensack for dogs and cats and strays and rescues. It is truly a great place to visit – modern, efficient and if I was a stray, not a bad place to be.

Jack passed back in September, after a tough battle with cancer. He was 82. The company will go on of course, and, as of early October, I'm not sure what direction they will take. Betty, chipper as ever, is the Animal Shelter's – it's called Paws and Claws – guardian angel so will devote her time there I imagine.

Jack Thomas.
Next Month.

Thirty four years isn't yet a legacy, but this company has certainly made a mark, a positive mark on beekeeping in this country and to a degree much of the world. We wish them the best. Rest in Peace Jack. You did OK.

•

Stay tuned for our December number because it's our annual Interview Issue! We've got some awesome folks lined up that our regulars have found and want to share. I'm going to be talking with Marina Marchese, the founder of The American Honey Tasting Society, and my co-author for our book *The Honey Connoisseur*. Marina has taken this tasting thing a long way since we put that book together, with studies in Italy and classes here in the U.S. Plus, she's doing an article for us next month, too. It's on pairing different honeys with different cheeses. If you do honey tastings at all, you need to expand your horizons past just a tiny spoonful and see what it tastes like – important, but not at all complete. You need to learn the secrets of what honey goes with what fruit, what crackers, what cheeses, what other foods that enhance both the honey and the food you are pairing it with. This article is a good start, but there is so much more to experience. Stay tuned for this one…it'll be an eye opener and a mouth-watering way to spend a bit of good-tasting time.

Ann Harman will be talking to Sam Ramsey, the scientist who has turned around varroa research with a storm. His discovery was that varroa actually are feeding on the fat bodies of bees, not the hemolymph of the bees. This has, we are told, changed the way we are looking at control and more when it comes to dealing with this most awful pest. And if you didn't make the EAS Banquet this year, you need to tune him in on YouTube for some of his musical presentations. His talent in entomology is equaled with a fantastic singing voice, and we were doubly treated by having him there.

Jim Tew is approaching this a bit differently. He's going to tell us about the folks in his life that got him where he is today. Sort of Interview Retrospect. I am looking forward to meeting some of those people.

Jay Evans is going to be talking to Christina Grozinger from Penn State about her programs there. Penn State has, in case you aren't aware a real gem in this researcher, with millions of dollars in grants, numerous awards and a boat load of research findings behind her, and many more to come. A not well-known member of our honey bee research community yet, I'm eagerly looking forward to what Jay finds out.

Kim Lehman, our Young Beekeeper advocate, is doing a follow up story on Mikaila Ulmer, From Austin, Texas. Kim did a story about her when she was nine some time ago and since then this young woman has gained national recognition as an entrepreneur and a philanthropist raising money to support bees. Kim keeps finding these exceptional young people through her work in the magazine and presentations, and I look forward to this second look she brings next month.

And there will be more. Jessica, Jennifer, Ross, Toni….they all know neat people they want to share. So, check us out next month for the Interview issue, unlike anything you'll find anywhere else in the beekeeping industry.

•

Just a quick note on the ongoing shortage of epipens, again. FDA in late August again extended the shelf-life dates on existing pens just so some were avaialble, but the shortage seems to be chronic. There is a generic pen available, if you can find it, but it's not the same as the one you are used to because of delivery methods and dose recommendations. The immediate fall out is that most schools require kids to have one if they have severe allergic issues. And, even if parents can find one, the $700+ price tag means that's not going to happen, and their kids are being kept out of school. If you, or someone in your family needs these, or you keep them handy for beeyard guests, keep an ear to the ground on the availability of these life-saving devices.

•

Just one last thought. Take a look at this month's honey report. We looked at honey production by region this month, and compared to last year's data taken at about the same time, and then at the final ERS Honey Report released earlier this year about last year's production to make some educated guesses. Going out on a limb here, looking at this year's data and last year's, they seem to be similar, meaning, he adds carefully, the crop should be about the same. But it's those top 10 producing states, and, actually the top five that set the standards. And they seem to be about the same as last year too, at least comparing our reporter's data to the ERS data. That comes to just under 150 million pound crop, again. That's only 20% or so of what we consume. We eat honey at a deficit. So far, pollination is protected from foreign intervention (and those prices keep inching up), and we aren't importing bees, yet. Two out of three isn't bad, but it's not perfect, either.

•

It's Thanksgiving time. All of us here want to wish you and yours the very best holiday season. It's been a strange year, and it isn't over yet, but stop for a moment and recall all the good things that have happened. And *Thank You* for being a part of our family this year. We are glad we can share some of what we do.

American Honey Producers Association

50th Annual Convention & Trade Show

Join us in 2019 in Phoenix, AZ at the DoubleTree by Hilton Hotel Phoenix Tempe!

January 9-12, 2019

For more information visit www.AHPAnet.com

It's Summers Time –

Autumn, Thanksgiving and Loss

Although the calendar says it's Fall, in Northeast Ohio it's still very Summer like. It's approaching mid October as I write this and it has been uncomfortably warm this past week – mid 80s. I know for some of you that's tolerable, but here we're not so accustomed to this warm weather this time of year. Although, October can be all over the map when it comes to predictable weather. I do remember taking my children out for Halloween and not needing a jacket and I do remember having all of our Winter garb on some years and only going up and down our block.

In mid October we have a Fall Foliage Tour that highlights a different part of Medina County each year. It's a self-guided tour with a published map that takes you on a route where different farms and businesses are open and featuring activities such as hayrides, mazes, lots of apple cider and other activities. There are alpaca farms in the county that will have things going on, several apple orchards, farm stands with lots of apples and fall crops for sale. This is coming up this weekend and the temperature is actually supposed to drop a bit, so it will actually seem a bit Fall like.

The chickens are in that molting season, so not many eggs right now. We lost one this past month, so holding at 19 right now. She wasn't one of the oldest ones, but not young either. It's sometimes very dramatic when they die, but this was very quiet and subtle. We noticed for two or three days that she wasn't moving around a lot and would sit right in the feed shoot that we have, so no one else could get to the food. On about the third or fourth day we found her in that spot not breathing.

We had a great time, as usual, at Mother Earth News Fair at Seven Springs Resort in PA. The Friday before the Fair got into full swing, Kim, Shane Gebauer and Toni Burnham taught a Beekeeping Institute for Beginners. It was literally held on top of a mountain right on a lake – a beautiful setting. And we made it through most of the day before it started to rain. I think I might be the only one who got stung while I was busy taking pictures. The bees were nice and calm for the beginners.

The beekeeping industry lost another friend to cancer in September. Jack Thomas, owner of Mann Lake Ltd. passed away. If you've been in the business for any length of time you know of and probably have met Jack at some time at some meeting, somewhere.

The last harvest.

I first met Jack at the 1994 EAS meeting which was held in Lancaster, PA. I had been doing my job of layout and design for about four years and that was the first big meeting I had the opportunity to attend.

I was a little 'star struck' to say the least. I knew of all of the important people in the industry, because many of them wrote for us and so I saw their pictures and read their words each month. But this was the first chance I had to meet many of the big names in the Bee World. That was also the year I met Jim Tew, Ann Harman, Richard Taylor, Roger Morse and so many more.

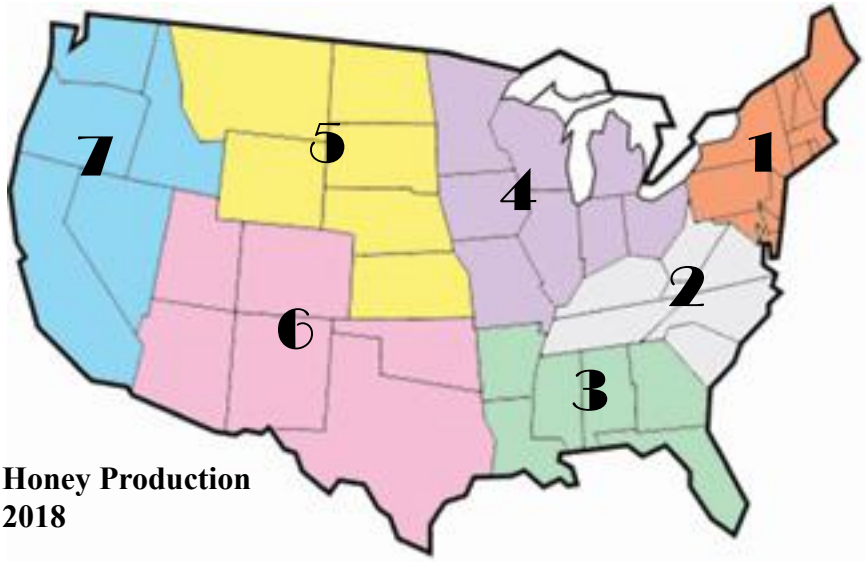
But my meeting Jack was memorable because he was the first person I had tell me that he really liked what we do here at *Bee Culture*. I didn't know who he was until Kim told me. I had not experienced that until that moment. I just came to work each day and did my job. I already knew that I loved this job, but it makes a difference when someone, especially someone important, tells you that they like what you do.

I've never taken that for granted. Now I go to lots of meetings, have spoken at meetings, have organized meetings and there still is nothing better than having someone tell you that they appreciate and love what you do.

Kim and I also lost another friend to cancer in September. His name was Dr. Ricci and he was our dentist. But he was more than just our dentist, he was a very cool guy and was very important to our Medina community. He did a lot of good things. I knew him before I knew Kim, even before I knew my children. He had been my dentist for more than 30 years. He had a very large practice, saw lots of people, but always seemed to remember my boys' names when I would run into him in the grocery store and he would ask how they were doing. Dr. Ricci will be greatly missed by a lot of folks here in Medina.

I don't know what your Thanksgiving looks like, but I hope it is a peacful, happy event at your house. Ours looks a little different each year. Sometimes it is just Kim and I, or we have it on Friday instead of Thursday so more of our children (biological and extra) can make it. Sometimes it's meatloaf or pot roast instead of turkey, but it's always one of my favorite times. It's the calm before the crazy holiday stuff starts. It's the week I take some vacation and put up the Christmas tree!

NOVEMBER – REGIONAL HONEY PRICE REPORT



Honey Production 2018

We asked our reporters to sum up the honey crop this year, including Spring, Summer and any Fall crop they were able to harvest. Coupled with that we asked about the weather for those crops in their regions. Take a look and see what went on this year. And better, what do you think the U.S. honey crop will be this season?

Region 1. Average production per colony overall all was 48 lbs., using 72% of the colonies they had available. About 2/3 thought it was better than last year, but some didn't have that kind of season this year. Spring weather was cool and wet, Summer warm and about right for moisture, and Fall warm and wet.

Region 2. Average production was 43 lbs, using only 63% of their available colonies. The crop this year was better than last season. Spring weather was wet, but temps were avg., Summer weather was warm and wet and Fall weather still warm and wet.

Region 3. Average production was 62 lbs, using 75% of available colonies. The crop this year right about the same as last year. Spring weather was generally warm and wet, Summer weather the same and Fall still warm but not quite as wet.

Region 4. Average production was 56 lbs, using 91% of their available colonies. The crop this year was just a little bit better than last year's crop. Spring weather was cool and wet, Summer warm and wet, and Fall weather was about the same.

Region 5. Overall average production was only 44 lbs, probably because only 55% of all colonies were used. This is much worse than last year's crop. Spring weather was cool and wet, Summer's was about average temp but much wetter than normal, and Fall's weather about avg temp but still, wetter than normal.

Region 6. Average honey production per colony was 60 lbs, using 74% of all the colonies owned. For almost everybody, this was better than last season, which is refreshing. Spring weather about average for that time of year in this region, with some reporting hot, some cold, and some dry. Summer weather was too warm, and too dry for almost everybody, and Fall weather has been still hot and still mostly dry.

Region 7. Average production out west was 66 pounds per colony, using fully 80% of the colonies available. Three to one this was worse than last year, but some did OK. Spring weather was about average but a bit on the dry side, Summer weather still warm and dry and Fall weather about avg temp but dryer than most would like.

We took this a bit further, making some educated guesses. Overall production per colony, across all regions boils down to about 55 lbs/colony. Last year overall production per colony was, according to ERS, about 55 pounds/colony, for a total of 147.6 million pounds. The top 5 producing states last year were ND, SD, CA, MT and FL. This year those regions overall averaged just under 60 pounds/colony, so the totals this year seem to be similar to last year's for overall honey crop. Time will tell. Stay tuned.

	REPORTING REGIONS							SUMMARY			History	
	1	2	3	4	5	6	7	Range	Avg.	$/lb	Last Month	Last Year
EXTRACTED HONEY PRICES SOLD BULK TO PACKERS OR PROCESSORS												
55 Gal. Drum, Light	2.14	2.19	2.10	2.50	2.25	2.24	2.14	1.74-2.50	2.16	2.16	2.19	2.24
55 Gal. Drum, Ambr	1.99	2.17	2.01	2.35	1.99	2.08	1.99	1.35-2.50	2.06	2.06	2.10	2.14
60# Light (retail)	196.70	186.67	190.00	159.00	159.00	191.44	200.00	150.00-250.00	193.41	3.22	205.03	203.98
60# Amber (retail)	194.53	187.50	183.00	157.33	194.53	179.19	200.00	145.00-250.00	191.57	3.19	203.95	205.81
WHOLESALE PRICES SOLD TO STORES OR DISTRIBUTORS IN CASE LOTS												
1/2# 24/case	91.43	77.20	84.26	74.50	91.43	84.00	91.43	57.60-134.40	86.86	7.24	84.58	84.22
1# 24/case	138.63	109.00	128.67	106.60	127.16	133.32	128.40	86.40-211.20	128.45	5.35	121.81	122.85
2# 12/case	123.51	95.70	112.10	101.80	97.44	112.80	114.00	73.43-192.00	114.31	4.76	110.65	109.23
12.oz. Plas. 24/cs	105.83	106.25	82.48	85.00	74.40	108.48	103.20	52.99-172.80	98.77	5.49	96.62	94.50
5# 6/case	134.47	106.00	118.37	117.83	102.30	126.00	134.47	71.50-210.00	128.19	4.27	126.22	120.25
Quarts 12/case	155.96	152.81	128.86	109.20	155.32	138.72	144.00	109.20-222.00	146.33	4.06	149.90	138.85
Pints 12/case	107.82	96.75	76.60	107.82	111.00	81.58	84.00	65.00-174.00	96.14	5.34	90.85	96.52
RETAIL SHELF PRICES												
1/2#	5.30	4.67	4.75	4.75	3.60	3.54	5.30	2.08-9.00	5.07	10.13	4.95	4.38
12 oz. Plastic	6.93	5.23	6.09	4.95	4.85	6.53	5.90	3.50-12.00	6.12	8.15	5.97	5.73
1# Glass/Plastic	8.30	6.89	7.68	6.20	8.10	6.12	8.00	4.00-14.00	7.59	7.59	7.35	7.33
2# Glass/Plastic	13.94	10.69	13.47	11.10	13.30	9.33	14.50	6.99-23.00	12.88	6.44	12.37	13.02
Pint	11.60	9.43	8.79	11.60	12.00	9.56	9.20	6.00-20.00	10.20	6.80	9.76	10.43
Quart	18.19	16.54	15.54	12.00	14.71	17.45	16.15	8.00-32.00	16.38	5.46	16.57	17.34
5# Glass/Plastic	26.34	26.00	31.00	25.00	20.83	22.66	26.34	11.00-42.00	26.17	5.23	26.62	28.40
1# Cream	10.26	8.25	9.66	9.40	7.00	8.50	9.00	6.00-16.00	9.53	9.53	9.22	8.78
1# Cut Comb	13.49	9.63	10.14	11.12	15.00	10.50	14.00	6.00-24.00	11.99	11.99	11.44	10.37
Ross Round	8.56	6.82	8.56	8.50	8.56	10.50	12.49	3.50-13.00	8.88	11.83	8.55	8.29
Wholesale Wax (Lt)	7.15	5.08	5.99	6.50	6.00	4.50	6.00	2.50-13.00	6.54	-	6.29	6.84
Wholesale Wax (Dk)	5.74	4.84	3.76	5.00	6.00	3.17	5.74	2.00-10.00	5.48	-	5.55	6.02
Pollination Fee/Col.	97.73	72.50	81.67	90.00	97.73	90.00	97.73	50.00-160.00	90.45	-	84.25	72.92

NOD
NATURES OWN DESIGN
APIARY PRODUCTS

Protect Your Winter Bees

Mite Away® Quick Strips

FORMIC PRO
FOR TREATMENT OF VARROOSIS
CAUSED BY VARROA DESTRUCTOR IN HONEY BEES (APIS MELLIFERA)

2 ORGANIC OPTIONS FOR VARROA CONTROL

It is highly recommended to monitor phoretic mite levels monthly during periods of brood rearing and treat when local thresholds are reached. Treat during POPULATION INCREASE to protect the bees going into the honey flow. Treat during POPULATION DECREASE to protect the bees that will make up the winter cluster.

In warmer climates additional treatments may be necessary due to longer brood rearing time. Missed treatments can lead to excessive Varroa loads and may require more than one treatment.

Treat between 50-85°F.

Formic Pro™ Now Registered in California

NOD APIARY PRODUCTS LTD.

Bee Cozy

WINTER HIVE WRAPS

PROTECTIVE
Supports the bees through the cold winters & helps maintain ambient temperatures.

SUSTAINABLE
Built from environmentally friendly materials.

EFFICIENT
Save valuable time with our slip on, slip off method!

AFFORDABLE
With a long life expectancy, annual costs are minimal.

Healthy Bees. Healthy Planet.

Now available through your beekeeping supply company

866-483-2929 | 613-398-8422 | www.nodglobal.com | info@nodglobal.com

FOUND IN TRANSLATION

Snowbirds, Snow, and Supplements Shed Light On Overwintering Success

Jay **Evans**, USDA Beltsville Bee Lab

It is too late for most of us to plan for this Winter, but insights continue to arrive from studies that connect Summer and Fall planning to more and stronger hives in the spring. Previously, I've highlighted papers that relied on beekeeper survey responses and various external measurements (weather, local land use) to model colony losses and infer causes (**https://www.beeculture.com/found-in-translation-14/**). More such surveys are now out and the scale and details of these surveys are only getting better.

Researchers are also describing ambitious colony, and even habitat, management experiments that strengthen arguments for how best to manage bees for overwintering success, and how to find the best sites for forage and 'storage' during dearths. Vincent Ricigliano and colleagues with the USDA-ARS in Tucson, Arizona have provided an important study that documents the impacts of queen replacement and food on winter success (Honey bees overwintering in a southern climate: longitudinal effects of nutrition and queen age on colony-level molecular physiology and performance (2018) Scientific Reports, 8:10475 | DOI:10.1038/s41598-018-28732-z). Importantly, this work is from the Imperial Valley of California. Near the Arizona border, this site is far more southerly than prior studies. If you are reading this article when it comes out in November, that month's average high temperature in nearby Yuma, Arizona, is 77°F and almost certainly sunny . . . but such is Winter there. Many beekeepers find this climate suits them for feeding bees and building numbers prior to almond pollination.

In the Ricigliano study, starting the season with replacement queens of matched Italian stock had a significant impact on brood production some months later, increasing production by around 25% averaged across all colonies. In addition, adding a mix of Michigan wildflower and California almond pollen to a pollen substitute tended to increase brood production, but not significantly given other factors from the field. Nevertheless, nine colony pairings that were scored in November and January (and split by site and queen replacement) showed higher brood production in the 'real-pollen' set while three such pairings showed lower production when pollen was added. Curiously, the three colony measurements that bucked the trend were at just one of three apiaries. In other words, at two of three sites, 'true' pollen increased brood production for each of the sampling points. As in every field study to date (or beekeeping operation, for that matter) there was far more variation colony-to-colony than could be explained by the researchers' manipulations. Two months after colonies were equalized, colonies in each set differed from each other by over 50% in either direction in terms of brood area and this 'noise' in the system persisted until the end of the trials. A million dollar question remains why do equalized colonies of the same stock, same management, and same location take such different paths in a couple months?

One way to solve this puzzle is to query the bees themselves to measure the physical state of individual bees. The tool of choice for this currently is to assess the activity levels of key honey bee genes linked to disease resistance, stress and overall robustness. In the Ricigliano study, those genes included immune factors (which increased upon entering 'Winter') as well as a family of established markers for honey bee adult development and nutritional status (e.g., vitellogenin, whose many properties are summarized by Miguel Corona and colleagues at **http://www.pnas.org/content/104/17/7128**). Expression levels of several immune genes and vitellogenin increased as the colonies entered November and December, consistent with a 'Winter bee' response, however benign that Winter turned out to be. The authors also describe levels of additional genes in the vitellogenin 'family', one of which (vg-like 'a') was actually a better predictor of seasonal status than vitellogenin itself. This result alone might help improve the ability of researchers and beekeepers to track the health status of colonies in different conditions and management regimes, perhaps clearing up some of the colony noise.

Another way to separate truth from noise is by brute force. When thousands upon thousands of colonies are tracked, individual factors that help colonies fail or prosper should emerge. I have reviewed before important efforts by both the USDA National Agricultural Statistics Service (**https://www.nass.usda.gov/Surveys/Guide_to_NASS_Surveys/Bee_and_Honey/**) and the Bee Informed Partnership (**https://beeinformed.org/programs/management-surveys/**) to identify signals in the noise of bee colonies. There is now an equally ambitious study from Austria to add to the mix. Austrians are dogged in registering and tracking their colonies and much else about the environment, and this has led to

numerous insights into the impacts of climate, disease, management and stress on Austrian bee colonies. In the most recent study, Sabrina Kuchling and colleagues analyzed data from 129,428 colonies tracked over six years (Investigating the role of landscape composition on honey bee colony winter mortality: A long-term analysis, Scientific Reports (2018) 8:12263 | DOI:10.1038/s41598-018-30891-y). Colony operations ranged from one or a few hives to 580 hives (one of the country's largest beekeepers). In this study, smaller operations fared better in terms of overwinter losses than larger operations, with a tipping point somewhere above 60 colonies. In addition, the landscape around apiaries played a significant role. One other nugget was that stress factors linked to colony losses were most clear in years that were bad overall. In other words, stresses placed on bees by habitat, climate and disease were additive, eventually pushing more colonies off more ledges. Despite this huge effort, noise persisted in terms of unpredicted anomalies (interactions) including factors that are good predictors of colony loss one year but poor or opposite predictors the next. To this end the authors conclude their extraordinary effort with a humbling "It also indicates that conclusions drawn from analyses of a single Winter should be interpreted with great caution, and further long-term studies are needed to understand honey bee colony losses." Knowing the minds of scientists, and competition for a breakthrough moment, this is not just a plea for more funding but an honest appraisal that, despite a few solid truths (disease=bad, stress=bad, forage=good) we are attempting to manage a social organism that is affected by rules we do not yet fully understand. BC

BXML Part 2

Achieving The Goal Of Standardized Data

Joseph **Cazier**
Walter **Haefeker**
Edgar **Hassler**

In Search Of The Genius Hive

Last month, in the October issue of *Bee Culture,* our article *"BeeXML Part I - The Power of Big Data and Analytics,"* discussed how and why data science can help bees and beekeepers everywhere by allowing us to analyze data and build support systems to facilitate smarter decisions. This idea builds on, but goes beyond, the concept we called the Genius Hive. A Genius hive incorporates analysis that builds on the base of a smart hive, as well as other standardized data, to provide solutions beekeepers need to optimally manage their hives. By way of review, here are just a few possible gifts from *Data Science* and the *Genius Hive*:

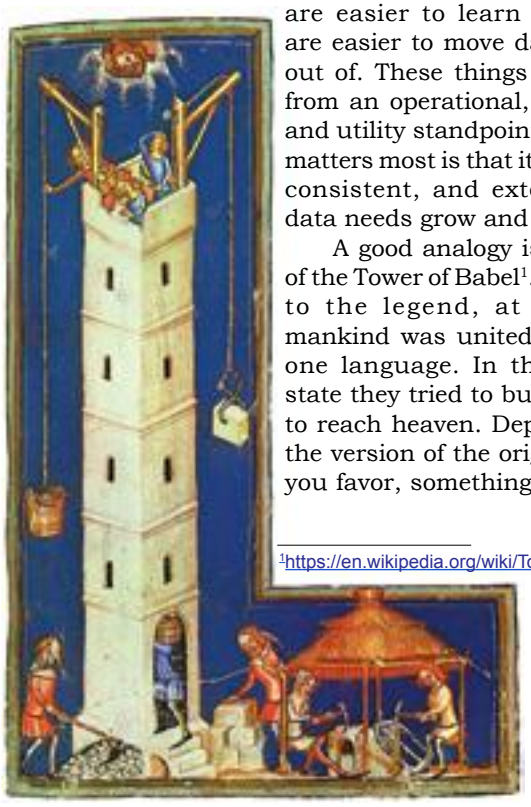
- *Hive Placement Optimization*: Determine the best location to place your bees, optimized for proper forage and environmental conditions for bees, honey production, and crops.
- *Status Alerts:* Provide updates on the current state of the hive, such as problems with the queen, pests, or pathogens.
- *Predictive Alerts*: Use predictive analytics to anticipate problems before they start and send alerts.
- *Treatment Optimization*: Use data from thousands of outcomes of similar hives to guide which treatment options would be most likely to succeed for a given hive under given conditions.
- *Trend Analysis*: Monitor regional and national trends in real time for better policy and response to incoming threats.

There is much more beyond this to help bees, beekeepers, farmers and society that can be done. However, none of this is possible without the right data, stored in the right way, and accessible with the right tools. The key to this is the development and adoption of a universal data standard for bees and all beekeeping activities coupled with the sharing of that data in a way that can be analyzed, incorporated into tools, and given back to beekeepers and other stakeholders everywhere. There is too much at stake to not take advantage of these tools.

As mentioned in last month's article, in the Fall of 2017 we formed a working group under the umbrella of Apimondia (Apimondia Working Group #15) focused on "*Standardization of Data on Bees and Beekeeping."* This group is working to identify important data, define an XML library, and encourage the creation of an appropriate data collection system to aggregate and analyze the data. This time we will look at how we can achieve this goal of building and adopting a data standard.

Defining a Data Standard

Just as there is no perfect or best language, there is no perfect or best data standard. Some are easier to use, some hold different types of information, some are easier to learn and some are easier to move data into or out of. These things do matter from an operational, efficiency, and utility standpoint. Yet what matters most is that it is defined, consistent, and extensible as data needs grow and change.



A good analogy is the story of the Tower of Babel[1]. According to the legend, at one time mankind was united, speaking one language. In this unified state they tried to build a tower to reach heaven. Depending on the version of the original myth you favor, something happened

[1]https://en.wikipedia.org/wiki/Tower_of_Babel

Joseph Cazier is the Chief Analytics Officer for HiveTracks.com and the Director of the Center for Analytics Research and Education at Appalachian State University. You can reach him at ***joseph@hivetracks.com***

Walter Haefeker is a professional beekeeper from Upper Bavaria, board member of the German Professional Beekeepers Association, as well as President of the European Professional Beekeepers Association.

Edgar Hassler, Ph.D is the Associate Director for Technology at the Center for Analytics Research and Education at Appalachian State University. You can reach him at ***hassleree@appstate.edu***

that caused them to lose the ability to speak the same language. Unable to communicate, the people scattered and were divided again. Their tower fell into ruin as their united effort was lost with the loss of their ability to communicate with one another. Thus we have the phrase, when we cannot understand what someone is saying, that they are babbling – after the story of Babel.[2]

Translation vs. Standardization

Whatever the historical accuracy of the story, it illustrates a key point. In order for different groups to communicate, they need to speak the same language. While each language may have its own character with its own advantages and disadvantages, we can generally communicate well if we are both speaking English, Spanish, Chinese, Klingon, German or any other language. As long as it is the same, we can generally get the message across. If we are speaking different languages, this becomes much more difficult. Even if we can translate, meaning and efficiency are often lost, slowing down the speed and accuracy of communication.

As it is with the languages people speak, so it is with technical and computer languages. In order to communicate effectively and efficiently, especially in a way that preserves a precise meaning – the kind needed for good *Data Science* – they need to be speaking the same language with clear semantic (meaning) definitions.

Openness

A standard, on the other hand, is a common language, designed to communicate items precisely. All can adopt it from the start and clearly define each parameter. It can be optimized from the beginning to collect, store, and transmit the necessary data. Ideally it is also one that can grow and adapt to changing needs over time. It should also be open to all so everyone can use it. Unless everyone uses it, it is not a standard.

Building a data standard is **not** the same thing as adopting whatever platform the winner or first system uses. It is about thoughtfully designing and maintaining a standard platform that everyone can use – existing, new and future vendors, researchers, and analysts alike. To be a standard, it needs to be shared. Because these standards are open, they can be used by anyone to innovate based on these standards providing more value back to society.

Examples of Standards

There are many examples of successful standards, especially in the tech industry. Here are a few of them.

- *Langstroth Hive:* Its development along with similar standard hives in the 1850s revolutionized beekeeping. Discovering the importance of "Bee Space" and having standard sizes of hives and frames allowed for the free exchange of equipment, bees, and other materials between hives and beekeepers, making it much easier to scale and manage bigger beeyards. This also lowered production and maintenance costs for hives considerably.
- *Structured Query Language* (SQL): This is a database manipulation and definition language developed in the 1960s and 1970s as a free and open standard that is still widely used today; in fact, it is perhaps one of the most popular computer languages[3] ever created. As new languages have grown in popularity, SQL is often merged with them to support common storage infrastructure.
- *Transmission Control Protocol/Internet Protocol (TCP/IP):* This is another standard that has had a large impact on society as it governs transmission of data across the internet. As an open standard it has become adopted for most traffic online, making moving information across the internet feasible and enabling the creation of the World Wide Web.

