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MAY 2022

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The Magazine Of American Beekeeping

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ROOT PUBLICATIONS

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# May Bee Culture...




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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. 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), May 2022, Volume 150, Issue 5, 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 • info@BeeCulture.com

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



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Cover Photo submitted by Greg Carey in the Image Gallery contest.

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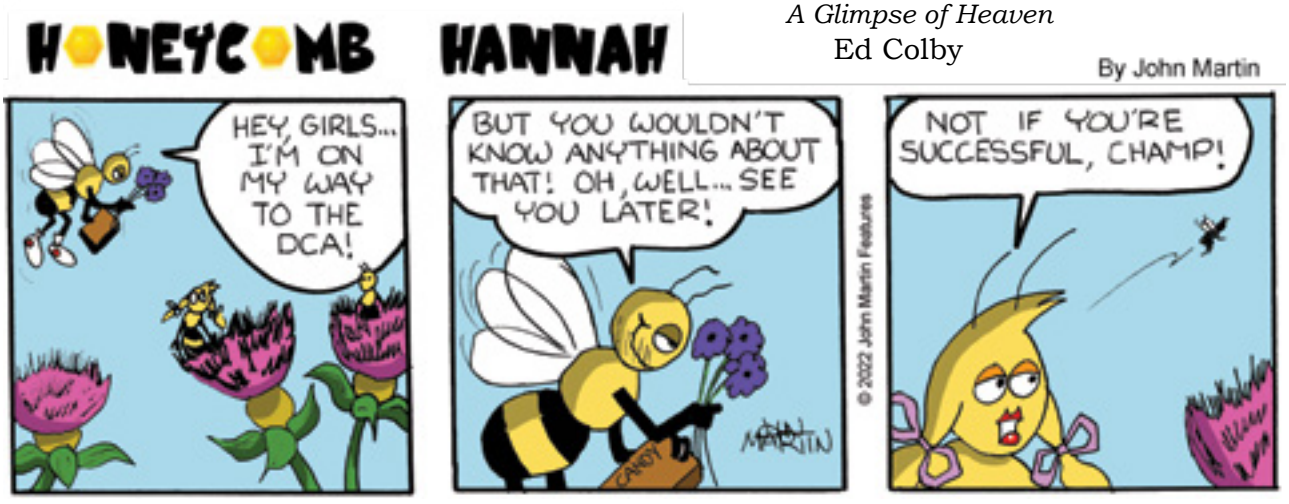

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Apistan, lab study: 95.72% Varroa mortality *(Insects, 2018)*

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

**96% Efficacy**
Apistan: 96.92% Efficacy *(2018, Veterinary Bee Inspector, Spain)*

**97% Efficacy**
Apistan + 50 g Apiguard: 97.97% Efficacy *(2018, Veterinary Bee Inspector, Spain)*

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

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

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In the spirit of transparency with all of you our great fellow beekeepers, we have some important news about upcoming changes to *Bee Culture*. We are updating our subscription prices. We know this isn't a fan favorite type of change. Looking back, it's been a long time since we've changed prices and unfortunately now is the time for this change. **The new prices will take effect on June 1, 2022.** We will not be able to honor any previous prices after June 1. This includes renewal letters, subscription cards, etc.

**One-year Print Subscription: $30, International: $70**
**Two-year Print Subscription: $54, International: $140**
**Three-year Print Subscription: $77, International: $210**
**One-year Print and Digital Bundle Subscription: $35, International: $75**
**One-year Digital Subscription: $20, International: $20**

This change comes from a variety of factors. First, the price of paper has gone up. There's been a shortage (as I'm sure longer subscribers are aware with the various delays) and because of that, the paper that is available now costs more, a lot more. You may see us start to change paper at some point to find what's most cost effective for us, but still provides a great product for you! We never want to change how great our magazine is, so if you feel that we are, please let us know. We are always happy to hear your feedback!

Another reason for the price change is the price of postage. Our foreign subscribers unfortunately will be hit the hardest here. We hope this isn't coming out of the blue to you all. The price of postage has gone up exponentially. You may or may not be aware, but the company *Bee Culture* is a historic part of is A.I. Root which is a big part in the candle industry nowadays. They are being hit hard by freight costs as well, so it's a business wide change. For our foreign subscribers, please consider our digital edition if you are struggling with our prices. We would love for you to continue enjoying *Bee Culture* as you have, just maybe in a more cost-effective way for you.

If any of you have been on our bookstore lately (**www.Store.BeeCulture.com**) we're sure you've noticed that we changed some prices there too. Eventually, we are planning on also charging for tax and shipping but as of right now, we're still working out the logistics of that on the back end here. But expect that change relatively soon. We will keep you updated as we know more ourselves...

We appreciate all your support, your love for what we do and your patience with us. Like we stated previously, if you have any questions, concerns or constructive criticism, please let us know at **Info@BeeCulture.com.**


# Bee Culture®

The Magazine of American Beekeeping

BEEing Diverse: Inspiring Leaders in Beekeeping

**Mark Your Calendars for September 30 - October 2, 2022**

***The Return Of Bee Culture's Annual Event***

We are optimistically going forward with our planning of this event.

We will continue to monitor the COVID situation.

We hope to see you in September/October!

*Be sure and visit* www.BeeCulture.com

ROOT PUBLICATIONS

# NEXT MONTH

**Region 1**
- Make room!!
- Make nucs
- Keep inspecting to get ahead of late swarms
- Honey supers
- Check queen laying pattern
- Alcohol sample check for mites
- Time to split hives
- Mite treatment that is labeled for use with supers on
- Is bear fence working?
- Queen rearing time

**Region 2**
- Extract Spring honey
- Alcohol mite check
- Add more supers
- Check queens
- Time to move colonies
- Split time
- Check for SHB
- Keep on mite check schedule
- Swarm cell check
- Let them make honey
- Do AFB/EFB check

**Region 3**
- Catch swarms
- Alcohol mite check, treat with approved product if needed
- Splits and nuc time
- Add boxes
- Add supers
- Check for swarm cells
- Check SHB populations
- Add SHB traps

**Region 4**
- Mite check/alcohol
- Put on comb honey supers
- Add honey supers
- Raise queens
- Extract Spring honey crop
- Make splits
- Inspect for swarm cells
- Non-synthetic pesticide *Varroa* control
- Swarm management
- Get ready for queen rearing

**Region 5**
- Catch swarms
- Add supers
- Check for swarm cells
- Make splits
- Check queen brood pattern
- Alcohol mite check
- Treat for mites with labeled and approved products
- Add boxes to make room

**Region 6**
- Mite wash and legal control
- Provide water
- Manage for swarms
- Order honey jars before price goes up even more
- Add supers
- Make splits
- Requeen AHB colonies

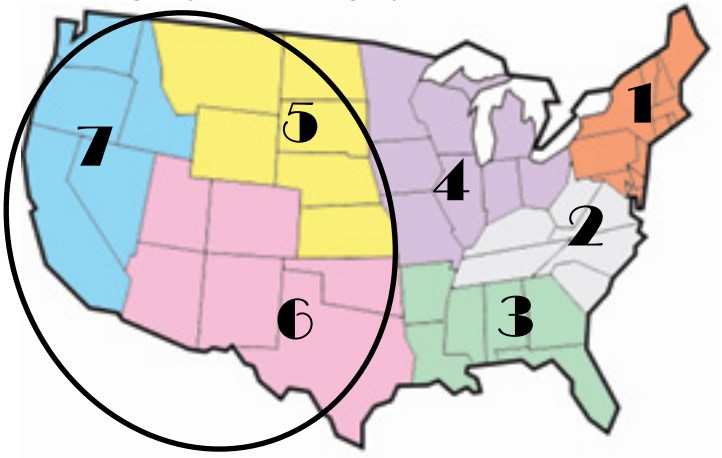
**Region 7**
- Rotate deeps to delay swarming
- Grow bees, feed, feed
- Check queen pattern
- Do a disease check
- Cut out queen cells
- Replace failing queens
- Install nucs
- Mites/sample/treat/sample to see if it worked

## Honey Reporters Wanted

We are expanding our Honey Reporter population and need new reporters in EVERY region. We ask that you fill in most of the wholesale or retail or both sections, most months, and our short survey on the bottom. We give you a FREE subscription for your service. So if you are interested fill out the form **https://forms.gle/EnZW531NHM7sbMUz8** OR send an email to **Emma@BeeCulture.com** and put REPORTER in the subject line. Include name, email, phone number and mailing address and we'll get you the next Honey Report form. Sign up today and be a part of the BEST Monthly Honey Price and Beekeeping Management Report in the industry.

*Scan this to go straight to the form online!*

*West Coast! We need your help! Please sign up to be a honey reporter if you're willing! You get a **Free Subscription** as long as you're sending reports back!*



# MAY – REGIONAL HONEY PRICE REPORT

| | REPORTING REGIONS | | | | | | | SUMMARY | | | History | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | Range | Avg. | $/lb | Last Month | Last Year |
| **EXTRACTED HONEY PRICES SOLD BULK TO PACKERS OR PROCESSORS** | | | | | | | | | | | | |
| 55 Gal. Drum, Light | 2.98 | 2.18 | 2.50 | 6.42 | 2.38 | 2.48 | 2.73 | 2.15-29.17 | 3.96 | 3.96 | 3.75 | 2.23 |
| 55 Gal. Drum, Ambr | 2.83 | 2.14 | 2.23 | 6.33 | 2.43 | 2.40 | 1.65 | 1.30-29.17 | 3.77 | 3.77 | 3.66 | 2.19 |
| 60# Light (retail) | 238.96 | 207.50 | 197.33 | 196.06 | 174.00 | 192.19 | 222.50 | 138.00-330.00 | 211.41 | 3.52 | 215.64 | 204.26 |
| 60# Amber (retail) | 237.73 | 214.60 | 221.00 | 198.11 | 138.00 | 182.69 | 224.35 | 138.00-310.00 | 213.90 | 3.57 | 213.12 | 198.17 |
| **WHOLESALE PRICES SOLD TO STORES OR DISTRIBUTORS IN CASE LOTS** | | | | | | | | | | | | |
| 1/2# 24/case | 112.78 | 99.75 | 96.00 | 86.36 | 108.00 | 96.00 | - | 64.80-200.00 | 100.41 | 8.37 | 100.09 | 89.16 |
| 1# 24/case | 169.83 | 189.76 | 145.00 | 119.68 | 173.91 | 85.08 | 144.00 | 48.00-325.00 | 149.49 | 6.23 | 149.32 | 134.01 |
| 2# 12/case | 162.41 | 181.50 | 118.00 | 112.40 | 81.42 | - | 156.00 | 39.00-300.00 | 139.08 | 5.80 | 141.80 | 124.11 |
| 12.oz. Plas. 24/cs | 134.88 | 150.07 | 103.50 | 95.69 | 99.72 | 119.76 | 108.00 | 72.00-250.00 | 115.07 | 6.39 | 118.51 | 107.81 |
| 5# 6/case | 163.86 | 229.05 | - | 128.79 | 123.84 | - | - | 50.00-330.00 | 150.84 | 5.03 | 156.92 | 139.22 |
| Quarts 12/case | 222.25 | 191.67 | 169.25 | 149.28 | 163.90 | 147.90 | 189.00 | 120.00-330.00 | 176.47 | 4.90 | 182.83 | 163.53 |
| Pints 12/case | 90.00 | 128.00 | 104.00 | 90.65 | 101.33 | 96.00 | 96.00 | 60.00-180.00 | 101.54 | 5.64 | 106.15 | 95.03 |
| **RETAIL SHELF PRICES** | | | | | | | | | | | | |
| 1/2# | 6.47 | 5.84 | 5.33 | 5.06 | 5.07 | 4.65 | - | 3.00-10.00 | 5.72 | 11.43 | 5.78 | 5.25 |
| 12 oz. Plastic | 7.59 | 6.73 | 6.97 | 6.45 | 6.04 | 6.00 | 7.00 | 3.59-12.00 | 6.82 | 9.09 | 6.94 | 6.11 |
| 1# Glass/Plastic | 9.65 | 9.58 | 9.94 | 7.85 | 8.42 | 7.00 | 9.00 | 5.00-18.00 | 9.06 | 9.06 | 9.15 | 8.68 |
| 2# Glass/Plastic | 16.55 | 16.53 | 17.90 | 13.69 | 11.89 | 6.99 | 16.33 | 6.99-30.00 | 15.72 | 7.86 | 15.55 | 14.06 |
| Pint | 12.02 | 12.18 | 12.42 | 11.96 | 12.35 | 11.00 | 10.30 | 7.00-22.00 | 12.09 | 8.06 | 11.54 | 10.90 |
| Quart | 23.30 | 21.32 | 21.64 | 19.97 | 21.33 | 16.33 | 20.04 | 10.99-42.00 | 20.95 | 6.98 | 20.75 | 18.31 |
| 5# Glass/Plastic | 34.91 | 33.98 | 36.17 | 28.39 | 31.57 | 18.89 | - | 15.00-60.00 | 32.19 | 6.44 | 33.53 | 30.76 |
| 1# Cream | 12.58 | 13.69 | 8.00 | 10.60 | 12.55 | - | 12.00 | 8.00-28.00 | 11.94 | 11.94 | 11.65 | 13.02 |
| 1# Cut Comb | 14.96 | 15.13 | 14.17 | 14.50 | 10.00 | - | - | 8.00-25.00 | 14.43 | 14.43 | 14.65 | 13.02 |
| Ross Round | 17.33 | 11.25 | 22.00 | 14.50 | - | - | 13.75 | 6.50-22.00 | 15.37 | 20.50 | 12.26 | 11.02 |
| Wholesale Wax (Lt) | 9.96 | 6.58 | 6.50 | 7.65 | 6.23 | 4.75 | 5.83 | 3.00-18.00 | 7.58 | - | 8.32 | 7.20 |
| Wholesale Wax (Dk) | 9.00 | 6.38 | 5.75 | 6.57 | 6.20 | 4.00 | 6.00 | 3.00-15.00 | 6.73 | - | 6.47 | 5.90 |
| Pollination Fee/Col. | 83.59 | 69.17 | 175.00 | 146.67 | 80.00 | - | 117.50 | 6.99-240.00 | 103.82 | - | 99.04 | 92.11 |

*Please note: anywhere within each region that there is a '-' it is because no information was sent to us for that specific item in that region.*

American Honey Producers Association
www.ahpanet.com

Salutations AHPA members! What a crazy start to 2022! We finally get over the hurdle that is the pandemic just to have record high gas prices and war in Ukraine waiting for us. Can we catch a break? As I'm writing this in mid-March I saw $7.29 diesel in Oakdale, CA yesterday. Yikes! It will be expensive getting the hives out of CA. A quick anti-dumping suit update: In our meeting with Customs last week, they told us that China was the country of origin for a significant portion of the imported honey they have recently tested. Customs is tight-lipped about their database for NMR and protocols (which is understandable). They have been having talks with the FDA about honey and it's always a good sign when two federal entities are communicating. There was a 90% surge in honey from Vietnam from May 2021 to September 2021 compared to the previous five months. As a result, Commerce found critical circumstances exist and we are hoping the U.S. International Trade Commission will confirm that. Customs is already collecting antidumping duty deposits retroactively back to August. Leaders from Sue Bee and AHPA are participating in briefing and hearing preparation before the April 12 final International Trade Commission Hearing. That hearing is open to the public and will be broadcast on Webex if you want to watch. Our attorneys tell us they are optimistic for a win and a higher duty on Indian honey. The Commerce Department has put a 90-day pause on the Ukraine part of the suit due to the war there and will revisit it after July 6th.

In other news, a huge issue is arising in California... where else right? The SGMA (Sustainable Groundwater Management Act) is starting to take effect on farmland in the state. The almond industry has practically been the hero of the beekeeping industry the last decade. With low honey prices and high mortality losses, getting three times the price for almond pollination compared to 15 years ago has helped keep many beekeepers in business. Well, with SGMA, we may see the almond industry slowing a bit. It has been amazing watching one billion pound crops turn into two billion pound crops and Blue Diamond and others market and sell all those nuts. Unfortunately, with SGMA, growers will be given an "allotment" monitored via satellite. Growers will then be charged $600-$650 per acre foot they use above their allotment, plus a re-

placement water fee of up to $500 per acre. One can easily foresee where this will likely go: growers will be forced to fallow some of their ground in order to remain economically viable. For example, for my almonds, the allocation was about 70% of my usual irrigation. The cause of the disparagement between my actual use and their allotted amount is that the technology is being rolled out too fast; many this past year said the meters on their wells didn't match what the satellites said they used. There are currently two lawsuits over this in just my county, one being brought by the irrigation district itself. To add to the unfairness, those that have their land within the irrigation district will be in much better shape than those of us relying solely on well water. Wendy Wang, a water law attorney said, "A key SGMA principle is that there's a carrot and a stick," she said. "The local agencies will be given an opportunity to regulate a groundwater basin themselves, and if they don't, this is the stick – the state will come in." So you have the incentive to regulate the groundwater sustainably yourself and if not, the state will come in, and it is a national food security issue. Do we want to import more of our food? Hasn't the covid supply chain crisis shown us the importance of having more our food and products made here? The war in Ukraine has shown us that with gas prices. Did you know, of the top 25 fruits consumed in the U.S., 43% is imported? How green is that?

The almond industry has been amazing over the years overcoming hurdles, let's hope for our sakes they can manage to jump this hurdle. I just worry how bruised and battered all associated with the industry might look after clearing this hurdle.

Chris Hiatt
President
American Honey Producers Association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# U.S. Honey Industry Report – 2021

*Released March 18, 2022, by the National Agricultural Statistics Service (NASS), Agricultural Statistics Board, United States Department of Agriculture (USDA)*
*Supplementary by Kim Flottum*

## United States Honey Production Down 14 Percent in 2021

United States honey production in 2021 totaled 126 million pounds, down 14 percent from 2020. There were 2.7 million colonies producing honey in 2021, down slightly from 2020. Yield per colony averaged 46.9 pounds, down 14 percent from the 54.5 pounds in 2020. Colonies which produced honey in more than one State were counted in each State where the honey was produced. Therefore, at the United States level yield per colony may be understated, but total production would not be impacted. Colonies were not included if honey was not harvested. Producer honey stocks were 23.5 million pounds on December 15, 2021, down 41 percent from a year earlier. Stocks held by producers exclude those held under the commodity loan program.

## Honey Prices Up 21 Percent in 2021

United States honey prices increased 21 percent during 2021 to $2.54 per pound, compared to $2.10 per pound in 2020. United States and State level prices reflect the portions of honey sold through cooperatives, private, and retail channels. Prices for each color class are derived by weighing the quantities sold for each marketing channel. Prices for the 2020 crop reflect honey sold in 2020 and 2021. Some 2020 crop honey was sold in 2021, which caused some revisions to the 2020 crop prices.

## Price Paid per Queen was 20 Dollars in 2021

The average prices paid in 2021 for honey bee queens, packages, and nucs were $20, $91, and $125 respectively. Pollination income for 2021 was $269 million, up six percent from 2020. Other income from honey bees in 2021 was $102 million, up 82 percent from 2020.

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*Released August 2, 2021, by the National Agricultural Statistics Service (NASS), Agricultural Statistics Board, United States Department of Agriculture (USDA).*

## January 1, 2020 – Some History

### Honey Bee colonies Up Two Percent for Operations with Five or More colonies

Honey bee colonies for operations with five or more colonies in the United States on January 1, 2021 totaled 2.92 million colonies, up two percent from January 1, 2020. The number of colonies in the United States on April 1, 2021 was 2.86 million colonies. During 2020, honey bee colonies on January 1, April 1, July 1, and October 1 were 2.88 million, 2.97 million, 3.18 million, and 3.14 million colonies, respectively.

Honey bee colonies lost for operations with five or more colonies from January through March 2021, was 372,630 colonies, or 13 percent. The number of colonies lost during the quarter of April through June 2021 was 255,860 colonies, or nine percent. During the quarter of October through December 2020, colonies lost totaled 484,920 colonies, or 15 percent, the highest number lost of any quarter surveyed in 2020. The quarter surveyed in 2020 with the lowest number of colonies lost was April through June, with 300,990 colonies lost, or 10 percent.