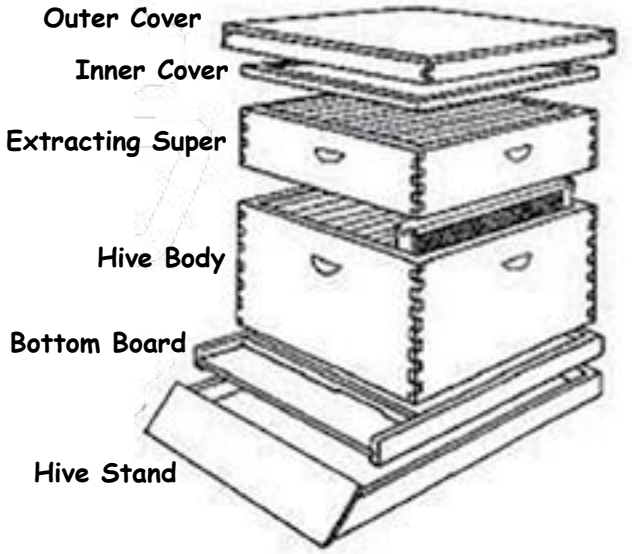


Figure 1. *An early illustration of a Langstroth hive as discussed in his book,* The Hive and the Honey-bee.

HTML and XML

Two of the most successful standards in recent history are HTML and its semantic twin XML. Most of our readers will be familiar with HTML, which stands for *Hypertext Markup Language.* This is the standardized web language that makes browsing on the internet seamless and enjoyable. Regardless of the browser (within reason), anyone from anywhere can see essentially the same thing on their device, independent of the underlying technology or system they are using.

The reason is that HTML is a *markup language.* That is, it encodes meta-tags (information about the content) focused on how to display the content in a standard consistent way. For example, it might have a tag like this **TEXT** (makes text bold) embedded around the words, pictures, and tables we see. As users, we do not see the meta tags, just the content. However, it is the meta-tags that tell your browser where and how to display the content you want to see, regardless of the device you are using. I think most of us would agree that this little innovation has had a very large and significant impact on our society. Though the standard has evolved over time (we are now mostly using HTML 5.0), it has revolutionized how we work, live, and communicate.

XML is the less well known, but no less important, little sister to HTML. Whereas HTML focuses on how to

[2]German Late Medieval (c. 1370s) depiction of the construction of the tower.

[3]Technically it is a data definition and data manipulation language, and not a complete programming language in the modern sense.

display content on your screen in a standard way, XML focuses on defining what that data means. This is a very important point, so let me give emphasis here.

XML is also a markup language, known as *Extensible Markup Language*. It focuses on marking up the meaning of the data whereas HTML marks up the formatting of the information to tell a computer how to display it in a standard format, e.g. color, position, font size. But it leaves it to the person to interpret the meaning of the information. Put another way, XML focuses on the meaning of the data whereas HTML focus on the format the content that is displayed.

The Semantic Web

XML uses tags very similar to HTML where a person or computer can read and interpret the meaning of the data. That is, rather than tag a block of text to make it appear bigger or smaller, red or green, it tags a block of text in a way that another computer can read the meaning of the data. That is it "tags" blocks of text to show structure, relationships, and other semantic attributes of the data so the next information system knows how to receive, store and process the data. It is a protocol for one machine to talk to another and convey the meaning of the data. For example, you might tag a hive id with a tag like this: <Hive_ID> #34543 </Hive_ID> so the next system knows that the text (or numbers) in between identify a hive.

Figure 2. *Sample XML Code for a beekeeper application developed by Walter Haefeker.*

Regardless of where it is located in the document, or the system being used to transmit the data, when the computer sees that tag, it knows that that is the hive id and can move it to the proper place in the local database or information system and process it accordingly. This concept, on conveying not only the form, but also the meaning of content has become known as the *Semantic Web*, and XML is a critical part of it. The term is derived from the ancient greek word *sema*, to sign or signal meaning.

Everyday XML

Most of us use XML everyday, perhaps without knowing it. XML has become the default means of data exchange for many industries, including:

- RSS, Atom, SOAP, SVG, and XHTML
- Industry data standards, e.g. HL7, OTA, NDC, FpML, MISMO etc. are based on XML
- Data interchange in internet applications

In fact, even Microsoft Office now uses XML as a portable data standard: it is actually the x in .docx, xlsx, pptx, etc.

XML vs JSON

While there are newer technologies like JSON (*JavaScript Object Notation*), XML remains a leading technology due to its history, flexibility, and adaptability given the low computational overhead needed to transmit data such as that which you might find in a bee yard. Additionally, XML permits annotating the data with metadata (data about data) such as the equipment used, last calibration date, precision and other facts concerning the providence of the data. This provides a richer source for data over the long term. It is also human readable and easy to code without extensive computer skills, making it easy for those who wish to add their data to a repository to do so. Consequently, it is likely the best choice for data related to bees and beekeeping.

Exploring How XML Can Help Beekeepers

Currently, all hardware vendors for smart hive tools use their own unique data standard mostly locked away in a proprietary data management system. Moreover, at the technical level of the sensors, they use different calibration techniques from different equipment to measure what is happening in the hive. These calibration techniques are generally stored in their native format - largely unreadable to humans - and require software applications to convert the sensor reading to something we can understand.

Different vendors will do this differently and calibration techniques are not automatically interchangeable without translation. Notably, different vendors also track different things and the same things in different ways. For example, let's look at temperature sensors. A vendor could measure

Figure 3. *A sample of a few data sources.*

temperature with a variety of tools, such as thermocouple, RTD (resistant detector), thermistors, semiconductor sensors, infrared sensors or others[4]. Additionally, a vendor can measure the inside top, bottom, center, left, or right of the hive or outside the hive in various locations. A vendor can also have different time frequencies for reporting and different units of measurement.

Each of these measurements can mean different things to the hive and may need to be recorded in a different way. If we just say "this is the temperature," we don't know which one or how it was measured. Additionally, sensors are just part of the equation. There are hundreds of elements that can be measured; however, it is likely that only a few are important. Figure 4. shows a taxonomy of a few categories of elements we should measure. Each category holds many more. We then need to think about how best to measure a particular element. At this point, we are still learning which ones are important to what. Until we know more, we need to measure as many as we can.

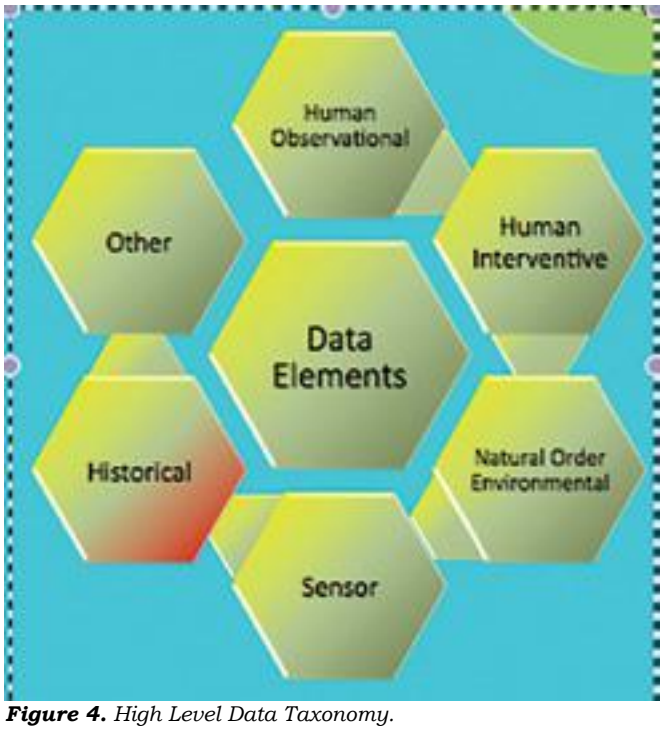


Figure 4. *High Level Data Taxonomy.*

XML will help beekeepers by defining data, along with the meaning of that data, so that it can be shared, pooled, analyzed, and used to build better tools for beekeepers everywhere. **BeeXML.org**, founded by Walter Haefeker, is a non-profit group aimed at working with all the stakeholders to build and host a data standard that any beekeeper, vendor, or researcher can use. The organization does not make tools or analyze the data, but rather provides a framework and XML library that can serve as a building block for others (like **HiveTracks.com** or Arnia) to use to make sure their data is compliant and aggregatable. Future upgrades can incorporate the same standard. Likewise, new open source manufacturers can apply it, all of which makes the data more readily available to beekeepers.

[4]https://www.elprocus.com/temperature-sensors-types-working-operation/

Governmental institutions, academic research projects, as well as breeding programs of beekeeping associations inevitably gather data about bees and beekeepers. Unfortunately, these databases become data islands and the information is of limited value for the beekeeping community as a whole. BeeXML is intended to be the answer to this problem. The project is not about creating a central database. Rather, XML is a self-describing data format that can allow for the exchange of data.

In order to create an XML standard, it is necessary to agree on what data is collected on a particular topic. If we apply a self-describing structure, it makes the exchange much more flexible than it would be with rigid table definitions. In addition, there are countless development environments for ready-made software libraries to read and write XML. Once we have a standard for a particular topic, the existing databases can be provided with XML interfaces. This in turn would later allow for a meta database, where it will be possible to query all connected databases via a common interface.

While still in its early stages, specific objectives include the following:

- *Key Data Identification:* Identify key data that is critical in developing solutions to problems faced by bees and beekeepers.

Data Source Identification: Identify and aggregate existing sources of data to help build and adapt the standard, including data collected from beekeepers, researchers, industry partners and governments. For example, the European Food Safety Authority (EFSA) published a very helpful document defining common terms and definitions related to bees and other pollinators that can be a nice starting point for data definitions. It is located here: **http://www.efsa.europa.eu/en/supporting/pub/en-1423**

Define XML Library: Build, define, and publicly release the XML library standard with key stakeholders here and abroad. This standard could then be downloaded and used by beekeepers and researchers globally.

Data Collection System: While it is not the purpose of **BeeXML.org** to build its own collections system, this standard will allow for others to do so. Such a system (or group of systems) could collect, manage, and store this information in a way that will be accessible to researchers and data scientists.

Data Diversity

One of the key benefits of a standard like XML is that it is, as its name implies, *extensible.* This means it is easily extendable to include multiple data points. One of the key advantages of XML is its ability to be user-defined. That is, if you have existing data, you can create a meta-tag. A meta-tag contains information about the data for the computer to process, from meta, providing information about itself.

This means that data we already have can be captured, encoded and transmitted in a standard format that can be analyzed today, which is important for two reasons: 1) we will not have to wait as long for tools like the Genius Hive to emerge if we can use what we have; 2) since we do not yet know which data will be most predictive, we can extend and adapt the standard overtime.

Together, these two features allow for more *Data*

Diversity, increasing the chances of us finding useful information during the data analysis phase. Additionally, because it is extendible, future data may be added to the repository for things we may not even be able to measure today, but could become very important over time as remote sensing technology evolves.

Helping With This Effort

Contributions to the BeeXML initiative are welcome from many sources. If you care about bees, there are many ways you can help with this important effort. Here are some ideas:

- *Vendor*: If you are a provider of hive tracking software or beekeeping hardware, please consider providing sample data sets similar to figure 3, which would be helpful for us to surface the commonalities of the proprietary databases and adjust the standard.
- *Researcher:* If you are a scientist who has created databases to keep track of the data from the hives in your experiments, please consider providing sample data sets to help define a useful standard.
- *Funder of Research:* If you are part of a government agency or a commercial enterprise and you are funding bee-related research, please consider making it a requirement that all project data be handled in BeeXML. If the standard does not cover your type of data yet, submit a sample data set to drive the standardization effort in this direction.
- *Donor:* If you are a donor, please consider donating funds to support the researchers, technicians, and publicity and data library development
- *Farmer:* If you are a farmer, please consider helping us expand this effort to include data from farms, given that bees are responsible for pollinating any of the crops we grow, and because the health and vitality of bees are greatly affected by their environment in the field. Farmers could "advertise" sites with pollination requirements, foraging opportunities as well as threats to bee health or potential contamination sources for hive products. Based on the data beekeepers can decide where to place their hives.
- *Beekeeper:* If you are beekeeper and a customer of hive tracking tools, please insist on being able to import and export your data using BeeXML. It is not in your interest to become a captive user of a certain platform because your data are stuck in a proprietary format.

Our message to everyone is to please encourage the adoption and use of this data standard and the data science that can be built on it by adopting and supporting it when you can and, when you find something that works, sharing it with others. BC

Acknowledgments

We would like to acknowledge the hard work of our volunteers trying to make this vision of a data standard free for all beekeepers. Updates on our progress and the participants working hard to make it a reality can be found at **https://www.apimondia.com/en/activities/working-groups**

Finally, special thanks to *Project Apis m.* for supporting a portion of this work with a Healthy Hives 2020 grant and to the editors of *Bee Culture* for publishing this work. These efforts would not have been possible without visionary groups like this one providing support and resources.

A Closer LOOK

MUSHROOM BODIES IN THE BEE BRAIN

Clarence **Collison**

Mushroom bodies (MB) are brain centers required for specific learning tasks.

Mushroom bodies or corpora pedunculata are a pair of structures in the dorsal part of the brain (protocerebrum) of honey bees that act as multimodal sensory integration centers and are involved in learning and memory.

Farris et al. (1999) using 5-bromo-2-deoxyuridine incorporation and the Feulgen technique, showed that immediately before pupation, the brain of the developing honey bee contains approximately 2,000 neuroblasts (embryonic dividing cells that will develop into neurons) devoted to the production of the mushroom body intrinsic neurons (Kenyon cells). These neuroblasts are descended from four clusters of 45 or fewer neuroblasts each already present in the newly hatched larva.

Subpopulations of Kenyon cells, distinct in cytoarchitecture, position, and immunohistochemical traits, are born at different, but overlapping, periods during the development of the mushroom bodies, with the final complement of these neurons in place by the mid-pupal stage. Neurons are specialized cells that transmit nerve impulses; electrical and chemical signals. The mushroom bodies of the adult honey bee have a concentric arrangement of Kenyon cell types, with the outer layers born first and pushed to the periphery by later born neurons that remain nearer the center of proliferation. This was the first comprehensive study of larval and pupal development of the honey bee mushroom bodies.

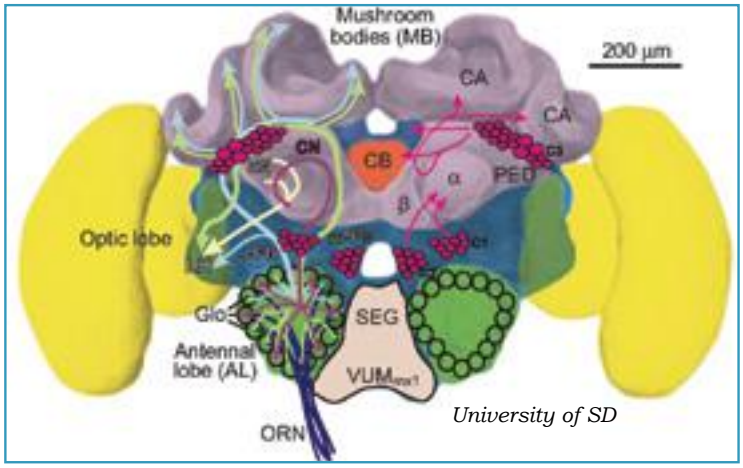
A worker honey bee performs tasks within the hive for approximately the first three weeks of adult life. After this time, she becomes a forager, flying repeatedly to collect food outside of the hive for the remainder of her five-six week life. Studies have shown that foragers have an increased volume of neuropil (a dense network of interwoven nerve fibers and their branches and synapses) associated with the mushroom bodies. Farris et al. (2001) reported that growth of the mushroom body neuropil in adult bees occurs throughout adult life and continues after bees begin to forage. Studies using Golgi impregnation asked whether the growth of the collar region of the mushroom body neuropil was a result of growth of the dendritic processes of the mushroom body intrinsic neurons, the Kenyon cells. Branching and length of dendrites in the collar region of the calyces were strongly correlated with worker age, but when age-matched bees were directly compared, those with foraging experience had longer, more branched dendrites than bees that had foraged less or not at all. The density of Kenyon cell dendritic spines remained constant regardless of age or behavioral state. Older and more experienced foragers therefore have a greater total number of dendritic spines in the mushroom body neuropil.

Their findings indicate that, under natural conditions, the cytoarchitectural complexity of neurons in the mushroom bodies of adult bees increases as a function of increasing age, but that foraging experience promotes additional dendritic branching and growth.

The behavioral maturation of adult worker honey bees is influenced by a rising titer of juvenile hormone (JH) and is temporally correlated with an increase in the volume of the neuropil of the mushroom bodies. Fahrbach et al. (2003) explored the stability of this neuropil expansion and its possible dependence on JH. They studied the volume of the mushroom bodies in adult bees deprived of JH by surgical removal of the source glands, the corpora allata. They also asked if the neuropil expansion detected in foragers persists when bees no longer engage in foraging, either because of the onset of Winter or because colony social structure was experimentally manipulated to cause some bees to revert from foraging to tending brood (nursing). Results show that adult exposure to JH is not necessary for growth of the mushroom body neuropil, and that the volume of the mushroom body neuropil in adult bees is not reduced if foraging stops. These results are interpreted in the context of a qualitative model that assumes that mushroom body neuropil volume enlargement in the honey bee has both experience-independent and experience-dependent components.

The volume of the mushroom bodies of the brains of honey bee queens was estimated using the method

of Cavalieri. Tissue samples were obtained from queens in five different behavioral and reproductive states: one-day-old virgin queens, 14-day-old virgin queens, 14-day-old instrumentally inseminated queens, nine- to 13-day old naturally mated queens, and five-month-old naturally mated queens. There were significant volume changes within the mushroom bodies during the first two weeks of adult life. The volume occupied by the somata of the intrinsic neuronal population (Kenyon cells) of the mushroom bodies decreased by approximately 30% and the volume of the neuropil of the mushroom bodies increased between 25 and 50%. These volume changes are strikingly similar to those previously reported to occur for worker honey bees switching from hive activities to foraging (Withers et al. 1993). However, in this study they were found even in queens that had no flight experience. In addition, queens exhibiting these volume changes were found to have low blood levels of juvenile hormone while previous studies have shown that foraging worker honey bees have high hormone levels. These results suggest that some aspect of behavioral development common to both the queen and the worker castes is fundamental to protocerebral volume changes early in adulthood in honey bees. If juvenile hormone regulates this process, results from queens suggest that it may play an organizational role (Fahrbach et al. 1995).



Fahrbach et al. (1997) found that drone honey bees, like the workers and queens, exhibit comparable morphological changes in the mushroom bodies of the brain during adult behavioral development. The volume of the mushroom bodies (MB) in the brains of drones was estimated from tissue sections using the Cavalieri method. Brains were obtained from six groups of drones that differed in age and flight experience. Circulating levels of juvenile hormone (JH) in these drones were determined by radioimmunoassay. There was an expansion of the neuropil of the mushroom bodies that was temporally associated with drone behavioral development, as in female queens and workers. The observed changes in drones were maintained in the presence of low levels of JH, also as in females. These results suggest that expansion of the neuropil of the MB in honey bees is associated with learning the location of the nest, because this learning is the most prominent aspect of behavioral development common to all members (workers, drones, queen) of the honey bee colony.

Mushroom bodies (MB) are brain centers required for specific learning tasks. Cabirol et al. (2017) showed that environmental conditions experienced as young adults affect the maturation of mushroom bodies neuropil and performance in a mushroom body-dependent learning task. Specifically, olfactory reversal learning was selectively impaired following early exposure to an impoverished environment lacking some of the sensory and social interactions present in the hive. In parallel, the overall number of synaptic boutons (an enlarged part of a nerve fiber or cell where it forms a synapse with another nerve) increased within the mushroom body olfactory neuropil, whose volume remained unaffected. This suggests that experience of the rich in-hive environment promotes mushroom body maturation and the development of MB-dependent learning capacities Brain structure and learning capacities both vary with experience, but the mechanistic link between them is unclear. Cabirol et al. (2018) investigated whether experience-dependent variability in learning performance can be explained by neuroplasticity in foraging honey bees. The mushroom bodies are a brain center necessary for ambiguous olfactory learning tasks such as reversal learning. Using radio frequency identification technology, they assessed the effects of natural variation in foraging activity, and the age when first foraging, on both performance in reversal learning and on synaptic connectivity in the mushroom bodies. They found that reversal learning performance improved at foraging onset and could decline with greater foraging experience. If bees started foraging before normal age, as a result of a stress applied to the colony, the decline in learning performance with foraging experience was more severe.

Analyses of brain structure in the same bees showed that the total number of synaptic boutons at the mushroom bodies input decreased when bees started foraging, and then increased with greater foraging intensity. At foraging onset mushroom body structure is therefore optimized for bees to update learned information, but optimization of mushroom body connectivity deteriorates with foraging effort.

In adult workers, the volume of neuropil associated with the mushroom bodies is larger in experienced foragers compared with hive bees and less experienced foragers. In addition, the characteristic synaptic structures of the calycal neuropils, the microglomeruli (synaptic complexes), are larger but present at lower density in 35-day-old foragers relative to one-day-old workers. Age- and experience-based changes in plasticity of the mushroom bodies are assumed to support performance of challenging task, but the behavioral consequences of brain plasticity in insects are rarely examined. In this study, foragers were recruited from a field hive to a patch comprising two colors of otherwise identical artificial flowers. Flowers of one color contained a sucrose reward mimicking nectar, flowers of the second were empty. Task difficulty was adjusted by changing flower colors according to the principle of honey bee color vision space. Microglomerular volume and density in the lip (olfactory inputs) and collar (visual inputs) compartments of the MB calyces were analyzed using

anti-synapsin I immunolabeling and laser scanning confocal microscopy. Foragers displayed significant variation in microglomerular volume and density, but no correlation was found between these synaptic attributes and foraging performance (Van Nest et al. 2017).

In honey bees, the mushroom bodies exhibit neuroanatomical plasticity that is dependent on accumulated foraging experience. Lutz et al. (2012) investigated molecular processes associated with foraging experience by performing a time-course microarray study to examine gene expression changes in the mushroom bodies as a function of days foraged. They found almost 500 genes that were regulated by duration of foraging experience. Bioinformatic analyses of these genes suggest that foraging experience is associated with multiple molecular processes in the mushroom bodies, including some that may contribute directly to neuropil growth, and others that could potentially protect the brain from the effects of aging and physiological stress.

Kiya et al. (2007) established a method to visualize neural activity in the honey bee brain, using a newly discovered immediate early gene which they termed *kakusei*. Kakusei-expression was induced transiently in the brains of workers with a peak at 30-60 minutes after seizure induced by awakening the workers from anesthesia, and was useful to detect neural activity in the worker brains. In addition, kakusie-transcript contained no significant open reading frame that encodes a protein, and was located in the nuclei of the worker brains, suggesting that kakusei-transcript functions as a non-coding nuclear RNA. In the forager brains, kakusei was preferentially expressed in a mushroom body neuron subtype, the small-type Kenyon cells (sKCs). In contrast, the sKC-preferential expression pattern of kakusei was not observed in the other behavioral groups, including the nurse bees, lightexposed bees (workers that had been exposed to white light after dark adaptation, and bees that underwent the re-orienting flights after the hive was moved. These results strongly suggested that the sKC-preferential neural activity is related specifically to the behavioral components of foraging, rather than to common behavioral traits among foraging and other behaviors, such as the flying experience and/or memorizing landmarks.

Kiya and Kubo (2011) set out to elucidate the sensory basis that underlies the mushroom body neuron activity in the forager brain, by investigating the relationship between kakusei expression and the types of foraging behavior. Through analyses of the round and waggle dancers, they observed a higher number of mushroom body neurons are active in the round dancers than in the waggle dancers. In addition, through the analysis of foragers that flew through the narrow tunnels with vertical or axial stripes, they observed that the amount of kakusei transcript correlated with the foraging frequency, while the kakusei signal density is different between the tunnel patterns. Their results suggest that the foraging frequency and visual experience during the foraging flight are associated with the different mushroom body neural activities in the forager brains. BC

References

Cabirol, A., R. Brooks, C. Groh, A.B. Barron and J.-M. Devaud 2017. *Experience during early adulthood shapes the learning capacities and the number of synaptic boutons in the mushroom bodies of honey bees* (Apis mellifera). Learn Mem. 24: 557-562.

Cabirol, A., A.J. Cope, A.B. Barron and J.-M. Devaud 2018. *Relationship between brain plasticity, learning and foraging performance in honey bees*. PLoS ONE 13(4): e0196749 https://doi.org/101371/journal.pone0196749

Fahrbach, S.E., T. Giray and G.E. Robinson 1995. *Volume changes in the mushroom bodies of adult honey bee queens*. Neur. Learn Mem. 63: 181-191.

Fahrbach, S.E., T. Giray, S.M. Farris and G.E. Robinson 1997. *Expansion of the neuropil of the mushroom bodies in male honey bees is coincident with initiation of flight*. Neurosci. Lett. 236: 135-138.

Fahrbach, S.E., S.M. Farris, J.P. Sullivan and G.E. Robinson 2003. *Limits on volume changes in the mushroom bodies of the honey bee brain*. J. Neurobiol. 57: 141-151.

Farris, S.M., G.E. Robinson, R.L. Davis and S.E. Fahrbach 1999. *Larval and pupal development of the mushroom bodies in the honey bee*, A mellifera. J. Comp. Neurol. 414: 97-113.

Farris, S.M., G.E. Robinson, and S.E. Fahrbach 2001. *Experience-and age-related outgrowth of intrinsic neurons in the mushroom bodies of the adult worker honeybee*. J. Neurosci. 21: 6395-6404.

Kiya, T. and T. Kubo 2011. *Dance type and flight parameters are associated with different mushroom body neural activities in worker honeybee brains*. PLoS ONE 6(4):e19301. doi:10.1371/journal.pone0019301

Kiya, T. , T. Kunieda and T. Kubo 2007. *Increased neural activity of a mushroom body neuron subtype in the brains of forager honeybees*. PLoS ONE 2:e371.

Lutz, C.C., S.L. Rodriguez-Zas, S.E. Fahrbach and G.E. Robinson 2012. *Transcriptional response to foraging experience in the honey bee mushroom bodies*. Dev. Neurobiol. 72: 153-166.

Van Nest, B.N., A.E. Wagner, G.S. Marrs and S.E. Fahrbach 2017. *Volume and density of microglomeruli in the honey bee mushroom bodies do not predict performance on a foraging task*. Develop. Neurobiol. 77: 1057-1071.

Withers, G.S., S.E. Fahrbach and G.E. Robinson 1993. *Selective neuroanatomical plasticity and division of labour in the honey bee*. Nature 364: 238-239.

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

Dadant

Beekeeping & Honey Bees - Our Business Since 1863

2017 PRICING
On all orders picked up at any of our 11 Branch Locations!

NOW OFFERING FREE SHIPPING on purchases of $100 or more. Some items do not apply.

HONEY CONTAINERS

Honey Bears

2 oz. Clear Bear w/Snap Cap

Hex Jars

Muth Jars

3 lb. Plastic Jar with Hexagon

Glass Skep Jars

3 lb. Glass Round Jars (Quarts)

Check out our website or catalog for other types and sizes of quality honey containers!

Inverted Plastic Jars

Classic Plastic Honey Jars

Queenline Glass Honey Jars

www.dadant.com

51 S. SECOND STREET, HAMILTON IL 62341 • PHONE (217) 847-3324 • FAX (217) 847-3660 • TOLL FREE 1-888-922-1293
• CHICO, CA (877) 332-3268 • FRESNO, CA (877) 432-3268 • PARIS, TX (877) 632-3268 • SIOUX CITY, IA (877) 732-3268 •
• WATERTOWN, WI (877) 232-3268 • ALBION, MI (877) 932-3268 • WAVERLY, NY (877) 532-3268 •
• CHATHAM, VA (800) 220-8325 • FRANKFORT, KY (888) 932-3268 • HIGH SPRINGS, FL (877) 832-3268 •

Bee Whisperers

Greta **Burroughs**

Watching, Listening & Learning – Citizen Science Comes To The Honey Bee

Beekeepers are naturally citizen scientists. They do a lot of experimenting, asking questions and learning through trial and error. It's inherent in the beekeeping culture to ask why and then find ways to make it better.

It is getting more and more complicated to be a successful beekeeper. Outsiders think all you have to do is set up a few hives, get the bees and let them do all the work.

At one time, our father or grandfather may have operated that way. But today the bees are more susceptible to outside factors affecting their health and production, leaving you, their guardian, with the responsibility of finding the solutions to their problems.

James Wilkes discovered this fact when he established a few colonies of bees in 2000. "My dad had bees while I was growing up. He got his first bees in 1964. At that time, the most important thing was to give them space. They did their thing, and we did ours.

"The biggest issue back then was to add boxes to the hive in Spring when they started growing, and then harvest the honey at the end of Summer. Today, there are a lot of pressures on bee health that makes the old way of doing it unsuccessful. We have to manage the bees or they'll die.

Rich Morris noticed many of his bees died during the winter. "We closed up the hives in November and opened them back up in March to see if the bees were dead or alive. It was frustrating to see so many dead bees. I wanted to know when, why and how they died and figure out interventions to keep it from happening any more."

Both gentlemen wanted to know if other beekeepers had the same or similar problems and provide a solution. Wilkes and Morris needed to contact, communicate with and brainstorm with fellow beekeepers. They both found the means to do just that through citizen science.

What is Citizen Science?

Citizen scientists voluntarily contribute their time, effort and resources toward scientific research. Most beekeepers do not consider themselves as scientists but in actuality you are. You see a problem that needs to be addressed and use trial and error or experimental methods to solve the problem. That is the basic principle of scientific research.

Maintaining your own hives is as important as the research conducted in formal clinical studies. It is a hands-on approach that searches for the best answer. The same issues and problems inevitably arise throughout the honey bee industry, and the solutions you discover may benefit other beekeepers. By participating in citizen science projects, those results can be shared.

The value of citizen science comes in when a group of people work on one particular issue and share the information, otherwise known as crowdsourcing. There are a number of ongoing beekeeping related citizen science projects listed on **xerces.org**, **SciStarter.com** and **iNaturalist.org**. These and other web-based platforms support and encourage ordinary people to join in and contribute to scientific research.

Modern technology is wonderful. James Wilkes keeps track of the data gathered during his hive inspections with an app he developed called Hivetracks. (courtesy of James Wilkes)

Candace Fallon, Monarch Projects Coordinator for xerces.org says, "Having a crowdsourced project is incredible because you can have a lot of people on the ground gathering data, way more than a single researcher or team can collect."

Citizen Science in Action

A benefit of citizen science is the ability to help others. Wilkes was interested in maintaining a healthy hive so he developed a way to collect and save valuable information from inside the hives.

Wilkes' focus was to perfect a method of obtaining and storing data gathered during hive inspections to notate any changes. He created a tool called **Hivetracks** where beekeepers can maintain a record of the information and use it to improve the health and productivity of the honey bees.

He explains, "It's sort of like a web-based logbook of

inspections so beekeepers can keep track of their own hives as well as [have the information available to] do citizen science. They can contribute data and information to the beekeeping community to better understand honey bee health, practices, and answer any questions someone may have."

Morris began his citizen science project by engaging other people to document what is normal for beehives across the nation. He summarizes his idea, "I wanted to create a device for beekeepers that would automatically record the conditions inside the hive 24/7. It would have a simple way to harvest the information by cell phone and be able to send it effortlessly to a nationwide database. There's been a lot of work done previously but mostly only on a local level. My aim is to get lots of data in order to see trends and make the information public domain so everyone can have access to it."

Morris' device, called **Broodminder**, records temperature, humidity and weight in the hive, as well as indicating the presence of brood which is very important for the growth of the hive.

Jane Crayton works with kids through a 4-H Youth Development Program and wanted to share her passion for honey bees with the kids. She developed the **BeeWise Honey Bee Pollen & Nectar Map** to engage the young people in gathering data and learning about the kinds and locations of plants bees prefer as well as the time of year bees collect pollen from them.

She says, "This started as a way to teach students how to do citizen science and to be friends with bees. Since then, the scientific aspect has grown and BeeWise has become a tool for all beekeepers to use to chart the data of what's blooming and when nectar flows, locations, etc."

These three citizen science projects were created to provide great web-based tools for beekeepers to use in maintaining the health and productivity of their hives. Other projects ask for your assistance in gathering information.

- *Bees and EZ Water* request pictures and information on how, when and where bees water and if any particular types of water affect honey production.
- *ZomBee Watch* is mapping locations across North America where honey bees have been infected by the zombie fly.
- *Feral Honeybee Colonies* is asking for help in locating, describing, and measuring feral honey bee colonies.

By participating in projects like these, you can help the bee whisperers to better understand what the honey bees are trying to tell us. Along the way, you watch, listen and learn from the pollinators. You may even come up with your own observations not covered in any of the existing forums; something you would like to follow up on. Would it be worth the time and effort to start your own project?

Setting up a Citizen Science Project

"Beekeepers are naturally citizen scientists," observes Wilkes. "They do a lot of experimenting, asking questions and learning through trial and error. It's inherent in the beekeeping culture to ask why and then find ways to make it better."

If you notice an issue and want feedback from others to resolve it, should you begin a project to get the help you need?

Darlene Cavalier, a professor at Arizona State University and the founder of **SciStarter.com** advises careful consideration before tackling the task of starting a citizen science project.

"It's a lot of work; a big responsibility to follow through to the end," says Cavalier. "You have to devote a lot of time and effort and be available for comments and questions from volunteers. You have to sift through the data and post updates and do whatever it takes to keep the interest of the participants."

She suggests, "If it is a general question, post it on a beekeeper website or on an existing citizen science project, or use social media platforms such as Twitter.

"If you need evidence-based information to resolve the problem or answer a question, then definitely do a project to get data, maps, photos, etc."

The general consensus of everyone asked about how to set up a new project echoes Jane Crayton's thoughts, "First of all, participate in one or more citizen science projects to get the feel of what others are doing and how it is being done. Make sure you have the time to devote to it."

Other suggestions from the experienced citizen scientists include:

- Determine the information you want. Make it simple and easy to gather, not requiring a lot of time or difficulty on the part of the participants.
- Write up a description that includes the data needed, time frame, location, and the tools and information needed from participants (photos, records of date, time, location, etc.)
- Design a project page using a template from one of the citizen science platforms (iNaturalist, CitSci.org, CrowdCrafting, Zooniverse)
- Monitor your project daily replying to all questions and comments from the volunteers. Thank people for their help.
- Keep track of the data and post updates on a regular basis.
- Devote lots of time to the project and keep it interesting.

A popular platform for setting up citizen science

Beekeeping Citizen Science Projects

Hivetracks.com - **https://hivetracks.com/index.php**
Broodminder.com - **https://broodminder.com/**
ZomBee Watch - **https://www.zombeewatch.org/**
BeeWise Honey Bee Pollen and Nectar Map - **https://www.inaturalist.org/projects/beewise-honey-bee-pollen-nectar-map**
Bees and EZ Water - **https://scistarter.com/project/17710-Bees-and-EZ-Water**
Feral Honeybee Colonies - **https://scistarter.com/project/20291-Feral-honeybee-colonies**

Platforms to Create Your Own Citizen Science Project

CitSci.org – **http://citsci.org/**
CrowdCrafting – **https://crowdcrafting.org/**
Zooniverse – **https://www.zooniverse.org/lab**
iNaturalist – **https://www.inaturalist.org/**

Healthy bees are happy, productive bees. (courtesy of James Wilkes)

Jane Crayton works with young people through a 4-H Youth Development Program in Pueblo County, CO. She also runs the BeeWise Beekeeping Camp during the Summer months where she shares her passion for honey bees with the kids. In this picture, Crayton is showing the youth a frame of emerging brood. (courtesy of Jane Crayton)

projects is iNaturalist.com. Tony Iwane, Outreach and Community Coordinator for the website comments, "Many people join iNaturalist and immediately start a project, but it's difficult to do that without experience with our platform and community, and without a very strong commitment to continue engagement and outreach. So we recommend that you start out as a participant, make some observations, add some identifications to other users' observations, and enjoy yourself out in nature."

To sum it up, think twice before starting a project. Make sure you have the time and dedication it takes to follow through. But by all means, if you believe it will benefit the beekeeping community, go for it.

Citizen Science is Contagious

Whether you are a volunteer or an administrator, you will find yourself drawn to participate in citizen science more and more. It may start out as a beekeeping related project but lead to other subjects such as Alzheimer's research, weather, or the environment.

Cavalier sums up the reasons why we participate in citizen science. "We do it to connect socially, as a way to make the world a better place, to give back, because it's good for soul, mind and body, and most of all for the pure joy of it."

She also points out that it is satisfying to know you can do things to advance research and knowledge without a formal degree and without taking a whole lot of time.

Whatever your reason for becoming a citizen scientist, the honey bees thank you. BC

Greta Burroughs has worked as a freelance writer since 2005 and has been published in magazines and newspapers as well as online publications. She enjoys discovering, researching and writing about interesting topics people may not be familiar with. Whether it be health-related, historical, human interest, or nature/environmental issues, there are many stories out there begging for attention, and Greta is on the lookout for them. You can usually find her typing madly away at her home in South Carolina where she resides with her husband and three dogs.

Sources

Jane Crayton
BeeWise Honey Bee Pollen & Nectar Map (project)
STEAM / 4-H Youth Development
Colorado State University Extension, Pueblo County
janeecrayton@gmail.com
719-557-1633

Candace Fallon
Monarch Projects Coordinator
xerces.org
candace.fallon@xerces.org
954-815-5429

Darlene Cavalier
Arizona State University
Professor of Practice
Center for Engagement and Training in Science and Society
School for the Future of Innovation in Society
Founder of **SciStarter**
darcav1@gmail.com
(267) 253-1310

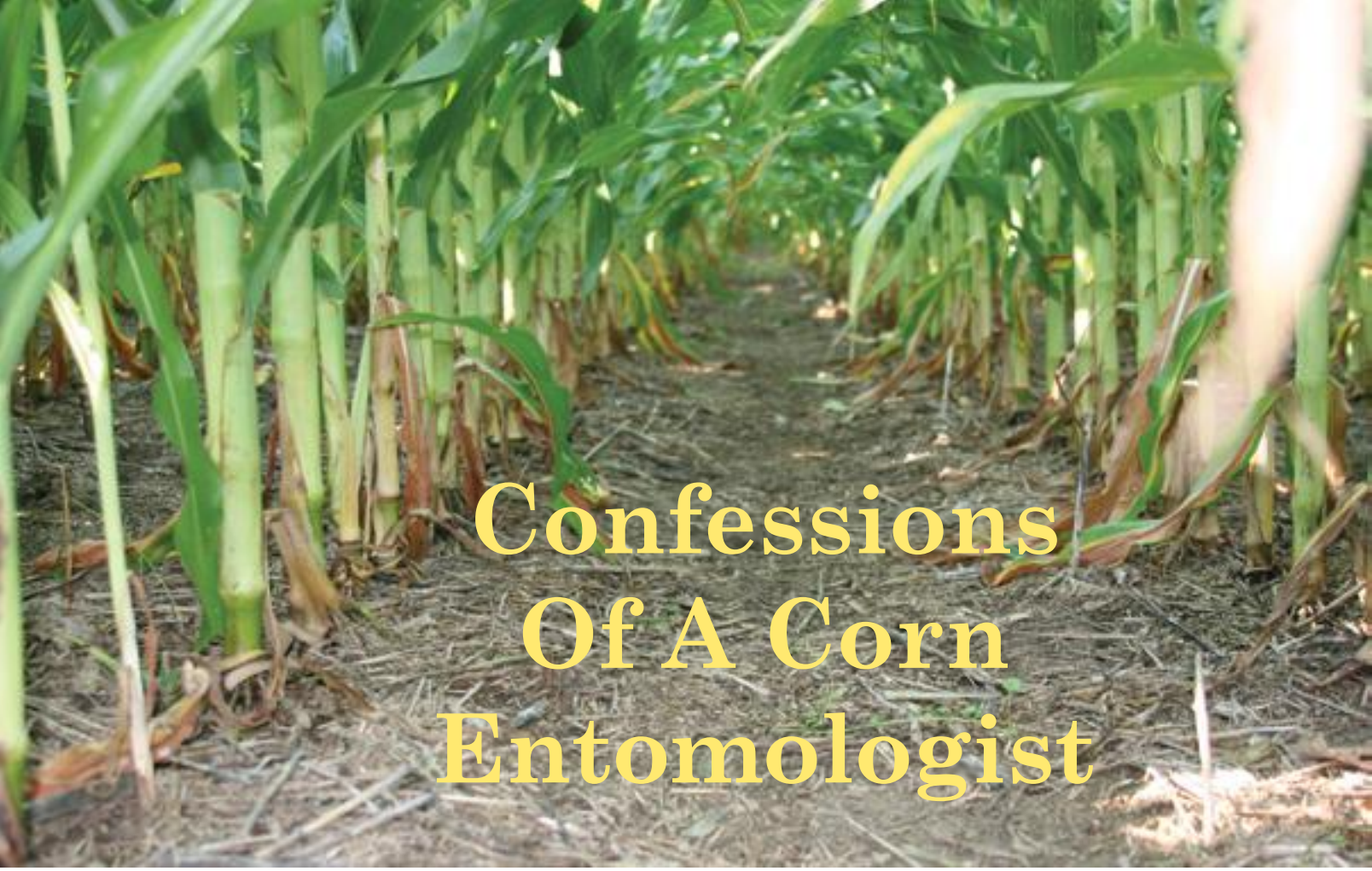
James Wilkes
828-265-6263
james@hivetracks.com
https://hivetracks.com/index.php

Rich Morris
608.201.6227
rich@broodminder.com
https://broodminder.com/

Tony Iwane
Outreach and Community Coordinator
iNaturalist
help@inaturalist.org

iNaturalist - how to set up project **https://www.inaturalist.org/pages/managing-projects**

SciStarter – about Citizen Science - **https://scistarter.com/citizenscience.html**



Confessions Of A Corn Entomologist

Jonathan **Lundgren**

Conventional wisdom in commodity based agriculture has done more harm than good.

Many are looking for a component solution to bee die off. Control the Varroa mite; Ban pesticides; Grow more flowers, etc. All of these problems are symptoms of a simplified food system, and unless we reform how we produce food, the bees will continue to die. "If you want to save the honey bees, heal the soil", Dr. Jonathan Lundgren coined this phrase based on his research in agroecology.

Additional articles will be focused on risk assessment of GM plants and pesticides, predators and how they reduce pests, and how insect communities function to avoid the use of pesticides. The articles will be of direct application in bee operations, but also allow the beekeepers to have some fodder when they discuss changing agriculture to their landowners and farmer friends.

As a young scientist, I swore I would never work in corn. So many of my peers had devoted their entire careers to studying the insect pests of corn, each carving out a narrow niche around which they could weave their identity. After 40 years, they would be world renowned for their encyclopedic knowledge of the corn rootworm mating system, or dispersal of the European corn borer, or what color or lures these pests see best. I don't begrudge anyone their study focus: the world needs to know how beetles have sex. But there seemed to be a disconnect between the problems that farmers were facing and the solutions that were being provided. Looking back after 20 years in the field, I think that what I was sensing is that science in corn was in a rut. Indeed, science in agriculture feels like it was in a rut.

Where was the innovation going to come from that was going to advance food production? Currently, innovation in agriculture comes in the form of new ways to add value to a narrow suite of crop commodities (subsidized, fossil-fuel intensive, corn-based ethanol anyone?). Or in the new technologies that farmers could purchase that would help them to grow more of these same commodities (i.e., Bt corn, RNAi-based corn). The innovation was directed toward making a broken system work, rather than asking the more pressing question of whether the system itself was fundamentally flawed.

Despite my earlier proclamation of avoiding work in corn, it wasn't long before I found myself immersed in a project on predatory insects in this crop. Over the course of several years and on two continents, we discovered that corn rootworm larvae were frequently consumed by predators in the soil; invertebrates like ground beetles, rove beetles, ants, crickets, spiders, centipedes and many others. This predator community is a functional unit rather than simply an assemblage of individual species,

Claire LaCanne led a study that showed regenerative cornfields had fewer pests and were twice as profitable as their conventional neighbors.

Our research team dissecting corn plants, searching for insects. We found that cornfields with higher insect diversity had fewer pests.

and that the predator community is dynamic and that it frequently changes over the day and growing season. And most importantly, the predator community in corn (and likely many agroecosystems) is depauperated in species, and only attains its potential for pest control when it is saturated with species. I was even so bold as to suggest that we can replace GM corn seed and insecticides with natural pest controls, if we change the habitat in cost-effective ways that positively affect predator communities.

Presenting this data to various conventional farming groups was discouraging at first; most farmers were not willing to listen to some scientist telling them to change their lifelong approach to farming when pesticides are so easy to use and readily available. Eventually, I encountered a growing number of farmers that had stopped using pesticides and seldom worried about pests. I didn't know it at the time (and these farmers may not have known it at the time either), but these farmers were to define *regenerative agriculture* as it is practiced today. The motivation for changing their farms had little to do with insect pests: reduced pest populations were simply gravy over the meal made good through soil health and biodiversity promotion.

In a regenerative system, plant diversity (and the myriad other species it supports) and soil biology replaces many or all agrichemical inputs. The principles employed by these farmers are simple: stop tilling, never leave bare soil, more plant diversity on the farm is better than less, and livestock and crop production belong together. The practices that they use to support these principles vary substantially. From cover crops, to crop rotations, to intercropping, to managing field margins, to allowing pastures to rest from intense grazing pressure, the practices are adapted to the conditions and goals of a particular operation. Regenerative farms are knowledge intensive, not technology/input intensive.

Our team, led by Claire LaCanne (now at the University of Minnesota), decided to empirically test the claims of benefit made by regenerative corn farmers. The trouble with many similar systems-level studies is that they do not necessarily represent best management practices. For this study, we visited with regenerative farmers that were recognized as regional leaders in North and South Dakota, Minnesota, and Nebraska. We asked each to point us to their neighbors that were considered good farmers but using a conventional approach to farming. Thus, we evaluated the two corn production systems from a regional focus and allowed the farmers themselves to design the treatments based on experiential knowledge. While specific practices varied substantially among the different farms, some consistencies were that all of the conventional farms used Bt corn seed treated with neonicotinoid insecticides, and none of regenerative corn farms used insecticides of any kind (often, it was decades since the last insecticide application).

We then proceeded to conduct a full bioinventory of insect life in each field, dissecting insects out of the corn plants, sucking up insects from the soil's surface, and extracting insects out of the soil column. Claire also examined yields and did a profit-loss calculation for each field.

The results of this work should be nothing less than the basis of a revolution in how pests are managed. The insecticide-treated cornfields had 10 times more pests than the insecticide-free, regenerative cornfields. The key to this result is that the regenerative farmers did not simply abandon insecticides and GM corn; they replaced these inputs with practices like diverse rotations and winter cover crops. What these farmers showed is that they did not have to react to pest populations if they favored diversity and soil health on their operation.

The regenerative farms produced about 29% less grain than the conventional farms, but were nearly twice as profitable. The main reasons for this discrepancy is

that the conventional farmers spent substantially more money on corn seed and fertilizers than their regenerative counterparts. Moreover, the regenerative farmers marketed their grain beyond just selling it to the local coop, and this increased their gross profits substantially.

When we looked at the relationships between profits and yields, another surprise presented itself. Yield did not correlate well with profits, in large part because of the increased costs associated with attaining high yields in a conventional farming system. In contrast, the amount of particulate organic matter in the soils of these cornfields was predictive of a cornfield's profit.

In the end, this study overturned a number of preconceptions that are widely held about farming. Input-intensive corn production was not the best business decision: farming for yield was not necessarily farming for profit. Farmers that chose practices that fostered soil organic matter had higher profits than their neighbors who farmed for yields.

In entomology classes during graduate school, I was trained that pests were inevitable and the best we could hope for was to optimize our reaction to reduce their financial cost. Alternatives to pesticides are given some attention in coursework and research, with the unspoken knowledge that farms need pesticides to survive. On one level, this is true. Large monoculture farms that destroy the biology in their soil require pesticide inputs to replace the ecosystem functioning that the biota once gave the farmers for free. But this study shows that pests are not inevitable in a well designed system.

It was regenerative farmers that taught me that there was a better way. Conventional wisdom in commodity based agriculture has done more harm than good, and misguided science has been the basis of this conventional wisdom. Pests are a symptom, not the problem. And until we address the problem of a simplified food system, pests will continue to try to correct our imbalances.

I now know that my distaste for corn was misguided. I imposed my unhappiness for the state of agricultural science on a plant that has come to represent that system. It was only when my mind was ready to dispose of the untruths of agriculture that I could listen to the lessons that I learned in cornfields. The most striking of which is that we can solve planetary scale problems using our food system, and that regenerative agriculture opens that path. BC

Dr. Jonathan Lundgren, Ecdysis Foundation, Blue Dasher Farm, Estelline, SD, 57234; ***https://peerj.com/articles/4428/***

MELISSOPALYNOLOGY

The Science Of Using Pollen To Study Honey

Vaughn **Bryant**

INTRODUCTION

Melissopalynology is the study of pollen in honey. The term comes from the Greek words for "bee" and "honey" along with the words for "study of dust," which now refers to "pollen." Today, it is recognized worldwide as being the least expensive and quickest way to determine the floral contents and geographical origin of honey. However, the effectiveness of the technique depends on the skills of the pollen analysis (palynologist), the method of extracting the pollen from honey samples, and the skill of the analyst in interpreting the results. Today honey has become an important commercial business and provides sweetness used in thousands of products.

Humans have five basic taste abilities, sweet, sour, bitter, salty, and umami (defined as savory). Of these, we generally do not enjoy foods that are too bitter, too sour, or too salty. However, humans seem to love sweetness and most cannot get enough of eating sweet things. This is probably what drove our ancestors to begin robbing bee hives is prehistoric times. How early that might have begun we don't know, but paintings on the walls of the Altamira Caves in Spain date to about 15,000 years ago and show people on ladders robbing hives for the honey. In historic times the Egyptians, Greeks, Romans, and other early cultures all wrote about the importance of honey as their main sweetener for foods and wine. During medieval times dome-shaped beehive skeps were in common use and the skep is still the most common symbol for beekeeping.

THE BEGINNING OF MELISSOPALYNOLOGY IN THE UNITED STATES

In the New World, Native Americans in Mexico and Central America developed bee keeping using a variety of stingless bees. When early Spanish explorers conquered those areas they reported the natives could get about two kg of honey from one stingless bee colony, far less than the bee colonies in Spain and Europe. The first European bees introduced into the New World are believed to have arrived in Virginia in 1821. After the introduction of European honey bees, some Indian tribes called them "White Man's flies" and referred to the newly introduced white clover (*Trifolium repens* L.) that often accompanied the spread of honey bees as "White Man's foot" because both clover and honey bees expanded with European settlers. Reports from early New England colonists reported that beekeeping was not profitable until 1851, when Rev. Langstroth developed the removal frames in hives that most people still use today.

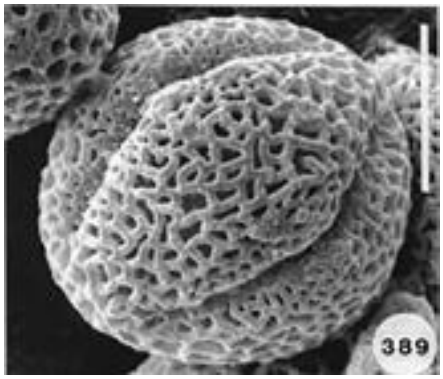
By the mid-1800s European bees were fairly common throughout the New World. In 1865 Hruschka invented the centrifugal extractor, which greatly increased commercial sales of honey because it could now be sold as a liquid, as opposed to comb honey and the comb wax could be turned into added profit when made into candles or other products.

Today, the United States is a major honey producer but ranks far behind China and Turkey, but we have made little effort to determine the contents of U.S. domestic honey. Some work was done during the early 20th century but most of the research in the U.S. focused on the chemical composition of honey and ways to identify honey adulteration. Little effort during that time was focused on the study of pollen in honey, even though pollen composition was being recognized elsewhere as the fastest and least expensive way to determine honey floral types and geographical origins.

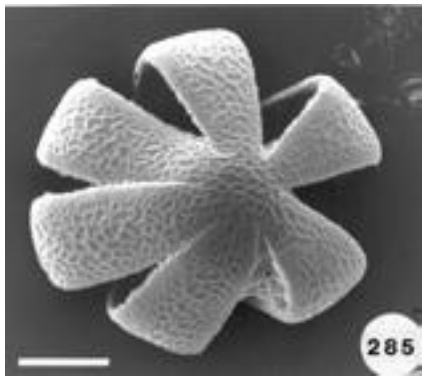
The history of the scientific investigation of U.S. honey and their pollen contents began in the early 1900s, when Young, of the United States Department of Agriculture (USDA), published a brief report on the analysis of domestic honey produced in the U.S. He said goals were to determine U.S. honey types, establish a variation range for U.S. honey types, improve methods of U.S. honey analysis, and see if pollen in honey could be used to "judge the adulteration of the samples." He reported that "lower pollen counts" probably indicated altered honey.

After Young's initial study in 1908, no other major pollen study of domestic honey was conducted until the early 1940s. Two USDA scientists, Todd and Vansell, began their study of U.S. honey in 1940. They wanted to determine how many pollen grains were present in the nectar produced by different plants, how many pollen grains were actually collected by honey bees from various types of flower nectar, and how efficiently could bees remove various types of pollen from their honey stomach during their return flight to the hive. Their research represented years of effort and they examined over 2,600 individual nectar samples. They caged bees and fed them only solutions of clear syrup mixed with pollen, or diluted honey they had analyzed. They also put bees on blooming flowers of different plants, then trapped and dissected the bees' honey stomach immediately after they left the blooms.

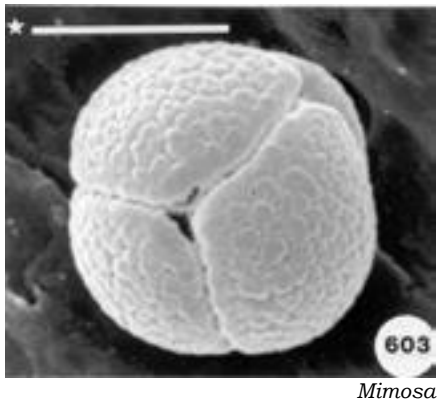
Their research determined some dramatic differences that nobody had realized and their results became the basis for future research and studies that established "coefficient values" for the expected pollen amounts found in many types of honey. For example, they discovered that the same amount of nectar from different plant species contained different amounts of pollen, and that bees could eliminate various amounts of pollen from



Citrus



Mint



Mimosa

their honey stomachs before depositing it in the hive. They found that bees full of nectar will rapidly filter out certain types of pollen, but not other types from their honey stomach using the action of the ventriculus and their honey stopper. That process could eliminate much, but not all, of the pollen the bee had collected with the nectar. In one experiment they found that caged bees fed a syrup solution containing 200,000 pollen grains/cc of fluid could eliminate most of the pollen if allowed to fly around for 15 minutes in a caged area with no food. In other words, after collecting nectar, during a normal return trip of 15 minutes to a hive, bees could effectively remove, up to 90% of some pollen types from their honey stomach. Other parts of the Todd and Vansell study focused on determining the amount of pollen found naturally in the nectar of many different plant species. For example, they found that the nectar/pollen ratio for fireweed nectar contained only about 220 pollen grains/cc of nectar, however, the nectar/pollen ratio for privet was about 6,130 pollen grains/cc. They concluded that the many different nectar/pollen ratios they had calculated might help determine the true amounts of expected pollen in honey. They found that depending on how long bees took to return to the hive determined how much of the pollen in the nectar they could eliminate. They also discovered that the bigger the pollen grains the faster and more efficient the bees were at eliminating those types. Therefore, large pollen types found in the flowers and nectar of magnolia and tulip trees could be eliminated rapidly while smaller pollen grains in the flowers of sweet clover, blue weed and forget-me-nots could not.


Vaughn Bryant

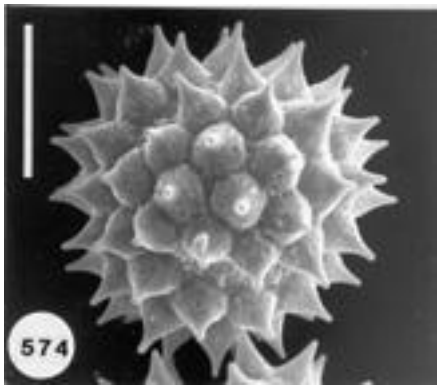
After the Todd and Vansell report in the 1940s, there were only a very few minor studies or mention of the pollen contents in U.S. honey. It wasn't until the 1970s, and early 1980s, that the first extensive pollen studies of domestic U.S. honey were conducted by Meredith Lieux at Louisiana State University. Her research represented the first U.S attempt to produce detailed pollen analyses of honey, and she was the first to use the combination of pollen types as a guide to determining the geographical location where each honey sample had been produced. She was also the first to use tracer spores to determine the precise pollen concentration values (the amount of expected pollen) in different types of Louisiana honey.

Since Lieux's studies in the 1970s and early 1980s there were only two additional studies of pollen in U.S. honey, both during the last part of the 20th century in the 1990s. The first one was a study by Jonathan White and Vaughn Bryant examining the chemical and pollen properties of different mesquite and cat's claw acacia honey samples collected from regions in Texas and Arizona. The focus of their research was to search for ways to identify adulteration of honey using both stable sugar isotope levels and pollen. They focused on samples of mesquite and cat's claw acacia honey that were purported to be either adulterated or unifloral types; however, their research showed otherwise. Their second study focused on ways to identify unifloral orange blossom honey based on both pollen percentages and levels of Methyl Anthranilate.

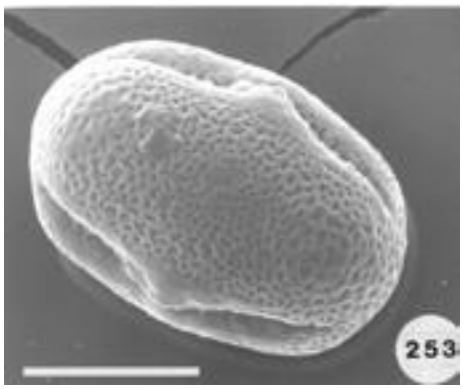
The only published pollen study of U.S. honey this century is the one by Gretchen Jones and Vaughn Bryant on the honey from East Texas. The apparent reason why in more than 100 years there have been so few published studies of U.S. honey types is a reflection of why so few people have the skills to analyze honey. Learning to analyze the pollen trapped in honey requires a broad understanding of botany and bee biology. Each study is also very time-consuming and requires both concentration and an inquisitive mind.