Honey bee colonies added for operations with five or more colonies from January through March 2021 was

Colonies, Yield, Production, Stocks, Price, and Value – States and United States: 2021

| State | Honey Producing Colonies[1] | Yield per Colony | Production | Stocks Dec 15[2] | Average Price per Pound[3] | Value of Production[4] |
|---|---|---|---|---|---|---|
| | 1,000 | Pounds | 1,000lbs | 1,000lbs | Dollars | 1,000 Dollars |
| AL | 8 | 40 | 320 | 112 | 5.99 | 1,917 |
| AZ | 23 | 40 | 1,040 | 368 | 2.34 | 2,434 |
| AR | 17 | 50 | 850 | 255 | 2.07 | 1,760 |
| CA | 290 | 33 | 9,570 | 1,627 | 2.40 | 22,968 |
| CO | 29 | 40 | 1,160 | 232 | 2.78 | 3,225 |
| FL | 193 | 44 | 8,492 | 849 | 2.42 | 20,551 |
| GA | 96 | 34 | 3,264 | 261 | 2.73 | 8,911 |
| HI | 15 | 93 | 1,395 | 56 | 2.21 | 3,083 |
| ID | 100 | 30 | 3,000 | 270 | 2.37 | 7,110 |
| IL | 10 | 46 | 460 | 115 | 5.83 | 2,682 |
| IN | 10 | 52 | 520 | 177 | 3.89 | 2,023 |
| IA | 38 | 55 | 2,090 | 502 | 2.46 | 5,141 |
| KS | 7 | 42 | 294 | 144 | 2.74 | 806 |
| KY | 7 | 37 | 259 | 73 | 4.60 | 1,191 |
| LA | 37 | 58 | 2,146 | 205 | 2.50 | 5,365 |
| ME | 11 | 34 | 374 | 60 | 3.18 | 1,189 |
| MI | 101 | 51 | 5,151 | 1,957 | 2.97 | 15,298 |
| MN | 125 | 57 | 7,125 | 285 | 2.32 | 16,530 |
| MS | 25 | 71 | 1,775 | 71 | 2.77 | 4,917 |
| MO | 8 | 35 | 280 | 92 | 3.99 | 1,117 |
| MT | 117 | 57 | 6,669 | 1,934 | 2.17 | 14,472 |
| NE | 39 | 47 | 1,833 | 550 | 2.17 | 3,978 |
| NJ | 15 | 35 | 525 | 158 | 3.27 | 1,717 |
| NY | 57 | 53 | 3,021 | 665 | 4.15 | 12,537 |
| NC | 13 | 39 | 507 | 104 | 6.84 | 3,468 |
| ND | 515 | 55 | 28,325 | 2,266 | 2.19 | 62,032 |
| OH | 16 | 64 | 1,024 | 389 | 3.70 | 3,789 |
| OR | 86 | 31 | 2,666 | 693 | 2.14 | 5,705 |
| PA | 20 | 42 | 840 | 336 | 3.40 | 2,856 |
| SC | 16 | 42 | 672 | 67 | 5.32 | 3,575 |
| SD | 250 | 49 | 12,250 | 5,268 | 2.27 | 27,808 |
| TN | 8 | 56 | 448 | 81 | 5.00 | 2,240 |
| TX | 137 | 56 | 7,672 | 384 | 2.30 | 17,646 |
| UT | 31 | 33 | 1,023 | 92 | 2.18 | 2,230 |
| VT | 7 | 47 | 329 | 76 | 3.28 | 1,079 |
| VA | 6 | 40 | 240 | 79 | 8.23 | 1,975 |
| WA | 96 | 32 | 3,072 | 1,206 | 2.52 | 7,741 |
| WV | 6 | 43 | 258 | 136 | 4.80 | 1,238 |
| WI | 42 | 47 | 1,974 | 750 | 2.81 | 5,547 |
| WY | 38 | 58 | 2,204 | 242 | 2.07 | 4,562 |
| Other States[5,6] | 28 | 48 | 1,349 | 340 | 4.90 | 6,610 |
| United States[6,7] | 2,696 | 46.9 | 126,466 | 23,527 | 2.54 | 321,224 |

[1]Honey producing colonies are the maximum number of colonies from which honey was harvested during the year. It is possible to harvest honey from colonies which did not survive the entire year.
[2]Stocks held by producers.
[3]Average price per pound based on expanded sales.
[4]Value of production is equal to production multiplied by average price per pound.
[5]Includes data from States not published in this table.
[6]Due to rounding, total colonies multiplied by total yield may not exactly equal production.
[7]United States value of production will not equal summation of States.

308,530 colonies. The number of colonies added during the quarter of April through June 2021 was 677,690. During the quarter of April through June 2020, the number of colonies added were 536,170 colonies, the highest number of honey bee colonies added for any quarter surveyed in 2020.

The quarter of October through December 2020 added 271,500 colonies, the least number of honey bee colonies added for any quarter surveyed in 2020. Honey bee colonies renovated for operations with five or more colonies from January through March 2021 was 156,270 colonies, or five percent. During the quarter of April through June 2021, the number of colonies renovated were 480,380 colonies, or 17 percent. The quarter surveyed in 2020 with the highest number of colonies renovated was April through June with 626,870 colonies renovated, or 21 percent. The quarter surveyed in 2020 with the lowest number of colonies renovated was October through December 2020, with 128,990, or four percent. Renovated colonies are those that were requeened or received new honey bees through a nuc or package.

**_Varroa_ Mites Top Colony Stressor for Operations with Five or More colonies**

*Varroa* mites were the number one stressor for operations with five or more colonies during all quarters surveyed in 2020. The period with the highest percentage of colonies reported to be affected by *varroa* mites was July through September 2020 at 55.7 percent. The percent of colonies reported to be affected by *varroa* mites during January through March 2021 and April through June 2021 are 31.3 percent and 48.7 percent, respectively.

**Colonies Lost with Colony Collapse Disorder Symptoms Down 27 Percent for Operations with Five or More colonies**

Honey bee colonies lost with Colony Collapse Disorder symptoms on operations with five or more colonies was 76,930 colonies from January through March 2021. This represents a 27 percent decrease from the same quarter in 2020.

**Honey Price by Color Class - U.S.: 2016 - 2021**
**[Producers with five or more colonies that also qualify as a farm]**

| Price | | | | | | | |
|---|---|---|---|---|---|---|---|
| Color Class | Co-op and Private | | | | | | |
| | 2016 | 2017 | 2018 | 2019 | 2020 | 2021 | % Change in 5 Years |
| | dollars per pound | | | | | | |
| Water white, extra white, white | 1.85 | 1.89 | 2.98 | 1.63 | 1.73 | 2.22 | 17% |
| Extra light amber | 1.85 | 1.89 | 2.01 | 1.70 | 1.81 | 2.24 | 19% |
| Light amber, amber, dark amber | 1.89 | 1.95 | 2.10 | 1.95 | 2.00 | 2.42 | 22% |
| All other honey, area specialties | 2.44 | 2.46 | 2.64 | 3.16 | 2.39 | 2.55 | -2% |
| All honey | 1.88 | 1.92 | 2.03 | 1.73 | 1.84 | 2.30 | -2% |

| Price | | | | | | | |
|---|---|---|---|---|---|---|---|
| Color Class | Retail | | | | | | |
| | 2016 | 2017 | 2018 | 2019 | 2020 | 2021 | % Change in 5 Years |
| | dollars per pound | | | | | | |
| Water white, extra white, white | 4.91 | 3.80 | 3.63 | 4.70 | 4.18 | 5.35 | 9% |
| Extra light amber | 3.78 | 4.59 | 3.44 | 3.63 | 4.67 | 3.80 | 1% |
| Light amber, amber, dark amber | 4.36 | 4.84 | 4.89 | 5.30 | 5.51 | 5.51 | 21% |
| All other honey, area specialties | 7.93 | 6.24 | 7.17 | 6.62 | 7.23 | 6.71 | 15% |
| All honey | 4.62 | 4.78 | 4.38 | 4.82 | 5.23 | 5.04 | 8% |

| Price | | | | | | | |
|---|---|---|---|---|---|---|---|
| Color Class | All Honey | | | | | | |
| | 2016 | 2017 | 2018 | 2019 | 2020 | 2021 | % Change in 5 Years |
| | dollars per pound | | | | | | |
| Water white, extra white, white | 1.93 | 2.02 | 2.01 | 1.70 | 1.81 | 2.30 | 12% |
| Extra light amber | 1.95 | 2.14 | 2.12 | 1.90 | 1.93 | 2.35 | 1% |
| Light amber, amber, dark amber | 2.25 | 2.32 | 2.51 | 2.57 | 2.53 | 2.85 | 1% |
| All other honey, area specialties | 3.86 | 3.74 | 3.62 | 3.99 | 3.00 | 3.56 | -1% |
| All honey | 2.08 | 2.16 | 2.21 | 1.99 | 2.10 | 2.54 | 1% |

## USDA Honey Prices 2003-2021

| Cents/lb. | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 | 2021 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| All Honey | 138.7 | 108.5 | 90.4 | 104.2 | 103.2 | 141 | 144.5 | 160.3 | 172.9 | 195.1 | 212.6 | 216.1 | 209 | 207.5 | 215.6 | 216.6 | 197 | 203 | 254 |
| Retail Shelf | 188.5 | 188.7 | 183.3 | 191.0 | 196.1 | 197.6 | 278.4 | 305.4 | 328.4 | 340.5 | 373.5 | 406.6 | 409.6 | 462 | 477.7 | 421.1 | 485 | 522 | 504 |
| % Difference | 26% | 42% | 51% | 46% | 29% | 28% | 48% | 48% | 48% | 43% | 43% | 47% | 51% | 45% | 45% | 51% | 41% | 39% | 50% |

**COST & INCOME**

| | 2017 | 2018 | 2019 | 2020 | 2021 |
|---|---|---|---|---|---|
| Queen Costs | 19 | 18 | 18 | 18 | 20 |
| Pkg. Cost $ | 88 | 92 | 85 | 84 | 91 |
| Nuc Cost $ | 138 | 110 | 100 | 105 | 125 |
| *Varroa* Control Cost/ Colony $ | - | 5.52 | 5.81 | 4.33 | 4.29 |
| Workers x 1000 | 22 | 23 | 25 | 24 | 24 |
| Feed Cost/Colony $ | - | - | - | 15.30 | 15.79 |
| Pollination Income | - | 301.8 | 309.6 | 254.0 | 265.6 |
| Other Income x 1000 | - | 94.6 | 77.7 | 55.8 | 101.7 |

For producers with five or more colonies, costs and income have significantly changed in some areas. *Varroa* control costs are down this year over last, which is good. These figures include the cost of the chemicals, plus the cost of labor to apply them. Speaking of labor, those numbers are the same as last year, but still remain higher or the same as the past few years. But it's the income figures that are most interesting this year. Pollination income is up which is good. Other income, too, is way up. Some of this is due to the increased sales of bees and queens. However, the sales of nucs and packages is up, keeping income and costs about the same for those, so the drop in income healthy.

**Per Capita Consumption, 2021**

We calculate this figure each year using data from USDA ERS, NASS, ERS, FARM SERVICE and the U.S. Census Bureau. From these sources we determine how much honey entered the system, how much honey left the system, how much was used, how much wasn't used and the population on July 1, 2021. These figures include U.S. production, U.S. exports, honey put under and taken out of the loan program and honey remaining in storage, plus how much was imported from off shore. Essentially it's a measure of honey in minus honey out. The resultant figure, divided by how many people were here on that particular date results in how much honey was consumed by each and every individual in the US last year. And yes, you are correct, not every person eats honey, but by producing this figure on an annual basis, we are able to compare apples to apples each year in honey consumption.

The chart below compares these figures for the previous 12 years. We've included the USDA's price of all honey for comparison too.

**Honey Consumption, Population, Prices 2010-2021**

| Year | Million lbs Honey in | Million lbs Honey out | Millions Population | lbs/person | Price/lb$ |
|---|---|---|---|---|---|
| 2010 | 398 | 29 | 307 | 1.20 | $1.60 |
| 2011 | 470 | 80 | 309 | 1.27 | $1.73 |
| 2012 | 487 | 53 | 312 | 1.26 | $1.95 |
| 2013 | 500 | 49 | 314 | 1.44 | $2.13 |
| 2014 | 547 | 56 | 318 | 1.55 | $2.17 |
| 2015 | 544 | 58 | 321 | 1.51 | $2.09 |
| 2016 | 573 | 55 | 323 | 1.62 | $2.12 |
| 2017 | 600 | 43 | 325 | 1.71 | $2.19 |
| 2018 | 594 | 46 | 327 | 1.70 | $2.17 |
| 2019 | 585 | 60 | 328 | 1.60 | $1.97 |
| 2020 | 617 | 58 | 330 | 1.69 | $2.03 |
| 2021 | 513 | 36 | 332 | 1.4 | $2.41 |

**Honey Into The U.S., 2020**

U.S. beekeepers with more than five colonies in 2020 produced, according to USDA, 147.6 million pounds of honey. The Honey Board calculates that an additional eight million pounds or so were produced by those with fewer than five colonies for a total production of 155 million pounds. Additional honey in figures include 40.9 million pounds taken out of warehouses from last year, 4.8 million pounds taken out from last year's loan program, and a whopping 134.5 million pounds imported for a rough total of 513 million pounds of honey in, during 2021. This honey sold, on average, wholesale, retail and speciality honey for $2.41/pound, according to USDA figures. Commercial beekeepers in the U.S. will tell you to make a living, this price should be about the same price as diesel fuel. Take a look next time you are at the gas station.

**Honey Out Of The U.S., 2020**

For the honey out figure, we exported nearly 10.7 million pounds to other countries, have nearly 40 million pounds still sitting in warehouses and put just under five million under loan, for a total of about 58 million pounds of honey produced in 2021 that were moved out of the U.S. figures for 2021.

The July 1, 2021 population was right at 332 million people in the U.S. So, to calculate per capita consumption, subtract honey out (put under loan, exported or still in warehouses) from honey in (honey produced this year, left over from last, or imported) and divide by 332 million, for a total of 477 million pounds consumed in the U.S. last year. Divide this by 332 million people which gives you about 1.4 pounds of honey consumed by each and every person in the U.S. during 2021, the lowest since 2012.

These figures represent the various categories of honey imported, how much of each and the value. The price of comb honey to sell directly retail is the closest to the U.S. price, while extra light amber, a very comon honey, is very low. Basically, U.S. honey producers are at $2.54/lb, while imports are at $2.41. Elsewhere, you'll see income issues for U.S. beekeepers, and here is one good reason.

**Breakdown of 2021 Imports**

| Category | Million pounds | Value | Avg price/lb |
|---|---|---|---|
| Natural honey, not retail, light amber | 149,056,448 | 150,586,887 | $1.01 |
| Comb honey and packaged for retail | 11,635,342 | 54,112,053 | $4.65 |
| Natural honey, not for resale, white | 49,550,807 | 76,124,113 | $1.54 |
| Natural honey, not for resale, ELA | 142,749,178 | 186,382,115 | $1.31 |
| Natural honey, not for resale, Amber | 45,769,398 | 78,077,058 | $1.71 |
| Organic | 72,218,441 | 134,408,215 | $1.86 |
| Total | 470,979,614 | 679,690,441 | $1.44 |
| U.S. Produced | 134,466,000 | 323,474,000 | $2.41 |

## Top Ten Producing States Each Year

| 2015 | | | 2016 | | | 2017 | | | 2018 | | | 2019 | | | 2020 | | | 2021 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| State | x1000 Col | x1000 Prod lbs | State | x1000 Col | x1000 Prod lbs | State | x1000 Col | x1000 Prod lbs | State | x1000 Col | x1000 Prod lbs | State | x1000 Col | x1000 Prod lbs | State | x1000 Col | x1000 Prod lbs | State | x1000 Col | x1000 Prod lbs |
| ND | 490 | 36.2 | ND | 485 | 37.7 | ND | 455 | 33.7 | ND | 530 | 38.2 | ND | 520 | 33.8 | ND | 495 | 38.6 | ND | 515 | 28.3 |
| SD | 290 | 19.1 | SD | 280 | 19.9 | SD | 255 | 14.3 | CA | 335 | 13.7 | SD | 270 | 19.4 | SD | 245 | 14.9 | CA | 290 | 9.6 |
| MT | 146 | 12.1 | MT | 159 | 12.2 | CA | 335 | 13.7 | SD | 255 | 12.0 | CA | 335 | 16.0 | CA | 320 | 13.8 | SD | 250 | 12.3 |
| FL | 220 | 11.8 | CA | 310 | 11.2 | MT | 145 | 10.4 | FL | 215 | 10.5 | MT | 173 | 14.9 | TX | 157 | 9.0 | FL | 193 | 8.5 |
| TX | 126 | 8.3 | FL | 215 | 10.8 | FL | 205 | 8.8 | MT | 160 | 14.7 | FL | 205 | 9.2 | MT | 110 | 8.9 | TX | 137 | 7.7 |
| MN | 122 | 8.2 | TX | 133 | 9.3 | TX | 120 | 7.9 | TX | 132 | 7.4 | TX | 126 | 7.6 | FL | 192 | 8.8 | MT | 117 | 6.7 |
| CA | 275 | 8.2 | MN | 124 | 7.3 | MN | 126 | 7.8 | MN | 119 | 7.3 | MN | 118 | 7.0 | MN | 108 | 5.9 | MN | 125 | 7.1 |
| MI | 90 | 5.2 | MI | 89 | 5.3 | ID | 95 | 4.2 | GA | 98 | 3.3 | MI | 94 | 4.7 | MI | 95 | 4.5 | MI | 101 | 5.2 |
| LA | 44 | 4.3 | LA | 50 | 4.3 | LA | 43 | 3.5 | ID | 96 | 2.9 | LA | 54 | 3.9 | ID | 107 | 3.7 | ID | 100 | 3.0 |
| NY | 58 | 3.5 | GA | 96 | 3.7 | WA | 77 | 3.5 | OR | 93 | 3.3 | NY | 59 | 3.4 | NY | 58 | 3.2 | GA | 96 | 3.3 |
| Total | 1861 | 117.4 | | 1941 | 121.8 | | 1850 | 107.8 | | 2033 | 110.4 | | 1954 | 119.9 | | 1887 | 111.4 | | 1924 | 91.5 |
| All Sts. | 2660 | 156.5 | | 2775 | 161.8 | | 2669 | 147.6 | | 2803 | 139.9 | | 2812 | 156.9 | | 2706 | 147.6 | | 2696 | 126.5 |
| % of Tot. | 70% | 75% | | 70% | 75% | | 69% | 73% | | 73% | 75% | | 69% | 76% | | 70% | 75% | | 71% | 72% |

But what about the top three producing states? Total, the top three contain 56% of the top 10's colonies, and produced 58% of the honey produced by the top 10 states. The rest of us are sitting somewhere way, way back on the list.

**Top 10 Producing States**

The places that yield the most honey every year are pretty much determined by the climate, the soil, agriculture and politics. The crops grown, or not grown in a region certainly play a role in what can be found relative to nectar, pesticides and regulations relative to how many colonies can you put on any given acre that won't starve after a couple of months. Of course, government conservation programs lend a hand here too.

We've been curious about this for the last eight years or so, just because it's interesting to see what changes, and what doesn't. The Dakotas, California, Montana, Florida, Minnesota, Michigan and Texas are almost always in the top eight, with the last two changing occasionally: New York, Louisiana, Georgia, Idaho, Michigan and perhaps a few others round out these performers.

This year provided few surprises in who is on the list, and the totals for the top 10 this year were essentially where they always are relative to the number of colonies counted in these states and the amount of honey produced. Again, these states produced 71% of all of the honey produced in the U.S., and had 72% of all the colonies in the U.S. sitting somewhere within their borders. It's pretty clear that what happens in these few states is going to determine the U.S. crop.

But, just because we can, this year we looked at the contributions of the top three states, for almost every year, the Dakotas and California. Combined, they held on to 40% of the colonies used last year and produced just short of 40% of all the honey U.S. beekeepers made last year. This means, of course, that 60% of the colonies, and 60% of the U.S. honey crop is spread out over the remaining 47 states. You can see this comes to just under 1%/state. That sort of puts us in our place, doesn't it? This extreme unbalanced situation commands notice, then, as to what will happen when climate change erodes, or doesn't, weather patterns in these three states including rainfall, Summer and Winter temperatures, farming practices and conservation practices.