FINDING THE POLLEN IN HONEY

The process of recovering pollen from honey is not complicated and it can be done fairly easily provided one has the right kind of equipment and in some cases the right type of laboratory. Because of the role pollen analyses play in honey and honeybee research, it is essential that pollen recovery techniques produce accurate and repeatable results. Extracting pollen from honey is not a difficult process. The original recommended standard procedure



Composites.



Clover.

There are over 352,000 angiosperms (flowering plants) from which honey bees can collect pollen and/or nectar.

established during the early 1900s was to dilute 10 g of honey with 20 ml of water, centrifuge the solution at as slow speed of 2,500 revolutions per minute (RPM) for five minutes and then examine what was retained in the bottom of the centrifuge tube. Subsequent researchers claimed other techniques were better. Some of the later techniques focused on using a quantity of honey ranging from one – 20 g, while the amount of water used to dilute the honey ranged from 20 – 100 ml; centrifugation speeds also varied from 2,000 to 4,500 RPM and centrifugation times varied from one minute to 10 minutes.

One of the reasons there were so many pollen recovery techniques suggested is because often there really isn't much pollen in honey. The loss of any pollen from honey can create problems in classifying the honey's true nectar sources and determining the honey's geographic location. Think of it this way, suppose you had a bag of 20 marbles with 10 marbles that are black and 10 that are white. What if you reach into the bag and take out a handful and discard them? Now count what marbles you have left. Do you still have 50% of both colors? I doubt it. In other words, you no longer have a true representation of what was originally in the bag of marbles. Honey is the same way, if pollen is inadvertently discarded, you no longer have a true pollen profile of what was originally in the honey.

The two most successful pollen extraction techniques, proven through experimentation, is filtering honey or diluting it in alcohol before processing. The filter process, developed in 1983, by Lutier and Vaissiere, consists of using honey diluted with ample amounts of water and carefully filtering through a cellulose filter with openings no larger than two to three microns. Using that technique, they lost no pollen, but the process is very time-consuming and filters can become clogged with large molecules of sugar. The other technique, developed in 2001, by Jones and Bryant, is to dilute 10 g of honey in 100 ml of ethyl alcohol (ETOH) instead of water and then centrifuge the diluted solution. By using ETOH the specific gravity of the honey/ETOH solution is lowered to 0.7 allowing all the pollen to sink quickly when centrifuged. Their published data showed it was as effective as the Lutier and Vaissiere filter technique, but it was considerably easier and faster to use. When water (specific gravity of 1.0) is used to dilute honey, without pressure filtering it, some pollen can continue to float after it has been centrifuged even at high speeds for long periods of time, thus some pollen can be inadvertently discarded.

IDENTIFYING THE POLLEN IN HONEY

Beekeepers are thrilled to find out what their bees are collecting to make honey. They like to use the information gained from pollen analyses of their honey to increase sales and also brag about their good honey. Some beekeepers then decide that they can get results much faster if "they" could do their own pollen study. Some beekeepers call me and say they want to visit my lab for a few days to learn how to do this. I try to discourage those eager callers not because of my unwillingness to spend time with them but because a few days is totally inadequate for learning this complex type of analysis. I usually respond to these enquires with a positive reply offering to work with them if they wish, but adding that, "I have been doing this for over 40 years and I am just now getting good at it!" Being able to analyze the pollen contents of honey samples requires a "long learning curve!" This is not to say that it is impossible for a beekeeper to learn how to do this, but most of them do not have the needed scientific background, the equipment to do the extraction process, or the pollen reference collections needed to help them identify the potential thousands of pollen types they might find in their samples.

To analyze pollen in honey there are many hurdles one must overcome. Aside from the botanical and entomological academic training that is needed, perhaps the biggest hurdle is learning how to identify the pollen types one might find in honey samples and then know the geographical regions where all the different plants producing the pollen in the honey live. According to recent botanical records, worldwide there are over 352,000 angiosperms (flowering plants) from which honey bees can collect pollen and/or nectar. Of that total about 17,000 species are native to the United States. An estimated additional 3,800+ ornamental flowering plants have been introduced into the U.S., not counting hundreds or maybe thousands of additional species of introduced agricultural plants. Each species of angiosperms produces a unique pollen type that is different from all others. Many can be fairly easy to identify using a light microscope at magnifications up to 1,200. For other pollen species the only way to be certain of the precise taxon is to use the higher resolution ability of either or both scanning and transmission electron microscopes to distinguish the very finite differences that exist between types. The next major hurtle in doing this type of research is making a modern pollen reference collection from known plant species and then using that collection for later comparison with types of pollen found in honey samples. Some help

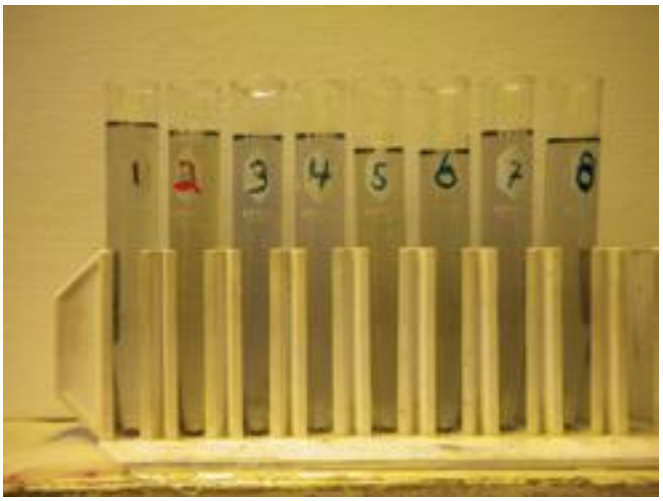
can also come from pollen web sites on the internet and from published articles and pollen atlases. Nevertheless, searching for the identity of some pollen types in honey can take hours or days and in the end it might remain unknown. Perhaps the final hurdle is recognizing where a honey originated. Many consumers want to buy "local honey" from the area where they live, however, all too often honey labeled as being "local" is not local at all. How do we know this? By examining the pollen in the honey and realizing that the nectar sources they represent do not come from plants living in the "local area!"

THE FUTURE FOR POLLEN STUDIES OF HONEY

If pollen studies of honey require so much training and such a long learning curve, which most students these days are not willing to do, then why not use a different way to test honey, such as isotopes? For years we have known that various types of adulteration can be detected by using carbon stable isotopic ratio analysis (SIRA). Variations from established isotope ratios in honey often suggest some degree of adulteration created by the addition of high fructose corn syrup or cane syrup. However, sugar added to honey made from beets or rice, is not often detectable using only stable isotope testing.

Other isotopes in the proteins of pollen grains in honey include variations of carbon, hydrogen, nitrogen, and oxygen that can be used to reveal the general climate and environment where a honey sample is produced, and in some cases can be used to identify types of pollen. However, none of the individual isotope values found in honey proteins or pollen is usually unique enough to identify a precise geographical region or the percentage of some pollen type in a sample. Sometimes, the use of multivariate statistical analysis of the various isotope signatures can help to discriminate between different geographical locations.

What about the DNA of honey? Why not analyze the deoxyribonucleic acid (DNA) properties of honey? Recently, there has been significant progress in this area with the development of pyrosequencing and the use of barcoding strands of DNA. For plants, the ideal is to barcode selective DNA strands that have one or a few standard loci that can be sequenced easily and reliably in large sample sets. Comparisons of those sequenced data against available plant DNA data bases enable specific pollen types to be distinguished from one another. DNA barcoding can also be used to link specific pollen types in honey bee pollen pellet studies. The screening process is becoming faster and less expensive than having palynologists spend hours or days sorting through pellets to identify the many pollen types and the ratios of each type. However, there are still many challenges, as noted by Richardson and his research group in 2017. When using pollen pellets in tests that paired DNA data against pollen data identified by skilled palynologists, Richardson' group found that neither technique was perfect. Nevertheless, the field of DNA analysis of honey and pollen pellets is evolving rapidly with new studies in genetics using gene-based results. New testing comparing DNA data against actual pollen counts are showing great promise and helping to refine the gene-based techniques. It appears that for large pollen pellet studies funded by state or federal agricultural agencies, emerging genetic techniques might prove to be the fastest and most efficient way to study vast amounts of data collected from large areas.



Honey samples at finish of processing.

Currently, a major problem is that not everyone has access to the equipment or expertise needed to conduct isotope or gene-based analysis of either pollen pellets or honey. Therefore, there is still room for palynologists using light microscopy to analyze both honey and pollen pellets. Small studies that focus on limited numbers of samples, which are often requested by local beekeepers, may not warrant the use of expensive methods for testing. Pollen studies conducted by palynologists using the limits of light microscopy are still adequate for many types of honey and pollen pellet studies where quick results are needed and where the main concern might be determining the primary (but not all) floral types and not needing an ID down to the species level.

In recent years, there have been advancements in using three-dimensional synchronous fluorescence spectroscopy (3-D SFS) to provide unique "fingerprint" types of identification for the phenolic contents in honey. Those identifications provide good signatures for the floral sources and can identify the geographic origin of honey samples. Nevertheless, melissopalynology studies of honey using standard light microscopy to determine the geographical origin of specific honey samples (local vs. not local) is still less expensive and faster than using other techniques.

On the fringes of current honey research there are researchers searching for ways to use liquid and gas chromatography to identify the amino acids in honey and thus identify the various honey types. Different amino acid patterns exist in different types of honey and if you have a good database of the expected amino acids in honey, then by applying discriminant analysis one can distinguish some key honey types.

Volatiles contribute significantly to the flavor of honey and variations in taste result from different nectar types. The isolation and analysis of phenolic acids and the volatile flavonoid components in honey is difficult, but possible. Previous attempts confirm that a careful analysis of the volatiles in honey could become a useful tool for determining nectar sources. However, the volatile components could be changed and altered depending on how the honey was treated and stored before testing it. High performance liquid chromatography has been

successfully used to characterize the flavonoid patterns in specific types of honey, such as citrus, sunflower, lavender, rosemary, and heather. Some believe that flavonoid patterns could become a good way to determine the floral contents and geographical origins of honey, provided one could develop a good database and use multivariate statistics.

The mineral and trace elements in honey samples have shown some promise when used to indicate types of environmental pollution that can pinpoint certain geographical locations as the origin of honey samples. Tests of the composition of organic acids in honey have also demonstrated that it might become useful in identifying specific unifloral types of honey.

Unfortunately, all of these other methods of honey and pollen pellet identification thus far suffer from some type of problem. For some, the problems focus on the need for special and expensive laboratory equipment. Others are too time-consuming and require an extensive database before the results can be determined. Some methods are too costly to use routinely; others require skilled technicians or analysts. It seems there is not yet an inexpensive, foolproof, or simple way to verify the floral and/or geographical origin of a honey sample.

In summary, melissopalynology still has a promising future as a way to identify the floral sources, potentials of adulteration, possibility of blending, and the determination of local or foreign origin of a sample. Worldwide melissopalynology currently remains the least expensive and quickest method to get reliable answers, provided the pollen extraction and analysis is conducted by competent individuals. Nevertheless, the rapid advancements in the field of gene-based methods of pollen identification may someday make melissopalynology, conducted by individuals using a light microscope, obsolete! BC

Honey samples.

Vaughn M. Bryant, PhD, Professor and Director, Palynology Laboratory, Department of Anthropology, Texas A&M University, College Station. ***www.//anthropology.tamu.edu/vaughn-bryant.***

The Legacy Of CCD

Honey Bee Research On The Rise

Malcolm **Sanford**

In retrospect, 2006 appears to have been a banner year with reference to honey bee research. It began with bad news, the appearance of something that beekeepers heretofore hadn't confronted, colony collapse disorder, or CCD. Arguably the poster child for this malady at the time was migratory beekeeper David Hackenberg, who was the first to recognize it as a recurring phenomenon and not a unique event. He was recently recognized for bringing national attention to the situation by the Union County Historical Society, and honored as a notable Union Countian in Lewisburg, PA for his life's work contributing to pollinating crops using honey bees in six states: Florida, California, Georgia, Pennsylvania, Maine and New York.

In 2016, the Hackenberg family again suffered losses in its beekeeping operations, losing some 1400 colonies. At the same time, Bret Adee, the biggest beekeeper in the world, also lost a massive amount of investment, going from 90,000 to 40,000 hives.

"We haven't seen any of this colony collapse disorder here," Adee first stated back in 2007. But a few months later, he returned to discover the largest loss ever seen in beekeeping history – 40,000 hives containing two billion bees had disappeared. The event became known as a 'bee holocaust.'"

Both Hackenberg and Adee sued the Environmental Protection Agency (EPA) in the 2016 incident for "inadequate regulation of the neonicotinoid insecticide seed coatings used on dozens of crops." And Hackenberg was quoted as saying, "As a beekeeper for over 50 years, I have lost more colonies of honey bees in the last 10 years from the after-effects of neonic seed coatings than all others causes over the first 40 plus years of my beekeeping operation." There was no mention of CCD as an issue with respect to the losses in this specific report.

Those pursuing the 2016 legal case against the EPA did not seem prepared to abandon CCD as a possible problem, however, appearing to conflate it with the effects of the neonicotinoids, stating ". . . CCD is not a random & undefined 'disorder' but a direct result of these poisons that have been wreaking havoc on our environment for already more than two decades. And yet, manufacturers like Bayer and Syngenta, along with the EPA, are still denying their effects, despite a growing body of science and empirical observations from beekeepers around the world."

The decade from 2006 to 2016 in fact revealed a lot of research emphasizing CCD. A wikipedia page lists the following events:

"In 2006, the Colony Collapse Disorder Working Group, based primarily at Pennsylvania State University, was established.

"In July 2007, the United States Department of Agriculture (USDA) released a CCD Action Plan, which outlined a strategy for addressing CCD consisting of four main components: survey and data collection; analysis of samples; hypothesis-driven research; mitigation and preventive action.

"The first annual report of the U.S. Colony Collapse Disorder Steering Committee was published in 2009, and the second was released in November 2010.

"A 2015 review examined 170 studies on colony collapse disorder and stressors for bees, including pathogens, agrochemicals, declining biodiversity, climate change and more. The review concluded that "a strong argument can be made that it is the interaction among parasites, pesticides, and diet that lies at the heart of current bee health problems.

"Furthermore: During the spring of 2015, President Barack Obama unveiled the very first national strategy for improving the health of bees and other key pollinators. The plan calls for restoring seven million acres of bee habitat with a variety of different flowering plants for bees to gather nectar from. The administration is also proposing spending $82.5 million for honey bee research."

Wikipedia may not be considered by some a reliable source, but the above list seems to correlate with results described in Notes and Comments in the Journal of Apicultural Research in 2010: "Colony losses, Managed Colony Population Decline, and Colony Collapse Disorder in the United States," Journal of Apicultural Research 49(1): 134-136 (2010) © IBRA 2010, DOI: 10.3896/IBRA.1.49.1.30. **https://naldc.nal.usda.gov/download/41836/PDF**:

"The cause(s) of CCD in U.S. bee colonies remains under investigation but are similar to those for colony losses in general. For example, Israeli acute paralysis virus (IAPV) has been found in many samples taken from colonies exhibiting CCD-like symptoms although it is not believed to be the sole cause of CCD (Cox-Foster et al., 2007). Similarly, Nosema ceranae has become widespread in the U.S. (Klee et al., 2007; Chen et al., 2008), though its role in colony losses is not understood fully (Paxton, 2010). Consequently, many conceivable and realistic hypotheses remain plausible. Not listed in any particular order, the primary hypotheses include, but are not limited to: 1. traditional bee pests and pathogens (for a listing of bee pests / pathogens present in the U.S., see Ellis and Munn, 2005); 2. how the Colony losses in the U.S. were managed (management stress); 3. queen source

(poor genetic biodiversity); 4. chemical use in bee colonies to control bee pests / pathogens; 5. chemical toxins present in the environment; 6. V. destructor mites and associated pathogens; 7. bee nutritional fitness; 8. undiscovered/newly discovered pests and pathogens or increasing virulence of existing pathogens; and 9. potential synergistic interactions between two or more of the above hypotheses."

The spate of attention to CCD, and an increasing hue and cry from the press and others about honey bee losses, along with the often unrealistic contention that the human food supply was at risk, was a public relations boon for honey bees and by extension, apicultural research. An influx of significant funding began to emerge relating to a new term coined during the period, which went beyond colony collapse disorder, "honey bee health."

Ironically, the same year of the law suit against the EPA noted in the report above (2016), the following was published:

"It may not be the Ice Bucket Challenge, but even minor environmental awareness is good, right? Actually, in this case, it may not be necessary. That's because honey bee populations are not in decline. They haven't been for a few years now. In fact, many experts believe that honey bees are not in any imminent danger of extinction."

With the subtitle: "After Years of Uncertainty, Honey bees Appear Poised to Recover From Collapse" the report was able to state: "CCD was a real problem, probably six or seven years ago . . ., but in the past three to five years researchers have not seen much CCD and that globally honey bee populations are not in decline."

The remarkable turn around expressed in the above report appears to lose sight of the impact of increased funding for honey bee research. And the consequences of expanded emphasis on honey bee health by beekeepers and the research community alike, set in motion when the specter of CCD when first raised, continue to be pretty much ignored in present-day reporting.

Perhaps, the best example of increased attention to honey bee health referred to above is emergence of several university

University of Minnesota's Honey Bee Lab

laboratories dedicated to apicultural science. Three come to mind at the moment. Each is in its own state of development, and based primarily on funding available, the diversity of its staff and the vision of its founder.

The University of Minnesota's Honey Bee Lab has got to be considered one of the jewels of its type, as is its founder, Dr. Marla Spivak, MacArthur Fellow and McKnight Distinguished Professor in Entomology at the University of Minnesota. Her recent awards include the 2015 Minnesota AgriGrowth Distinguished Service Award, the 2016 Siehl Prize laureate for excellence in agriculture, and the 2016 Wings WorldQuest Women of Discovery Earth Award.

Dr. Spivak worked for a commercial beekeeper in New Mexico in 1975 and obtained her PhD from the University of Kansas in 1989, working with Dr. Orley (Chip) Taylor, on the identification and ecology of Africanized and European honey bees in Costa Rica. She was a post-doctoral researcher at the Center for Insect Science at the University of Arizona before being hired at the University of Minnesota, St. Paul Campus, in 1993.

Major programs of what is now being called the Spivak Bee Lab include its educational outreach, the bee squad, an extensive research agenda focusing on honey bees and a "native bee" study effort. Perhaps most significant is a long list of former students, most whom have gone on to be hired in bee-related employment. A unique presence in the laboratory is that of "Gary-of-all-trades," Gary Reuter, who adds a bit of reality to the academic environment. Beyond maintaining a beekeeping operation of his own, as well as the research colonies of the lab, he trains and work with students in the field, designs and builds specialty equipment, and speaks to beekeeping, student and civic groups. He plans the extension short courses and together with Dr. Spivak teaches beginning as well as experienced beekeepers.

The university has built two new facilities: A Bee and Pollinator Research Lab on the St Paul campus, and the Tashjian Bee and Pollinator Discovery Center, for the public, at the University of MN Landscape Arboretum. The Budget for this "Scientific Research St. Paul Campus Bee and Pollinator Research Lab" complex was about $6.45 million. State-funded bonds cover two thirds of the cost of the project. The remaining must be funded through private gifts. To date, gifts and commitments of over $1.5 million have been secured for this project. Fund raising is ongoing via a number of initiatives.

The Washington State University (WSU) Honey Bee and Pollinator Research Facility is expected to provide the means to conduct unparalleled research and outreach to create sustainable solutions to problems facing pollinators.

It currently features a diagnostic lab set up at WSU in 2008 to evaluate samples for the presence and prevalence of parasites and pathogens. In the first year, over 1800 were processed, including those obtained from commercial and hobby beekeeper operations and university research apiaries.

Research using 250 colonies distributed in 10 research and teaching apiaries is centered on projects addressing problems of major importance to Pacific Northwest (PNW) beekeepers. Current specific efforts include: monitoring

seasonal variation in *Nosema ceranae* infestations, molecular characterization of Nosema species in the PNW, evaluation of interactions between parasites and pathogens and examining sub-lethal effects of chemical residues in the hive and the environment.

The lab's honey bee selection and breeding program is now in its 16th year. It provides honey bee stocks through provision of selected queens to the Washington State Beekeepers Association and so-called "collaborative apiaries." A related program coordinated by WSU and University of California, Davis is designed to enhance U.S. honey bee diversity through importation of honey bee semen from Old World sources, evaluation of progeny and release of germplasm to the queen production industry.

Dr. Steve Sheppard is the guiding light at the WSU lab, as well as chair of the Department of Entomology. Receiving a Masters degree at the University of Georgia and Ph.D. student of Dr. Elbert Jaycox, University of Illinois, Dr. Sheppard has been Thurber Chair Professor since 1996. A specialist in population genetics and evolution of honey bees, as well as insect introductions and mechanisms of genetic differentiation, he currently heads the Apis Molecular Systematics Lab, and remains U.S. Editor of the journal *Apidologie*, an international journal of bee research with WSU as editorial lead institution.

Steve Sheppard

With a great many graduate students and a host of international researchers from as far away as Egypt and Brazil, the WSU lab is the "goto" place for all things relating to honey bee genetics and breeding. Dr. Sheppard continues searching the globe for genetic material of interest and has entered into a partnership with Susan Cobey to collect semen, which is the only way to bring in honey bee genetic material at the moment. Ms. Cobey is one of the premier breeders in the industry, who developed the New World Carniolan honey bee, while associated with The Ohio State University, and more recently, the University of California at Davis. In addition, the lab has a relationship with Melanie Kirby, a "professional apiculturist" with an imposing resume as a Peace Corps beekeeping volunteer in South America. She also has beekeeping experience in the Yucatan Peninsula of Mexico, and the states of Hawaii and Florida. In 2005, she established Zia Queenbees Farm & Field Institute in northern New Mexico, which specializes in chemical-free management and longevity based selection and breeding of queen honey bees.

The newest honey bee research laboratory in the U.S. is now open at the University of Florida. In its unique subtropical environment, this facility made up of two separate buildings is a sight to behold. Some $200,000 in matching funds triggered around $2.5 million in state funds to house the new home of The Honey Bee Research and Extension Laboratory (HBREL), which has now ballooned to $4.3 million thanks to further donations and appropriations. It will not only feature extensive laboratory facilities, but also house a beekeeping museum and The Amy E. Lohman Apiculture Center, new home of the State of Florida Bee Inspection effort, considered by many and the most mature and professional institution of its kind in the U.S.

Dr. Jamie Ellis, Gahan Associate Professor, Honey Bee Husbandry, Ecology, and Conservation; Integrated Crop Pollination at the University of Florida is the force behind this project. Educated at the University of Georgia and University of South Africa, where he worked on small hive beetle biology, Dr. Ellis has developed a premier beekeeping education program, featuring a number of "bee colleges" around the state and in the nearby Caribbean, representing a growing master beekeeper program.

The extension program is now so extensive it merits its own coordinator. The University has just hired a faculty member who will be an instructor strictly in apiculture, while at the same time involved in developing a more extensive online curriculm in entomology. Finally, an "Applied Honey Bee Researcher" has been employed to assist the current commercial beekeeping industry in addressing some of its unique challenges.

Dr. Ellis' research program includes a robust effort consisting of three emphases: 1) improving managed honey bee health, including honey bee colony disease/pest management, nutrition, and toxicology; 2) attempting to understand wild honey bee ecology and genetic diversity/structure in an effort to sustain honey bee populations through informed conservation efforts; and 3) maintaining an active research program focused on integrated crop pollination.

University of Florida Bee Lab.

The laboratory has produced a number of graduate students who have become faculty members in their own right and are also now employed in other bee-related positions. Most recently, The New Zealand Institute for Plant & Food Research Limited (New Zealand's equivalent to the USDA) employed a graduate of the HBREL facility. Finally, a robust visiting scholar program exists with participation from Europe as well as South America.

Beyond strictly academics, a growing research environment continues to be created incorporating other organizations. The Bee Informed Partnership (BIP), Pollinator Partnership, North American Pollinator Protection Campaign and Honey Bee Health Improvement Project are among a raft of other initiatives are now employed in honey bee and pollinator health.

Project Apis m. was created in 2006, partially in response to CCD, in collaboration with the California Almond Board. Since that time it has been directing and funding honey bee research with some of the top researchers, scientists, and institutions in the world. Project Apis m. has so far Funded and Directed over 115 Research Projects and infused over $6 million into honey bee research.

Recently the Project teamed up with the National Honey Board to produce between them $10 million in research funding for honey bee research by the year 2020. The collaboration will seek to improve the well-being of nearly 2.9 million bee colonies, with a specific focus on three main threats to bee health: pesticides, pathogens and nutrition.

National Honey Board™

Randy Oliver

Finally, a unique research effort that has often flown under the radar is that of Randy Oliver, a professional beekeeper with a scientific background, who founded the web site **ScientificBeekeeping.com** with the subtitle: "Beekeeping Through the Eyes of a Biologist." Again his first posts were in the year 2006, when CCD made its appearance. The effort is totally funded from Internet contributions and boasts a long list of $500 plus contributors! He currently manages around 1000-1500 hives with his two sons, but spends most of his time doing honey bee research and presenting the results around the country. His observations are a gold mine of information published regularly from California.

The above examples are just a few of the efforts that reveal a flowering of honey bee research since 2006. Many more have no doubt been missed here and/or are in the pipeline. These are now contributing to the toil of the traditional U.S. Department of Agriculture apicultural laboratories (Beltsville, MD; Baton Rouge, LA; and Tucson, AZ) as well as the "native bee lab" in Logan, UT, an effort going as far back as the 1890s.

In conclusion, It looks like the fallout from the year 2006, when CCD was first detected, and subsequently named the "beepocalypse," is a mixed bag. Proclaimed first a disaster for honey bees and beekeepers, which continues to be raised in some circles, that "banner year" would also mark the beginning of a wave of concern about all pollinators.

Paradoxically, it would signal a future of great promise, via the ramping up of scientific effort all across the research spectrum, in the continued search for a healthier honey bee and more prosperous pollinating enterprise. BC

THERMOGRAPHY
PERSONAL APPLICATION

R. Micheal **Magnini**

In part one of this article in May I outlined the availability of this technology to beekeepers, and its prospective uses. From here we shall look at the practical application of the technology as demonstrated here at my home apiary through the later part of the winter 2017.

After a brief reprieve in late February (a mid-winter thaw), the force and fury of the Cape Breton, Nova Scotia Winter returned on about March 1st. Although temperatures by continental standards would not be considered severe, a low of 1.5°F (-17°C), the accompanying winds reached 66 mph (106 km/hr) to 72 mph (115 km/hr) velocities. These winds, mostly northwesterly, were continuous for days at a time, with sustained velocities of 38 to 50 mph (60 to 80 km/hr). Needless to say, the wind-chill factor was severe.

These conditions caused concern for the health of my colonies to peak. I made daily forays to the hives and read their thermal signatures, took thermographs, and varied my approaches to the problem.

The March sunshine is bright while the sun is still low in the sky, and this caused some false readings. The black tarps used for hive wrap heated in the sunlight and prevented internal signatures from being read. To correct this problem I took two actions. To by pass the external heat of the hive body I focused the thermal camera onto and into the front entrance hole of the hive (see thermograph T1). The other approach was made at night, which produced better results in respect to internal heat signatures (thermograph T2 and T3). Some residual external heat was visible, but the differences were more pronounced.

Readings taken at night produced some fascinating effects. When focused on strong colonies that had a distinctive localized cluster, and a bright spherical signature the individual bees could be seen moving around. (thermograph T4 and T5).

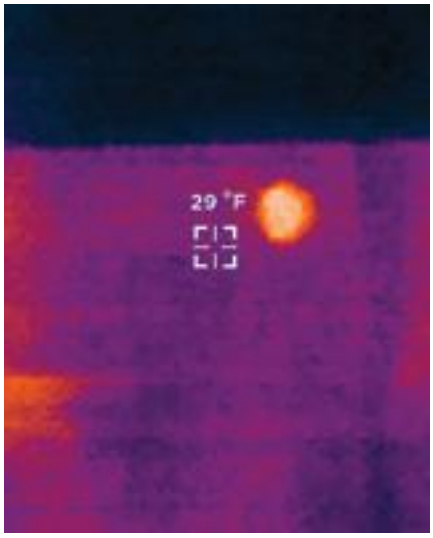
This effect of visibly moving bees has the advantage of eliminating false positives created by residual solar heating. It also provides confirmation of life, and precise location of the cluster. In some cases the cluster takes a rather flattened shape (usually at the top of the hive), or it may be spread out in a lower section. (thermograph T6)

Having now acquired the heat signature readings, some interpretations of the raw data should be made by the beekeeper. In the course of experience and developing techniques these interpretations would undoubtedly become a set of rules. Data collected, as in heat signatures and temperatures, become more significant when accumulated from all sides of the hive bodies. The elimination of extraneous thermal anomalies prepares the data for baseline comparisons from which the expected set of rules would be derived.

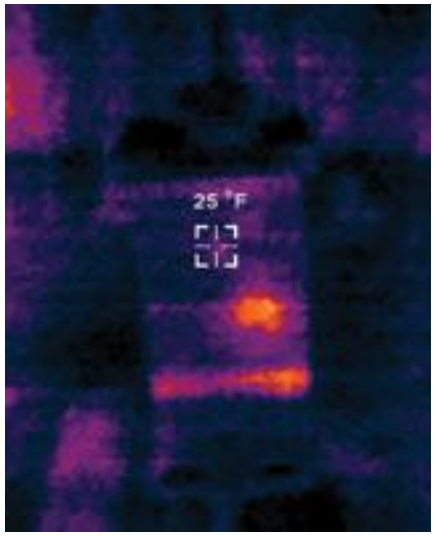
This would be a simple matter if the ambient temperature were a constant absolute. However, as our 'laboratory' is in the context of the natural environment other factors need to be considered. The living organism of the bee colony will be subject to such environmental factors of the atmosphere as humidity, concentration of CO_2, and most acutely the thermal effects of wind chill.

In the highlands of Cape Breton, as well as any other coastal or elevated and exposed areas, winds become the *force majeure* in the struggle for survival of honey bee colonies. Wind chill calculating equations, and charts, are widely available from climate based data banks such as NOAA, Environment Canada, and your local weather station.

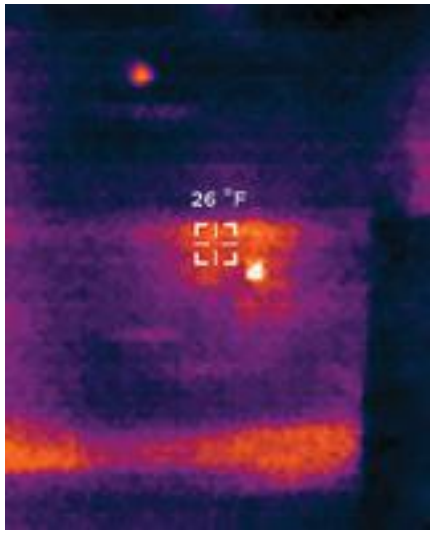
The effects of wind chill are



T1



T2



T3

caused by the increased convection of heat away from the exposed surface. The rate of convection depends on both the difference in temperature between the surface and the fluid (air) surrounding it and the velocity of that fluid with respect to the surface. As convection from a warm surface heats the air around it, an insulating boundary layer of warm air forms against the surface. Moving air disrupts this boundary layer, allowing for cooler air to replace the warm air against the surface. The faster the wind speed, the more readily the surface cools.

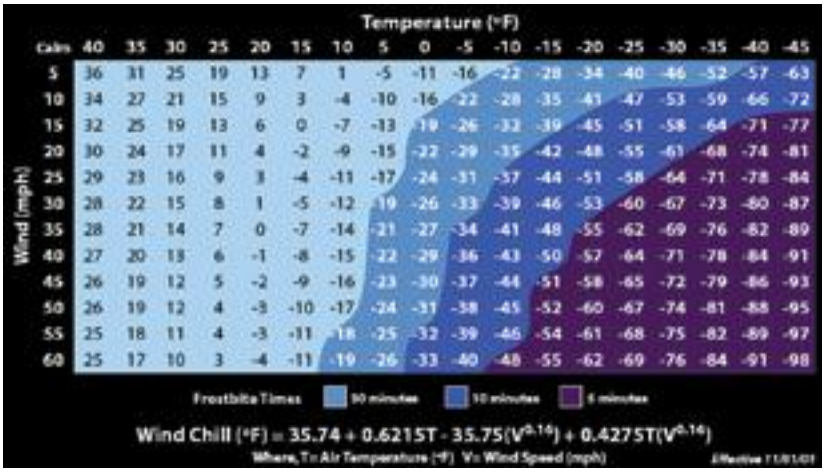
The original formula for the index is:

$$WCI = (10\sqrt{V} - V + 10.5) \times (33 - T)$$

WCI = Wind chill index, kcal/m^2/h
V = Wind velocity, m/s
T = Air temperature, °C

Several other formulas are in use by meteorological services such as Environment Canada and NOAA in the United States. The 2007 McMillan Coefficient calculates wind chill by subtracting the wind speed in mph from the Fahrenheit temperature. The 2012 Breedlove Coefficient subtracts the temperature in Fahrenheit from the wind speed rather than subtracting the wind speed in mph from the Fahrenheit temperature.

Although the object's surface temperature cannot be reduced below the ambient air temperature, the *rate* at which it drops increases with the wind's velocity. The total heat loss then, usually measured in BTUs, increases.[1]

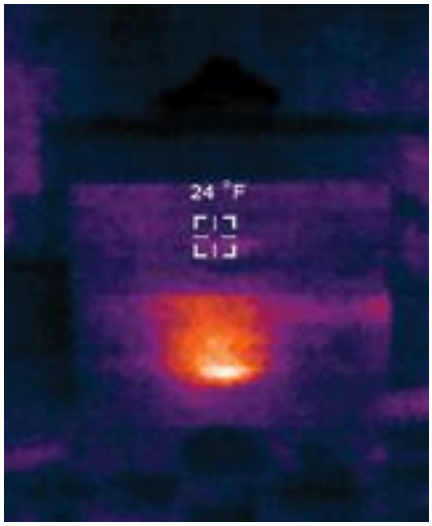


The physiological response of biological organisms, such as honey bees, is to generate more heat to replace the lost thermal energy from heat transfer to the exterior environment.

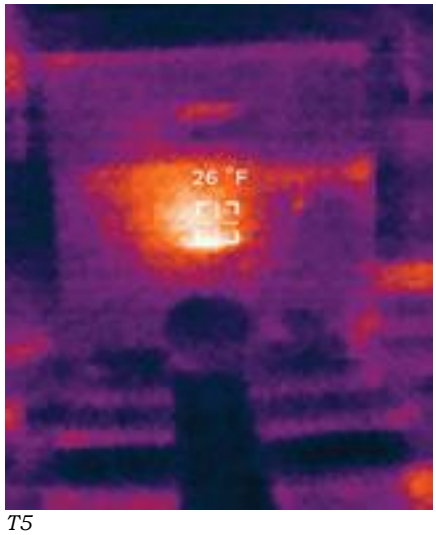
Heat regulation is critical to the survival of the honey bee cluster in winter. The heat that is primarily generated in the core of the cluster maintains the colony between an upper and lower limit. The mantle (outer layer of bees) of the cluster sustains a lower temperature as it acts as an insulating barrier. The lower limit of the bees is 41°F (5°C). At this temperature the bees are unable to produce metabolic heat and stop moving.

'One aim of thermoregulation is to keep the peripheral temperature above +5°C. When the ambient temperature drops in the course of a Winter night, the core temperature rises by more than 10°C and stabilizes the peripheral value at around +6°C. On the other hand, increasing ambient temperatures in a Winter morning results in a lowering of the central temperature by 8°C while the periphery warms up slowly. Plotting the temperature T_c of the center versus the ambient temperature Ta gives two straight lines with a slope of + 15°C/ -10°C and -10°C / + 10°C for falling and rising ambient values, respectively. The heat loss from the cluster is proportional to its momentary surface, the heat conductance through the surface and the temperature difference between the periphery and the surroundings. This loss has to be compensated by the heat production of the bees in the cluster. The reduced heat loss through the surface and the increased heat production in the cluster lead to a temperature rise in the core. [Plotting] shows a linear relationship between the central temperature and the temperature difference between periphery and environment over a wide temperature range. The accumulation of data at T = 10°C again points to the economic aspect of thermoregulation.

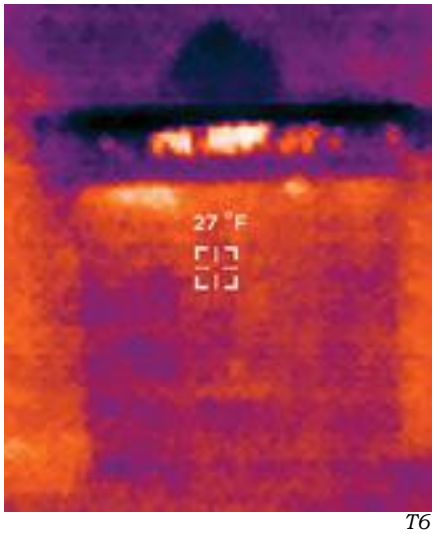
The temperature in the centre of an overwintering cluster is maintained at an average value of 21.3°C (min 12.0°C, max 33.5°C). With rising ambient temperatures



T4



T5



T6

the central temperature of a winter cluster drops whereas the peripheral temperature increases slightly. With decreasing external temperatures the peripheral temperature is lowered by a small amount while the cluster's center temperature is raised. Linear relationships are observed between the central and the ambient temperature and between the central temperature and the temperature difference of the peripheral and the ambient temperatures. The slopes point to two minimum threshold values for the central (15°C) and the peripheral temperature (5°C) which should not be transgressed in an overwintering cluster.' [2]

From this description of thermoregulation, and its upper and lower limits in regard to temperature, it is evident that the heat transfer from inside the hive to the outside must not exceed the cluster's capacity to produce the required thermal balance.

To assist us in quantifying the heat parameters of an overwintering bee colony we shall attempt the following calculations.

The basic formula for heat loss (transfer) is:

Heat transfer = surface area x (temp A – temp B) /R

Surface area shall be considered the four vertical sides of a Langstroth double hive body. We will consider the bottom board and top lid to be less exposed and better insulated. Thus the surface area involved in our calculation shall be equal to 1460 sq in, or 10.13 feet square. The R-value (insulating coefficient) of pine wood (1") is 1.25.

Temperature A is the internal average heat, and temperature B is the ambient outside temperature. From our thermographs it can be seen that the heat in the cavity around the cluster is cool, and would be no warmer than the temperature of the cluster's mantle. We will calculate for minimum and maximum mantle temperatures.

With these parameters selected we can now begin our calculations.

Heat Loss = 10.13' x (41°F – 5 F)/1.25

= 291 btu / hr

Now if we calculate at the upper cluster temperature.

Heat Loss = 10.13 x (50F – 5F)/1.25

= 364 btu / hr.

From these calculations it is evident that the minor insulating value of wooden hives, and the relatively large surface areas causes rather extreme heat loss. If our overwintering colony was entrenched in the hollow of a tree the surface area would be much reduced (cylinder vs. cube), and the thickness (and R-value) would be increased.

Let's try a hypothetical calculation.

Assume a tree of 18 inch diameter with three inch thick walls. The surface area becomes 56.5 x 20" = 1130" or 7.85 square feet.

Heat Loss = 7.85 x (41°F – 5°F)/3.75

= 75.36 btu/hr

Obviously, the rectangular dimensions of the common beehive has inherent disadvantages to the natural habitat of wintering honey bees. It becomes imperative then that beekeepers modify their wintering bee colonies to reduce excessive heat loss and mitigate the ensuing colony mortality when the thermal limits are exceeded.

There are, of course, other more complicated formulas for detecting heat loss and transfer, but I would think that the above calculations would provide *quod erat demonstrandum* (QED) of the risk to bee colonies in unprotected hives.

It would seem at this point that a value for the heat produced by a winter cluster of honey bees would prove to be useful. In my search for this value I was unable to locate any research in this regard. However, I have found a measurement of the heat produced by one bee! If we can do some simple arithmetic the total heat produced by a cluster should be found.

We will estimate that a Winter cluster should consist of 10,000 (min.) to 20,000 (max,) bees. To this number we should multiply our thermal unit (heat produced by one bee).

From L. Fahrenholz, I. Lamprecht, and B. Schricker we obtain:

Microcalorimetric determinations of the heat production were performed on the three castes of the honey bee: workers, drones and queens of different ages. Among these groups single adult workers showed the highest heat production rates (209 mW·g−1) with only negligible fluctuations in the heat production rate. Juvenile workers exhibited a mean heat production rate of 142 mW·g−1. The rate of heat production of adult workers is strongly dependent upon the number of bees together in a group. With more than 10 individuals weight-specific heat dissipation remains constant with increasing group sizes at a level approximately 1/17 that of an isolated bee.[3]

Thus, taking the strong heat production of adult workers – as would be expected in a winter cluster – the calculation becomes: 209 mW x g^{-1} x 10^4.

= 209 mW x g^3

For a three pound cluster (1362 grams): 1362 x 209 = 284,658 mW

= 284.658 Watts

1 W = 3.412 btu

Thus 284.658 x 3.412 = 971.25 btu/hr.

At this point we have a sustainable equilibrium based on a healthy cluster of sufficient size and a calm ambient air temperature. Other factors can upset this balance.

A weak colony of reduced size would not produce this level of heat; wind chill that increases the rate of heat loss; and infiltration of cold air through cracks, holes and vents. In conditions of high wind the infiltration factor can be severe.

Let's presume that the wind chill has the effect of "equivalent" temperature. If we plug these numbers into our heat loss formula the status of the colony changes drastically.

Heat Loss = 10.13 x (41°F – (-31°F))/1.25

= 583.5 btu/hr

As the cluster shrinks through the course of the Winter (a normal attrition), and the winds continue, the difference between heat production and heat loss diminishes and quite often it reaches the vanishing point.

Beekeeping in the Summer is fun. Beekeeping in the Winter is hard work. Thermography is a multifunctional asset, and the application of this technology to beekeeping should enhance and advance the practical aspects of modern apiculture.

Apologies for any errors I may have made in the above calculations. BC

References:

[1]BTU, British Thermal Unit: heat required to raise one pound of water 1°F.

[2,3]Journal of Comparative and Environmental Physiology B Thermal Investigations of a Honey Bee Colony: L. Fahrenholz, I. Lamprecht, and B. Schricker

Universitait Berlin, K6nigin-Luise-Strasse 1-3, D-1000 Berlin 33, Institut fiir Biophysik der Freien Universit/it Berlin, Thielallee 63, D-1000 Berlin 33

Accepted July 11, 1989

PLAN AHEAD

Next Season In The Southeast

David **MacFawn**

Planning is critical for your operation's success and your colony growth plan is one of several important plans you will need, including your financial plan and the sales and marketing plan. It is better to put your thoughts on paper so you can develop and evolve your plan. At the minimum, the plan should be well thought out and continually developed as events change, resources are added or deleted and as the season progresses.

The colony growth plan starts with planning in the Autumn (October, November and December) with the beekeeper thinking about what should be implemented by February/March in the Southeast and a bit later in the north. The beekeeper needs to assess their operation as follows:

- Colony Number:
  - How many colonies do you currently have?
  - How many colonies do you want to have?
  - Are you going to use 10 frames or eight frames equipment?
    - Ten frame equipment helps minimize swarming by minimizing congestion
    - Eight frame equipment is easier to lift and handle. It also matches four to eight comb feral bee colony average. The bees swarm more but they seem to develop quicker than a 10 frame. Eight frame equipment is easier to handle for pollination.
    - Deep brood chambers and/or supers does minimize equipment but is heavy to lift. I typically use a deep brood chamber because it is quicker for me to find the queen and it is cheaper equipment wise.
    - Shallow or medium supers should be matched to your nectar flows and the amount of "honey" needed to over Winter.
- Spare equipment:
  - Do you have enough spare equipment to support your growth plan?
  - In South Carolina, I use a deep brood chamber and medium supers. Medium supers match the 40-pound average nectar flow. In addition, we need about 45 to 50 pounds of honey to overwinter colonies. I also minimize different equipment sizes used in my operation.
- Honey processing equipment:
  - Have you anticipated how much and what type of honey extracting equipment will support your future colony numbers and its cost?
  - If you have ewer than 15 colonies, you may consider working with someone who has an approved honey processing facility instead of purchasing extracting equipment.
- Extracting and workshop buildings:
  - Is your extracting equipment and facility large enough to support your future plan?
    - Do you have enough honey storage tanks, buckets and bottling tanks?
  - Do you have a place to assemble and store equipment?
- Vehicles for transportation:
  - Are you going to use your current vehicle, or will you require additional trucks / trailers?
  - Will you rent or purchase the trucks and trailers?
- Colony losses:
  - Will colony losses impact your honey yields?
  - How are you going to address *Varroa* mites?
  - Frames and foundation for the brood chamber, food chamber, and any extracting supers.

Eight-frame.

Ten-frame.

- Are you going to use wax coated plastic foundation in your supers in addition to your brood chamber?
- Are you going to use beeswax foundation in your brood chamber and wax coated plastic foundation in your supers?
- Wax moths are after the dark comb/protein where brood and pollen has been stored. If you use beeswax coated plastic, will you let the wax moths clean up old comb/frames that have been culled from the colony then recoat the frames with beeswax?
- Will you use 10, nine, or eight frames in your brood chamber and/or supers? I use 10 frames in my brood chamber and nine frames in my supers. Nine frames in the supers result in the bees drawing the comb just past the top bar making it easier to get your uncapping knife under the cell caps. It is debatable whether to use frame spaces in your equipment. Spacers ensure the frames are spaced properly but Small Hive Beetles (SHB) may be able to hide in the back of the spacer.

- Feeders and equipment, you will be using and to support the feeding:
  - Boardman feeders that insert the colony entrance can be used for water. Feeding sugar syrup in boardman feeders may result in robbing,
  - Frame or division board feeders inserted in place of a frame works well in the Summer, but the Autumn/Winter months the bee cluster may have difficulty accessing the syrup,
  - Pail feeders inserted over the porter bee escape hole in the inner cover are ideal. Likewise, feeders (pail or glass/plastic jars) inserted in holes in a top cover also work well. No hive disturbance is necessary to check and replenish,
  - Hive top super feeders work well in warm and cold weather, but may be considered expensive,
  - In many parts of the Southeast, it does not get cold enough for long enough to freeze 1:1 sugar syrup. Hence, an extra brood chamber may not be needed around a plastic pail feeder. In addition, 1:1 sugar syrup may not freeze in glass one-gallon jars.
- Colony number expansion and splits; how will you make up lost colonies and the resulting bee and frame expense?
  - Split existing colonies?
    - When will you split the colonies?
    - Will you let the colony raise their own queen?
    - Use mated queens?
    - Use queen cells?
    - Will you have drawn comb available to aid new colonies? Drawn comb gives the new colony an extra head start timewise.
  - Purchase packages
  - Purchase NUCs (Nucleus Colonies),
  - Purchase existing colonies,
  - No matter what your strategy, the queens/bees should be ordered in the November/December time frame.
- Outyards necessary to support the number of colonies,
  - Location,
  - Distance to the outyard from your home base of operation,
  - Supporting vegetation and flora for honey production,
  - Water sources,
  - Easy access; can you drive up to the hives to minimize heavy lifting and carrying from the hive to the truck,
    - If on a farm, will the hives be located such that you will be able to access the hives even after the farmer tills and plants.
  - If pollinating, are the colonies located such that they provide optimal pollination,
- Miscellaneous equipment needs like smokers, veils, hive tools, bee brushes, etc. are all part of the costs of doing business.
- What type of top covers are you going to use?
  - In the Southeast we can use a "migratory" cover or a cover made out of 23/32" exterior plywood. Without an inner cover, the migratory cover may become propolized to the top super. However, a hive tool may be easily inserted between the "migratory" cover and top super to remove the cover. An inner cover is

Jar feeders.

Pail feeder.

needed if a telescoping cover is used to be able to get the telescoping cover off.

- What type of bottom boards are you going to use? Solid or screened IPM bottom boards.
  - Screened IPM bottom boards results in the bees building their nest further up the equipment stack.
  - Screened IPM bottom boards do allow more ventilation through the colony. This is especially important when moving colonies in warm weather.
  - The Bee Informed Partnership data shows no statistically significant colony mortality differences between solid and screened bottom boards. (**support@beeinformed.org**).

A spreadsheet can be used to develop the colony growth plan which can help determine what equipment is needed and the amount. It also helps in developing an order list while allowing easy editing of the information. This preplanning allows you to shop for the best price for the equipment quality you want.

After the colony growth plan is developed, you can develop the financial plan, and sales and marketing plan. If a small "backyard" operation, the beekeeper may be able to develop these plans in their head. However, once you get to the 50 or more-colony level, the plans should be further developed, with consideration for putting the plan on paper. A lot of thought is required in the Autumn and early Winter. The colony growth plan will help ensure your success next year. BC

DOWNTOWN

It's Harder For You, Urban Newbee

The most experienced beekeepers I know tell me of golden years some three decades ago, before *Varroa* made its landfall in Florida in the 1980s. My friend Ken once said, "It was almost as if you could just throw some bees in some boxes behind the barn, then just grab the honey come August." Then it got harder. A lot harder.

A lot of beeks like Ken threw up their hands in those days–they hadn't signed up to *kill* bees, after all–and the numbers of sideliners declined. Urban beekeeping is one of the reasons that the number of beekeepers may be rising again, but it seems that may present some challenges in the city, too.

If I were a new beekeeper facing some of today's hurdles, I might soon be in the bleachers with Ken. You can actually get to blue skies from here, now, though.

Hitting the Jackpot

There is absolutely no question that I've been lucky, both when and where I started (though my bees have taken a bunch of shots along the way). My first bees overlapped mostly with feral colonies, since beekeeping hadn't become hip yet, and the mites weren't packing the horrid viral cocktail they are serving now. There were simply no Small Hive Beetles. Only one *Nosema.* There's a colony on my roof that has wintered every year since 2005/6, and it has produced glorious healthy bees, honey and the occasional swarm right up until now.

But it's not because of me. Things I have done wrong: feeding 2:1 at below freezing temperatures, leaving a honey super on the porch in August ("It was just a few minutes!"), storing (unfrozen) brood boxes in a dark basement, procrastinating until October for mite tests and treatments, failing to secure the upper entrance while moving a hive (down a spiral staircase!) . . . oh, the comedy goes on and on. You can learn how to fix a wide range of emergencies when you trigger a lot of them.

Bottom line: my bees survived because the urban world around them was a more forgiving place.

A few years of skill-building before facing the deluge has mattered for the long term. When I took a September mite count for the **2018** Mite-a-Thon, it was 2/100 even with brood in two deeps and a medium, the way they have been running all summer. I've split it, twice. Did I mention the 3.5 supers of honey?

When I look at my wonder hive and my haphazard management, I wonder why it has been so difficult, in recent years, to help many of the new beekeepers here to get to this place I call "Cruising Velocity."

What is this "Cruising Velocity?!"

To me, this means a state of equilibrium where the city bees have become well-adapted to the place they live: adjusting their populations in synch with local seasons and signals, foraging well, splitting every Spring, managing mites and beetles without much help, needing feeding support only occasionally, being polite neighbors.

The cool thing about this Zen state of beeing is that the interventions the bees need are not huge/emergency/high stakes/life-or-death magnitude events.

Big interventions, even when desperately needed, are high risk/high reward, and nature prepares critters for more normal stuff. Nature's favorite number is "average:" average temperatures, average rainfall, average colony size, average forage availability. Everything has evolved to know what to do with what usually happens. It's the outlier events that test the odds.

Those super successful bees on my roof have (mostly) *got this,* and if I maintain a modest glimmer of a clue (the best I can muster some days), I'm there when they need me, and not as a superhero.

But our urban newbees have no reason to believe they will encounter luck like mine. It is luck, too: my major contribution to local beekeeping has been to make every error or succumb to every bad idea. Until the next one.

Why is it harder to get to equilibrium?

It's especially harder for folks here who have started in the past five years to get to Cruising Velocity, I think. Beekeepers are now thick

The Golden Years Are Gone.

on the rooftops (and the community gardens, and the campuses, and every patch of urban greenspace they can find). We have nearly 500 registered hives in the 68 1/3 square miles of Washington DC today (I could find only a dozen or so in 2005).

This means that newly established urban honey bee colonies will be exposed to every existing threat without exception, just because there will inevitably be a hive within foraging distance which is succumbing already. We also bring in bees constantly to meet growth that outstrips the capacity of our relatively new local nuc producers, and to replace high losses. That's a potential conveyor belt carrying pests and pathogens from other regions to our doorstep on a regular basis, too.

This is not because someone is awful or at fault: it is the odds.

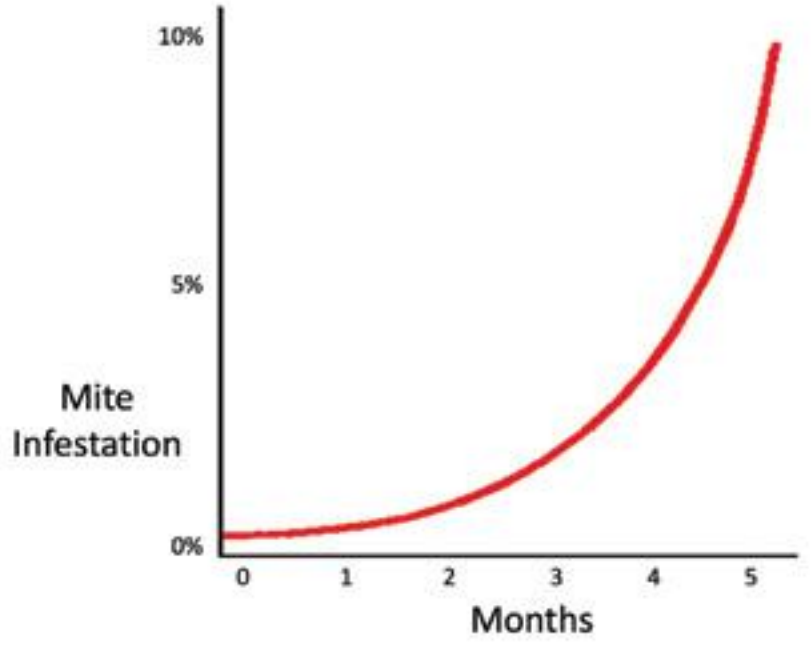
It works like this: do you know the rule of thumb that only one out of four uncaptured swarms survive to establish a new colony? How would you do this math?

If you have 100 other honey bee colonies within flying distance of your apiary, all have been exposed and some significant number are weak from a *Varroa* vectored illness. Some are also weak because a queen is in decline and perhaps Small Hive Beetles are finding a way in (I've had this happen while a decent colony was just requeening). Some of your neighbor colonies have inevitably robbed a hive that dwindled away due to *Nosema*; some are competing for dearth-time forage in places so crowded with bees that pests can practically jump from thorax to thorax. Those dearth periods may have effectively gotten a whole lot worse when (no exaggeration) ten times as many colonies are competing for the resources to survive a few critical weeks, so nutrition ain't great.

"OK, prove it."

Many of our new beekeepers here tell me, at some point, that none of this could be true for their bees. For example, they have never "seen" a mite on a bee. After I finish slapping my forehead, I like to show them one of the graphics from the Honey Bee Health Coalition:

If you have an urban colony with a near-zero level of Varroa mite infestation, your bees will not stay clean forever. According to work by



Meghan Milbrath at MSU Extension, if you have even one mother mite in your colony, she is capable of exponential growth that can put you at 12,000-14,000 mites within 10 brood cycles. In your city, there is a mother mite somewhere, with her legs extended on top of a flower in a patch of high-demand dearth-time forage, just waiting for her ride back to your place.

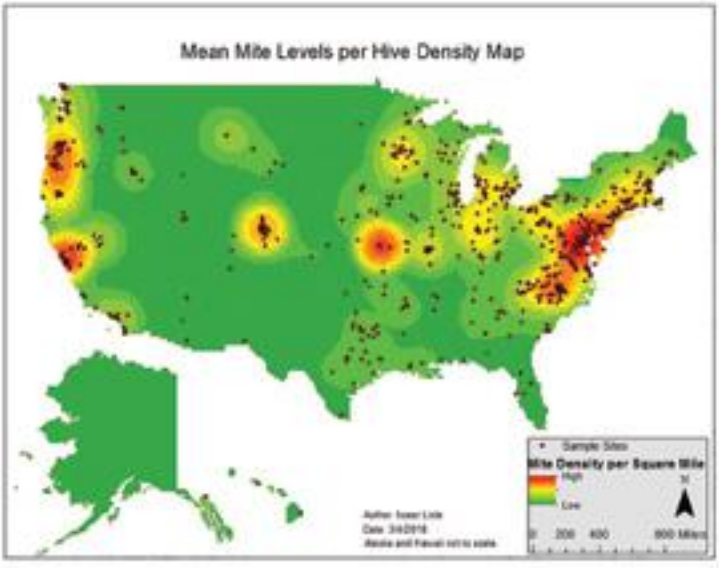
As part of the annual Mite-A-Thon (now in its second year), The Pollinator Partnership has also shared a recap graphic from last year's survey. Here, you can see that the place where I live is a potential red-hot zone for *varroa* mite density.

This map is based the number of reporting locations from 2017s first-ever survey program, so many areas (especially in the West) may look light on mites when there were really just no participants. But there were LOTS of reports where I live, and the story was sobering.

The path to blue skies

A Master Beekeeper once told me that the recipe for successful beekeeping is this: a good class, a good mentor, and a good community. Many urbanites like me live around a lot of people but starve for that kind of community.

Well, that will starve your bees, too: join a club, take *their* course, work with people who have been



This map is based ont the number of reporting locations from 2017's first-ever survey program, so many areas (especially in the west) may look light on mites when there were really just no participants. But there were LOTS of reports where I live, and the story was sobering.

doing this–in your area–for a while. Even if you are shy. Even if you are the smartest person you ever met. Even if the bees you have purchased were promised to be pure as the driven snow and immortal.

The best start you can get for the bees is a local nuc, too, but you can get to strength even if you start with a shipped-in package. We have been experimenting with Oxalic acid vaporization on incoming packages and supporting just about anyone who is willing to graft queens from overwintered local stock. This is meant to knock down loads, then get a healthy new colony ready to take a readily-available, well-mated local queen.

And requeen that package. Just do it. Pinching your first queen (who may not yet have done anything wrong) seems like a heartlessly cruel thing, counter to your goal of *raising* rather than *killing* bees (I still cry inside when I do it). But every single bee in that colony would take one for the team, and they are not averse to making new mommies on their own, either.

Buy one of the increasingly easy to use mite testing kits and learn to use it as soon as you have a couple of frames of capped and some mixed brood. Go ahead and do a small (less than 300 bee) sample if you are worried about losing too many bees too soon. Write down your result. Do it again after another brood cycle (21 days, plus or minus). Use an alcohol wash if you have become as worried as I am, do a sugar shake if you can't bring yourself to kill the sampled bees (but do it really, REALLY, well). Go to the Honey Bee Health Coalition website (**http://honeybeehealthcoalition.org**) and grab a copy of their mite threshold matrix to analyze your results. After you have done this a bunch, you get a tremendous eye for what looks right (or wrong) even before you pop the top of a hive.