Already, drought in the western third of the U.S. is having an effect, not only on the bees, but their forage and the crops they pollinate as well. Like it or not, we are at the mercy of big weather - call it climate change or whatever - it's dry out there!

**Colonies and Value of Production**

| Year | Colonies (million) | Value (million US$) |
|---|---|---|
| 2000 | 2.620 | 132.8 |
| 2001 | 2.506 | 133.1 |
| 2002 | 2.574 | 228.3 |
| 2003 | 2.599 | 252.1 |
| 2004 | 2.556 | 199.6 |
| 2005 | 2.413 | 161.0 |
| 2006 | 2.393 | 158.4 |
| 2007 | 2.443 | 159.8 |
| 2008 | 2.342 | 232.7 |
| 2009 | 2.498 | 215.1 |
| 2010 | 2.692 | 285.7 |
| 2011 | 2.491 | 261.9 |
| 2012 | 2.539 | 283.5 |
| 2013 | 2.640 | 320.1 |
| 2014 | 2.740 | 387.4 |
| 2015 | 2.660 | 329.7 |
| 2016 | 2.775 | 343.0 |
| 2017 | 2.683 | 334.2 |
| 2018 | 2.803 | 333.5 |
| 2019 | 2.812 | 309.1 |
| 2020 | 2.706 | 299.6 |
| 2021 | 2.696 | 321.2 |

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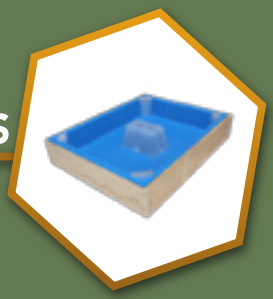

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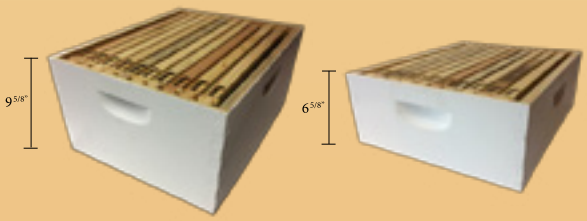


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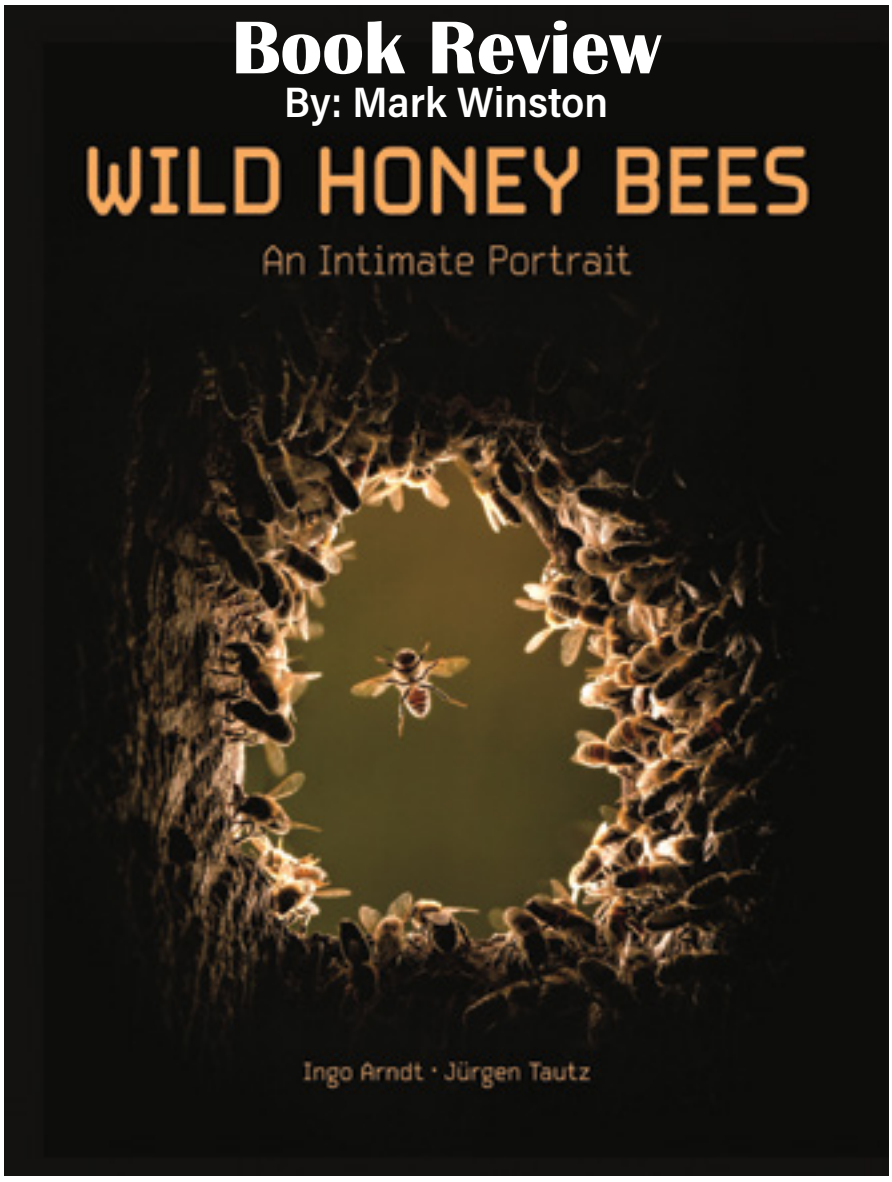
# Book Review

By: Mark Winston




Review of *Wild Honey Bees: An Intimate Portrait* by Ingo Arndt and Jurgen Tautz, 2022, Princeton University Press

I have a particular fascination with feral honey bee colonies, wherever they may be found; in tree hollows, behind the walls of man-made structures, or in the case of African/Africanized honey bees simply hanging externally from tree branches.

My interest in wild colonies began in South America, where we were studying Africanized bees in the mid-1970's to determine why they had been so successful since their introduction to Brazil in 1956. Chain saws, axes and hand saws to cut into wild nests; cameras, rulers and weigh scales to record and measure, we carried these tools of feral nest research through the savannas and jungles of French Guiana, Venezuela and Peru, removing and assessing about 40 wild nests. Later, while writing and finishing my doctoral studies at the University of Kansas in Lawrence, we took nests out of houses and barns and the occasional tree, partly for study but mostly because, well, it was challenging and just plain fun to explore the world of feral honey bees.

We recorded reams of data about nest size, number of bees, amount of brood and stores, age of comb and more from the South American and Kansas feral nests. We then transferred colonies into hive bodies, attaching the comb to frames with strapping tape, and kept the hived colonies for research or gave them to local farmers.

I was left with an appreciation for the variety of nest sites and configurations, each adapted to the cavity, external branch or overhang from which the comb hung. I was also left with muscle memory of how strenuous accessing wild nests can be, from tree climbing to cutting trees down to removing exterior walls from houses and barns.

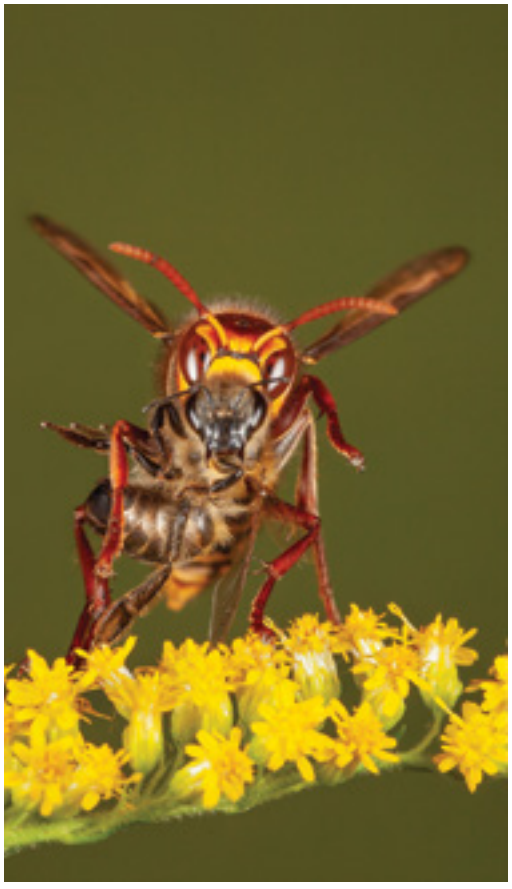
I was reminded of my interest in feral nests when I received a copy of *Wild Honey Bees: An Intimate Portrait* by photographer Ingo Arndt and biologist Jurgen Tautz (2022; Princeton University Press). This is a glorious book, the best collection of honey bee photographs I've ever seen, set in the evolutionary context of honey bee adaptations in wild nests.

The authors are both distinguished in their fields. Arndt is internationally prominent as a nature photographer, his career replete with awards, honors and photographs in major magazines and newspapers. Tautz is a German bee researcher and science communicator, author of a number of popular books about bees.

How Arndt captured bees in photographs is itself a story. As he wrote in the book, "*Working with honey bees requires a certain capacity for suffering*." By "suffering" he doesn't mean only stinging, although he does provide a photo of himself with one eye swollen after a sting. The shoot was physically demanding, requiring climbing trees and positioning himself for many hours outside wild nests. He built an observation lodge high up a tree through which to extensively photograph one wild nest profiled in the book, tolerating oven-like conditions during hot Summer days.

Patience and painstaking attention to details also characterized the eight months and two Summers he spent capturing bees and their forest habitat on film. The project required countless hours to take over 74,000 pictures to choose from in composing the visual story of honey bees in the forest. Arndt also notes the technical measures required for many of the photographs, including use of a high-resolution 50-megapixel single lens reflex camera, and macro and magnifying lenses to create images that could print out clearly on a full page.

I can not find enough superlatives to describe the photographs in *Wild Honey Bees*. "Spectacular," "Gorgeous," "Stellar," "Stunning," are only a start. The close-ups of individual bees are detailed in a way that bring home the complexity of



honey bee anatomy, with each hair, eye lens, mandible and sting standing out in sharp delineation.

The images also provide insights into the behavioral adaptations that have made honey bees favorites of insect aficionados for thousands of years. Among my personal favorites are a crisp photo of the queen laying an egg, surrounded by her attendants; water collectors with tongues extended, slurping up liquid; two worker bees guarding the nest's entrance, mandibles open to attack invaders; and a ball of worker bees surrounding and killing a wasp attempting to pillage the colony.

All of the photos were taken in and near feral nests in Eastern European forests. The framework for the images is delineated in the text, loosely organized into chapters about social behavior, other organisms that live in wild colonies, defense, forest habitat, and honey bee orientation. The final chapters include a series in which a swarm colonizes a former woodpecker nest, and a short bit about traditional forest beekeeping in which colonies are left intact but villagers living nearby regularly remove a few combs of honey.

*Wild Honey Bees* should become a part of every beekeeper's library, as a visual reminder of the feral origins of our managed insects, and of their stellar beauty and elegance. The text and photographs remind us that forests were the original habitat for European honey bee subspecies, and the authors call for conservation of what remains of these unique habitats. Arndt and Tautz also ask us to notice that honey bees in the wild are threatened in many parts of the world, including European forests.

The authors chose not to engage with the context of beekeeping today, or to provide a comprehensive discussion about the biology of feral honey bees, maintaining the book's focus on the photographic images. Perhaps the old adage "a picture is worth a thousand words" applies here. Still, more depth in the text would have been welcome; readers interested in a deeper dive into what we can learn from wild nests about honey bee biology and the future of beekeeping might obtain Tom Seeley's most recent book *The Lives of Bees*, also published by Princeton Press.

I was astounded at the book's low price, considering the excellence of the photographs and the book's high production qualities. This is a hefty coffee table book that you would be proud to display in your living room, but priced at only $23.00 to $29.00 dollars, depending on where you purchase it. Similar books are usually two to three times the cost, so I can only assume the authors and publisher are keeping the cost low as a public service rather than to generate a profit.

I particularly enjoyed *Wild Honey Bees* because my relationship with wild nests has become vicarious since I moved to SFU and coastal British Columbia, Canada 42 years ago. I had expected a wealth of wild colonies to remove from trees and houses, as the Vancouver area where I live experiences a much milder climate than the rest of Canada. I thought I'd find many opportunities to immerse myself and my students in feral nests.

Not so; I've yet to find or be told of a single wild honey bee nest. I learned the reason early on; while our winter temperatures are mild, rarely dipping below freezing, there is a floral dearth in May and early June. Earlier in the season, colonies thrive on Spring nectar sources such as maple and dandelion, and grow well, perhaps swarm, but then crash in late Spring as there's not enough nectar in the field to sustain colonies or the swarms they issue. Managed colonies must be fed to get them through this dearth period, but feral colonies have no such options.

Whatever your role in beekeeping, or if you're a civilian outside the beekeeping sphere, *Wild Honey Bees* will enhance your pleasure and interest in these most fascinating of creatures. And perhaps, just perhaps, readers will be inspired to do whatever they can to preserve wild honey bees, myriad other wild bee species, and the healthy habitats so critical if both wild and managed bees are to survive and thrive.

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

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# Image Gallery
## Swarms


A swarm from our homestead in Crawford, Maine.
Submitted by Craig and Theresa Fisk


Submitted by Stephen Repasky


Submitted by Al Blyth


Anthony Stewart, Honey Toast Farm, Cooperville, GA capturing a swarm in the Crimson Clover field.
Submitted by Alan Stewart


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# FOUND IN TRANSLATION

## *Bees and the Web that Traps Them*

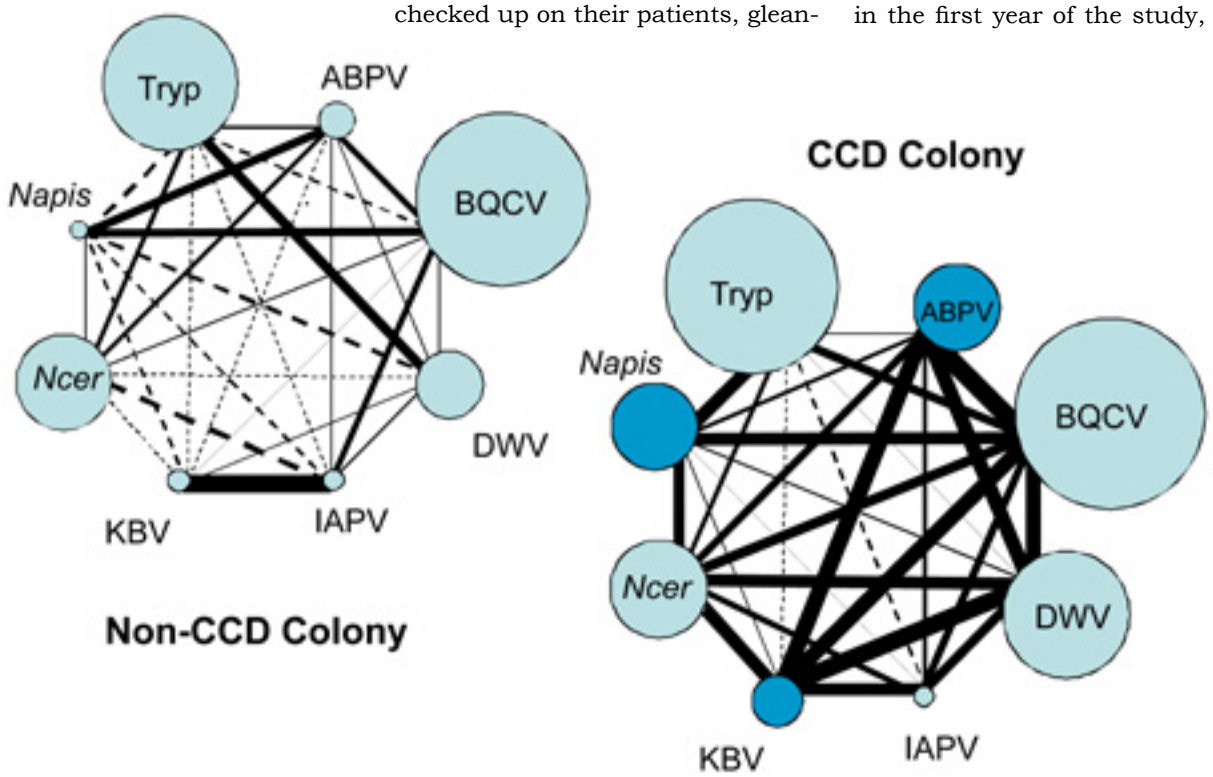
**Jay Evans,** USDA Beltsville Bee Lab

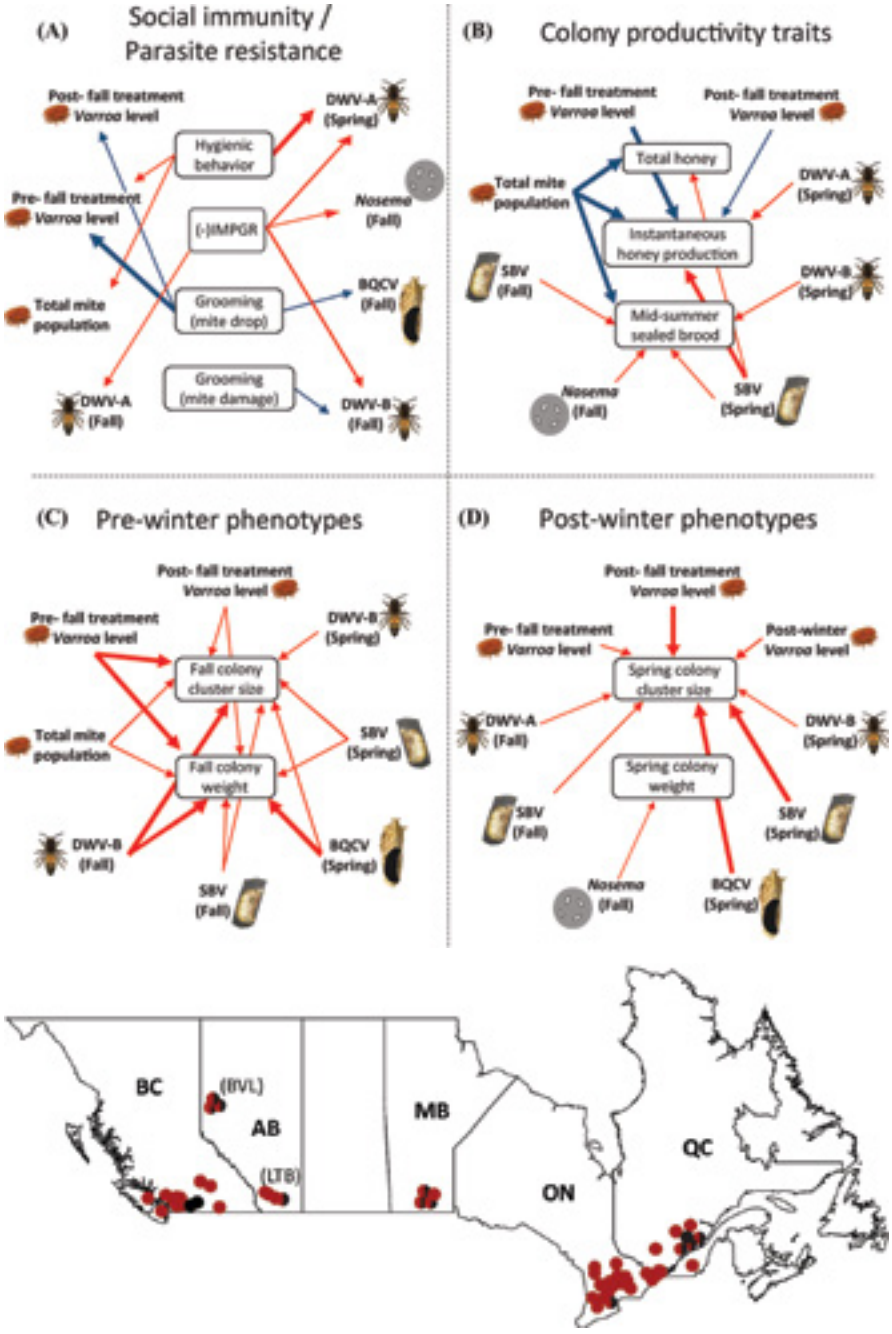
While big injuries, exposures and accidents are always a risk, it is more often an accumulation of small insults and decay that bring down honey bee colonies. Baffled by not being able to find a singular cause for Colony Collapse Disorder, we coined 'pathogen webs' ten years ago to describe what was actually seen in collapsed colonies (Robert Cornman and colleagues, *Pathogen Webs in Collapsing Honey Bee Colonies*, 2012, PLoS One, **https://doi.org/10.1371/journal.pone.0043562**). Troubled bees contained multitudes of microbes, but those multitudes were different from Bakersfield to Okeechobee and from Harrisburg to central Texas. We might have missed the forest for the trees, as I mused for *Bee Culture* in *C-C-Decade*, (2018, **https://www.beeculture.com/found-in-translation-13/**) but perhaps the multitudes would have given us better insights if we had just waited long enough.