Reporting data gaps in 2017 Mite-A-Thon.

If you spot your problems early, even if you have not gotten to a truly established colony yet, you can still do easier, less risky interventions.

And ask for help: this is just a lot to learn, and I am still learning shamefully basic things every year. Almost all of us will help you newbees if we can and you are trying hard, too. I'd love to think that there are more of us up on our roofs, drinking morning coffee and watching the first pollen packs of the morning fly in.

What Is the Mite-A-Thon?

In 2017, The Pollinator Partnership, the BeeInformed Partnership, and an impressive number of partner organizations from across the commercial and academic bee worlds launched the Mite-A-Thon, an effort to collect mite infestation data and to visualize *Varroa* infestations in honey bee colonies across North America within a one-week window each year. The idea is that beekeepers will become more aware about infestations and better able to monitor and address them. Later, the partners will make management strategies available for discussion within bee organizations using information and outreach materials they develop.

It's easy for individual beekeepers to participate: do a *Varroa* mite sampling test during the annual sampling period (a week in September), then go to **www.mitecheck.com** and report your results (mites per hundred and apiary location). You can see graphics displaying survey information as it comes in!

In 2018, the Mite-A-Thon provided recap data for the previous year that compared mite densities among reporting locations, giving beekeepers an idea of infestation levels they might confront in the areas where significant numbers of beekeepers participated in the survey. BC

Those Who Care Enough

Jennifer **Berry**

Last month's article highlighted the first ladies to have passed the Georgia Master Beekeeper Journeyman exam. This was possible because of the Georgia Beekeeping Prison Program which to date has certified over 80 inmates behind bars. But more importantly, this is due to the hard work, kindness and selfless sacrifices of those who volunteer. The ones who take time out of their busy schedules, lives and work to drive to these prisons. The ones who go through background checks, and the same airport security measures (with even more scrutiny) so they can teach those so desperate for knowledge and a taste of the outside. I want to highlight each of these wonderful people and shine a bit of light onto them since they have brightened so many lives over the years. I've asked each of these volunteers to write, in their own words, how they became interested in bees, how they became a part of the prison beekeeping program and why it needs to thrive. Here are those making a difference.

Bear Kelley

I started beekeeping around the Fall of 2007 from a wild idea that I could have all the honey that I wanted. Wow, from there this little hobby blossomed into a real life changing event for me. My love of nature has always existed and flourished as I lived on a boat for ten years enjoying the coastal United States from the Florida Keys to Maine. I learned to appreciate nature's way of expressing herself with her different moods and weather patterns as well as the wide variety of sea life. But when I started keeping bees, I became immersed into their world and was not only fascinated but wanted to change the many things we do as humans in order to protect these little creatures. It started off small when I stopped killing dandelions growing in the yard and ceased using so many chemicals. I realized these actions were a detriment to bees and other creatures and decided to provide them with life instead of elimination. But it didn't stop there. The more I studied, the more I became involved with the politics of beekeeping, from the local level, to the state level, to the national level. Serving as the President of the Georgia Beekeepers Association, it allowed me to help bees in a different capacity and to meet so many others who have been "stung" as bad as I.

In my travels around Georgia, I learned of an Inmate in one of the state prisons who had an interest in beekeeping before he was incarcerated. I coordinated with the Warden to meet this inmate who had started teaching an introductory beekeeping course. As I was introduced to each of the students taking this class, I saw in these men a sincere desire to learn more about the practice of beekeeping. From there, I took it upon myself to coordinate with the state officials and the University of Georgia to expand the program and insure that they had bees, hives and plenty of study material. I coordinated with the local bee club and encouraged them to take on the challenge of mentoring the inmates and assisting them with the success of this new endeavor. It worked so well, that numerous inmates at that facility are now Certified beekeepers through the Georgia Master Beekeeper Program. It is also part of their prison educational records. From that project, blossomed beekeeping programs in six facilities across the state and is now part of the state educational program.

The volunteers who have stepped up to mentor and are dedicated to this program have been remarkable. Although they may seem tireless, since they all have day jobs, family life and their own bees to manage, I'm afraid the time will come when they must move on. Somehow, we must encourage new volunteers to step in and even get the state legislature to fund a state apiarist position to travel to each prison and coordinate activities; such as one facility growing queen bees, one facility building hives and another preparing bee packages and nucs to transfer to the other facilities.

I visited each of the prisons and talked to the inmates at length about their future in beekeeping.

Bear Kelley, left and Broadus Williams.

The interest is strong, and I believe sincere. A few revealed that before this started they had no hope. But now they have something to learn, practice and hopefully benefit from upon their release. In addition to all that, they are amazed at the life-giving effort of the bees and take it personally when some of them die or a hive swarms and departs the prison apiary.

This has developed into an important program that must continue and spread throughout other prisons because it is giving these folks something for their horizon; something to believe in and something real that they can prosper from. Not only in the monetary sense, but the personal gratification for giving life to a creature that often gets bad press but is so important to our very existence. Bees were instrumental in changing my life, so I hope they can continue changing lives on the other side of the wall.

Julia Mahood

Growing up in a house full of girls who were all terrified of bugs, I never imagined that I would become a beekeeper. Things that flew and stung were to be completely avoided. But when I became a mother, my two sons introduced me to the fascinating and wonderful world of insects. In 2004, I was inspired by the book, *The Secret Life of Bees*, thereby taking a weekend course at the Campbell Folk School. My yard, and passion for bees, has been buzzing ever since. I have hives at my home, at community gardens in Atlanta, and in the north Georgia mountains.

I have found that the educational opportunities within the beekeeping community, both as a student and as a teacher, have greatly increased my enjoyment and continued fascination with all things Bee. In March 2016, I expanded my love for bees by teaching in the largest women's prison in Georgia. This all came about when I heard about the Georgia Beekeeping Prison Program from Bear Kelley. I told him if there is ever a program at a woman's facility, please let me know. Months later, Arrendale State Correctional Facility contacted Bear about starting a beekeeping program. That's when I got the call.

I decided to give a lecture first to the general audience to see how many women would be interested in taking a beekeeping class. 300 women signed up for the lecture but because certain populations can't be together in the same room, they broke it into two lectures, at separate times. Afterwards, 100 women signed up for the class but only 24 were selected.

Teaching at Arrendale has been very rewarding since I have always been a huge advocate for inmate vocational training, but driving several hours each way, twice a week, for a year, was becoming a real hardship. After the first class was certified, I decided to visit the prison once a month. Unfortunately, no other volunteers were available, and without a volunteer, the women are unable to visit the bees when needed. The apiary is located at the back end of the prison grounds, and one must traverse through numerous locked gates in order to get there. Like most of the prisons in Georgia, they are underfunded and understaffed, so finding a guard willing and able to escort the students to the apiary, even once a week, was not happening. That's when I decided I needed to be there more often and returned each week.

There are other issues one faces when teaching behind bars, besides the obvious. You'll be in the middle of teaching a class, alarms sound off signaling there's an emergency count, which means everyone must return to their dorm, immediately, no exceptions. So much for that class. Or there's a new guard at security who decides you are not allowed to bring in your teaching materials. Or there's a lock down which no one is allowed into prison. Plus, it's impossible to communicate with the women inside since there is no email, no phone, no text.

Even though there are obstacles, there is so much good coming out of the program that it far outweighs the problems. Since March of 2016, there have been 26 women certified through the Georgia Master Beekeeper Program. Plus, the classes and beekeeping experiences enrich their lives in so many ways. You can see it on their faces; how excited they are that you are there to teach them, and how excited they are learning about something they love. The women are so grateful for the experience and anything you are willing to share with them. I truly love my involvement in the program not only because I see how happy it makes these women, but for the experiences I've gained as well. And let me tell you, it's really hard to feel sorry for yourself after spending four hours a day in prison, because at the end of it all, you get to go home.

Virginia Webb, left and Julia Mahood.

Virginia Webb

My Father, Joe Stephens bought me my first beehive in the early 1960s. This was a family hobby and I can remember as a young girl the joy of watching bees going in and out of the beehives and fascinated with their behavior. Extracting honey was always a special time for us, with the honey house filled with supers of fresh honey, I always imagined that heaven would smell like freshly extracted honey. 50+ years later I am still keeping bees (so is my Dad) and enjoying each and every day as a beekeeper.

When I lived in Atlanta, one of my volunteer activities was a program of Prison Ministry with women. This involved providing services for women

held at the Federal Detention Center in Atlanta. It was a program I became involved with through a friend.

After moving to Habersham County in the late 1990s, I began my career as a full time commercial beekeeper, but I still enjoyed working with new beekeepers and speaking about bees throughout the state and nation. In 2016 the Georgia Beekeepers Association inquired through our local beekeeping club if there was interest in teaching beekeeping at Arrendale State Women's Prison. This would be a first class in a women's state prison in Georgia. I personally liked the idea of providing vocational training to inmates.

Working with individuals who have never seen the inside of a beehive is exciting for me. The women we work with were excited about the program and we began by focusing on the fundamentals of getting started in beekeeping. I am the helper in the class that is led by Julia Mahood, Master Beekeeper from Atlanta. It was great seeing how dedicated she was in getting the class started. After two months of reading "First Lessons in Beekeeping", the bees arrived (six packages) and we were ready to get to work.

The women at the prison have come a long way in three years. The women have their own beekeeping club, and fall under the guidance of the Georgia State Beekeepers Association. One great accomplishment they have made is through the UGA Georgia Master Beekeeper Program. All of the women have passed the first level "Certified Beekeeper" and a number have also passed the second level "Journeyman Beekeeper". I believe many will continue this track and become Master Beekeepers in this program.

Each of these women who are in our beekeeping class show a dedication to the program. They continually work to find ways of sharing their knowledge of beekeeping with other inmates and visitors and family who visit on weekends.

For a beekeeping operation, needing to find qualified and confident beekeepers to work, should consider giving an ex-offender who has been through the prison beekeeping training a job. In some employment, working with the Georgia Dept. of Corrections, a candidate you hire could be bonded by the GDC and they may supplement part of the ex-offenders salary for a period of time. Because I do not have all the information needed, you can check with the Georgia Dept. of Corrections for eligibility.

Having this program certainly gives purpose to many of our students. That is a sweet reward for this important program being offered. I am very grateful that the Georgia Department of Corrections is allowing this vocational training for the ladies at Arrendale.

Broadus Williams

I have been keeping bees for over six years now. I got interested in bees because of a problem I was experiencing at my farm. I had planted several fruit trees, and they were about five to seven years old but would not produce any fruit. Each year there would be lots of blossoms on the trees but never any fruit. That's when I started to read and research for answers. I bought a few books on gardening and fruit trees and found out that fruit trees need bees or pollinators to produce. I remember learning about pollination when I was in grade school, and I had also helped my kids learn about it as well. However, it did not register until I was face to face with the problem.

I joined a local bee club and purchased one hive, which quickly became nine hives, which then became 49 hives and the numbers just keep growing. Now to my amazement, my trees are finally producing fruit.

The former president of our local club and, at that time president of Georgia Beekeepers Association, was Bear Kelley. One day he invited me to help him with the prison program and I was happy to join in. It's a great program and the guys just soak up the information. I saw a lot of pride in the guy's eyes as they showed us their apiary and passed their exams. It was also very important to them that they do well and continue in the program. They asked lots of questions and were all very eager to hear the answers.

There are many challenges the guys face on a day-to-day basis, but then add beekeeping? Getting beekeeping tools and equipment behind bars is not easy and then getting to use those tools and equipment is even harder. But it is worth it for them. Bees and beekeeping have brought these guys together and to keep their bees thriving, they must help each other out, put away their differences and work side by side for the same cause. That to me is the greatest return, which is why I hope the program will continue to grow because of all the good it is doing on the inside.

Brutz English

I've been keeping bees for ten years. I was introduced to beekeeping while I was incarcerated. I had a cell mate who had kept bees before he was in prison, and he introduced me to the idea. I checked out some beekeeping books through the prison library system, and once I was released I purchased two colonies. Since then, my love for beekeeping has changed my life. I have become a commercial honey producer, a Georgia Master Beekeeper, and a Senior Welch Honey Judge. I started a local bee club in my area, and I have served several

Brutz English

terms as club president. I have served six years as an elected member of Georgia Beekeepers Association (GBA) Board of Directors, and I was the GBA's 2017 Beekeeper of the Year.

I became involved in the Georgia Beekeeping Prison Program right after I heard about it. Once I realized there was a prison out there willing to let us in, and there were beekeepers out there willing to go in; I knew I had to get behind this program. I became an advocate on the GBA Board for the program, and in 2017, convinced my local club to agree to sponsor one of the prisons in our area.

I want to see the beekeeping prison program expanded system-wide in Georgia. I also want the GA Department of Corrections to commit to a full-time position which will train inmates and help facilitate the beekeeping program in individual prisons. I would like to see more support and involvement from local bee clubs and local beekeepers. We need more volunteers to help out with these programs, especially starting up at new prisons. I would also like to see the day where we gave program graduates bees and equipment once they are released from prison. Finding work for newly-released prisoners is hard and getting the extra money to get into bees will be tough for anyone coming out of prison. Giving them the basics to get going will give them something constructive and productive to do straight away.

There are many reasons why this program is important. I'm sure some of the other program sponsors will list off the vocational and rehabilitative value, or the structure and discipline beekeeping can teach, or even the constructive use of time and resources for inmates. For me though, this program is about opportunity and redemption. Beekeeping gave me both. Beekeeping gave me something constructive and productive to do the minute I was released from prison. It has been the vehicle largely responsible for my reintegration into society, for my financial rehabilitation, and ultimately getting my life back on track. My time and experiences as a beekeeper, and in the beekeeping community, have been among the most valuable and meaningful of my life. The world of beekeeping has opened (and re-opened) doors to a world I thought were surely lost to me. I have lived this experience and every day reap the benefits. I firmly believe others who have been where I have, if given similar opportunities, can similarly benefit from the world of beekeeping, just as I have.

Rick Moore

Rick Moore

I started beekeeping in my head years before I had any bees because I've loved honey and reasoned if I had bees I'd get free honey. Boy, is that free honey EXPENSIVE! I started with one beehive eight years ago. The first years were rough but I did not give up and by the fourth year had managed to keep ten hives alive. That's when I thought, I'm finally a beekeeper! But I realized, I still had much more to learn.

Shortly after being elected President of the Heart of Georgia Beekeepers Association, our club was asked to start a beekeeping program at Dooly State Prison, which was 25 miles from home. Volunteers were needed and since I'd not been inside a prison before, I thought it would be fun to go and help out. But before I knew it, I was the new Dooly State beekeeper instructor to 15 eager inmates who knew nothing about bees. This is when I began to

realize that there is no better way to learn than to teach others. Their questions were thought-provoking and probing so much so, that I would have to go home and research for the answers. Therefore, I became a better beekeeper and instructor because of the students. It's been three years since I first walked into Dooly State Prison, and since then, we have certified every student who sat for the Georgia Master Beekeeper exam, including myself and the prison Chaplain.

This program has turned around many ideas I previously held about inmates, incarceration, punishment, and of course beekeeping. Seeing on a daily basis the transformation, the eagerness with which they yearn for knowledge, and their exploding respect and love for honey bees, has changed my life. I feel beekeeping in prison has given these inmates, aged 18-70, and myself a second chance at life. I am teaching them what I've learned so they may teach others and when released have some beneficial life skills. As you know, beekeeping is biology, botany, animal husbandry, chemistry, interpersonal relationships with each other and the bees, and much, much more. The prison beekeeping program has saved some from themselves. They have gained a purpose, and are looked upon by other inmates as 'the lucky ones' who get to play with bees.

The future of prison beekeeping is constantly in danger though. At the whim of the Governor, or Department of Corrections Commissioner, this program could be squashed. And as real as that threat is, it is not the largest threat our there; the lack of volunteer beekeepers may kill prison beekeeping as well. We have six prisons in Georgia with beekeeping programs, each with the original volunteer who first entered the prison. There is a dire shortage of people willing to undergo the background check, to be cleared to enter the prison as a volunteer, and then to make the time commitment necessary to lead and teach a year-round program. The inmates are there and ready, the bees and equipment are there and ready, the volunteers are not forthcoming.

We talk a good game at our clubs and at the local and state level, but the people either don't hear the pleas or turn a deaf ear to the opportunity. My beekeeping experience inside prison has truly been one of the most rewarding experiences of my life. Yes, the students I teach and work closely with, are murderers, rapists, thieves and gang members. Prison is a dangerous place. But, the students in beekeeping are the best in the prison, having been thoroughly vetted for disciplinary issues, and have an insatiable desire to learn and grow. With over 200 applicants each time we have offered a new class, we have picked less than 20 to be in the class. We are very particular about who is in the class. Never, repeat, never have I ever felt unsafe, intimidated or afraid inside the prison. To the contrary, working with the inmates, I have developed a respect for the individual, not the criminal. Society is punishing them, I am there only to teach beekeeping.

As you can see from the words of the inmates to those of the volunteers, this program is worth saving.

Take care of you and the bees! BC

Hive House Therapy

Cassandra **Vore**

"Take a deep, calming breath and in your mind's eye, image if you will, being led into a small clearing. A gentle breeze is blowing in the trees, and the sun warms your skin. Ahead lies a quaint, cozy, tiny house. As you approach, you see a roped off yard with pollen laden honey bees seeming to fly in and out of the lower wall. You are drawn to a gathering of miniature stepping stumps that lead to a door. Pulling it open, the warm scent of fresh wood mixed with the sweet aroma of honey and beeswax greets your nose. The interior is bathed in sunlight from a large south facing window. Below the window is a chest-high cozy bench cushioned by a blanket and pillows at either end. The antique wicker chair invites you to sit and remove your shoes. A nap is sounding more and more inviting. You step onto a handmade wooden stool and climb up onto the bench and lie down. Now that you've settled in, your ears are greeted by a soothing sound not unlike a gentle tide. You suddenly realize it is bees under the bench. The deep thrumming sound resonates through your body. And could that actually be micro vibrations you almost sense rather than feel. Whatever it is, you find the scents, sounds, and feelings so relaxing your eyes drift closed. Slipping off to sleep you wonder, "What exactly is this enchanting place? Why do I feel so deeply relaxed? Who built this here?"

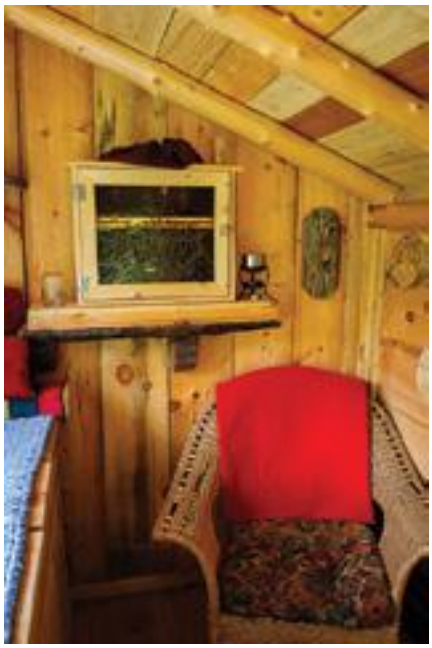
Most parents know that allowing a child to have a pet of their own often means that the furry friend may end up theirs for a while when the child leaves the nest for the first time. Whether it is off to college, an apartment and full time job, or a gap year of traveling, pets are often not part of that plan. However, not too many parents get left looking after thousands of animals. That is unless their child happened to be a beekeeper. Luckily for me, I started the hobby with my father, and he had made it his own as well. Of course the liquid gold honey he became accustomed to helped to sweeten (pun intended) the deal of doing the work on his own!

For years after I left the nest, my father continued to tend his bees, learn the art of beekeeping, and enjoy a very solid flow of honey. Although I did none of the work, a jar of honey always seemed to make it into my home – even when I lived across the country! And then my father retired from his paying job as an educator of 30 + years. He is a man with a drive to learn, work, and share his knowledge with others. No taking it easy for him. So, when retirement meant relocating over 350 miles north to the Upper Peninsula of Michigan, his bees went with him. What he found were some interesting new challenges to spark his imagination and kick his interest in bees up a notch.

What followed is quite a list of experiences that I only highlight in order to get to the newest. I'll give you a little spoiler: it's an expansion to our current concept of apitherapy here in the United States. Let's start at the beginning. After one rather devastating episode, my father learned that electric fencing is a must if you want to keep bees in bear country. He also learned that the short season and long harsh winters of Skandia, Michigan, meant new overwintering techniques if he wanted to avoid 100% winter hive losses. Once he figured these things out, he shared them via videos with other beekeepers on his new website U.P. Michigan Bees. He learned that in his new location, with fewer acres of open farmland full of clover and buckwheat, his bees depended on the "bee pasture" along the roadsides and in yards that was getting mowed too often and too early in the season. He now shares a bee pasture preservation message with people far and wide when he presents at schools, bee conferences, and other events in the hopes that awareness will bring change in behavior. It was the spring of 2014, at the Michigan Beekeepers Association Conference, that he learned of a centuries old apitherapy structure.

At this conference, Anne Marie Fauvel presented a talk on her trip with Therese McCarthy to Apimodia in Kiev, Ukraine. From her talk, my father learned about the idea of creating an enclosed space over hives in which a person derived therapeutic effects from their nearness to the bees. When my dad shared this information with me, I was entirely intrigued. There was only one problem…information about these apitherapy houses was in short supply. So, the idea went to my father's subconscious where it could be recalled at a later date.

After months of pondering, in the Winter of 2014, my father decided he would simply have to make his own version of the Ukranian apitherapy house. Having successfully built a number of structures over the years from woods harvested on his own property, he knew he would do the same with this project. Planning commenced. His determination brought out my own, and in the



Spring of 2015 I was successful in my online search for information. Granted it wasn't a lot, but I found some loosely translated information from the Ukraine and a video out of Canada where someone else had created one of these apitherapy houses. From there it was just a matter of time until the weather permitted a start on the physical structure.

Ground breaking was April 20, 2015, although four handsome handmade Nucs (decided upon to make tending them easier) were constructed earlier in the month for later use in the "Hive House." Yes, Hive House was the name we finally settled on as any time we used apitherapy in the description those we were talking to immediately thought we were talking about them getting stung. Not the pleasant and relaxing connotation we wanted to go along with this new venture! The Hive House quickly began to take shape with the help of my mother and his young grandchildren. The logs were cut and milled on the property, carried to the carefully chosen building site (close to the bee yard, backed by woods, and facing a small open field), and assembled from the plan in my father's head. This worked out well most of the time and "mistakes" just meant innovative solutions.

At first he planned to put a small window on the wall opposite the door. As the building progressed, he envisioned lying on the bench on a warm summer's day and realized that he not only wanted to hear and smell the bees below, he wanted to watch them go about their fascinating work. The solution was a home-made observation hive with an entrance to the outside. Since he was milling his own lumber, he decided to highlight the various types of trees growing on the property. Cherry, spalted white birch, popple, spruce, balsam, maple and hemlock make up the ceiling above the sleeping bench. As with the rest of the buildings on the property, his desire was to have things serve more than one purpose. So, in went a comfy chair to create a spot for someone to relax with a cup of coffee or a glass of wine. Top off the décor with pillows and a handmade afghan to cushion the sleeping bench, and on May 17th, less than a month after the initial groundbreaking, the Hive House was complete. Two days later it received its first snow with a late season storm! Now it was time for the bees.

The Hive House was finally up and buzzing by mid June of 2015. It's official reveal was Saturday, June 20th at the annual Meeting and Bee Social of the Superior Beekeeping Club. Along with the 40 + members who came to participate in hive inspections, enjoy a mead tasting, and socialize during the potluck, the group hosted a special guest, Terry Toland, President of the Michigan Bee Association. The buzz generated here only continued with the publishing of a short video explaining the Hive House on the UP Michigan Bees website, and finally the announcement of it's existence at the July, Heartland Apiculture Society Conference held at Albion College in Michigan. The excitement generated there has already led to a special trip by one gentleman to take pictures of the Hive House and request by many for the plans.

Now all that is left to do is for the creator, his family, and his visitors to enjoy the many benefits of this "new" old form of apitherapy. Remember that imaginary trip you took at the beginning of this story? Well, all those scents, sounds, and vibrations are said to have a healing effect on emotional, physical, and psychological ills that many of us carry around. While no promise can be made about the claims to benefit pulmonary and respiratory function, blood composition and the body's immunity (among many others) we do feel confident that, at the very least, peaceful sleep in the Hive House allows for the deep rest and rejuvenation that helps counter the stresses of our modern, fast-paced life. It sure is a great place to enjoy a glass of local mead! BC

My father and I would very much like to know of any other such apitherapy houses in the United States that are based on the Ukranian model. So far, our search for others has been unsuccessful. Let us know at ***www.upbees.weebly.com*** *if you are aware of others in existence.*

Photos by David A. Vore

A Summer / Winter Hive Ventilation Box

Directions for one 8 frame ventilation box

By Lorna Cook

Buy List / Cut List

1-1x4 Pine KD x 8 feet, cut 2-20 inches long and 2-11 1/2 inches long

1 Bullnose Stop x 8 feet, cut 2-20" long, cut 1-11 1/2" long, cut 2-5"long

 # 8 Hardware Screen, cut 1-13 3/4"x19 5/8" piece, cut 2– 2"x8" pieces

Plastic Window Screen, cut 1-24"x30" piece

1 1/2 inch self taping star drive screws, need 8

3/4 inch #6 Philips drive screws, need 24

Prep the longer box sides by using a scrap piece of 1x4 to mark each end of the two long sides. Pre drill two holes on each end with a #8 countersink bit. Set holes centered and 3/4" from each side.

Prep the two shorter box sides by measuring in from the end edges 4" and from the top 1". These mark the ventilation holes to be.

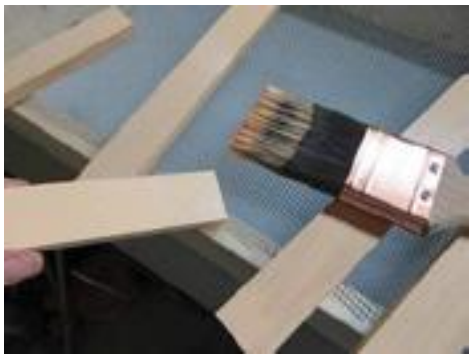
Drill out the ventilation holes using a 1" forstner bit.

Clamp the box sides using pipe clamps and adjust each corner with a square until correct. Box must be on a very flat and true surface.

Pre drill with a straight bit, use the existing countersink holes as a guide, to extend the screw holes into the short sides of the box. Keep the bit really straight.

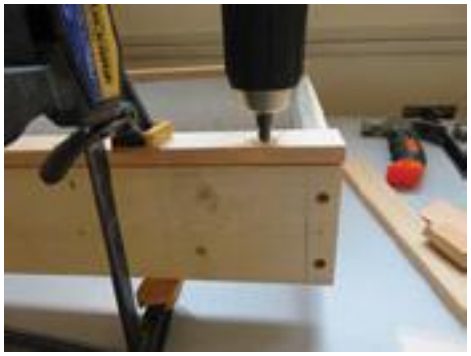
Drive the 1 1/2 inch screws in to tighten the box snug.

Turn the box so the ventilation holes are closest to the countertop. Place the #8 mesh piece on the now top edges and attach with a staple gun. Trim as needed.



Paint bottom sides of bullnose stop.

⇨



Clamp the long side bullnose stop to the box. Round side to outside. Using a #6 countersink bit pre drill four holes. Place 3/4" #6 screws in holes and drive to attach bullnose stop. Repeat for other side and the piece for the short side.

Attach the 5" bullnose stop pieces as above to create the winter escape opening.

Screw pattern for the bullnose stop. If you are **painting** your boxes now is the time to do that. Two coats of an exterior latex paint is fine.

Staple the screen material, 2"x8", to cover up the ventilation holes on each end**.** This is done after painting .

A finished **summer ventilation box** ready to be placed on the hive.

Accessorizing for Winter

Accessorizing for winter for the colder temperate regions means cutting a hole in the screen for a winter feeder and making a bee quilt to go on top.

Cutting a hole in the screen to accommodate a Barnyard Bee top feeder.

Add the sugar and cover.

Take the 24" by 30" piece of the plastic screen material, fold it length wise and sew two of the open sides shut. Fill the bag with shavings 1/3 full. Sew the last opening shut. Shake to get rid of dust.

A finished **Winter Hive Ventilation Box**.

Beeyard Thoughts, Observations, and Updates

A Summer of washboarding behavior – Some wild guesses and assumptions?

We are told, but we cannot understand

I have a three-year-old grandson who has a slight, but cute, speech issue that he is expected to outgrow in just a few years. He speaks his own language that many cannot understand. He is very patient. He has little else to do other than repeat himself until someone – anyone – finally comprehends.

That is a lot like washboarding behavior in honey bees. The washboarding bees are telling beekeepers something over and over and over, but we beekeepers just can't understand. Heaven knows, many have tried. It would seem that the bees will perform this behavior until someone – anyone – does understand. *(Now that's clearly anthropomorphic. The bees are not performing this behavior for beekeepers, but beekeepers do want to know what is being said or done by these rocking bees.)*

We have been through all of this before

Yes, we have previously discussed this topic[1], and I do not mean to fixate on this behavior, but I personally find it very frustrating that the bees are right there – performing this behavior right before my eyes, letting me get very near them, and allowing me to watch and photograph them. Yet, I have no idea why they are doing this.