Dr. Renata Borba, from Agriculture & Agri-Food Canada's Beaverlodge Research Farm (and now with the Alberta Beekeepers Commission), led her Canadian colleagues in a tremendous project to identify web players and ultimately connect them with poor colony health. Their open-access study, *Phenomic analysis of the honey bee pathogen-web and its dynamics on colony productivity, health and social immunity behaviors*, (2022, PLoS One, **https://doi.org/10.1371/journal.pone.0263273**), one-ups, or rather three-ups, prior work. 1) They sampled far more extensively both at each sample point (hundreds of bees) and across the country, 2) they looked at other key colony traits, from behaviors to honey yield, and 3) they checked up on their patients, gleaning data from one season to the next, important for assessing what really matters in sustainable beekeeping.

With over 1500 bee colonies, mostly started from packages, they had many opportunities to see how bee traits, management, and bad luck could lead to colony losses and honey production. You should read and discuss the paper to get more of their insights, but here are a few that stood out.

First, hygienic behavior really works: Colonies that scored high for a freeze-killed brood assay or for signs of grooming (in the form of mangled mites on the bottom board or in the sheer number of mites dropping over three days) showed lower mite growth rates, lower virus levels, and generally fared better. In fact, in the first year of the study, when






1000 colonies were vetted, 14/16 negative traits, from virus loads to mite numbers in multiple seasons, decreased significantly as hygiene scores (freeze-killed brood assay) increased, and the other two traits were non-significant but trending negative. The two other signals of grooming were not significantly tied to as many traits, although this might reflect the difficulty in quantifying these traits more than their importance as a form of social defenses against mites. In fact, in the second year the grooming 'mite-damage' score was a better correlate with decreased disease risk. This is comforting news and rare data for the colony level.

The study also quantified the importance of mite control on bee health. Mite numbers (as measured by alcohol washes) were positively tied to viral and nosema disease, and negatively tied to cluster size at both the time of measurement and the start of the next Spring. Several mite-transmitted viruses also showed predictive value for the state of colonies in current as well as subsequent seasons. Since there are not yet direct controls for viruses, the authors recommend effective mite controls coupled with selection for hygienic traits as the best way to decrease this threat. Interestingly, 'total mite count' in colonies was positively tied to sealed brood, in large part because of the ample mites found reproducing in sealed brood. This measurement was made by longterm exposure of colonies to amitraz while collecting fallen mites via sticky boards and is not normalized by the net amount of bees or brood. Results showing that mite control improve colony odds are not new, but the consistency of this work across Canada when compared to longterm studies in the U.S. and Europe suggests that *Varroa* and its viral partners remain the biggest drain on honey bees in most places. Another 2022 study, by Julie Hernandez and colleagues in Switzerland, showed 25-fold higher colony survival rates when beekeepers followed recommended mite treatments (*Compliance with recommended* Varroa destructor *treatment regimens improves the survival of honey bee colonies over Winter*, 2022, Research in Veterinary Science, **https://doi.org/10.1016/j.rvsc.2021.12.025**). The Borba study from Canada gives hope that some of the treatment burden, at least, can be reduced via good genetics.

Borba and colleagues refine additional yardsticks beekeepers might use to predict colony health and treatment regimes. While the results are confined to the eight populations studied, the authors argue that Spring colony weight is a poor predictor of current or future health, in large part because of greater honey stores in declining or lost colonies when compared to colonies that were ready to really take off. This is most evident in the first Spring cohort. Conversely, Fall colony weight does seem to predict disease load and, by correlation, colony health status in the Spring. Worker bee cluster size was a robust predictor of mite and disease status in both fall and spring, and this measurement is preferred.

The authors will report separately on the impacts of different management schemes (mite regulation and indoor versus outdoor storage) that varied across beeyards in this immense experiment. Integrating genes, behaviors (human and bee) and climate across a wide country is sure to give helpful insights for beekeepers everywhere, so keep an eye out for that study. In the meantime, mind the web and beat the mites.

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A Closer Look

# Queen Pheromones

Clarence Collison

*Honey bee queens produce a sophisticated array of chemical signals.*

Honey bee queens produce a sophisticated array of chemical signals (pheromones) that influence both the behavior and physiology of their nest mates (Beggs et al. 2007). Well known impacts of the queen's pheromones include formation of the queen's retinue, inhibiting ovary development in workers, inhibiting the production of queen cells and attraction of drones during her mating flight(s). However, there are several other less known effects associated with the queen's pheromones.

Queen mandibular pheromone (QMP) is a chemical blend that primes bees to perform several colony-related tasks. Beggs et al. (2007) found that QMP has profound effects on dopamine pathways in the brain, pathways that play a central role in behavioral regulation and motor control. In young worker bees, dopamine levels, levels of dopamine receptor gene expression and cellular responses to this amine are all affected by QMP. They identified homovanilly alcohol (a chemical component of QMP) as a key contributor to these effects and provided evidence linking QMP-induced changes in the brain to changes at a behavioral level.

Small colonies containing 600 workers were trained to collect syrup from counter-feeders in screened flight cages. Foraging activity was recorded for two days while all colonies had caged queens. Some queens were then replaced by porous plastic blocks containing queen extract, synthetic 9-oxodec-trans-2-enoic (9-oxodecenoic) acid, or alcohol. Foraging activity was recorded for three more days. Bees from colonies receiving only alcohol flew fewer trips and carried less syrup than those from colonies that received 9-oxodecenoic acid or that retained their queens. Bees receiving extract visited the feeder about as many times as those with alcohol but carried significantly greater quantities of syrup. Death losses were greatest in colonies that received alcohol and least in those that retained their queen. Field experiments using colonies of about 10,000 workers confirmed the cage results and indicated that pollen foraging is not controlled primarily by queen pheromones as is nectar foraging. In both field and cage experiments, synthetic 9-oxodecenoic acid, at sufficiently high dosage, was an effective substitute for a queen in stimulating nectar foraging (Jaycox 1970).

Higo et al. (1992) investigated the effects of synthetic queen mandibular gland pheromone on colony foraging and brood rearing. Colonies newly established in the Spring showed a significant, dose-dependent increase in the number of foragers gathering pollen, and individual pollen foragers returned to the nest with larger pollen loads. These two effects combined resulted in a doubling of the amount of pollen brought into colonies by foraging bees. Brood rearing also increased, but not significantly. In contrast, large, established colonies showed no effects at their Summer population peak. They concluded that queen mandibular pheromone can significantly affect foraging, but its effects depend on colony conditions and environmental factors.

Synthetic queen mandibular gland pheromone (QMP) was applied to honey bee colonies to test two hypotheses: (i) QMP acts like a primer pheromone in the regulation of age-related division of labor, and (ii) this primer effect, if present, varies in three strains of workers that show genetically-based differences in their retinue attraction response to QMP (a pheromone releaser effect). Strains of workers that were high, or low in their response to QMP in a laboratory bioassay, as well as unselected 'wild-type' workers, were fostered in queenright colonies with or without supplemental QMP. Effects of QMP on foraging ontogeny and juvenile hormone III (JH) blood titers in worker honey bees were measured. Bees in QMP-supplemented colonies showed significant delays in foraging ontogeny, and foraging activity was reduced. They also had significantly lower JH titers, although the titer curves were somewhat atypical. There were no differences in foraging ontogeny or JH titers among the three strains. It was concluded that (i) QMP can delay the ontogeny of foraging by some mechanism that suppresses JH production, (ii) this QMP primer response is independent of the retinue releaser response, and (iii) QMP can play an important role in regulating division of labor (Pankiw et al. 1998).

Honey bee workers develop from fertilized eggs, but those reared in a queenless colony develop into 'rebel' workers, which are more queen-like than typical workers. Rebels develop after an old queen leaves with a swarm

and before a new queen hatches. It was hypothesized that larval food lacking queen mandibular pheromones trigger the rebel phenotype. Larvae reared under queenright or queenless conditions were additionally fed with water or a drop of macerated queen mandibular glands. After following development of the bees and subjecting them to dissection, they found that those reared with a queen or fed the macerated glands under queenless conditions developed into typical workers. Only those workers reared without a queen and without macerated glands added to their food developed into rebels; these rebels had more ovarioles, smaller hypopharyngeal glands, and larger mandibular and Dufour's glands than did typical workers. This is the first evidence that larval perception of the presence or absence of queen pheromones causes an alternative development strategy (Woyciechowski et al. 2017).

Honey bee queen attendants disperse queen pheromones to supplement pheromone dispersal by direct queen-worker contacts. With time they lose their dispersal function exponentially due mainly to volatilization of queen pheromones carried on their bodies. The elimination of those airborne pheromones together with the air while ventilating the hive is balanced by pheromone release by the queen. This equilibrium results in a certain level of queen pheromones in the broodnest. The change of the pheromone level (for example, due to loss of the colony of its queen) can serve as a signal to alter the behavior of the workers and the state of the colony (Juška et al. 1981).

Worker-laid and queen-laid male eggs were transferred into combs of empty drone cells in four honey bee (*Apis mellifera ligustica*) colonies. Worker-laid eggs treated with an ethanol extract of queen Dufour's gland were removed by workers (worker policing) at a significantly lower rate than either untreated or ethanol-treated worker-laid eggs, but this effect was less when 1:10 dilution was used and it disappeared at a 1:100 dilution. Worker-laid eggs that had been touched to an area of a queen at the base of the sting and between the sting sheaths ('sting-wipe' treatment) were also removed at a significantly lower rate than untreated worker-laid control eggs. In all trials, the removal rate of worker-laid eggs exceeded that of queen-laid eggs. Queen-laid eggs treated with the polar solvents methanol and ethanol were removed more rapidly than those treated with the less-polar hexane and methylene chloride, but it was not possible to determine if this was because methanol and ethanol were more effective at removing a possible pheromone or because they caused more damage to the eggs. The results support a hypothesis that recognition of worker-laid eggs during worker policing is via a queen-produced egg-marking pheromone (Ratnieks 1995).

The influence of the queen and her pheromonal signal on comb construction was examined. Four treatments were tested with newly hived packages of bees containing: 1) a mated queen, 2) a virgin queen, 3) no queen but with a dispenser containing synthetic queen mandibular pheromone (QMP), and 4) no queen and no pheromone. After 10 days, the comb produced by each colony was removed, comb measurements made, bees from the comb-building area collected, the size of the scales on the wax mirrors of the collected bees ranked on a scale of zero to four and the queens removed and analyzed for QMP components. Queenless workers built substantially less comb and the comb they did build had significantly larger, drone-sized cells than for the other three treatments, indicating that both cell size and the quantity of comb built are mediated through the queen, particularly QMP. The observations of wax scale size suggested that QMP influenced comb

building behavior rather than wax scale production. These results support the idea that queenless honey bees can adopt a strategy of constructing drone-sized cells in order to increase reproductive fitness through male production following queen loss (Ledoux et al. 2001).

Queen pheromones ensure that the queen successfully accompanies swarming workers to their new nest site. The area spanned by a migrating swarm of bees is vast: flying swarms of 11,000 bees can occupy a space that is eight to 12 meters long, six to eight meters wide, and three to four meters high (Beekman et al. 2006). The presence of a queen in an airborne swarm improves the moving swarm's cohesion—swarm clusters that liftoff without a queen are much more dispersed, spanning a diameter of up to 60 meters (Morse 1963). Furthermore, if the queen is prevented from accompanying the flying workers, workers will return to the last place that they clustered with her (Avitabile et al. 1975) or move to her new location if she is placed nearby (Simpson 1963; Morse 1963), thereby ensuring that the queen remains with the swarm to establish the new nest. Some components of queen pheromone play a clear role in informing swarms of the presence of their queen. When queens are prevented from lifting off with swarms but some workers are marked with 9-ODA, workers will relocate to their new nest site without returning for their abandoned queens (Avitabile et al. 1975). Swarms will also cluster stably around a lure impregnated with 9-ODA and/or 9-HDA (Butler et al. 1964; Butler and Simpson 1967; Winston et al. 1982). However, while 9- ODA, 9-HDA, and QMP are attractive to workers from queenless swarms, whole-queen extracts or live queens are significantly more attractive (Boch et al. 1975; Winston et al. 1989). Thus, additional queen-produced compounds may be involved in swarm cohesion, attraction and migration (Grozinger et al. 2014).

Bahreini and Currie (2015) studied the effects of honey bees with different grooming ability and queen pheromone status on mortality rates of *Varroa* mites, mite damage, and mortality rates of honey bees. Twenty-four small queenless colonies containing either stock selected for high rates of mite removal (n = 12) or unselected stock (n = 12) were maintained under constant darkness at 5°C (41° F.) Colonies were randomly assigned to be treated with one of three queen pheromone status treatments: (1) caged, mated queen, (2) a synthetic queen mandibular pheromone lure (QMP), (3) queenless with no queen substitute. The results showed overall mite mortality rate was greater in stock selected for grooming than in unselected stock. There was a short-term transitory increase in bee mortality rates in selected stock when compared to unselected stock. The presence of queen pheromone from either caged, mated queens or QMP enhanced mite removal from clusters of bees relative to queenless colonies over short periods of time and increased the variation in mite mortality over time relative to colonies without queen pheromone, but did not affect the proportion of damaged mites. The effects of source of bees on mite damage varied with time but damage to mites was not reliably related to mite mortality.

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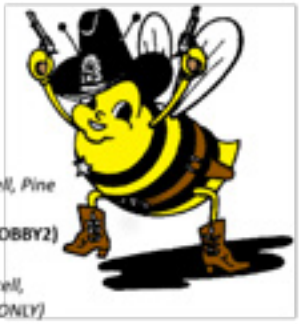

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# A Reunion Worth Waiting For

**Mattie Joiner**

The American Honey Producers Association 53rd Annual Conference and Trade Show took place December 1-4, 2021, and was a happy reunion amongst beekeepers. The buzz of conversation between them rivaled even the busiest of hives, the joy of being together intensified by being so long apart.

Held in Baton Rouge, LA, the conference began with a welcome reception and the opening of the Trade Show where members enjoyed Cajun style food, live music, and entertainment.

The first full day of the conference featured many important industry updates. Our Keynote Speaker was Mr. Alan Luberda, partner at Kelly Drye and AHPA's representative in matters of trade litigation and enforcement under the anti-dumping duty laws. Mr. Luberda presented information on the work he does for us, along with an update on the current anti-dumping lawsuit filed by AHPA. Other presentations included those on almond pollination and teaching honey bees' immune systems to fight diseases.

Excitement swirled among members the next day as they participated in a panel hosted by veteran commercial beekeepers who shared what has and hasn't worked for them in the battle against *varroa* mites. Lectures about the problems impacting honey bee health, the PAm and Hilo Queen Project, and the requeening of colonies were also offered. That evening, members enjoyed a night out unlike any other.

Our group outing to historic White Oak Estate and Gardens was highly anticipated and thoroughly enjoyed by all! Owned by renowned chef, John Folse, the estate boasts a restored and operating distillery, sugar mill, grits mill, and beautiful antebellum-style house. Members enjoyed a tour given by Chef Folse himself and authentic Louisiana cuisine prepared by Chef and his team in the estate kitchen.

Friday began with a New Member Breakfast where new, longtime, and board members had the opportunity to connect. Presentations were given on the Canadian Honey Council, effects of the past year's high temperatures on honey production, new varroacides, and updates on bee stressors. Our banquet and live auction were a wonderful way to conclude the day.

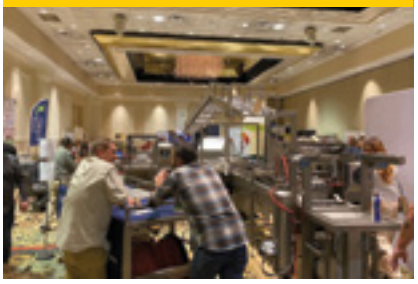
During the banquet, we were pleased to honor Kim Flottum with the Beekeeper of the Year award. The Friend of the Industry award was happily given to Mike Coursey. In a touching speech, Kelvin Adee announced he was stepping down from the AHPA Presidency. Vice President, Chris Hiatt, moved into the role and long-time executive board member, Steven Coy, became our new VP.

We were also pleased to present Richard Adee, Jack Meyer, and Bobby Coy with the Lifetime Member Award for their outstanding, decades-long support of AHPA and their contributions to the beekeeping industry.

Several months have passed since our 53rd Annual Conference, but we are already preparing for this year's conference! Witnessing the reunion of old friends and the creation of new ones is perhaps the best part of our gathering. The solidarity and fellowship enjoyed by these beekeepers cannot be found anywhere else. We look forward to seeing you all this December in Tucson, Arizona!

Richard Adee, "Friend of the Industry" Mike Coursey, and Former President Kelvin Adee

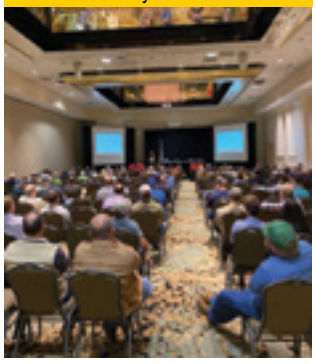
Trade Show



Wonderful sponsors and vendors at the Trade Show

Members enjoying a tour of White Oak Estate and Gardens with Chef John Folse

Members attend lectures on latest honey bee research



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# NWC Transition Part 2

## *Buzz's Bees and Strachan Apiaries Certified New World Carniolan Producer Partners*

**Sue Cobey**

Valeri Severson, Marla Spivak & Sue Cobey (Left to Right) Inspecting colonies at Strachan Apiaries.

The New World Carniolan is one of the longest running and most successful bee breeding programs. It's an industry standard, "time tested and industry proven," now going into its 40th generation. In addition, NWC stock has been utilized to enhance several breeding programs in the U.S., Canada and Mexico. Modeled on the Page Laidlaw Closed Population Breeding Program, selection and maintenance are based upon working with a known, genetically diverse population, as reviewed in Part 1. A key success factor is attributed to this practical, flexible, and dynamic breeding system.

A Certified NWC Producer Partnership has been established to ensure continuation into the future. Two well respected, multi-generational family businesses in northern California, Buzz's Bees and Strachan Apiaries, have taken on this venture and bring their expertise and experience to the program. Buzz and Nicole Landon of Buzz's Bees and Valeri Severson and her son Phillip Strachan-Russell of Strachan Apiaries will maintain the breeding population and produce instrumentally inseminated NWC breeder queens for the industry. They will also continue to provide NWC natural mated production queens to beekeepers for pollination and honey production.

Susan Cobey and Steve Sheppard at Washington State University will continue to provide technical support and augmentation of the breeding population. WSU holds a USDA- APHIS permit to import honey bee germplasm from Europe. Sourcing *A.m. carnica* stocks to enhance genetic diversity is key to strengthening fitness in the breeding population and ensuring the future longevity of the NWC program. Buzz's Bees and Strachan Apiaries, well recognized and highly regarded within the industry, are featured here to share some insight into their beekeeping operations.

**Strachan Apiaries, Yuba City**

Strachan Apiaries was founded by Don Strachan in 1953, having learned beekeeping in his youth working with his cousin. He settled in the northern Sacramento Valley at the base of the Sutter Buttes, a highly productive and fertile region for beekeeping and agriculture. Here, he established his business, purchasing 600 hives and Caucasian Unlimited, a queen production operation. Don moved the business to its present location in Yuba City in 1961, where he and his wife Alice raised three daughters: Debbie, Donna and Valeri.

Don decided to work with Carniolan bees in 1980, obtaining stock from Everett Hastings in Saskatchewan, Canada. Hastings initially worked with Caucasian bees in the 40's, and incorporated Carniolan stock into this in the 60's, selecting for wintering ability and productivity. When Everett Hastings passed, this stock was not maintained. Strachan Apiaries began using NWC in the early 1980s. Carniolan bees became the backbone of the business, built into a 10,000 colonies operation with a focus on queen production, pollination, and honey production. Active in the industry, Don served as president of the California State Beekeepers Association during the centennial year of 1989.

Facing challenges is part of the business. The 1987 ban on importing bees to Canada due to the spread of tracheal mites, significantly reduced the queen and package bee market. The cold climate adapted Carniolan bees, reared in California, were favored. The impact of the closure was harsh on both the U.S. producers and

Philip Russel & Valeri Strachan


Russell Family, Trinity & Philip, with Caleb, Lilly and Dillon

Canadian beekeepers. The border reopened in June of 2004, and Strachan Apiaries were the first to ship queens to Canada. In the 1990s, low honey prices and weather disasters caused havoc. In the 1997 floods, Strachan Apiaries lost 1300 colonies. Resilience in overcoming these factors is an aspect of their success.

Valeri joined the business in 1975, as a bookkeeper, organizing queen orders and managing the office. Within a year she took interest in the beekeeping tasks, working in queen production, going out with the field crews, moving bees and learning the essential aspects of the business. With tenacity and persistence, among the all-male crews of the time, she made herself indispensable. Working closely with her dad for more than 25 years, the transition to management was a given. Valeri's strong sense of responsibility for family and business provided stability. With Don's passing in 2003, Valeri bought out her two sister's interest in the business. Today, Valeri runs the largest female owned beekeeping operation in the U.S., averaging 10,000 hives. She credits her success to having good people to work with her in managing the operation.

Valeri's interest in the Carniolan breeding stock included learning the insemination technique from Sue Cobey. She produces breeder queens to augment the program. Philip is now learning this skill. Jeronimo Vidaurri, a longtime employee of Strachan Apiaries, manages the cell builders for queen rearing and helps care for the breeding stock. Valeri says, his keen sense of quality control in queen production and breeder selection, and his conscientiousness in critical matters are highly valued. Jeronimo's sons, Jerardo and Vicente, are following his footsteps, also work at Strachan Apiaries.

Valeri's son, Philip has been working with her since 2010, learning the business. After many years and life changes, he decided to return to beekeeping and is transitioning to take over in a few years. During high school he worked in the warehouse extracting honey and building boxes though decided his interests were elsewhere. Philip went on to get a degree in accounting, which has proven valuable to the business. Happy to be back, he wished he had realized this was his passion sooner. Valeri feels fortunate to have him involved. Philip bought his grandparents' house close to the business, and lives there with his wife Trinity and their three children: Dillon, 12 years old; Caleb, 9; and Lilly, 6. Valeri says, "I'm looking forward to seeing which one will be the beekeeper."

An important aspect of this specialized industry is leadership. Valeri is a longtime member and supporter of the American Beekeeping Federation and the American Honey Producers Association. She has served as president of the California Bee Breeders Association and the California State Beekeeper Association. A supporter of bee research, Valeri also served on the National Honey Board and currently serves on the California Department of Food & Agriculture Apiary Board. She also worked on the initial organizing committee of Project *Apis m.* Philip, following this path, currently serves as Vice President of the California State Beekeepers Association.

Valeri lives with her husband of 44 years, David, a retired school principal and superintendent who continues to fill in at schools and colleges as needed. With a strong Christian faith, they are active in the church and keep busy with their three grown children, Philip, Kari and Jaycen, and six grandkids.

**Buzz'z Bees, Oroville, CA.**

Named "Buzz" before his family bought their first beehives, Buzz was destined to be a beekeeper. He grew up in the bee business, starting as a small child helping his dad, Skip. Skip Landon ran 500 hives for pollination and honey production as a sideline business. His mother, Lisa, worked weekends and Skip's weekday job pushed the beekeeping to weekends only. Buzz and his brother Chris were hauled around to bee yards, helping with the beekeeping, and sometimes causing mischief.

Buzz always enjoyed the bees with strong interest. Skip set him up with his first colonies, trading Buzz for his labor. While still in high school, Buzz purchased an additional 100 colonies and managed these while attending California State University, Chico. He earned a degree in Plant and Soil Science and then his PCA, Agricultural Pest Control Adviser license. Upon Skip's retirement in 2001, Buzz purchased his father's operation.

While attending Chico State, Buzz met his wife, Nicole, who quickly realized hanging out with Buzz meant she would have to learn beekeeping. Together they ran bees as a sideline business while pursuing full-time careers in the rice industry. Buzz managed a rice farm and Nicole, with a degree in Agricultural business, worked as a bookkeeper.

Buzz and Nicole spent evenings and weekends maintaining the hives and raising queens to expand their operation. Working seven days a week grew increasingly demanding with their jobs, a growing bee business and starting a family. They choose to take a leap of faith, quit their jobs, and follow their passion to give the bee operation full attention.

Buzz decided to focus on raising queens, seeing a growing demand and limited supply, as he struggled to obtain enough queens for his own operation. Working bees together, Buzz and Nicole built their queen rearing business. Initially, just the two of them, they managed the intensity of the workload. While catching queens, they would set up a tent for their young son Max to play in the yard. Nicole says, it was rough, but worked and has grown into a very successful operation. Buzz and Nicole have three kids: Max is now 15 years old, Bryce is 13 and Josie at 11 is already grafting queen cells.

Today, Buzz's Bees is a 6,000 colony operation, running hives in California, Nevada and Wyoming. Based in the eastern foothills of northern California, they produce both Carniolan and Italian queens, package bees, nucs and provide pollination services. They also have a bee operation in Wyoming for honey production. After the active bee season, they run a woodshop producing bee equipment, keeping their employees busy in the off season.

In Oroville, CA, Buzz purchased property in 2012 and built his warehouse. He expanded with a second building in 2019 to accommodate the growing business, including a grafting and packaging room, and a cold storage facility. Buzz is always looking for ways to improve his business. The cold storage facility, based on a Washington State University research project, provides a means to bank queens and to maintain colonies while avoiding the stressors of the dry Summer dearth. Colonies placed in cold storage shut down, reducing feed, labor and provide an opportunity to treat colonies in a brood-less state. Creative in applying innovations, the cold storage facility is also being used to successfully introduce and establish the new instrumentally inseminated breeder queens.

Buzz loves his career, the people he works with and the uniqueness of the industry. He also enjoys flying and holds a private pilot license. His flights include travel to Wyoming to manage his bee operation. Some trips have included the transported bees in nucs.

Nicole runs the office and the numerous aspects this business demands. Buzz's mother, Lisa, provides the quality control, and does grafting, managing queen cells, and packaging queens for shipment. Key to the operation is a loyal returning all-woman Latina crew responsible for caging queens.

Rob Snyder, with the Bee Informed Partnership, has joined the team, splitting his time between BIP and Buzz's Bees. Rob works in the queen department, with the breeders and cell builders. To help with the breeders, Rob is learning the technique of instrumental insemination. Buzz has mastered this skill, having taken Sue's class a few years ago, and is now teaching Rob.

Josie, Buzz, Nicole, Max, and Bryce (Left to Right)

Sue Cobey, Buzz Landon, and Valeri Severson

Dillon Russell in the Queen Bank Yard.

The Strachan Bee Crew. Jaime and Alberto (Seated Left to Right). David, Gabriel, Pio, Larry and Chris (Standing Left to Right).

Grafting Larvae for Queen Cells at Strachan Apiaries. Bertha, Luis, Jeronimo grafting, and Adolfo taking frames to cell builders (Left to Right).

Buzz with Dan Wyns from BIP performing the Freeze Kill Brood assay on breeder colonies.

Bryce Landon driving the forklift.


Dr. Marla Spivak, with Buzz, taking a photo of the UBO test area on Buzz's breeder colonies.

A recognized leader in the industry, Buzz currently serves as the president of the California State Beekeepers Association, CSBA. He is the past president of the California Bee Breeders Association. Acknowledged as a strong team, Buzz and Nicole were presented with prestigious awards at the CSBA convention in 2021, Buzz awarded the CSBA Beekeeper of The Year Award and Nicole awarded the CSBA President's Award. Buzz was also the recipient of the CSBA Young Beekeeper of The Year Award in 2013.

Buzz and Nicole are also active in supporting research programs to benefit their operation and the industry. Looking for ways to improve his breeding stock, Buzz is involved in field testing a new pheromone-based assay that measures colony resistance to pests and diseases. This "unhealthy brood odor" or UBO assay involves application of a mixture of brood chemicals associated with honey bee stressors to a small area of capped brood cells. Colony hygienic response to the treated brood cells over the two-hour test period has been shown to be a reliable indicator of colony *Varroa* resistance and virus levels. Developed by Drs. Kaira Wagoner and Olav Rueppell and backed by a decade of research, the UBO assay is expected to be a practical new tool for bee breeders that provides a quick and precise method for measuring colony pest and disease resistance. Buzz hopes this will allow him to run tests himself, complimenting the BIP team's hygiene assessment using liquid nitrogen freeze killed brood tests.

Honey bee health and nutrition is an increasing concern and many new products are being developed. Buzz is assisting in running field trails to test Optima, a bee feeding supplement and feeding stimulant. Optima contains plant polyphenols and essential oils known to promote bee health and reduce the prevalence of diseases.

To encourage beekeepers to use the BeeWhere program, Buzz is featured in a supporting video. The GIS technology tool, a geographic information system, is a software mapping program designed to protect pollinators with a pesticide notification system and promote the statewide registration of hives, as required by California law.

In addition, both Buzz and Valeri are featured in the Netflix series *Rotten*, an investigative report on the corruption in the global food supply chain. The episode Lawyers, Guns & Honey, aired Jan. 2018.

**Information and Videos Links**

**Buzz's Bees** (530) 532-4302 **https://www.buzzsbees.com**

**Strachan Apiaries** (530) 674-3881 **https://strachanbees.com**

**New Tool to fight *Varroa* Mite with Dr. Kaira Wagoner**

Inside the Hive TV **https://www.youtube.com/watch?v=f9SeQYL0cAQ**

**WSU Indoor cold storage project, posted on Project Apis m. https://www.projectapism.org/indoor-storage-of-honey-bees-blog/indoor-storage-conference-2021**

**BeeWhere https://beewherecalifornia.com**

**https://www.californiastatebeekeepers.com/beewhere/**

**Netflix series *Rotten*** Episode Lawyers, Guns & Honey. Aired Jan. 2018.

Link **https://www.imdb.com/title/tt7830582/?ref_=nm_flmg_slf_1**

**Credits**

Thanks to Buzz & Nicole Landon and Valeri Severson & Philip Russel for information and photos for this article.

Thanks to Kaira Wagoner and Anna Marie Fauvel for comments and BIP photos of the UBO assays, and to Katie Lee for field testing photos.

California State Beekeepers 2021 Awards Banquet. Buzz awarded the CSBA Beekeeper of The Year and Nicole aswarded the CSBA President's Award.

Buzz checking new breeder colonies.

# Beekeeping and the Organizations that Support Us

Debbie Seib


Attend a beginning beekeeping class and one of the first things you're told is find a mentor and join a local bee club. At your local club meeting, someone asks if you're a member of the state association and you think "Should I be?" Next, you hear about a regional conference coming up and then you get a Facebook or Twitter blast about something the national association is doing. By now your head is swimming and your pocket book, unlike COVID weight, is getting lighter and lighter.

You question, why do I need to join anything besides my local club? So let's take a look at the different organizations, what the benefits are from each one and then you'll have the information you need to make an informed decision.

Let's start with your local club, which has monthly meetings. Most local clubs have less structure, they may or may not elect officers. Many have a core group that arranges and manages the club meetings, speakers and event days. Local clubs have no dues, minimal dues or a donation jar to cover the cost of the meeting location and any beverages or snacks they serve. Depending on the size of your state and how many local clubs there are, they will encompass a local club for a single county. Multiple counties and large cities may have multiple local clubs per city. They usually have a mentor program so your mentor will be someone close to you. They hold hands-on clinic-like field days, demonstrating how to make candy boards, catch a swarm or maybe how to assemble equipment. Some local clubs will bring in speakers from your state who specialize in a specific topic. Local information can be found on Facebook; however, some have a website as well.

State associations are structured with officers and a board of directors. They are governed by a set of by-laws and directed by a Policy and Procedure document. Dues are collected and used to further enhance beekeeping in your state, as well as put on Spring and Fall events bringing, in national and international speakers. Your state associations are involved in the regional and national programs. Many states sponsor programs that are accessible by their membership, and some are available to all beekeepers, such as scholarships, getting new beekeepers started, awards for young beekeepers and honey shows. They produce newsletters, rosters and partner with other state associations that are affiliated with our industry. State associations share a list of beekeepers willing to assist the public by collecting swarms, performing cutouts and giving education talks to the public. State associations publicize their information, governance documents and how to join on social media (Facebook/Twitter) and websites.

Several factors define a regional society and not all regional societies are the same. They all hold an annual conference and while some have dues and require a beekeeper to be a member in order to attend their annual conference, some do not. These groups are also governed by officers, a board of directors following their by-laws, a mission statement and a Policy and Procedure document. They are tightly tied to the state associations and rely on them to fill board positions, volunteer to host their annual conference and share regional information to their state members. Some grant scholarships, sponsor honey shows and run an accredited Master Beekeeping program.

Our national association represents beekeepers of all levels. Governed by officers and a board of directors, it runs many different programs that encompass many areas of beekeeping, including the American Honey Queen, Foundation for the Preservation of the Honey Bee and Friends of the Bees. The federation creates and shows educational webinars, free programs for new beekeepers and supports bee labs and scientific research in the United States. They are the only group that is large enough to lobby in Washington for new changes and corrections

to laws that affect beekeeping and our industry. They host an annual conference that moves from region to region every year giving all beekeepers in the U.S. and across the world the opportunity to attend. Speakers include researchers, professors at highly accredited bee labs and beekeepers that are renown across the world. Sharing information about the conference, our industry and our members is done via Facebook, a Quarterly Newsletter and an online publication called *eBuzz.*

And finally, we have our international organization "*Apimondia.*" The name *Apimondia* is a combined word; *api*, referring to honey bees, and *mondia*, referring to the world and as the name suggest, it is all about beekeeping across the world. Issues that affect beekeepers no matter where they live are addressed by the international organization. They host a conference every other year in different countries so the hosting country can exhibit beekeeping in their country. Managed by an international board of directors, both the officers and the board of directors gather several times a year to discuss world effects on our honey bees. Each country that is a member of the international association has delegates that vote for policy and locations to host the world conference. They also hold the international honey judging.

In the future, when deciding what organizations to join, donate to or volunteer for, keep in mind that all of them provide some benefits to us as beekeepers, researchers that we rely on and laws that protect our industry. All of the above organizations can use your help. If you can't donate your money, donate your time.

Debbie Seib, Beekeeper
The Beekeepers of Indiana, Treasurer
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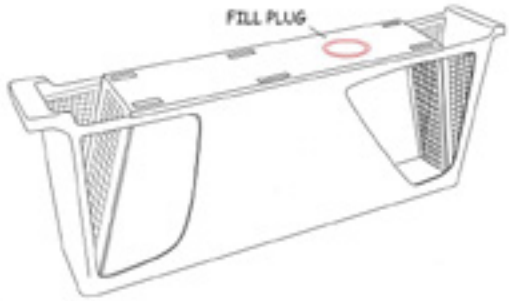


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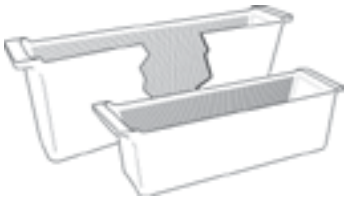

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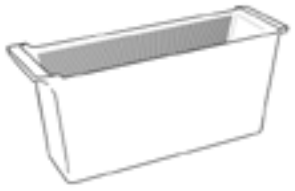

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# The Reliability of Science - Part 1

We have all come to rely on science. It is responsible for most of the technologies we use daily and we rely on it to guide our decision making. As a writer for *Bee Culture*, I certainly rely on scientific articles to justify and provide credibility for the challenges I highlight that are facing our bees, ranging from pesticides and climate destabilization to electromagnetic radiation. I also use some scientific methods in my beekeeping. For example, I keep a journal to record data and observations, and I will try different honey bee management techniques by experimenting with them on a few hives before I commit to using them on my entire operation. However, while science is helpful, it isn't the be-all and end-all that it is often made out to be.

**What is Science?**

Science (sometimes referred to as the scientific method) is the process of asking questions (creating a hypothesis) and then using experimentation and observation to test the veracity of the hypothesis. When science has established a fact, we tend to take it as the absolute truth. In reality, we can't *prove* anything in science. What scientists do is gather observational evidence that support some theories and refute others. Over time, the accumulated evidence becomes overwhelmingly convincing, so we can say with a high level of confidence (but never 100%) that one theory is likely a good approximation of the "truth," while the competing theories are very likely wrong. Thus, a single study on its own does not prove anything much without replication. This process has been the bedrock of the esteem in which science has been held, as an honest and impartial source of evidence-based knowledge that not only advances the frontiers of science but also informs the public and political leaders and aids in decision-making.

Ultimately, science is the best guess we are able to make about the reality of the world based upon what we know, and since what we know is always changing, the determination of what is scientifically "true" is always changing.

**Limitations of Science**

Because science seeks to be objective, there are large areas of human existence that are outside the bounds of scientific discovery. Science requires the collection of hard data (measurements of some kind) in order to extrapolate patterns and use scientific outcomes to help describe or predict real world experience. However, when it comes to something that cannot be weighed or measured objectively, science becomes useless and things like love do not exist according to science.

Science is also slow, takes a lot of work and is often costly. The time and money required to carry out research severely limits the speed with which new knowledge can be disseminated to the public. The high price of subscriptions to scientific publications and the many publications that exist behind paywalls, along with the often highly technical language scientists use, can further limit access to scientific information.

**Problems with Science**

One problem with delays in the dissemination of new scientific information is that it can provide a small group of people with inside information that they can act upon, long before it gets out to a wider audience. This creates an uneven playing field in the development of new technologies.

Science has also evolved to exhibit numerous problems and complications that have degraded its integrity. These problems can be categorized into two basic groups: honest mistakes and dishonest mistakes.

Honest mistakes occur when researchers create poorly designed studies or make errors in carrying out their research. Researchers may also allow bias to creep into the process which can unduly influence the questions that are asked, and how questions are investigated. Such errors made following the scientific method have the potential to be fixed and leave room for improvement. At its best, the use of the lengthy peer review process, where fellow researchers unrelated to the study review it, can ask questions and seek revisions in order to validate the legitimacy of the conclusions prior to them being made publicly available, catches many honest mistakes and errors. The peer review process however is not without its own potential pitfalls. Scientific work can so challenge the established dogma that even carefully conducted science can be rejected in what some have referred to as a "political review" process.

Meanwhile, since money is required to fund scientific work researchers often gravitate toward outcome driven science that has the potential for patents and marketable products or systems. This comes at the expense of curiosity driven science that lays down the basic research that can lead to future discoveries and inventions.

Unfortunately basic research, especially that conducted by PhD candidates, is not followed up upon often enough. If there was some process that would guarantee a progressive path that would shepherd basic research projects from one level to the next until it either totally fails and the data can be used to inform future projects, or it produces something of value, scientists would be less likely to shun basic research and such research would become useful faster.

**Scientific Integrity**

Sometimes scientists appear to get so wrapped up in their work, they succumb to a kind of tunnel vision that causes the researcher to lose sight of moral and ethical standards as they focus on getting their data and finishing their experiment. This can lead to some truly horrific things being done in the name of science


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The poster child for the 'political review process' is the Italian astronomer Galileo (widely considered the father of the scientific method) whose support for the theory that the earth revolves around the sun, and not the other way around, was so opposed by the Roman Catholic Church that he was forccd to recant and spent his final years under house arrest for this heretical stance. *Painting by Cristiano Banti (1857) Galileo facing the Roman inquisition: Soucre Wikipedia*

such as experiments on Jews by the Nazis, and the United States Public Health Service Syphilis Study at Tuskegee (originally called the "Tuskegee study of untreated syphilis in the negro male"). Honey bee researchers may be falling into this trap with the current research into genetically engineered bees. Scientists are far from fully understanding the full impacts to an organism when they change or modify one or more genes and if changes that are harmful get released into the global population of bees, honey bee bioengineering could cause more harm than good.