For you new beekeepers who are still learning all the bee ropes, washboarding behavior occurs when worker bees very nearly align themselves in discernible rows and rock to and fro with front legs raised. While rocking, the bees use their front legs in a quick quiver movement from side to side. Their tongue may or may not touch the surface of the hive. The behavior looks like some kind of line dance. No kidding.

On my web page, I would estimate that I have been given around 40-50 suggestions for what is happening. In my opinion, none have effectively answered the question – *what's happening here?*

What follows...

My comments that I present below are not proven facts nor or they formed into a testable hypothesis. My remarks are comments and observations that I present here based on the behaviors of my ten beehives in my one apiary. I made these observations during several Summers. I wish I could tell you that I had a thorough diary and bundles of records. Truth – I'm intrigued by washboard behavior – but not *that* intrigued.

When is this behavior generally performed?

This season – only – washboarding began sometime in mid-June and continues until this minute. Today is September 25, 2018. It has been raining for two days and is gently raining at this minute. The temperature is 66, totally overcast, and cool. I made this photograph today of the washboarding activity that was happening this morning. Compared to other years, this year's dancers, over the Summer, were particularly showy.

Figure 1. *Still a few washboarding bees on cool rainy day, September 25, 2018.*

How many workers perform the behavior?

In my beeyard, on my hives, the number of bees washboarding seems to be proportional to colony strength. Colonies may have the same amount of equipment, but a smaller population (due to previous swarming, queen productivity, or general health). The weaker colony will have (apparently) proportionally fewer bees performing the behavior.

Figure 2. *Four deep colony, abundant washboarders, August 8, 2018, 1:00p.m. (same hive box as figure 1, different perspective).*

[1]Bee Culture, August, 2016

Where does this behavior occur on or within the colony?

You know the drill – within my yard and using my colonies for casual observations, I have observed that bees only washboard (mainly) above colony openings. (See Figure 2) A few bees will usually be on the bottom edge of the entrance, but by far most will be above the entrance.

Other than those areas around hive openings, I have not seen *any* bees performing this behavior away from these areas.

Bees perform this behavior during warm, Summer nights. The numbers of bees involved in this evening activity seem to be fewer. Maybe it's the nightshift bees.

A question…

Note in Figure 2 and in other photos, that during Summer months, I generally push an upper deep back in order to provide an upper ventilation entrance. I provide about 3/8" inch for the opening. That means that I have a smaller opening at the back that is the reverse of the front. No bees washboard on the back. None-the-less there is a back opening. Why no behavior there? Next season, I will provide a 3/8" entrance there (resulting is a wider entrance at the front) to observe if the behavior occurs at the wider back entrance.

A second question…

I have clearly observed washboarding within an observation hive on the inside of the glass. The washboarding bees are not nearly as numerous – even scant, but they are clearly washboarding. Similar behavior, but somewhat different. I don't know why.

Figure 3. *Two washboarding bees within an observation hive. Note they are standing on four legs while using the front two in a waving motion.*[2]

Plastic hive equipment

Plastic hive equipment does not have many – if any wash boarders – on the hive front. Though I wrote above that the behavior was not shown very much below the entrance, plastic equipment with a deep plastic bottom board will have some washboarding bees. In general, on most types of plastic, the behavior is not shown.

A comment that has no particular place to be inserted is that bees do not use the upper opening as an entrance. Though heavily guarded and intensively wash boarded by workers, the upper opening is primarily used for ventilation. The occasional drone may use it to depart or return from flights.

Figure 4. *Entrance bees are mixed with washboarding bees below the entrance, but only a few bees are performing the behavior above the lower entrance.*

If you hear hoof beats, you know what to do . . .

To develop a rock-solid assumption, some of the measurements that I would need would be standardized colonies that have the same bee populations. Colonies would need to be in the same types of hive equipment. Individual bees would need to be marked to determine how long they perform the behavior – when they start and when they stop. Honey crops from performing bees would need to be excised to determine contents. Hive surfaces would need to be evaluated before and after the behavior has occurred for a measured time. Finally, I would need control colonies that were prevented from performing the behavior. All of these measurements would need replication.

Well, I'm not doing all of that. No way.

Drum roll . . . therefore, my casual guesses are . . . The reason bees do this behavior . . .

The bees are laying down a very thin layer of propolis from a thin liquid mixture held within their crop. They are doing this to protect or disguise any opening to the colony. I conjecture that the bees perform this activity each summer because (1) we frequently change hive equipment that subsequently changes openings and (2) the thin surface layer needs recharging.

Washboarding going on in an observation hive.

[2]Photo shot at night with flashlight as light source. Inside glass. Still photos captured from video. Unedited video footage at: https://youtu.be/M1t3UUHGV1I

The reason bees are mostly aligned in rows...

I would suggest that bees rock in rows because it is efficient to cover the area needing to be treated. It is a bit like searchers walking nearly shoulder to shoulder to each other when they search an area for clues to some malfeasance that has been previously committed. If bees did not organize themselves, areas would be randomly wash boarded. Energy and materials use would be used less efficiently.

The reason bees are in the head-down position . . .

The thin propolis liquid they are applying would respond to gravity and ever-so-slightly flow downward into the wood fibers. The leg movement is to spread the coating material into small fiber spaces while the tongue is applying the material. An analogy would be the application of paint onto a rough wooden surface using a paint sprayer. Very soon afterwards, a paint roller would be rolled over the wet, sprayed paint finish to work it into the wood fibers. Otherwise, the paint forms a surface film that is not embedded into wood fibers that could prematurely fail.

If needed, the bees can apply propolis globs and lay down a thick layer, but that would take a huge amount of effort to gather the resin, produce the propolis, and divert workers to the task. I wonder if that diversion would not decrease foraging efficiency? Many years ago, I found a lost colony that had been forced to repair the long degraded outer cover. They had done the job with repeated heavy propolis applications.

Figure 5. *Heavy propolis, applied over time, to improvise an outer cover for a neglected colony.*

A better solution would be to use a thin film that is essentially laid down much of the Summer over and again, until the film builds up to a protective barrier composed of thin, laminated layers. Applying gold leaf in multiple layers might be a comparison.

The photo of the abandoned nest shows bees' use of thin propolis applications rather than heavy wads of the material. I feel that the propolis shadow is the same that bees apply to the inside of wooded hive boxes. Why would it not be the same propolis material and procedure used near the entrance?

Figure 6. *In this abandoned nest, look at the use of thinned propolis as an ant barrier. Is this barrier similar to what bees are doing when they washboard?*[3]

An accidental water test

Last Summer, I was planting a Fall season pollinator garden. In order to gently water the young plants, I had a spray wand screwed on the hose end. It was a hot day and many of my colonies had large numbers of bees doing the rocking behavior. Not to harass the colonies, but to see how they would react to a gentle simulated rain shower, I used a high arch to let the gentle water fall on the hot bees working outside.

I was startled to see what was left when the working bees moved from the washboard area. A perfect outline or shadow of where they were working was plainly visible.

Most of my equipment is painted. As expected, the effects of this behavior do not show up on equipment that has been painted or stained. A second hive showed a similar outline.

Then, I went crazy wetting my hives..

When becoming wet, working bees would move into the colony. However, if bees were in the upper protected edge of the hand hold or sheltered beneath the outer cover rim, they continued to perform the behavior even as the artificial rain continue to fall. On my painted equipment, water would bead into obvious droplets whereas water would spread smoothly on hive painted surfaces that had not been wash board treated.

Upon drying, which happened very quickly, the bees were back on the job – rocking and weaving. Only about

[3]I made this photo (Figure 6) many years ago in Arizona. It is commonly said that the propolis barrier is to restrict ant invations. From the photo, I can't tell if the propolis shield is completely beneath the combs. If it is, I would speculate that the propolis layer is there to clean and prepare the stone for attaching combs to it. Don't you suspect that it would take more of a barrier to stop the persistence of ants? There I go again – guessing.

Figure 8. *A second unpainted hive body showing the outline of where bees were generally washboarding.*

30 minutes were needed for the bees to return to the work site. It was a hot day so the water evaporated quickly.

This rocking behavior is still a conundrum...

This bee behavior is a mystery still. The glaring problem with my assessment is that it is too simple. Nearly any bee lab could have a look at the residue and determine what components are there. Yet no one has reported it. (I may remember that a study did examine the washboard area and found nothing there. That is a foggy memory.)

In my colonies, where the bees are rocking, most are not where bees are departing and returning. At the upper opening, lots of bees are there, but they are guarding, fanning, and applying propolis along the edges and within the opening. Then there are the rocking bees, doing their thing. The reason I lean toward simple propolis usage is that it is actually visible as the Summer progresses.

Occam's Razor (*The Law of Parsimony*) is the problem-solving principle that the simplest solution tends to be the right one. One of the simplest answers would certainly be that the rocking bees are either masking or developing a barrier at the hive openings.

Figure 9. *The propolized hive front. This is the same hive front as shown in Figure 2.*

To the long-suffering...

To those who have gotten to this point, I am aware that I wrote about this in 2016. But you must know that since 2016, I have watched this behavior many spring and summer days. The bees are still doing it, and I'm still watching.

If you are inclined, look at a video piece that I uploaded years ago on this subject. The piece is my most watched video (20,000+). Many people have left comments. See what their ideas are. Due to my guesses here, I'm expecting to take some hits on my comments. I will keep you informed. **https://youtu.be/sxjc4tSKJFs** BC

H. L. Mencken **There is always an easy solution to every human problem—neat, plausible and wrong.** ***(Jim, Don't forget this.)***

Thank you,
Jim Tew

Dr. James E. Tew, State Specialist, Beekeeping, The Alabama Cooperative Extension System, Auburn University, Emeritus Faculty, Entomology, The Ohio State University, **Tewbee2@gmail.com; http://www.onetew.com; One Tew Bee** RSS Feed (**www.onetew.com/feed/); http://www.facebook.com/tewbee2;**@onetewbee

Is It A Coincidence That A Large Group Of Baboons Is Called A Congress?

Information – Good or Bad

Ann **Harman**

Words surround us in various ways all during our waking hours. Our brains get bombarded every day by words. Radio, television, newspapers, cell phones, emails, computers, books, and more! Is all of it useful? correct? important? It may or not be, depending on many factors. Some of the messages get discarded because we are not interested in the particular subject. However, if it has to do with honey bees, we'll stop and listen or read. Let's just look at the honey bee and beekeeping world for a while.

The news media encountered the Colony Collapse Disorder a number of years ago. That event started an interest in honey bees and the importance of doing pollination. That interest has remained, thus making bees good topics for articles in newspapers and magazines. An article in a large national one such as the *New York Times* may prompt an article in a small local newspaper. So you, a beekeeper known locally, may be asked to be interviewed. Here is where problems may occur.

The reporter may know nothing about honey bees but can think of questions to be asked. How good is your bee knowledge? If you are in your first or second year of beekeeping you may be uncertain about certain aspects of bees and even beekeeping itself. Are you prepared to say you really don't know the answer to a particular question? Do you know someone who could answer the question? If so, let the reporter know. Creating an answer may give readers an incorrect or misleading bit of information. For example, this was found in a small local-circulation newspaper: "...Inside their tiny bodies, honey bees combine pollen and nectar with water. Then they excrete the resulting honey into cells in their hive."

Is that what the beekeeper actually said? Or did the reporter jot it down wrong? We will never know.

Now look at the other side. As you are rattling along about the topic, the reporter is trying to keep up with you. Perhaps taking notes with pen and paper, perhaps recording your answers, maybe even using a laptop. It would be fair, from time to time, to ask the reporter what has been written down. There is no point in asking to see a newspaper article before it gets printed. Deadlines, remember? A newspaper has to be assembled, printed and delivered or emailed on time! Articles to appear in magazines usually have a more lenient time frame than newspapers. Sometimes you can read the article before it gets printed. Always ask if that is possible. If so, there is a chance that corrections can be made, if needed.

As a beekeeper, what would you do if you read that sentence? It does not seem fair to the honey bee, or to honey itself. And the information is actually quite wrong, to say nothing about the choice of words. How about a Letter to the Editor? If you have some credibility, such as being a Master Beekeeper, write a letter! Make it short, simple, easy to understand and to the point. Just give the correct information. Will that help? Yes! A Letter to the Editor, giving correct information, was sent and was printed in the next edition of the weekly newspaper. Now some of the newspaper readers have the correct information.

Beekeepers need to keep up to date on local information not only for their own knowledge but also just in case an opportunity arises for an interview. What is the highway department doing about planting bee-friendly flowers? Did the beekeepers in your club have a good Winter or did many colonies die? Both of these topics are appearing more frequently in the news. Another topic is pesticides and their effect on bees. Beekeepers in rural crop-farming areas are more apt to get pesticide questions than those keeping bees in towns and cities. The appearance of swarms in strange places will get attention in cities.

More and more Farmers' Markets are appearing each year in towns and villages. You have been selling your honey at one of them for several years. Have you visited any of the other markets recently to see if other beekeepers are selling honey and other hive products? You may know some of the beekeepers but perhaps not all of them. Here is an opportunity for an article in the local newspaper or in the regional farmers' newspaper. The appropriate time for such an article is just before the farmers' markets open for the season. You need to know if the newspapers would be interested in such an article. You also should ask the beekeepers if they are willing to be interviewed about their bees and their products.

If the beekeepers and the newspapers are willing and enthusiastic, now just what questions are you going to ask the beekeepers? Well, since you are one of those beekeepers what would you like to tell people? You have plenty of time between now and next season so start making a list of those questions. How many hives? Does the family participate? Plant sources, for the honey? Creamed honey, comb

honey? Candles? Keep the list handy because a great question will pop into your head at some point – write it down! Review the list from time to time and revise it as needed. Just keep in mind that you are not writing a book but a short, informative article.

Ask the beekeepers in your club if they have any bits and pieces of beekeeping "stuff" they would like to get rid of. Your club could have a Spring-Cleaning Sale, or an Autumn Cleanup Sale. It could be held on a Saturday morning in Spring, just right before "busy season" in the beeyards or in Autumn as everyone is putting equipment away for Winter. There's that box half-full of never-used two-pound bears that nobody wanted to buy (so you didn't fill any more). Someone in the club was moaning about a perfectly good, well-cared for box of thin surplus foundation, shallow, that was just taking up space on a shelf. There's Uncle Ned's assortment of unused hive tools – he kept buying different ones and didn't like any of them. Every beekeeper can find something not wanted that someone else really wants. Time to organize a sale!

That is when a sale notice needs to be prepared for circulation to all the members of the bee club. If it turns out to be a great quantity of "stuff" and especially if it includes something large like a three-frame tangential extractor, then the announcement could be sent to a neighboring club also. The sale notice should be only one page with a catch-attention title in big bold letters. TRASH TO TREASURE. BEEKEEPING BONANZA. Oh come on, you can think of better ones. Then on separate lines give day and date, time, place. List separately a few choice items. Then follow that with "and more!"

If you make the announcement with too much information it may look like "too much to read right now" and get set aside and forgotten. From experience, put at the bottom of the page, in smaller print but still easily read, the name and contact information (phone or email) of someone in the club willing to answer questions about the sale. Oh yes, you can get questions! "Are there any photos of the sale items?" "Can I come early to see if there's anything I want?" (Yes, those were just two real questions, out of more, for a real sale.) The information for the sale applies to any event that a beekeeping club would do. Once you set up the format you can easily change it for a picnic, a field day, or a bee event for the public.

If you wish to make your honey bee event open to the public, you may need to put in more information than if it is one just for your bee club members. Your members know where Beekeeper Burt's place is. Other people want something to put into their GPS. Is the event outdoors? If so, have you considered a rain date or an alternate place? No matter how clear you have made that information, someone may neglect to follow it. Is there a charge for your event? Or is it "donations appreciated?" So after you have composed your event notice, set it aside for a day or two – then review it again and make any changes or additions.

One thing to remember is that information submitted to a newspaper for an event may be cut by the editor to make it fit a space available. You probably will not be asked to shorten your information so some bits could be lost. Put the most important information first and do not use up space with entirely too big font size. If your information will appear more than once, it is possible that the lost information may appear.

You heard about a very interesting beekeeper who is a member of a nearby club. You would like to interview this beekeeper for your club's newsletter and also as a preview of giving a presentation to your club. Take a few days to jot down a list of questions you wish to ask. Some questions may actually appear during the interview from a comment the beekeeper made. Good – since your questions are at hand you can see where that question would be appropriate. If you have a chance, ask some of your club members what information they would like to know.

Now sit down with your list of questions. Are they all about beekeeping? Does the beekeeper have any interesting hobbies that have nothing to do with bees? As you go down your list plan to broaden the choice of topics. Interesting places lived or traveled in? Sports – or no sports. Participation or just favorite one to watch on TV? Now write your interview questions down. Always keep in mind that the topics could change or the arrangement of the list could change.

How will the interview be done? If the beekeeper lives within a reasonable distance you could arrange for a live one – at the beekeeper's, or in the beeyard, or at your home. Another way could be a series of emails back and forth. Although it takes more time with emails, it does work. Once you have the information you can compose your article. Make it very clear from the start that the person being interviewed will see the completed article before any publication of it. If something needs to be corrected, changed or deleted, it must be done before publication and have the OK of the person being interviewed.

You have occasionally thought about writing a bee or beekeeping article for publication – for *Bee Culture*, for a local magazine, perhaps for a farmer's newspaper. Would it get printed? Where to start! Well, what is the particular topic you want to write about? A local magazine might like an article about honey but not about how to capture a swarm. A farmer's newspaper might like an article about plants for bees but not about how to light a smoker. A beekeeping magazine could use something seasonal, about gadgets, about bear fences, about . . . possibly just about anything to do with bees and beekeeping. However, keep in mind – one article, one topic.

You need to inquire about length of article and also deadlines. If your topic is seasonal then deadlines are really important. Yes, you might be writing about early Spring flowers while seeing a foot of snow out your window. Photos to accompany your article could be important. Ask the editor about photos before sending them with your article. Use correct terms, especially for hives and other equipment. Always remember that the "audience" for an article could be not only the entire United States but also other countries. Go ahead – write that article. Yes, set it aside for a day. Then go back and read it over. Now is the time to make any changes, corrections and additions. Then submit it.

Whether it's a meeting announcement or an article, if it's about bees and beekeeping, someone will read it! BC

Glyphosate

Safe For Bees And Beekeepers?

Ross **Conrad**

As a beekeeper I used to make the mistake of blaming farmers and chemical researchers for our pesticide problems. However, over time I have learned that the real culprits for our pesticide woes are the pesticide manufacturers who are focused on profits over safety, and a fatally flawed government regulatory system.

Farmers put their trust in our governmental pesticide regulatory system and the salesman that pitch pesticides to them. The same is generally true when it comes to pesticide researchers. Sure there are the occasional bad actors that lie and cheat when it comes to chemical testing, but most testing labs and those who run them are above board, are committed, sincere folks who are doing their best to do things right within a system that can never determine true safety. Our pesticide regulatory system is designed in such a way that it guarantees no pesticide makes it to market with the complete testing and evaluation needed to ensure absolute safety when used according to the label simply because practically, it is impossible to do so. Instead, we get pesticide approval based upon a bunch of data that focuses on toxicity [e.g. the acute contact lethal dose that kills 50% (LD50), Residual Testing that kills no more than 25% (RT25), the Level of Concern (LOC) which represents the "acceptable" loss, etc.] all of which may appear to be a thorough evaluation but it isn't.

It is commonly argued that large amounts of testing goes into each product approval, but this point ignores the fact that much more testing than is currently required, would actually be needed before we can really know with certainty that a product is safe to use as directed. (see my article in *Bee Culture* February 2018).

Instead of demanding true safety, we accept a compromise of what is economically achievable and extrapolate to infer safety, rather than do what would be necessary in order to actually prove safety. The situation I describe is proven out by our history which is littered with chemical pesticides that were deemed "safe" until they caused so much harm, death and misery that they were subsequently removed from the marketplace. Most people are not aware of this situation, or simply choose to forget, and instead put way too much faith in our flawed pesticide regulatory process and the science that that is used to justify claims of safety.

While many beekeepers are focused on neonicotinoids, one pesticide that has not received enough attention in beekeeping circles is Roundup and its active ingredient glyphosate. Glyphosate in the form of Roundup is the most widely used herbicide in the world. (Benbrook 2016) Well-meaning researchers, regulators, beekeepers and members of the general public often mention glyphosate as an example of a pesticide that is mistakenly blamed as being unsafe. On closer inspection however, we see that the assertion that Roundup is safe is not supported by the evidence which continues to mount.

To be clear, there is strong research indicating that glyphosate is relatively benign and not carcinogentic (cancer causing) for people. There are also studies that indicate that glyphosate is not toxic to honey bees.

Part of the explanation offered that there is insufficient evidence to state glyphosate is carcinogenic is the fact that we humans do not absorb the chemical easily and we excrete it without metabolizing it. While this is true for glyphosate, the active ingredient in the herbicide Roundup, it is NOT true for the final formulation of Roundup that is sold to farmers and consumers world-wide, and this is what is creating confusion.

This distinction is important since researchers have long established that chemicals when combined can change and react differently. In fact, the synergistic properties of chemicals form the basis of chemistry. What we are seeing is growing evidence that strongly suggests that the 49.8% of inert ingredients that comprise the Roundup formulation, and includes 13% surfactants along with other chemicals, make the glyphosate it contains much more toxic and allows it to be absorbed much easier.

Honey Bee Impacts

While there are plenty of studies that indicate glyphosate is not acutely toxic to honey bees, research published in the Journal of Experimental Biology has shown that "honeybees exposure to levels of glyphosate commonly found in agricultural settings (*read: applied as Roundup*) impairs the cognitive capacities needed to retrieve and integrate spatial information for a successful return to the hive." (Balbuena et. al., 2015) This study also cites other studies that have found glyphosate can harm earthworms, fresh water snails, amphibians, and amphipods.

These findings have been

supported by additional research which found that "GLY at concentrations found in agro-ecosystems as a result of standard spraying can reduce sensitivity to nectar reward and impair associative learning in honey bees." (Herbert et.al., 2014)

These studies point to a common occurrence in the world of pesticides, that the focus on toxicity by our pesticide regulatory system overlooks the long-term and sub-lethal impacts that can weaken bees without killing them outright and make them more vulnerable to nutritional stress, pathogens and pests.

One of the reasons for Round-up's commercial success is its alleged low toxicity for humans and animals. In actual fact, even before the International Agency for Research on Cancer (IARC) classified the product as 'probably carcinogenic,' many independent studies had demonstrated the harm it caused to human and animal health: neurotoxicity, DNA damage, disorders of the endocrine system and so on. Neither Roundup nor other glyphosate-based herbicides have been tested long enough to actually prove their safety for human or honey bee health.

Human Impacts

When it comes to the harmful effects of Roundup on human health, the evidence is much stronger and clearer. Last year, 17 of the world's top cancer researchers unanimously voted to elevate the cancer profile of glyphosate on behalf of the World Health Organization. The WHO's International Agency for Research on Cancer (IARC) now classifies the weed-killer as "probably carcinogenic to humans" after the panel of experts reviewed all of the publicly available research.

The IARC report concluded that the cancers most associated with glyphosate exposure through Roundup are non-Hodgkin lymphoma and other hematopoietic cancers, including lymphocytic lymphoma/ chronic lymphocytic leukemia, B-cell lymphoma and multiple myeloma. The report also found that glyphosate exposure caused DNA and chromosomal damage in human cells, as well as genotoxic, hormonal and enzymatic effects in mammals. Since the action by the WHO, the state of California has listed glyphosate as a known human carcinogen under its Prop 65 law, despite court action by Monsanto the manufacturer of Roundup.

In September 2016, the U.S. EPA office of pesticide programs published a "Glyphosate Issue Paper: Evaluation of Carcinogenic Potential" that stated glyphosate was not a cancer hazard. It is important to note that in this paper, the EPA reviewed studies that looked at the health impacts of the chemical glyphosate in isolation, while the IARC based their classification of glyphosate as "probably carcinogenic to humans" on the final formulation of Roundup.

There are also documents that have been unsealed by a federal judge that suggest Monsanto worked directly with federal regulators to hide the health risks of and manipulate the science supporting the safety of Roundup. The documents reveal that Monsanto pressured EPA officials to not publicly release information on the cancer risks of glyphosate in Roundup. The company also ghostwrote research for the EPA and worked with a senior official at the agency to quash a federal review of the chemical. (Hakim 2017)

Meanwhile, industry and government regulators confuse the issue in the minds of many by referring to the studies that indicate the active ingredient, glyphosate, as relatively safe, while ignoring the damning evidence of the complete Roundup formulation sold in the marketplace. It has become a common practice for industries that rely on harmful products for their profits, to manufacture doubt in people's minds about the potential harm of their wares as part of an overall strategy to keep sales flowing for as long as possible.

The clear indications of potential harm that the studies on Roundup suggest become all the more alarming with the recent announcement by the U.S. Food and Drug Administration that FDA researchers found glyphosate residues of 653 parts per billion (ppb) in honey samples – an amount that's more than 10 times the European limit of 50 ppb.

Other honey samples tested contained residues ranging from 20 ppb to 123 ppb. Sadly, in an internal email obtained through a Freedom of Information Act request, another FDA researcher complained that no honey (even "organic mountain honey") appeared to be free of glyphosate, as reported by The Huffington Post: *"It is difficult to find blank honey that does not contain residue. I collect about 10 samples of honey in the market and they all contain glyphosate."*

The situation is similar for most of the grain grown in the U.S. It has become common for farmers to use Roundup to kill and dry down crops immediately *prior* to harvesting in order to reduce crop dry-off time and increase profitability. As a result the levels of glyphosate residue found in wheat, soy and other crops grown with Roundup has increased tremendously. Testing has found Glyphosate residues in **93% of the 131 urine samples** from Americans tested at an average level of 3.096 parts per billion (PPB). Children had the highest levels with an average of 3.586 PPB. (Adams, et al. 2016) Unfortunately, most consumers are not aware of the glyphosate that is appearing in their food at higher and higher rates.

Monsanto's Secrets Revealed

Earlier this year Monsanto appeared in court to defend Roundup against charges that it causes cancer. The case *Dewayne Johnson v. Monsanto* hinged on the fact that Mr. Johnson, who used Roundup almost daily in his job, contracted non-Hodgkin lymphoma. In August a jury looked at all the evidence and found that Monsanto was not only guilty of making and selling the

product that caused Mr. Johnson's cancer, but they also found clear indication that the company knew its product could cause cancer and that the company intentionally hid that information from Johnson and the public. In other words, they knew what they were doing was wrong, but they continued with reckless disregard for human life. Monsanto was fined $289 million as a result of its actions.

Leaving out pertinent information and not telling the whole truth is the equivalent of lying. Many people get away with this form of deception due to the extreme difficulty of proving that an omission was intentional and not simply a matter of ignorance. In Mr. Johnson's case, the jury had enough evidence to see through the deception and justice was served. Keep all this in mind the next time somebody says the glyphosate is safe, or before deciding to use Roundup to control unwanted plants, like poison ivy, in the bee yard. BC

Ross Conrad is author of Natural Beekeeping: Organic Approaches to Modern Apiculture, *Revised and Expanded 2nd Edition.*

References:

Adams, A., Friesen, M., Olson, A., Gerona, R., *Biomonitoring of glyphosate across the United States in urine and tap water using high-fidelity LC-MS/MS method.* University of San Francisco, San Francisco, CA. UCSF-UC-Berkeley Joint Medical Program, Berkeley, CA 2016

Balbuena, M.S, Tison, L, Hahn. M.L, Greggers, U, Menzel, R, Farina. W.M., *Effects of Sublethal doses of glyphosate on honey bee navigation*, Journal of Experimental Biology (2015) 218: 2799-2805; doi: 10.1242/jeb.117291

Benbrook, Charles, M., *Trends in glyphosate herbicide use in the United States and globally*, Environmental Sciences Europe Bridging Science and Regulation at the Regional and European Level (2016) 28:3 DOI: 10.1186/s12302-016-0070-0

Hakim, D., *Monsanto Weed Killer Roundup Faces New Doubt on Safety in Unsealed Documents*, The New York Times, March 14, 2017 Monsanto Weed Killer Roundup Faces New Doubts on Safety in Unsealed Documents

Herbert, L.T, Vázquez, D.E., Arenas, A., Farina, W.M, *Effects of field-realistic doses of glyphosate on honeybee appetitive behaviour*, Journal of Experimental Biology (2014) 217: 34573464; doi: 10.1242/jeb.109520

SYNTHETIC BIOLOGY

An Advantageous Approach To Combat Bee Diseases

The iGEM "Tec-Chihuahua" Team

Honey. Floral and sweet honey. Fresh as fruits or aged as wine. Just like bees, beekeepers want to give the world a taste of this honey. Honey that depends not only on chemical processes or industrial protocols but also its essence. The goal is that its color, smell and consistency can be appreciated and accessible for everyone.

Despite the effort that beekeepers do to obtain the best product, is known that they are exposed to several microorganisms that could affect the honey´s quality. Thanks to new scientific technologies, it exists the possibility to overcome these pathological microorganisms without making the environment go out of control called synthetic biology.

Firstly, what is synthetic biology? This newly emerging field of genetic engineering gives living organisms new functions for them to obtain positive qualities.

As bee diseases roam wild and flowering rates lessen, treatment and care costs limit the growth of beekeeping companies. These companies strive to become profitable, that's why beekeeping needs the help of scientific and technological advances to truly achieve its potential. Chief among these advances is synthetic biology.

For example, master's students from Pierre and Marie Curie University designed a detection system for several pathogens in order to determine beehive´s health. These parameters can identify the bee pathogen *Paenibacillus larvae*, which is responsible for one of the most terrible diseases of beekeeping: American foulbrood. For this, they modified the genetic material of the bacterium *Bacillus subtilis* to express a pigment (not present under normal conditions) every time *P. larvae* is present, thus indicating the presence of this disease.