In many ways, today's scientific community has even greater challenges conducting quality science that won't get twisted in a dark way as they navigate more and more ethical questions and conflicts.

**Corruption of Science**

Science can obviously be helpful, but it can also be misleading or even harmful when manipulated for personal gain (profit, power, or prestige) rather than the sincere search for truth about the nature of reality. Due primarily to the corrupting influence of money, over the years there has been a growth in the amount of intentional mistakes, omissions, oversights, fraudulent work and censorship being made in the realm of science.

Some of the problem can be traced to administrators who have a profound influence on science. Since they hire and fire individual researchers in their departments or organizations they can have significant influence over which studies get carried out and which don't. In honey bee research this issue is most likely to emerge within regulatory agencies like the U.S. Environmental Protection Agency (EPA) or university settings.

Unfortunately when a scientist's research suggests a result that large donors are not happy with, administrators have been known to censor scientific work preventing it from being published and have even prohibited researchers from discussing their work publicly. Should a scientist blow the whistle on such actions, administrators are not above personal attacks or other forms of retribution designed to punish the whistle blower and discourage others in the organization from following a similar path (Lerner 2021a, 2021b). Unfortunately, the agency responsible for protecting bees and other pollinators from dangerous pesticides and other pollutants (U.S. EPA) has a long history of employees stepping forward as whistleblowers and then being retaliated against despite laws that are supposed to prevent such retaliation.

**Pseudo-Science**

Some companies market their products as "clinically proven" which sounds scientific but is often not the case. Even when a company actually conducts research it is typically not published in a peer-reviewed journal. Companies claim the additional time and expense of the peer review process is prohibitive, or that their research is proprietary information, when the real reason is because the "science" does not meet accepted scientific standards and/or is not reproducible.

Meanwhile, it has been estimated that there are hundreds of journals that lack ethical practices in carrying out the peer-review process and have extremely low standards. When such journals publish something, the information then becomes fodder for unknowing researchers and scientists who are duped into believing it's true. Given the immense amount of pressure on academics to publish, some become desperate enough to—either unintentionally or sometimes intentionally—engage with such predatory journals.

The importance of getting one's work published can impact scientific integrity due to the publication bias that is exerted within scientific circles. The more dramatic and surprising the study results, the more publishable the study is and researchers will sometimes sensationalize their findings, articles and publicity surrounding their research in order to help ensure publication and widespread dissemination.

As I have outlined above, many of the drivers of compromised science are systemic and embedded in the current scientific-process intended to gather and disseminate evidenced based knowledge. It is within this peer review process where we see the intersection of scientific advancement and reputational and financial rewards for scientists, publishers incentivized gaming to capture more eyeballs for the attention economy. Unfortunately there is another major factor that is at work in the realm of fraudulent science: big business. We will explore the corporate war on science and its potential impacts on honey bee science next month in part two of this series.

**Ross Conrad** is the author of *Natural Beekeeping: Organic approaches to modern apiculture*, and co-author of *The Land of Milk and Honey: A history of beekeeping in Vermont.* He will be teaching an organic beekeeping for beginners two-day intensive class May 7-8th and an intermediate beekeeping class on May 21st in Vermont. For more information visit: **www.dancingbeegardens.com/events.html**

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# BEE VET

## Another Arachnid

Dr. Tracy Farone

**'Tis the season**

Spring is an exciting time of renewal for nature and beekeepers. Everything is coming to life and the business of the bee yard awakens from long months of Winter slumber. ***Everything...*** is waking up, including things we would prefer never to emerge. This month, I would like to take some time to discuss an arachnid of concern for beekeepers... no, not *Varroa* mites...but ticks. While ticks do not directly affect honey bees, they certainly can affect the safety and health of beekeepers and a wide variety of our other animals. Since beekeepers spend so much time outdoors tending our bees, we are at a higher risk of encountering ticks and tick-borne diseases.

Before researching honey bees, my research involved ticks and tick-borne diseases. Since Pennsylvania has had the largest number of reported cases of Lyme Disease in the U.S. in the last decade or so, it was a worthy public health pursuit. My research students and I worked with several PA state agencies to collect and speciate about 3000 ticks from around the Commonwealth of PA. We also tested these ticks for five tick-borne disease agents, *Borrelia burgdorferi* (Lyme Disease), *Borrelia miyamotoi, Anaplasma phagocytophilum, Babesia microti,* and *Bartonella.* In summary, I can tell you that we found evidence of these diseases throughout the state. We published several papers, increased tick-borne illness awareness in PA, and found the **first evidence of the Powassan virus** in the tick population in Pennsylvania.

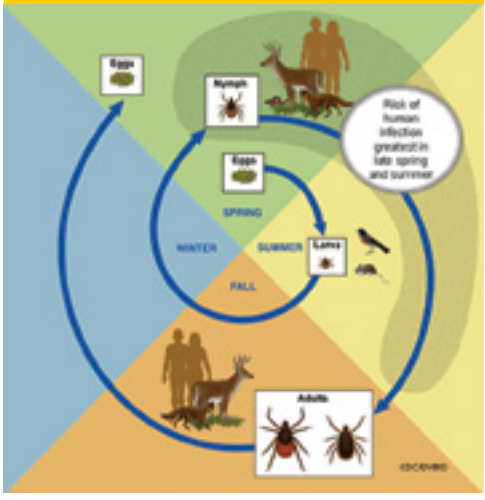
I am happily "retired" from our tick research work and have found honey bees to be a much more attractive research subject. However, I still sit on a tick task force of such, the Tick Surveillance Community of Practice for the State. These public health meetings help to keep me "embedded" in the current status of tick-borne diseases and I would like to pass the latest information on to you.

**Tick species**

First, here is a quick review of various tick species that can transmit disease. The following link provides some helpful pictures and descriptions of common ticks. **https://www.cdc.gov/ticks/tickbornediseases/tickID.html**

*Ixodes scapularis* commonly known as the Black-legged tick (locally as a deer tick, many tick species are locally known as "deer ticks," fyi), is well-established in the Eastern United States, west of the Rockies. *Ixodes pacificus* dominates the west coast of the U.S. And do not feel left out if you live in the Rocky mountains, *Dermacentor andersoni* or the Rocky Mountain wood tick would like to keep you company. Brown dog ticks, *Rhipicephalus sanguineus,* are distributed everywhere. There are several other species of ticks located around the country and all of them are capable of vectoring various diseases. Here is a great resource for checking out the ticks prevalent in your area. **https://www.cdc.gov/ticks/geographic_distribution.html**

Three tick lifecycle from the CDC website. https://www.cdc.gov/lyme/transmission/index.html, accessed March 3, 2022




In clinical practice, I used to get a lot of people bringing me ticks, asking me to identify the tick, and asking if the tick could be carrying diseases (and if they could be exposed). While the identification of ticks is a fun academic practice and can have *some* historical clinical significance to disease diagnosis, the short answer here is –"Yes!" If you have been bitten by a tick, any tick, whether deer tick, dog tick or damned tick, get checked, ASAP.

**Tick appearance and Lifecycle**

Ticks have four life stages: egg, larvae, nymph, and adult. All stages, except the egg, can carry and transmit pathogens. Eggs, larvae, and nymphs are very small and can be difficult to see with an unaided eye. Nymphs are less than two millimeters in size and are therefore the most common stage to parasitize humans without you even knowing it. Even adults can be tricky to find.

Ticks can have varying lifecycles; some will stay on one host their entire life but others will use different hosts throughout their lifecycle. These three host ticks have the greatest potential to transmit diseases, since they move from host to host during their life stages. Ticks **do not** perish over Winter but have lifecycles that last two to three years. Eggs are deposited in the leaf litter by female ticks typically in the Fall. Larvae then emerge in the Spring and typically feed on smaller animals, like rodents. This stage is typically where the ticks pick up most of their vectored diseases. Nymphs typically feed on larger animals, including humans and commonly emerge in the second Spring of the lifecycle. Fed nymphs will morph into adults by Fall, a time when adult ticks become the most active. Female adults take a blood meal from a host, mate with a male, and deposit a few thousand eggs into the leaf litter to start the lifecycle again. Both ticks die soon after mating, but if thousands of offspring are produced, one can see how an area can be infiltrated with ticks very quickly.

***So, especially look for nymphs in the Spring and Summer and***

Try to avoid ticks by avoiding tall grasses.

***adults in the Fall, but host-seeking ticks can be active in temperatures above freezing all year long.***

Here is a link describing a three-host tick lifecycle. **https://www.cdc.gov/lyme/transmission/index.html**

**Tick bites hypersensitivity**

In addition to vectoring many diseases, the tick bite themselves can cause a local hypersensitivity in the skin and subcutaneous tissue. Tick paralysis is a rare but dangerous neurological complication that can affect humans and most mammals. I have taught my students to add this unlikely event to their differential list. If an otherwise healthy patient presents with sudden onset of unexplained paralysis… check them for ticks.

**Tick-borne diseases – Sorry, it is not just Lyme Disease**

Many people and medical professionals are aware of the prevalence of Lyme Disease. According to insurance claims and the CDC, the number of people *diagnosed and treated* for Lyme Disease is 476,000 per year. They are not sure if this represents the true number since many people exposed to Lyme are asymptomatic or do not seek medical care. Also, many tick-borne diseases look clinically similar to Lyme Disease and may be misdiagnosed as such.

Your risk may vary depending on your geographical location. For migratory beekeepers, you may achieve exposure to the entire smorgasbord. Many of these diseases are bacterial in nature and others are caused by viruses. Here is a list of common tick-borne agents or diseases in the U.S.

*Borrelia burgdorferi* (Lyme Disease)
*Borrelia miyamotoi*
Anaplasmosis
Babesiosis
Bartonellosis
Rocky mountain spotted fever
Colorado Tick Fever Virus
Ehrlichiosis
*Rickettsia parkeri*
Tularemia

Check out this link for the details on each of these diseases. **https://www.cdc.gov/ticks/tickbornediseases/index.html**

**Similar clinical signs, diagnosis, and treatment**

The typical clinical signs tick-borne diseases can cause can be remarkably similar. This can make exact diagnosis difficult. The good news is that many people exposed to tick-borne disease may never become symptomatic and clear the infection on their own. However, "flu-like" symptoms like fever, fatigue, malaise, gastrointestinal signs, headache are also quite common. Skin rashes may occur, **but they are not diagnostic**! Unfortunately, some people, including medical professionals, still believe that if a "bull's eye rash" is not found on a patient, they can rule out tick borne disease – **this is completely false!** Joint pain and neurological signs can also be found. Changes in blood work can include varied blood cell values and increases in liver enzymes.

Exact diagnosis depends on a keen medical professional picking up on your diagnosis possibilities. Incubation for many tick-borne diseases can be weeks after a tick bite, so it may be several weeks until signs show up. Also, specific and antibody blood testing will likely be negative in the initial stages of infection, so testing may need to be done weeks to months after the initial tick bite. However, treatment should be started immediately.

More, sort of, good news… many tick-borne diseases can be successfully treated with antibiotics. Doxycycline is one of the most helpful. Sound familiar? It should as this is one of the approved and most popular antibiotics used by beekeepers on their honey bees. Tick-borne diseases are a perfect illustration of why we should use antibiotics judicially to reduce antibiotic resistance and keep doxy working for all of us. Tick-borne viral diseases are primarily treated using supportive care.

**Powassan update**

The main inspiration for authoring this article is an update I received about Powassan, or the Deer Tick Virus (DTV). The state of PA Department of Environmental Protection issued a precautionary statement in January 2022 based on 2021 findings within the state. A portion of the release is below.

"Among tick samples recently taken by DEP at Lawrence Township Recreational Park, 92%, or twenty-three out of twenty-five sampled ticks, were positive for DTV. The previous highest DTV infection rate found at a single location in Pennsylvania was 11 percent, and the highest infection rate reported nationally in scientific literature was approximately 25 percent. The statewide average infection rate for DTV was 0.6 percent in 2021 when adult tick samples were collected. The Deer Tick Virus, which is a type of Powassan virus, is rare in the United States, but positive cases have increased in recent years. It is spread to people primarily by bites from infected ticks and does not spread person-to-person through coughing, sneezing, or touching. Powassan virus can be transmitted from tick to human in **as little as 15 minutes after a bite** occurs, while other tick-borne diseases, such as Lyme Disease, take much longer to cause infection, typically 24 hours or more after the tick attaches to the host. Initial symptoms of a DTV infection may include fever, headache, vomiting, and weakness. Some people who are infected with DTV experience no symptoms, and therefore infection may go undetected. However, according to the CDC, 91 percent of patients treated for DTV infections develop severe neuroinvasive disease. Those who exhibit severe disease from Deer Tick Virus may experience encephalitis or meningitis and require hospitalization, with symptoms including confusion, loss of coordination, difficulty speaking, or seizures. About 12 percent of people with severe disease have died, and approximately half of survivors of severe disease have suffered long-term health impacts. There are no vaccines to prevent or medicines to treat Powassan viruses. Preventing tick bites is the best way to reduce risk of infection and disease."

**Preventative strategies for Beeks**

Some good news… we can take several steps to reduce our exposure to ticks.

1. Preventative Sprays. Maybe you do not like chemicals or are allergic, but preventatives like permethrin applied to clothing, and EPA-registered insect repellents such as DEET applied on exposed skin are proven to be the most effective in reducing tick exposure. Please read instructions and reapply as needed according to product label instructions. Here is a helpful link on tick preventative sprays. **https://www.epa.gov/insect-repellents/find-repellent-right-you**
2. Avoid tall grass and wood edges where ticks especially quest for hosts. Keeping the grass down around your bee hives is a good preventative health practice for your bees, too.
3. Ticks are less attracted to light clothing, so white clothing is good! Beeks are already ahead of the curve here. And do not forget to tuck into your boots.
4. Pets. If you have a canine friend that likes to ride along to bee checks remember, pets can pick up ticks, bring them in the house to us, and our pets can suffer from many of the same tick-borne diseases we get. Be sure to use a veterinary approved tick preventative on your pets and check over any pets exposed to tick habitats each time they return indoors.
5. Strip. This is the sexy part of the show. After returning home from the bee yard, remove all clothing, take a shower, and place clothing into the dryer on high heat to kill any lingering ticks. Examine gear such as backpacks for ticks.
6. Tick checks. Conduct a full-body tick check, including hidden areas such as the scalp, ears, armpits, belly button, and between the legs. It helps to have a partner.
7. Proper tick removal. If you happen to find a tick, do not just rip it off. Get a hemostat, tick removal key/tool, or thin tweezers to grasp the tick as close to the skin as possible and pull straight up to remove. It is possible to leave some mouth parts but just leave them alone if you do. The body will take care of it. Clean the area with alcohol, apply an antibiotic ointment, wash your hands, and consider making an appointment with your doctor. Do not use fire, teeth, petroleum products or any other kind of voodoo to try to remove a tick. Trust me, I have heard them all.
8. Find a good doc. Talk to your PCP about tick-borne diseases. Knowledgeable physicians should be happy to discuss any concerns in your area.

Wow, I know that is a lot of information. Truth is there are many disease threats that beekeepers and our honey bees face every day. But you gotta get out there and live your life! Hopefully, this article gives you some awareness and tools to mitigate tick-borne threat within reason and perhaps it can provide us with greater empathy to what our bees are going through with *Varroa* and the diseases it vectors.

Caught in the "act of love." This picture demonstrates the size difference between male and female Ixodes ticks. (The male is the little one)

Engorged female Ixodes scapularis or Black-legged tick.

**Other references utilized**

**https://www.merckvetmanual.com/dog-owners/brain,-spinal-cord,-and-nerve-disorders-of-dogs/tick-paralysis-in-dogs**, accessed March 3, 2022.

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# Honey Bee

The Bee Integrated Demonstration Project taught beekeepers, farmers and the program's proponents in the Honey Bee Health Coalition a number of important lessons about colony health, best management practices (BMPs) and improved foraging habitat. But the most pressing lesson of the project, which paired farmers and beekeepers in North Dakota from 2017 through 2021, was the importance of communication.

"The drumbeat that came through loud and clear throughout the Bee Integrated Demonstration Project was that beekeepers wanted farmers to understand how important it was to their livelihoods that the farmers practiced BMPs in the field, and farmers really wanted to know that there was a real, live beekeeper who benefitted from the practices they adopted and the habitat they planted," said Matt Mulica, facilitator of the Honey Bee Health Coalition. "It was all about communication."

Zac Browning, a beekeeper in Jamestown, North Dakota who participated in Bee Integrated, summed it up.

"They're trying to protect their livelihood and we're trying to protect ours, and in situations like that, communication is all we have," Browning noted. "When there's relationships, then we've got a fighting chance."

Through thousands of hive checks with the *Bee Integrated Demonstration Project*, the Bee Informed Partnership tech team validated the alcohol test for checking *varroa*.

**Paired Off**

Each of the six North Dakota beekeepers who participated in the Bee Integrated Demonstration Project established two yards of 40 to 60 colonies each for the project—a benchmark yard in which they followed their standard practices and a BMP yard in which they adopted the full suite of the Honey Bee Health Coalition's best management practices for colony management detailed in *Best Management Practices for Hive Health*. BMPs included regular hive checks for *varroa* and other health threats, an integrated pest management (IPM) approach to *varroa* management, proper application of miticides and other practices.

Meanwhile, participating farmers planted two forage habitat mixes designed by the Bee and Butterfly Habitat Fund. Forage plantings ranged from five to nearly 40 acres, and were located within one mile of the BMP yard managed by their beekeeping partner. Throughout the project, beekeepers and farmers were encouraged to stay in contact and even perform a job swap.

Four times per year, tech transfer teams from the Bee Informed Partnership thoroughly examined 10 colonies in each bee yard for *varroa*, diseases, colony size and more. A team from the U.S. Geological Survey Northern Prairie Research Center studied the activity of bees in the field as well as the amount, diversity and nutritional value of the pollen the bees collected. Farmers and beekeepers were surveyed twice during the project.

**BMP Motivators**

The surveys highlighted the motivating power of good communication. In the 2018 survey, farmers reported that identifying a partner beekeeper as a beneficiary of the habitat they provided was a critical motivation to adopt on-farm BMPs. The farmers also appreciated the results of pollen sample surveys that indicated that their efforts in establishing forage for the bees were paying off.

It was just as vital to keep beekeepers' crew members motivated to implement hive health BMPs.

"When crews are managing thousands of hives at a time, it's hard to ask them to slow down and adopt time-consuming practices—especially to test them on a small number of hives," noted Mulica. "But the commitment of the beekeepers and their crews made it possible for us to learn a great deal about hive health and the value of enhanced forage."

Mulica added that the project's hive-checking regimen allowed Bee Informed Partnership tech transfer crews to demonstrate the validity of the alcohol wash method of counting *varroa* mites in the field. Hive checks

# Health Coalition Building Bridges

Steve Werblow

revealed that BMP hives averaged slightly fewer *varroa* mites than benchmark hives. BMP colonies were also slightly larger than benchmark colonies, on average, in three of the four years of the project.

**Forage Findings**

The U.S. Geological Survey team, led by Clint Otto, also provided insights into the effects of enhanced forage habitat. Acreage planted to pollinator forage seed mixes was visited three times more frequently than Conservation Reserve Program (CRP) fields by honey bees and eight times more frequently by native bees, according to Otto.

Pollen analysis revealed that bees in both the benchmark and BMP colonies prioritized similar plants while foraging, including *Melilotus* spp. (sweet clover), *Brassica* spp. (mustards) and *Sonchus* spp. (sow thistle). However, Otto noted that bees in colonies exposed to the enhanced forage habitat visited more species than those from benchmark colonies. While the planted forage attracted both honey bees and native bees, Otto and his team found that honey bees were attracted to abundant stands of blooms of the same species, while native bees favored a more diverse mix of flowers.