One of the biggest mysteries in beekeeping is the Colony Collapse Disorder (CCD), a phenomenon characterized by the rapid loss of adult bees that never return to the beehive. Students at the Missouri University of Science and Technology suggest that bacteria could be genetically modified to produce fumagillin, an antifungal agent commonly used to kill *Nosema ceranae*. They discovered that this would be a viable solution for beekeepers, instead of constantly applying antibiotics to the beehives.

The CCD is of great importance at a global level since it is related to large economic losses and a decrease in the number of beehives of 30% per year (vanEngelsdorp et.al Hayes Jr, M. Underwood, and Pettis, 2008). The true cause of the CCD is uncertain, this because it is an infectious synergy of multiple factors.

One of the principal causes are nutritional complications. Due to the climate change, sometimes there are not enough flowers or pollen for their proper nutrition. It is understood that *Varroa* mites can cause the collapse of honey bee colonies as it states below.

Varroa mite infestation reduces the expression of genes encoding proteins related to bee immunity, which eventually leads to a low cellular and humoral immune response. Therefore, bee colonies can become more susceptible to various diseases such as Nosemosis, European Foulbrood, and American Foulbrood.

The iGEM "Tec-Chihuahua" team, a group of 13 young entrepreneurs of the career of Biotechnology Engineering in Mexico, is currently developing a product using synthetic biology in order to produce these proteins able to kill and inhibit bacteria. This alternative method is posed to eliminate American and European Foulbrood from the beehives by giving more defenses to bee larvae, without altering the natural genomic of the bee or causing any negative effect on them or their products.

Scientists strongly believe the diffusion of this new science branch can improve life qualities and lead the world to a new technological era, that's why for the scientific community is a priority to spread knowledge to beekeepers or people related in this business. We want to show and let people know that science is not only creating new technological advances for healthcare or for proper interests, but also to agriculture, beekeeping and the environment.

The scientific community wants to create responsible and informed citizens, who can make and defend their point of view having great information. We are concerned about the future of beekeeping, and the best we can do is try to solve problems affecting this sector using something we are passionate about, synthetic biology.

Bees on the Food and Development Research Center (for its acronym in Spanish "CIAD") in Cuauhtémoc, Chihuahua, Mexico. BC

References

Team:UPMC-Paris/Project/overview - 2016.igem.org. (2018). 2016.igem.org. Retrieved 26 July 2018, from **http://2016.igem.org/Team:UPMC-Paris/Project/overview**

vanEngelsdorp, D., Hayes, J., Underwood, R., & Pettis, J. (2008). A Survey of Honey Bee Colony Losses in the U.S., Fall 2007 to Spring 2008. Plos ONE, 3(12), e4071. doi:10.1371/journal.pone.0004071

Cornman, R., Tarpy, D., Chen, Y., Jeffreys, L., Lopez, D., & Pettis, J. et al. (2012). Pathogen Webs in Collapsing Honey Bee Colonies. Plos ONE, 7(8), e43562. doi:10.1371/journal.pone.0043562

The Useful And Versatile Castor Bean Plant

Connie **Krochmal**

A number of oilseed crops happen to be good plants for bees, including the castor bean (*Ricinus communis).* Reportedly native to Africa and possibly Asia, this species now occurs in most areas of the globe.

Also known as castor bean plant, it is often grown as an ornamental. The bold, showy, shrubby plant lends a tropical look to the landscape. Requiring minimal care, it is suitable for all regions of the country.

Related to the poinsettia, this is a member of the spurge family. Normally in these columns I alternate between woody and herbaceous plants. However, the castor bean can be either one, depending on the climate. In colder areas, the plant can be treated as an annual. This is hardy in zones eight and higher.

Castor bean has naturalized in many areas of the Old and New World, including some regions of America. It grows wild in the U.S. Virgin Islands and Puerto Rico. The plant is more likely to self sow in warm climates.

This species has escaped locally in waste places in some states, including California, Utah, Arizona, Texas, Kansas, Missouri, Tennessee, Illinois, Ohio, Michigan, Pennsylvania, New York, Massachusetts, and New Hampshire. In addition, it can sometimes be found in parts of the South, the Southeast, and the Atlantic regions mostly from Louisiana northward to Virginia.

Description of Castor Bean

In areas with short growing seasons, castor beans are six to eight feet in height, depending on the variety. Elsewhere, this can be a tender perennial that reaches fifteen feet in a single growing season. In tropical regions, it is a woody evergreen shrub or tree ultimately growing 40 feet tall. The species is mostly deciduous to semi-evergreen for it is damaged by even the slightest frost.

The large, coarse looking plant features a sparsely branched, stout, smooth stem that is generally light brown to greenish with a whitish bloom. In some cases, this can be red. However, the color of the stem and leaf can vary widely from one variety to another. In the tropics, the stem can reach four inches in diameter.

Castor bean has stout, rounded, toothed petioles, up to 1½ feet in length, with greenish-white margins. Mostly alternate, the large, toothed prominently veined, palmate foliage is quite large, ranging from 1¼ to four feet across. It typically contains five to eleven deep lobes.

Castor bean blossom.

The leaf color can vary considerably. These can be green, maroon, purplish-bronze, reddish-purple, purplish-black, or dark metallic, according to the variety. Roughly star shaped, the pungent smelling leaves develop very prominent greenish-yellow to white veins.

Those plants bearing green leaves will generally produce green fruit pods, while the red podded ones appear on red-leaved plants. The underside of the foliage is generally lighter green.

Typically in colder climates, castor beans bear flowers from July through October, depending on the planting time. In Texas and other warm regions where this survives the Winter, flowering can begin as early as March or April. Castor bean often blooms year-round in the tropics.

The seed pods are much more flamboyant than the blossoms. Lacking petals, the small flowers form dense, crowded clusters or panicles that can be one to two feet in length. These contain numerous, crowded, short stalked blooms.

Though generally terminal, the flowers can occasionally arise from the leaf axils. Possible colors are yellow, whitish, greenish, or reddish-brown.

The male blossoms emerge mostly towards the base of the flower cluster slightly earlier than the females. These feature a light green calyx and three to five lobes, numerous pale yellow anthers, and lots of crowded, much branched, fluffy, conspicuous creamy stamens.

The greenish female flowers appear on the upper portions of the flower clusters. Only ¼ to ½ inch in length, these have three to five lobes, a light green calyx, a spiny, light green ovary, and plume-like, three bilobed, brownish-red styles.

The burr-like, trilobed, castor bean pod is a large, soft, spiny capsule. Either smooth or shiny, these are elliptic and ¾ inch in length. They split when mature.

The species generally bears greenish-white pods that ripen to brown. Some varieties feature red or pink pods.

The Latin genus name refers to the tick-like appearance of the seeds. Often mottled, the oily, rounded, glossy seeds can be ovoid or ellipsoid.

These can reach ½ to 5/8 inch in length, according to the variety. The seeds display assorted shades from silver or brownish-gray to brownish-red. One end has a prominent white dot. Some varieties produce seeds with spots or streaks.

KIM FLOTTUM

In Business with Bees

How to Expand, Sell, and Market Honey Bee Products and Services Including Pollination, Bees and Queens, Beeswax, Honey, and More

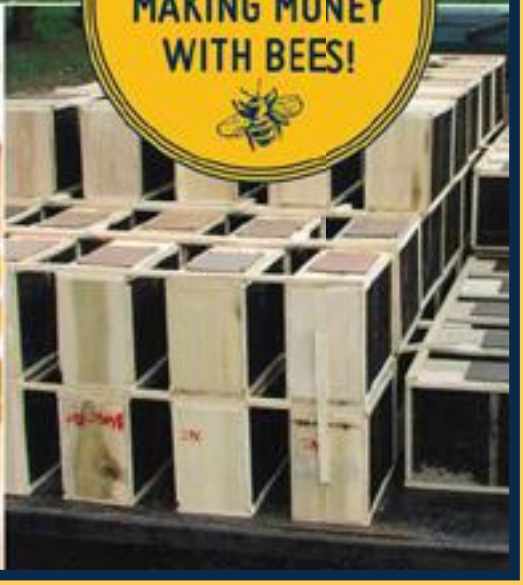
$26

Due out in September

Available at

www.beeculture.com

PROVEN STRATEGIES FOR MAKING MONEY WITH BEES!



Bee Value of Castor Bean

Castor bean blossoms are eagerly sought by bees. The plants produce lots of yellow pollen. A South American study found that when the pollen comprises more than 10% of the bees' diet that they tend to have shorter life spans.

Castor beans can provide a honey surplus when enough of the plants are available. There appears to be some disagreement as to which plant parts are releasing the nectar. Some bee experts report it arises from extrafloral nectaries located at the base of the leaves. In addition, there are also nectaries on the leaf stalks and stems as well.

Bees also appear to collect nectar from the young seed pods. This is described as being liquid early in the morning and tending to harden as the day progresses, which is often the case with some sources of honeydew.

Growing Castor Beans

Easy to grow from seed, castor bean is most widely cultivated in tropical regions. This sun loving species generally needs a growing season of 90 to 150 days, according to the variety.

As ornamentals, castor beans are sometimes planted as an annual hedge or screen. Shorter varieties are suitable for large containers. Some gardeners grow this plant to repel moles although there is scant evidence that it is an effective deterrent.

The seeds can be direct sown an inch deep after the danger of frost is past. In colder areas, castor beans can be started indoors six to eight weeks before the last expected frost. Since these resent transplanting, use large peat pots if sowing indoors.

For best results, soak the seeds overnight before planting. Take steps to ensure that children and pets won't come into contact with the soaking seeds as these are poisonous.

Often, the seeds will sprout within a week to two weeks. However, in some cases they can take longer. These have a germination rate of about 85%. They sprout best when the temperature is a minimum of 69°F.

Generally, castor beans should be spaced three to five feet apart, depending on the variety. The plants do best in a rich, well drained, moist soil. Suited to sandy and clay loams and most other soil types, these dislike constantly wet conditions.

Although the plant isn't drought tolerant, it does reasonably well in a dry soil. Fertilizer can be added when preparing the soil. For poor soils, an additional application of fertilizer during mid-Summer is helpful. Taller varieties of castor beans sometimes benefit from staking for they can blow over in areas that are particularly windy.

Since these plants are known to naturalize, beekeepers can prevent this by removing the seed pods before they split. Don't allow the seeds to fall on the ground. Remove these from the plant, and discard them in the household trash rather than in the compost bin.

A number of castor bean varieties are listed in seed catalogs, such as those of Baker Creek, Select Seeds, J.L. Hudson, Jung Seed, Richters, and Thompson and Morgan. Some varieties that are available include the following.

Zanzibarensis is an heirloom variety dating to at least the 1870s. This is by far the tallest – 15 feet. The thick green stems are covered with a violet or white bloom.

Green castor bean.

This variety also bears some of the largest foliage – 2½ to four feet across. Typically, it features large, white veined leaves. Mostly green, these are sometimes bright red or bronze.

Originating in the Victorian Era, New Zealand Purple castor bean grows to eight feet in height. This variety is named for the deep purple foliage, stems, and the purple seed pods.

There appears to be various strains of Carmencita castor bean. This dwarf, early flowering variety is only five feet tall or so. The stems are red.

The leaf color varies according to the strain. When Carmencita seeds first sprout, the seedlings are initially green, changing color as they mature. Possible leaf colors include green, maroon, brownish-purple, and chocolate brown. The leaf veins are red or burgundy.

Opening from vivid red flower buds, Carmencita flowers are typically red although they're sometimes pink or orange. The seed pods are generally bright red with the exception being Carmencita Pink, which bears lovely pink pods.

Sanguineus castor bean grows from eight to 10 feet in height. This heirloom, large seeded variety has been

Red castor bean.

Castor bean ripe fruit.

around since the 1940s. It bears very large, deep red leaves, bronze to blood red stems, and red seed pods.

The Toxic Castor Bean

This entire plant is considered poisonous with one of its three poisonous substances being ricin. Typical symptoms upon consuming the raw seeds are diarrhea, vomiting, and abdominal pain. In a few cases, victims have suffered kidney or liver problems. Neurological symptoms can occur when the seed capsules or leaves are eaten.

While castor bean oil is nontoxic, the raw seeds are harmful. Children appear to find the large, colorful, attractive, bean-like seeds very tempting. However, few fatalities have been reported, especially since the 1940s. Some deaths of adults were apparently suicides.

Eating as little as two seeds can result in poisoning symptoms. George E. Burrows, author of "Toxic Plants of North America," concludes that "the dangers of the seeds are often overstated." Assuming proper medical care is provided, poisoning victims typically recover after eating the seeds. Yet, there can be some variation in the severity of the symptoms, based on the individual's response, the quantity consumed, and whether the seeds were ground or whole with the former being much more toxic.

A number of animal species has experienced poisoning symptoms from castor beans, which usually isn't fatal. Those affected have included poultry, goats, sheep, cattle, pigs, rabbits, horses, and household pets.

Contact with the leaves and seeds can cause a skin rash in some individuals. This can be avoided by wearing long sleeves, pants, and rubber gloves when working around the plants.

The Useful Castor Bean

This plant has been used as a source of insecticide. Despite that, the leaves have been fed to silkworms, which appear to be immune to the toxic substances the plant contains. The stem pulp has been made into paper. The pomace from the seeds is used as a manure/fertilizer.

The seeds contain about 50% oil by weight. This oil has long been used for medicinal purposes – mainly as a laxative. In addition, it shows up in the manufacture of various products. These include lubricants, soaps, lamp oil, hair and leather dressings, candles, cosmetics, plastics, textiles, rubber, linoleum, paint, varnishes and other finishes, ink, coolants, oilcloth, ointments, waxes, and polishes.

In some cases, the oil is used as a flavoring for certain foods, such as baked goods, candy, frozen desserts, and drinks. It is also added to butter. In Nigeria, the fermented seeds are eaten cooked in stews and soups.

History of the Castor Bean

Castor bean has been cultivated since 7000 B.C. or so. The seeds have been found in ancient Egyptian tombs. The ancient Egyptians used the oil for lamps and for certain medicinal purposes.

This species was introduced to Europe around 1548 from the East Indies. In Spanish-speaking nations, the plant was called Palma Christa during the Middle Ages. This was widely grown in Victorian flower gardens. European colonists brought the seeds to the New World.

In the early 1900s, castor bean was widely grown as an oilseed crop in Illinois and Missouri. It yielded 20 bushels of seeds per acre, which resulted in about 500,000 gallons of castor oil annually. BC

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

A Closer Look

Basic Honey Bee Biology

X219

$15.00

www.beeculture.com

274 pages, color

Clarence H. Collison

GLEANINGS

NOVEMBER 2018 • ALL THE NEWS THAT FITS

OBITUARIES

Brazilian entomologist **Warwick Estevam Kerr** died on September 15 in São Paulo at age 96. Kerr leaves behind a complicated legacy, on the one hand maligned for the introduction of aggressive Africanized bees in the Americas and on the other revered in his homeland as a humanitarian.

Born on September 9, 1922 in São Paulo, Kerr was originally trained as a plant breeder at the Luiz de Queiroz College of Agriculture (ESALQ) of the University of São Paulo. His PhD was on a Brazilian native stingless bee species, and after graduating in 1947, he continued his work on those bees until he was awarded a fellowship from the Rockefeller Foundation in 1951 to work at Colombia University with geneticists Theodosius Dobzhansky and Sewall Wright. Upon returning to ESALQ in 1954 and until he left the institution in 1958 to start a biology department at the State University of São Paulo, Kerr was laying the foundations for his future contributions to the Brazilian agronomy.

During this time, he was in search of more-productive pollinators because the European bees that were often imported into Brazil from Portugal were not good enough in the Brazilian environment. This led Kerr to Africa. He traveled to Tanzania and South Africa in 1956 and brought back 51 queens of the aggressive African honey bees to cross them with European bees in the hopes that the hybrids would be better honey producers. But in 1957 about 26 queens of the aggressive African bees escaped, mated with European bees out in the wild, and produced aggressive offspring.

The Africanized bees, dubbed killer bees, caused problems as they crossed into Central and North America over the following decades, killing hundreds of people.

Kerr was upset and felt responsible, so he began to study the behavior of these bees to better manage them at the State University of São Paulo, where he began coaching beekeepers to manage these bees.

Africanized bees were a key to Brazil's improved agriculture and honey production since these are naturally resistant to varroa mites that often clear colonies of European bees, beekeepers in Brazil nowadays use only Africanized bees.

Kerr was also known as a humanitarian, boldly calling out the political and civil violence committed by soldiers when Brazil was under military rule during mid-20th century. For instance, he was once arrested for his opposition to the military soldiers who raped a Brazilian activist nun.

People in Brazil talk more about his contribution to Brazil than his Africanized bees.

Over the course of his career, Kerr was the first scientific director of the São Paulo State Research Foundation (FAPESP), the director of the Amazon National Research Institute (INPA), and rector of the State University of Maranhão (UEMA). He founded the department of biology in the Faculty of Philosophy, Science and Literature in the State University of São Paulo at Rio Claro, of medicine at the University of São Paulo at Ribeirão Preto, and of biology in the Federal University of Maranhão.

John "Jack" T. Thomas

Jack was almost 82 years young when he passed away after a hard fought battle with pancreatic cancer. He lived a life of entrepreneurship, with a passion for learning and curiosity.

He was born September 27, 1936 in Northeast Minneapolis and attended DE LaSalle High School. Jack spent three years as an intelligence officer in Taiwan in the late 50s. He attended the University of Minnesota and Mankato State University. The field of engineering and an air hydraulics business filled the following years.

In 1972 Jack moved to Mann Lake, near Hackensack, to live in a 100 year old log cabin where he had spent many childhood summer hours.

Mann Lake Ltd., a commercial beekeeping manufacturing company, was co-founded by Jack and wife, Betty in 1984. The hobby business started in their garage on Mann Lake; has grown to an international company, employing hundreds of individuals in Hackensack and at the U.S. branch locations. Jack's goal was to make people smile as he walked through the facilities. He was an icon of the industry. He innovated products and techniques that made keeping bees easier. Jack and Mann Lake have been recognized by the industry for the many contributions made.

Jack and Betty have traveled throughout the world, but there was never a place better than home. Jack spent many Summers enjoying his antique boats, a 1934 runabout Gar Wood and a 1915 Fay & Bowen motor-launch. They have been donated to the Maritime Museum in Alexandria, MN so others may enjoy these rare boats.

Animals have always been a part of Jack and Betty's life. In 2012 they decided to work towards building an animal shelter. They co-founded Paws and Claws Rescue & Resort, just south of Hackensack, that opened its doors in 2017. Jack felt that it was important to give back to the community he lived in.

Jack touched many lives in many ways, he is survived by his wife, Betty, and their three feline companions. Jack said many times that "when he died, he wanted to come back as a cat, taken care of by Betty."

Any memorials should go to Paws and Claws Rescue & Resort, P.O. Box 175, Hackensack, MN 56452, Attn: Jack. Memorials will go towards establishing a service dog program using candidate rescue animals that will aid Veterans with PTSD. This was very close to Jack's heart as he was a disabled Veteran.

CALENDAR

♦INTERNATIONAL♦

Cuba Beekeepers Tour 2018 will be November 10-18.

Featured will be visits to apiaries, queen rearing, processing plants, research centers and more.

For information contact Benita Lubic CTC, President, Transeair Travel LLC, 2813 McKinley Place NW, Wash, DC; 202.362.6100, 202.362.7411 Fax; **blubic@aol.com**

♦ARIZONA♦

The American Bee Research Conference (the annual conference of the AAPA) will be held in conjunction with **The American Honey Producers Association Conference** at the DoubleTree by Hilton in Tempe, 2100 South Priest Drive, January 9-12 .

For information **www.americanhoneyproducers.org**.

♦CALIFORNIA♦

California State Beekeepers Association will hold their annual convention November 13-15 at Harrah's Resort in Funner.

Visit **www. californiastatebeekeepers.com**.

♦CONNECTICUT♦

Southern New England Beekeepers' Assembly will be November 17 at Groton Inn, Groton, CT. Registration is $55, late registration, $75.

Speakers are Jay Evans, Rebecca Masterman and Larry Connor.

For information and to register visit **www.sneba.com**.

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

Speakers include November 27, Bill Hesbach.

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

♦LOUISIANA♦

Louisiana Beekeepers Association will hold its 57th Annual Convention at the West-Cal Events Center, 401 Arena Road, Sulphur, December 6-8.

Speakers include Randy Oliver, Juliana Rangel, Pierre Lau and others.

For information and to register visit **www.labeekeepers.org** or contact Jennifer Brown, 601.493.3447.

♦MASSACHUSETTS♦

Mass Bee Fall Meeting will be November 17 in Bristol County.

Speakers are Jamie Ellis and Sam Ramsey.

For information visit **www.massbee.com**.

♦NEW YORK♦

Empire State Honey Producers Association Fall Meeting – ESHPA 150th Anniversary – will be November 1-3 at the Hilton Embassy Suites-Destiny USA, Syracure.

Speakers are Jay Evans, Diana Cox-Foster, Richard Ball, Emma Mullen, Scott McArt, Dennis vanEngelsdorp.

For more information and to register visit **ESHPA.org** or contact Angel Conway, 315.263.7501.

♦OHIO♦

Lorain County Beekeepers, How To Collect, Process, Clean and Store Propolis, November 9, presented by Jeannie Saum, at Life Church, Grafton. Meeting starts at 7:00 p.m.

For information **www.loraincountybeekeepers.org.**

♦PENNSYLVANIA♦

Northwest Pennsylvania Beekeepers Association will hold their monthly meeting November 17, 10:00 a.m. at Edinboro University, R. Benjamin Wiley Arts & Science Center, 200 Cooper Circle, Edinboro.

The meeting is free and open to the public.

♦SOUTH CAROLINA♦

The american Beekeeping Federation Conference and Tradeshow ill be held January 8-12 at the Sheraton Myrtle Beach Convention Center Hotel in Myrtle Beach.

For details and to register please visit **www.abfnet.org**.

♦TENNESSEE♦

Honey Convention March 21-23 at Fountainhead College of Technology, 3203 Tazewell Pike, Knoxville.

For more information and to register visit **www.honeyconvention.com**.

Display Advertisers

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

That redheaded Tina got in a little over her head when she volunteered to re-structure the Colorado State Beekeepers Association (CSBA) Master Beekeeper program. Other states run big-budget programs through their universities, but we don't get a nickel from the state of Colorado. Tina quickly learned how challenging it can be to set up a comprehensive beekeeping instruction program on a shoestring. "I'm stressed out and losing weight," she confided.

"Well, take it easy, would you?" I said. "You're no good to me dead."

You have to keep things in perspective. But as president of the venerable Colorado Beekeepers, I appreciate Tina's never-flagging efforts. She hangs on like a pit bull. "I never, never give up!" she defiantly proclaimed.

CSBA budgeted $1,000 to send Tina to the Western Apiculture Society meeting in Boise in August so she could rub shoulders with a bunch of master beekeeper gurus. When we approved the money, I warned the board that Tina could be cheap. She showed us. She didn't even rent a room! She stayed with local beekeepers, drove, not flew, from Durango in her '94 Volvo wagon. Her total expenditures for her five-day adventure: registration, $175; gas, $246; food, $100; total $521. I am not making this up.

Mere minutes ago, as I sat here banging out his poor epistle, the gal Marilyn came rushing in. "Quick, get your gun!" she cried. The cutest mother skunk got into our hen house and chomped Marilyn's four three-week-old chicks. You could see one tiny set of chick legs back up in the corner where the skunk had trapped herself. "I can't watch," Marilyn said.

Nobody tells me anything. Out of the blue, Marilyn just bought a used food trailer, from which she intends to sell coffee and breakfast pastries. I had no idea, until some woman called wondering when Marilyn was going to pick up her purchase. We went over for a look this morning. Once we get some air in the tires and find the right ball hitch, we can tow it to Marilyn's house. The trailer has dainty little alpine flowers on it painted by the former owner's Polish wife. It needs some TLC. Marilyn has a business plan, sort of. I'm trying to be a good sport.

Speaking of business plans, mine took a blast of number four buckshot when I got cut off from sending my bees to the California almonds. For the past few years I've shipped bees to California in November with Paul's and Derrick's. The bees spend the winter out there and go into the almonds in February. It wouldn't be cost effective for me to hire my own truck for 100 colonies when a semi hauls 464. In the past, Paul tucked me under his wing and let me share expenses on one of his loads. Once the little darlings got dropped off in the Land of Milk and Honey, Derrick took charge, and I got to take the winter off. My colonies returned in March, generally full of bitter almond honey and bearing a nice paycheck. Nothing like kicking off a new season with some financial capital and colonies begging to be split!

I got sideways with the bee broker in California, a gentleman responsible for leasing thousands of hives to almond growers. He arranges contracts with the growers and tells Derrick where to put bees and how many. So the broker is the kingpin. I'm a bit actor in this huge production. Or was, because the broker recently informed me that my bees are no longer welcome in his operation.

It wasn't the bees' fault. I shipped strong, healthy hives. This had everything to do with bee politics and maybe a touch of lingering bad blood. That's all I'm going to say about that.

I've known the broker for 25 years. Until recently, we got along fine, or at least I thought we did. But now that my little darlings are *apis non grata*, what's a poor sideliner to do? Even if I found another broker interested in dealing with 100 colonies, I'd still have to somehow get them to California.

They say one door closes, while another opens. There are a thousand ways to make money with bees. I can over-winter colonies here in Colorado, but in March, Colorado bees don't look like their cousins just back from California, bustin' out of their boxes and getting ready to swarm. I've always been able to cover my annual losses with California Spring splits.

Seventy might be the new 50, and I suppose it could be, if you retired, took long walks in the park with your sweetheart, rode your bicycle and faithfully attended yoga class. Lifting heavy objects like brood supers is not a recommended senior activity. Maybe at 71 it's time for this beekeeper to cut back and slow down. I could sell some bees, and then they'd be somebody else's problem. What's the point of charging full speed into a brick wall? One serious back injury, and I'd be done. Maybe getting eighty-sixed from the almonds is a wakeup call. The Good Lord works in mysterious ways!

As it stands, my options are wide open. I'm just not sure what they are.

Ed **Colby**

Eighty-Sixed In The Almonds

Blue Sky bee supply®

WINTER PATTIES

#MB-WP $3.75/Patty
#MB-WP40LB $58.90/40lb box
For those colonies running light on stores and those needing to feed in emergency situations.

WINTER HIVE WRAP with INNER PAD

#644- $22.95

PROVAP 110 OXALIC ACID VAPORIZER

#PVOV- $485.00

It's not too early to think about Christmas Gifts....

LYSON CANDLE MOLDS

Many styles to choose from pictures on our website of all of our candle molds.

Subscribe to our newsletter & be the first to know what is in our

BLACK FRIDAY SALE

Honey Bottling

CLASSIC PLASTICS

8 oz - $19.99/50 ct. Case
16 oz - $23.99/50 ct. Case
32 oz - $39.99/50 ct. Case
No Caps

PLASTIC PANEL BEARS

2 oz Panel Bears $229.95/800 ct. Case No Caps
6 oz Panel Bears $181.45/660 ct. Case No Caps
8 oz Panel Bears $144.95/525 ct. Case No Caps
12 oz Panel Bears $114.95/400 ct. Case No Caps
16 oz Panel Bears $94.69/240 ct. Case No Caps
24 oz Panel Bears $89.50/195 ct. Case No Caps

DECO EMBOSSED JUGS

5 LB- $78.35/72 ct. Case
3 LB - $99.95/126 ct. Case
No Caps

12 OZ & 3 OZ GLASS SKEP JARS

12 oz skep jars $10.45/12 ct.
includes Gold Metal lids
3 oz skep jars $11.95/24 ct.

MUTH JARS

4 oz - $28.49/36 ct. Case
8 oz - $12.95/12 ct. Case
16 oz - $16.95/12 ct. Case
includes corks

CLASSIC GLASS JARS

8oz - $14.50/24 ct. Case
16 oz - $8.45/12 ct. Case
32 oz - $12.95/12 ct. Case

FOR BEES. FOR HONEY. FOR EVERYONE | (877) 529-9BEE | www.blueskybeesupply.com

Ultra Bee

High Protein Pollen Substitute

Mann Lake Ltd. FREE SHIPPING

FOR HEALTHIER, STRONGER, LONGER-LIVING BEES

GIVE THEM THE BEST

Scientifically developed to provide the best bee nutrition, Ultra Bee has been shown to match natural pollen's results in the field. Give your bees the nutrition they deserve!

- **Highest protein content available**
- **Balanced amino acid profile**
- **USA ingredients only**
- **FDA certified**

Ultra Bee Dry

1 lb canister		**$ 9.95**
10 lb pail		**$29.95**
50 lb bag	1-3	**$89.95**
	4-10	**$85.95**
	11-39	**$80.95**
	40 - 159	**$77.95**
	160+	**$73.95**
1500 lb tote		**$1495.95**

Crude 58% Protein

Ultra Bee Patties

10 lb box		**$30.95**
40 lb box	1-3	**$78.95**
	4-10	**$72.95**
	11-48	**$68.95**
	49+	**$65.95**
Bulk Pack 2100 lb		**$2595.95**

Crude 18% Protein

MANN LAKE
WE KNOW BEES
An Employee Owned Company

800-880-7694
www.mannlakeltd.com

Hackensack, MN • Wilkes-Barre, PA • Woodland, CA • Marshall, TX

*Free shipping applies to most orders over $100 sent standard ground service within the lower 48 states. Prices are subject to change without notice.