Understanding how different bees utilize forage could yield seed blends that minimize competition between honey bees and native species, Otto noted, and could reduce the chance of disease transmission between honey bees and their wild neighbors.

**More States**

In 2021, elements of the Bee Integrated concept were adopted by beekeepers and farmers in Michigan, Iowa and Oregon.

"It was exciting to see how beekeepers and farmers in each state adopted Bee Integrated principles that fit their circumstances," said Mulica. "For instance, fruit producers in Michigan and Oregon built closer relationships with their beekeepers, who are so vital to their crop yields. In Iowa, pollinators aren't seen as a vital part of Corn Belt agriculture, but the concept of planting pollinator forage mixes fit right into Iowa State University's emphasis on establishing prairie strips to protect water quality, build soil health and provide habitat for a wide range of species."

In a series of interviews recorded on video and posted on the Bee Integrated Demonstration Project website – **honeybeehealthcoalition.org/program/bee-integrated-demonstration-project/** – participants shared some of the practices they adopted.

Hive placement was a common denominator. For instance, beekeeper Dirk Olsen of Albany, Oregon, works closely with agronomists from AgriCare to locate hives on flat, grassy areas in AgriCare's blueberry fields so his crews can safely operate their forklifts. In Hart, Michigan, orchardist Mike Van Agtmael and beekeeper Jim Hilton place hives on apple bins to raise them higher off the ground, and aggregate them in large groups to try stimulating the bees to compete with each other to maximize pollination. And outside of Sandusky, Michigan, blueberry and vegetable grower Matt Jensen and beekeeper Jamie Ostrowski have moved Ostrowski's bees about a quarter-mile away from the farm to keep her hives clear of spray rigs and u-pick customers.

As in North Dakota, the Bee Integrated participants around the country found the greatest value in better communication. In one of the online videos, Ostrowski and Jansen described how their once-tense conversations—for years limited largely to scheduling, money, and misunderstandings about each other's business—grew more productive when they started communicating openly about how they could collaborate to keep bees safe and improve pollination.

"I shy away from the hostile environment and I always expect a little bit of hostility," Ostrowski confessed about calling farmers. "So each time I make that call, my stomach's turning and I'm thinking, 'I hope they don't take me the wrong way, but I just need to have the conversation.' Get past that and open the conversation. It's worth it. It really does change everything about your business."

*For more information on the Bee Integrated Demonstration Project, including videos, BMPs and a* Lessons Learned *document, visit* ***http://honeybeehealthcoalition.org/program/bee-integrated-demonstration-project/.***

Beekeeper Jamie Ostrowski (left) and farmer Matt Jansen teamed up as the *Bee Integrated* principles spread to Michigan.

Nelson Williams of the Bee Informed Partnership checks hives as part of the *Bee Integrated Demonstration Project*.

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# Minding Your Bees And Cues

## How would you like your eggs?

Becky Masterman & Bridget Mendel

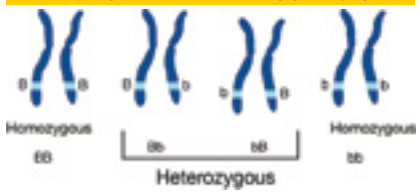
Beekeeping is exactly like crypto-currency: it's one of those topics that you have to think twice about bringing up in conversation, depending on how many questions you're in the mood to answer. Sometimes you wish you'd printed out a fact sheet to answer all the trivia (What do you mean *a divide*? What's *blockchain*? Is it true that queens fight each other? What is a *cryptokitty dragon* and why does my son want one? *Should I get some*?).

But within the beekeeping community, when the language is shared, the topic is always beekeeping, and it never gets old. We can oscillate between discussing the mundane (how do *you* get the bees out of your supers before pulling them?) and the sublime (was Zeus' mom a honey bee or what?) Then there are those science-y questions, which are the ones we truly love best. For example: haplodiploidy. Don your nerd glasses, dear reader!

Sex determination is important in honey bees, and not just for making jokes about how drones sit around eating all day while the females work. Honey bees are "haplodiploid," a chromosome condition in common with all members of the insect Order Hymenoptera (think ants and wasps as well as bees). A simple way to explain honey bee haplodiploidy is that workers and queens are female, have two sets of chromosomes (diploid) and develop from a *fertilized* egg. Drones, or males, have only one set of chromosomes (haploid) and develop from an *unfertilized* egg. This chromosomal setup makes our already impressive honey beasts even more fascinating. Haplodiploidy is a part of the behind-the-scenes science of two common (and commonly confused) beekeeping management issues: drone layers and laying workers.

In the honey bee haplodiploid system, sex is usually determined by whether the egg is diploid (female destined) or haploid (male destined). Also important in sex determination is the alleles, or different forms of the same

**Figure 1:** Examples of heterozygous gene inheritance. Honey bee workers and queens are diploid (two sets of chromosomes) and heterozygous (have two different alleles) at the sex determining locus.
**Photo credit:** https://commons.wikimedia.org/wiki/File:Heterozygous.jpg




gene, and the locus (position) along the chromosome. Diploid females are heterozygous (have two different alleles) at the sex determining locus (see Figure 1). Normal haploid males have only one set of chromosomes, so can't be heterozygous at the sex allele. However in some freak cases, a diploid egg can develop into a male called a diploid drone. This can happen if there is homozygosity (similar alleles) at the sex-determining locus on one set of chromosomes. Diploid drones are a sign of inbreeding, which is extremely rare in honey bees because the queen mates with multiple drones. Plus, you will not see diploid drones develop in the colony because workers cannibalize diploid drone larvae as soon as they hatch from the egg.

**Drone Layers**

Drone production in a honey bee colony is seasonal. When floral resources are plentiful, drones are produced. When food gathering and temperatures decrease, drone production ceases. The colony controls the rearing of drones; choosing to feed drone larvae or not depending on the resources available. But sometimes, a queen runs out of sperm and that's when the boys get out of control. Without viable sperm, the queen can only lay unfertilized eggs and therefore can produce only new males. It is relatively easy to spot a drone layer queen, as we can rely on the appearance of puffy, capped drone brood in worker cells within central brood nest areas where there should be worker brood. Queens can become drone layers for many reasons that include mating issues due to weather, running out of their stored sperm, extreme productivity, or relative old age. It is also possible for some of the sperm stored in the queen's spermatheca to die due to temperature stress or pesticides and therefore not be able to fertilize eggs as effectively (Amiri *et al.* 2017). The drone layer queen issue is easy to fix if you can remove the dowager in question and introduce a new queen. With limited availability of mated queens, both early Spring and late Fall are difficult times to requeen colonies headed by drone layers.

**Laying Workers**

Although workers do not mate, they can lay eggs in particular situations, albeit only unfertilized, haploid (aka male) ones. In a functioning colony, worker ovaries are suppressed by queen and brood pheromone (Ronai *et al.* 2016, Winston, 1987). If the queen dies, is removed, or is pheromonally not vital, and there is little or no open brood (larvae), worker egg production is not suppressed, and some bees in a colony will progress to become laying workers, which is difficult to reverse (Winston, 1987).

Workers only have three to 26 ovarioles per ovary compared to the range of 100-180 in a queen ovary (Snodgrass 2018, Jackson *et al.* 2011). So one could be forgiven for assuming they therefore leave the egg laying to Mom. But why? Was it due to a cryptic fortune cookie prophecy like in Freaky Friday? Most likely not. This is actually the superorganism's or worker's last ditch effort to get their genetics out there.

Laying workers aren't very good at egg laying (about as good as the first time you tried grafting) and the end result is far from the machine-like precision patterns of a queen (see Figures 2 and 3). When laying workers take over, you will see eggs on the side of the cells and often multiple eggs in each cell. We like

**Figure 2:** Worker eggs are not fertilized, so they are haploid (one set of chromosomes) and become drones. Workers also lack the elongated abdomen that enables efficient and accurate egg laying in cells. Instead of laying one egg per cell in a uniform pattern, workers will often deposit multiple eggs haphazardly into the cells.
**Photo credit:** Katie Lee, PhD

**Figure 3:** Here you can see multiple eggs in single cells, eggs laid on top of larvae, and two drones developing in a single cell: signs of a laying worker.
**Photo credit:** Katie Lee, PhD

an Australian study that quantified the impact those worker-produced drones might have in mating. Based on the smaller size of worker-produced drones, they measured their percentage in a drone congregation area at 0.23% (Utaipanon *et al.* 2019). While smaller than another study that estimated a 9% contribution of drones with worker moms (Berg 1991), the authors acknowledge that even at the less-than 1% contribution, it *is* a reproductive strategy that can move the colony's genes into the next generation.

You can't just requeen a colony that has laying workers. They will kill the new queen. Fixing a laying worker colony is more of a mad science experiment than a sound management decision. It requires you to move frames of open brood from a healthy colony to the laying worker colony over time until the brood pheromone odor begins suppressing the ovaries of the laying workers. You can introduce a queen cell along with the open brood and hope she emerges and mates. Meanwhile, you have been weakening the brood donor with the resource movement and wasting quite a bit of time. It is fun to do, but never officially recommended (like most fun things).

We hope you have a new or renewed appreciation of your bees' chromosomes, egg production and your diploid bees. At the very least, if you find a drone layer or laying workers this Summer, remember that your bee problems are less complicated than your crypto-currency opportunities.

Becky Masterman led the UMN Bee Squad from 2013-2019. Bridget Mendel joined the Bee Squad in 2013 and has led the program since 2020. Photos of Becky (left) and Bridget (right) looking for their respective hives. If you would like to contact the authors with your own advanced egg maneuvering success stories or other thoughts, please send an email to mindingyourbeesandcues@gmail.com

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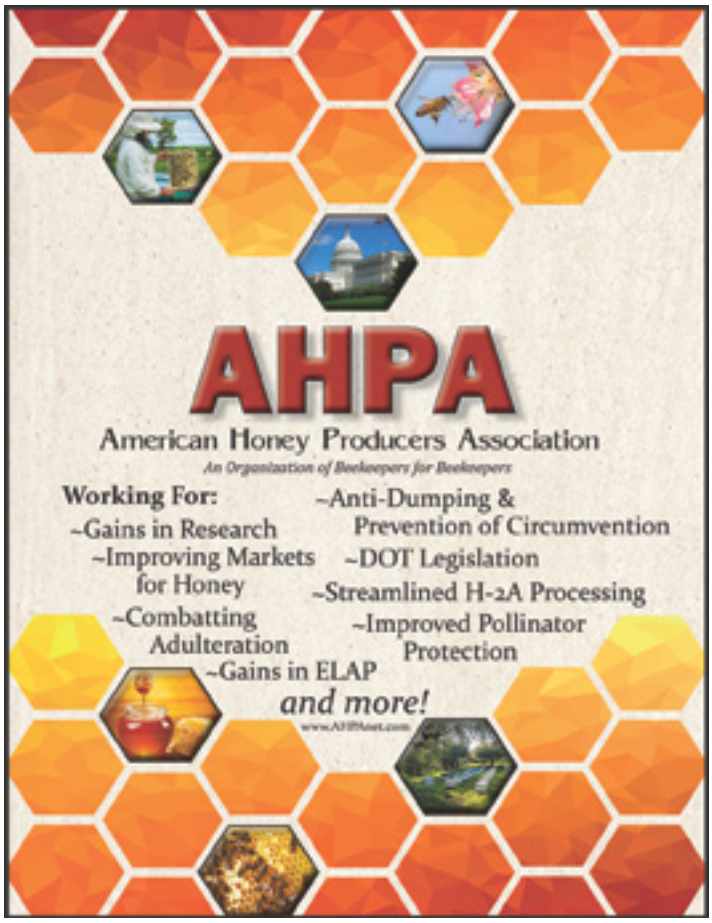
**Acknowledgement**

The authors would like to thank Dr. Marla Spivak for helpful edits and suggestions in our navigation of haplodiploidy.

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# The Stockholm Declaration about "Life EMC"

Olle Johansson

All around the world dramatic reductions in pollinating insect populations are noted, for instance in Germany, in 2017, where more than 75% of them were reported just gone, and recently the media have reported a more than 90% reduction of the bumblebee populations in the USA (2021). Many beekeepers can also witness similar decreases in honey bee populations as well as in other insect groups, and so can the ordinary citizens.

I am particularly concerned about this problem, and I already have a number of papers dealing with the impact of artificial electromagnetic fields (EMFs) from wireless communication such as cell phones, WiFi systems, tablets, baby alarms, smart meters, laptops and more, especially on honey bees (see e.g. Johansson O, "To bee, or not to bee, that is the five "G" question," Newsvoice.se 28/5, 2019, **https://newsvoice.se/2019/05/5g-question-olle-johansson/**). I also know that other areas around the world have reported extensive bee colony collapses, and my strong effort now is to seek ways to conserve, protect and enhance our pollinators, wherever they reside, and thus conserve, protect and enhance ourselves, and our coming generations. If we do not engage, then we certainly may head towards a moment in history where future generations - if any - will ask us *"Why didn't you react and act?"*

Against the above, I am trying hard - together with the various collaborating teams - to set various projects into motion, and especially regarding the "NO BEES = NO FOOD = NO CHILDREN" one. Remember this: *"While governments have authority, the people have the power. Change can be caused if this power is used."* Brett Dolter (Saskatchewan Opinion). Maybe this people's power – aka you! - is more needed than ever, especially since when my collaborator Robert Ferm and myself, already on October 19, 2021, wrote to the U.S. Fish and Wildlife Service, 5275 Leesburg Pike, Falls Church, VA 22041-3803, USA, attention: Louise Clemency, Chicago Ecological Services Field Office, about the American bumblebee situation *versus* impacts of artificial electromagnetic fields (EMFs), we didn't receive any reply at all.

Currently, as we all know, a lot of things are going on which impact insects... pesticides, deforestation, insecticides, air pollution... as well as consecutive effects such as strong, or very strong, reductions of other species dependent on insects, like birds (**https://www.theguardian.com/environment/2021/nov/16/house-sparrow-population-in-europe-drops-by-247m?utm_term=6195156f0b3481e9556e75f3232f7af5&utm_campaign=ThisIsEurope&utm_source=esp&utm_medium=Email&CMP=thisiseurope_email**). I therefore hereby will present an idea, a declaration, to help life on the planet.

**Artificial electromagnetic fields**

Pulsed, modulated, polarized, non-ionizing artificial electromagnetic fields, at various frequencies, including high-frequency radio and microwaves as well as extremely low-frequency electric and magnetic fields, at colossal exposure levels compared to natural background fields and signals, are present in the current, modern environment where there are technology actively emitting this kind of radiation and these kinds of fields and signals. We use them for our radio and TV transmissions bringing news, weather, debate, and entertainment to our homes; for powerlines distributing electricity to workplaces and homes; for cell phone systems, wireless Internet (WiFi), wireless tablets, laptops, baby alarms, smart meters, electric cars, autonomous robots and vehicles, toys, surveillance, social credit point identification, and many more everyday installations in our modern society. The big question today is if chronic, localized and/or whole-body exposure to such artificial electromagnetic fields from different kinds of sources are safe for humans and all other biology on planet Earth. This is *the* question having put increasing weight on my science table for the last decades.

***"Technical EMC" – "Human EMC" – "Life EMC"***

Thanks to strong regulations and laws, different gadgets are not allowed to interact with each other, thus jeopardizing each other's technical functions. To secure the electromagnetic robustness for this kind of adverse effects, and shielding off interference and/or disturbances, as well as geomagnetic storms, different technologies are tested for so-called *"Technical EMC"* (ElectroMagnetic Compatibility) demands. Many years ago, in a commentary in the Swedish magazine "Ny Teknik" ("Människan är lika känslig som maskinen" ("The human is as sensitive as the machine," in Swedish), no. 4, 1997), I launched the idea and new demand that since we protect all our various equipment from radiation interference and damage, we also have to do the same with our own health. In that commentary in "Ny Teknik," I introduced the concept of *"Human EMC."* Now I take it one step further and point to the need to establish stringent, law-abiding, hygienic absolute safety exposure standards for all life on the planet: *"Life EMC."*

Technical EMC regulations do not only protect equipment from serious damage but also from electromagnetic disturbances of various types, the latter interfering with the intended functionality, like unwanted background noise during a radio broadcast session, or securing correct altimeter performance of a passenger airliner (**https://www.bloomberg.com/news/articles/2021-11-04/carriers-delay-rollout-of-5g-one-month-due-to-aviation-concerns**). The same goes with "*Life EMC:*" it should not only protect life on this planet from serious damage and

death but also from any form of disturbance, including physiological, genetic, behavioural, functional, and/or anatomic. We, as human beings, do not have any God-given right to disturb the life of other species, and it is becoming overwhelmingly obvious humans already are! I say as Greta Thunberg: "blah, blah, blah" when it comes to real action from our rulers to restore and protect life on this planet.

Greta Thunberg has excoriated global leaders over their promises to address the climate emergency, dismissing them as "blah, blah, blahers." Thunberg, who recently inspired the global Fridays for Future movement, said that hopes and dreams drown in "empty words and promises" and asked where 30 years of "blah, blah, blah" have led us. *Now I, the author, ask the same when it comes to adverse health and biological effects of artificial electromagnetic fields from all our gadgets, installations and toys. Where is the reaction and Precautionary Principle resulting in real action?! After the recent COP26 in Glasgow … where are the real good cops?!*

**Human health effects**

For many years, I have been studying the health and biological effects of wireless gadgets, such as cell phones, WiFi systems, tablets, baby alarms, smart meters, laptops, and similar. Wireless communication is now being implemented in our daily life in a very fast way. At the same time, it is becoming more and more obvious that exposure to electromagnetic fields may result in highly unwanted health and biological effects. This has been demonstrated in a very large number of studies and includes cellular DNA damage (which may lead to the initiation of cancer as well as unwanted mutations that carry down generations of humans, other animals, plants, fungi, bacteria and/or viruses), disruptions and alterations of cellular functions like increases in intracellular stimulatory pathways and calcium handling, disruption of tissue structures like the blood-brain barrier (which may allow toxins to enter the brain), impact on the vessel and immune functions and loss of fertility. It should be noted that we are not the only species in jeopardy; practically all animals, plants, fungi, and bacteria may be at stake. For the latter, Taheri *et al.* (2017; cf. Johansson O, "Bacteria, mobile phones & WiFi - a deadly combination?," Nya Dagbladet 31/5, 2017, **https://nyadagbladet.se/debatt/bacteria-mobile-phones-wifi-deadly-combination/**) have demonstrated that the exposure to 900 MHz GSM mobile phone radiation (aka "The 2nd Generation Mobile Telephony" or "2G") and to 2.4 GHz radiofrequency radiation emitted from common Wi-Fi routers, respectively, made *Listeria monocytogenes* and *Escherichia coli* bacteria resistant to different antibiotics. To say this finding is "scary" is a classical English understatement, especially against the everyday clinical situation witnessed every day by health workers around the planet, and against the statement of the World Health Organization (WHO), and others, that antibiotic resistance in health care is a bigger problem than the recent pandemic (for instance, see **https://www.plymouth.ac.uk/news/pr-opinion/a-threat-greater-than-covid-why-we-should-be-paying-more-attention-to-antimicrobial-resistance**).

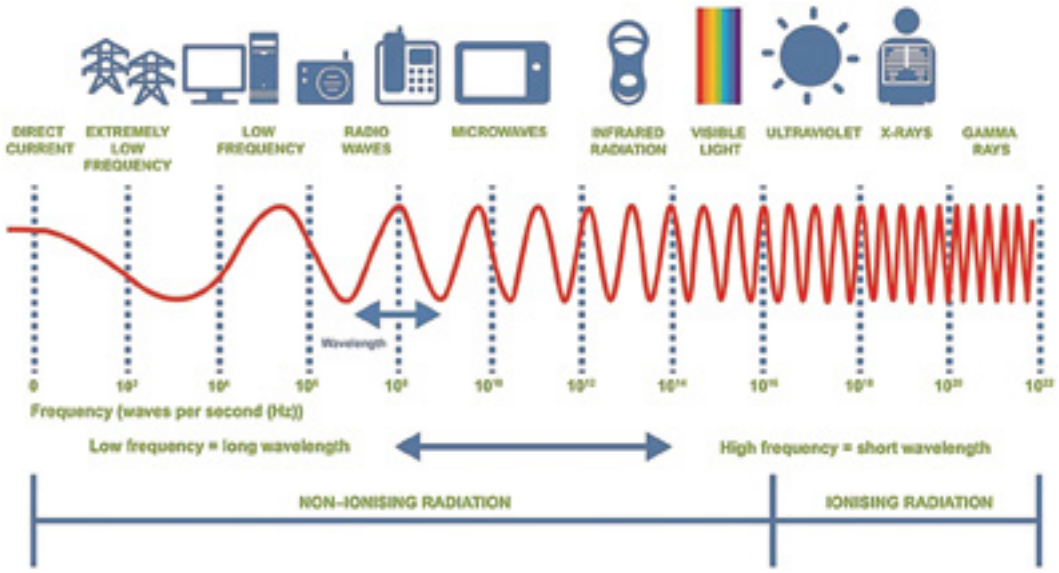
Because the effects are reproducibly observed and links to pathology can not be excluded, the Precautionary Principle should be in force in the implementation of these new technologies within the society. Therefore, policymakers immediately should strictly control exposure by defining biologically-based maximal exposure guidelines also taking into account long-term, non-thermal effects, and including especially vulnerable groups, such as the elderly, the ill, the genetically and/or immunologically challenged, children and fetuses and persons with the functional impairment electrohypersensitivity (which in Sweden is a group of persons with a fully recognized functional impairment, and therefore it receives an annual governmental disability subsidy). To this, *all* other lifeforms on the planet must now be added.

However, at the same time it is of crucial importance to always relate to observations in real life. I have, together with a colleague, for a long time, studied the public human health records and registers of the Swedish Cancer Foundation, the Swedish National Board of Health and Welfare, the Public Health Agency of Sweden, and the Statistics Sweden, and from them I see no signs of statistically significant incidence increases - at the general public level - during the last 40 years in those human illnesses traditionally attributed to cell phone exposure, and similar, that in any way correlates with the introduction of various communicative techniques. So you might say that reality can not yet replicate the laboratory experimental studies, something that I personally enjoy to the fullest, it certainly makes me very happy not having to witness a number of extra patients and extra grieving relatives. (Of course, this does not rule out an effect only seen at the individual level, and under special circumstances, but it has not yet been proven beyond doubt.) However, if we go back to the mid-1950s, and relate to our current times, there is a possible correlation between the introduction of chronic exposure from FM radio broadcast radiation and malignant melanoma as investigated by Johansson O and Hallberg Ö (see e.g. "Malignant melanoma of the skin – not a sunshine story!" Med Sci Monit 2004;10: CR336-340, and "FM broadcasting exposure time and malignant melanoma incidence," Electromag Biol Med 2005; 24: 1-8), and currently a lot of firm attention – and rightfully so – is focused on worries around human fertility as visualized in the form of human sperm cell count and quality, both the latter showing a dramatic deterioration around the planet.

**Biological effects**

The situation is, however, very different when you look out into the life for other species, such as insects, particularly pollinators like honey bees and bumblebees, bacteria and plants. So even if we do not get a brain tumour from our cell phones and wireless tablets, smart meters and baby alarms, we still will, as a species, be under an enormous threat, and a threat that may lead us to realize it is too late to respond to the early warnings sounded decades ago by me and others.

The world has lost two-thirds of its wildlife in the last 50 years, and according to Nathan Rott, in a recent article (**https://www.npr.org/2020/09/10/911500907/the-world-lost-two-thirds-of-its-wildlife-in-50-years-we-are-to-blame**;




NPR Radio Station, September 10, 2020), and many, many others, we are to blame. The "Holocene extinction," otherwise referred to as the "sixth mass extinction" or "Anthropocene extinction," is an ongoing extinction event of species during the present Holocene epoch (more recently called Anthropocene) as a result of human activity (**https://en.wikipedia.org/wiki/Holocene_extinction**). We, the humans, have used insecticides to save us and our crops for decades… maybe now it is time for a humanicide to save the insects from us, of course not killing us but at least holding us back from destroying the insects' life and living space? And an additional Nüremberg Code to protect the animal, plant, and bacteria rights? (Of course, this does not apply to *all* of humanity, and not single-eyed to "human nature" itself. The failings (short-sightedness, greed, lust for power, etc.) of the corporate and banking elites & of our politicians over the past century, or more, can not be blamed on everyone, but now we must *all* take firm action.)

More and more persons are now asking how can we halt this extinction crisis (**https://www.biologicaldiversity.org/programs/biodiversity/elements_of_biodiversity/extinction_crisis/**). So the $64,000 question is if any of this is caused by chronic or intermittent artificial electromagnetic fields, and my working hypothesis is that, yes, they may be part of this sixth mass extinction, especially when we look at pollinators – like honey bees - and other similar insects, as well as some other core species upholding the whole insect community.

So, in essence, science is providing ever more convincing evidence that the radiation emitted by our wireless telecommunications systems can affect biological systems including wildlife as well as – further up the food and environmental chains – humans, pets and livestock. These biological effects are normally acting even at very low exposure levels far below our current public exposure guidelines.

**All living beings are electrosensitive, also our microbiome!**

Life on this planet, including us humans, is based on a very complex biochemistry and highly intricate electromagnetic forces and signals, thus life may easily be at risk from the chronic exposure to artificial electromagnetic fields and radiation from modern, everyday present, technologies. And given the extraordinary electromagnetic sensitivity of living systems, it is not a surprise that they can be affected even at lower exposure levels, especially if the exposure is ubiquitous and prolonged. And the exposure levels, as you know, are not "low" - compared to the natural background of such frequencies the man-made ones come at colossal, astronomical, biblical levels; just the current 3G systems are allowed at a maximal exposure level of 1,000,000,000,000,000,000 times the natural background! Does that sound reasonable and safe to you?

As indicated above, all biology on earth, including humans, have a symbiotic microbiome, which in turn has electromagnetic properties. This microbiome functions as a cellular 'organ' system, i.e. the population of one species of the microbiome acts as an 'organ' of its own. Some of the functions of this 'organ' system(s) are;

- Assisting in digesting food
- Regulating the immune system
- Regulating neurotransmitters
- Regulating hormones
- Protecting against pathogenic bacteria
- Producing vitamins
- Producing antioxidants
- Producing molecules for information exchange
- Cleaning up diseased and dead cells in the body

Hence if chronic exposure from multiple artificial electromagnetic field sources harms any of the species populations of the microbiome organ system, the health of its host is at risk.

Our current recommended safety guidelines for electromagnetic fields and signals are only for acute exposure causing heating of 'body tissue' of a fluid-filled plastic doll (thermal effect) from one single event and do not consider chronic exposure from multiple sources resulting in adverse non-thermal biological effects. Therefore, I hereby strongly recommend the Precautionary Principle and that "*Life EMC*" testing should be applied for all and any electromagnetic field/radiation technology interacting with humans and all other biology on Earth.

Very recently, an amazing scientific paper in the journal *Reviews on Environmental Health*, was formally published as a three-part review that examines effects of non-ionizing electromagnetic fields, including wireless radiation from cell towers and extremely low-frequency electromagnetic fields from power lines, on flora and fauna. This 150-page tome (plus supplements, and more than 1,200 references) is written by B. Blake Levitt, an award-winning

journalist and free-lance journalist for the New York Times, Henry Lai, Professor Emeritus at the University of Washington and Albert Manville, a retired branch manager and senior wildlife biologist in the Division of Migratory Bird Management at the U.S. Fish and Wildlife Service, and an adjunct professor and lecturer for more than two decades at Johns Hopkins University where he has taught field classes in ecology, conservation biology and wildlife management.

The authors point out that ambient levels of electromagnetic fields have risen sharply in the last 80 years, creating a novel energetic exposure that previously did not exist. Most recent decades have seen exponential increases in nearly all environments, including rural/remote areas and lower atmospheric regions. Because of unique physiologies, some species of flora and fauna are sensitive to exogenous electromagnetic fields in ways that may surpass human reactivity. Biological effects have been seen broadly across all taxa and frequencies at vanishingly low intensities comparable to today's ambient exposures. Broad wildlife effects have been seen on orientation and migration, food finding, reproduction, mating, nest and den building, territorial maintenance and defense and longevity and survivorship. In addition, cytotoxic and genotoxic effects have been observed. Plants and animals are not being protected from this damage as there are no standards pertaining to wildlife. The above issues are explored in three consecutive parts by Levitt and coworkers: Part 1 focuses on today's ambient electromagnetic fields' capabilities to adversely affect wildlife, with more urgency regarding 5G technologies; Part 2 explores natural and man-made fields, animal magnetoreception mechanisms and pertinent studies to all wildlife kingdoms; and Part 3 examines current exposure standards, applicable laws and future directions.

Levitt BB, Lai HC, Manville AM, "Effects of non-ionizing electromagnetic fields on flora and fauna, Part 1. Rising ambient EMF levels in the environment," Rev Environ Health 2021, May 27. **doi: 10.1515/reveh-2021-0026**. Epub ahead of print.

Levitt BB, Lai HC, Manville AM, "Effects of non-ionizing electromagnetic fields on flora and fauna, Part 2 impacts: how species interact with natural and man-made EMF," Rev Environ Health 2021, Jul 8. **doi: 10.1515/reveh-2021-0050**. Epub ahead of print.

Levitt BB, Lai HC, Manville AM, "Effects of non-ionizing electromagnetic fields on flora and fauna, Part 3. Exposure standards, public policy, laws, and future directions," Rev Environ Health 2021, Sep 27. **doi: 10.1515/reveh-2021-0083**. Epub ahead of print.

Furthermore, in a recent paper by Lupi *et al.* ("Combined effects of pesticides and electromagnetic-fields on honeybees: multi-stress exposure," Insects 2021; 12, 716. **doi.org/10.3390/insects12080716**) they conclude "After one year of monitoring, a complex picture of several induced effects was present, especially in the multi-stress site, such as disease appearance (American foulbrood), higher mortality in the underbaskets (common to pesticide stress site), behavioral alterations (queen changes, excess of both drone-brood deposition and honey storage) and biochemical anomalies (higher alkaline phosphatase activity at the end of the season). The multi-stress site showed the worst health condition of the bee colonies, with only one alive at the end of the experimentation out of the four ones present at the beginning." Again, as pointed out many times over the years, the need for further investigation as well as replications is eminent, as is the introduction of the Precautionary Principle and "*Life EMC*" accreditation.

In no way am I naive, there are – of course – a number of other confounding culprits, and very much interest is already being paid to them. One of these is climate change, and in a recent paper by Soroye *et al.* ("Climate change contributes to widespread declines among bumble bees across continents," Science 2020; 367, 685-688. **DOI: 10.1126/science.aax8591**) it is pointed out that "One aspect of climate change is an increasing number of days with extreme heat." Soroye *et al.* analyzed a large dataset of bumble bee occurrences across North America and Europe and found that an increasing frequency of unusually hot days is increasing local extinction rates, reducing colonization and site occupancy, and decreasing species richness within a region, independent of land-use change or condition. As average temperatures continue to rise, bumblebees may be faced with an untenable increase in frequency of extreme temperatures. We, thus, get interesting combinatorial effects of climate change + chronic exposure to artificial electromagnetic fields + pesticides/insecticides, and how they affect bumblebees and other pollinators. Maybe yet a research project of immediate importance for the bumblebees? And equally so for us, mankind?

While pesticides have long been blamed for the decline in pollinators, a study published in Proceedings of the Royal Society B (Cohen H *et al.*, "Mass-flowering monoculture attracts bees, amplifying parasite prevalence," October 13, 2021, **https://doi.org/10.1098/rspb.2021.1369**) has found that the mass-flowering of single plant species is increasing the prevalence of bee populations infected with parasites. If you add to this chronic exposure to electromagnetic fields which will harm the pollinators' immune defense the negative impact of monocultures may be seriously amplified.

With all of this in mind, to me as a scientist, it is becoming more and more obvious that we, the humans, actually often don't have a clue any longer about what we are doing... money, profit & greed rule, but not common sense, and not the Precautionary Principle or "*Life EMC*" accreditation. Global commercial companies have lobbyists talking for them at ICNIRP (the International Commission on Non-Ionizing Radiation Protection), FCC (the Federal Communications Commission), and IEEE (the Institute of Electrical and Electronics Engineers), within the EU, the UN, the WHO, in Washington, D.C., Geneva, New York, Stockholm, Paris, Rio de Janeiro and elsewhere, but how many lobbyists do the bumblebees, the honeybees and all other pollinators have?

**My own studies... and the future**

The above papers rhyme very well with my own co-authored or authored publications from the last decade, like:

Cammaerts M-C, Johansson O, "Ants can be used as bio-indicators to reveal biological effects of electromagnetic waves from some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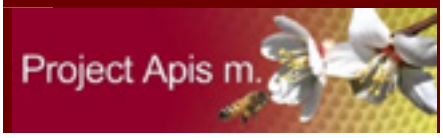

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Based on these papers, and on the above triplet of reviews by Levitt *et al.*, and on many other publications by my eminent peers, I hereby repeat: It is high time to recognize ambient electromagnetic fields as a form of harmful pollution, not so novel any longer but present for decades, and finally develop laws at regulatory agencies that designate the environment as a whole, including the airways, land and sea, as 'habitat' for all species, as well as for humans, so electromagnetic fields and signals can be formally and legally regulated like other pollutants. Wildlife loss is often unseen and undocumented until tipping points are reached, and – as many times stressed by me – could lead to catastrophic outcomes. Long-term, chronic, low-level electromagnetic fields exposure standards, which do not now exist, should be set accordingly for wildlife, and environmental laws should be strictly and firmly enforced.

The now applicable limit values for artificial electromagnetic fields are only technical as to their nature, thus no connection to the biological and medical reality exists at all. This in turn means that existing limit values from ICNIRP or FCC (or any other official authority or body) can not be used as a regulatory tool by authorities to protect people or nature from loss of wellbeing, from disturbances, ill health, damages, or from death.

Actually, the whole debate is upside down. Many persons and organizations call for dangerously high values which really only relate to a randomly set technical limit value used by the official authorities around the world as an adaptation to political/industrial lobbyists' pressure. These technical limit values totally ignore electromagnetic field dosimetry for chronic exposure from multiple radiation sources, using various characteristics as measures, and also including synergistic as well as cumulative effects, and its relation to life on this planet.

One should always remember that Professor Paolo Vecchia, head of ICNIRP at the time, at a conference at the Royal Society in London, said this in 2008 about using ICNIRP's technical guidelines:

"What they are not:
Mandatory prescriptions for safety
The "last word" on the issue
Defensive walls for industry or others"

(verbatim quote from voice recording)

He strongly emphasized that the ICNIRP guidelines are only technical in nature, and never were intended to be used as safety recommendations for medical or biological issues and/or to handle established risks.

It should be noted that only one such **genuine hygienic safety value** ever has been proposed: 0.00000000001-0.0000000000001 μW/m2 [for 1,800 MHz] – this is the natural background during normal cosmic activities; proposed by myself at a trade union meeting in Stockholm, already in 1997 (i.e. one year before the publication of ICNIRP's 1998 paper on setting public exposure standards), and since then many times repeatedly presented in scientific publications, at conferences, in interviews and more. (Given the highly artificial nature of the current wireless communication signals, e.g. of their pulsations and modulations, it may actually boil down to 0 (zero) μW/m2 as the true safe level of man-made electromagnetic fields/signals.)

And do not ever believe it is possible to play it "safer" by only somewhat reducing the exposure levels! (cf. Johansson O, "To understand adverse health effects of artificial electromagnetic fields… …is "rocket science" needed or just common sense?," In: Essays on Consciousness – Towards a New Paradigm (ed. I. Fredriksson), Balboa Press, Bloomington, IN, USA, 2018, pp 1-38, ISBN 978-1-9822-0811-0). Ironically, this means that even a Precautionary Principle – if it is not firm enough – may not prove precautionary at all. Instead, it could lead to the classical "Late lessons from early warnings" or to "Too late lessons from early warnings" (the latter quote from me). (Are you prepared to risk that for a set of toys, rather than protecting the life necessities we all are dependent on..? Or do you honestly believe our children and grandchildren, in the future, can eat money instead of food?)

If mankind gets real and makes "*Life EMC*" a genuine reality, then mankind has proven itself worthy of living – 'shoulder-to-shoulder' with all other species – on this beautiful planet we call home. Rachel Carson's famous book *Silent Spring* started our modern concern for nature and wildlife. Now it is time to save them through the ***The Stockholm Declaration about "Life EMC"***. I therefore, here and now, call upon everyone to demand and implement ***The Stockholm Declaration about "Life EMC"***.

**Author Bio**

**Olle Johansson,** associate professor, former head of The Experimental Dermatology Unit, Department of Neuroscience, The Karolinska Institute Medical University, Stockholm, Sweden, and former adjunct professor of The Royal Institute of Technology, also Stockholm, Sweden, now retired (from November 2017).

(If you want to support our research efforts, please, read and share this fundraiser call **https://honeywire.org/research**; always remember that no gift is too small, we badly need the economic support if we should be able to continue our research work regarding the adverse health and biological effects of artificial electromagnetic fields from cell phones, satellites, smart meters, WiFi, baby alarms, tablets, powerlines, laptops, and many more installations. Without your help we can not go forward.)

# Frank Benton on "A Beirut and Syrian Bee Convention May 1885"

Nina Bagley

Twenty years ago, I became a beekeeper and my mentor passed his beekeeping books on to me when he moved. I have always been a collector and am fascinated with history and anything to do with the 1800s. I was very excited and honored to have these books so that I could share the beekeeping stories and the history of beekeepers. I found myself reading the *ABC of Bee Culture: Cyclopedia of Everything Pertaining to the care of Honey-Bee* published in Medina, Ohio by A.I. Root 1891. Under the ABC Picture Gallery, Apiaries and Bee-Exhibits, I came across a picture of Frank Benton and his beekeeping friends, which excited my curiosity. This took me on a research mission to find out more about this picture of our friend Frank Benton and his beekeeping comrades in Beirut, Syria.

If you don't know who Frank Benton was, he was an American entomologist who invented the Benton queen cage for mailing queens. For eleven years Benton worked as a researcher for the U.S. Department of Agriculture. His mission was to collect the most effective bee species, which required him and his family to travel to many European and Asian countries. As I looked at the picture, I immediately recognized him. Benton was seated in the middle holding the *ABC of Bee Culture* by A. I. Root. Sitting on the cylinder below him to the left is Benton's son Ralph. Over time, I became more curious about the other people in the picture, who were they? One rainy afternoon, I was reading an 1884 copy of *Gleanings in Bee Culture*. I came across this story by Lucinda Harrison from Peoria, Illinois. She is one of my favorite women beekeepers during her time. Harrison wrote stories for women and juveniles on beekeeping for *Gleanings in Bee Culture* in the 1800s. She raised queens and traveled throughout the world attending the bee conventions and writing about her accounts and adventures. You can only imagine my excitement when I came across this account by Lucinda Harrison on what happened at the 1885 Syrian Convention.

**Conventions**

*"And Especially The One Over The Water, Where Frank Benton Resides."*

"I was laid up for repairs and while indisposed I enjoy nothing more than "Migratory Shadows" of the members of the New Orleans and Syrian convention who are all strange, yet peculiarly interesting, from the fact that the eleven composing the group represents eight different languages. The peasant's daughter, according to the custom of the country, allows us to see a small part of her face, and as we gaze upon her we fervently hope that her labors for beekeeping may be remunerative, and be the means to elevating her mentally and socially. I pity the poor bees that have to live in jugs and cylinders. I don't believe the bees of our country would stay in them: they would desert and I'm thankful for Mr. Benton in introducing a controllable hive into their country. The frame may be all right but it has a wonderfully long name. I've guessed, and I've guessed, again how it is held in place, put on my specs, and peered down into the hive to discover something, but failed. Mr. Root, don't you think the ends of the hive have bent wires of tin or zinc, like this  ? And the hive is reversed when turning it over, is it not?"
Peoria, Ill. Mrs. L. Harrison

Mr. Root replies, "I am as much at a loss as your self, my good friend. In determining how friend Benton holds those frames, all alike all around, just like a slate-frame. Friend Benedict at the Ohio State Fair had some hives with similar frames, they were held by bent wires like you mentioned. But the strangest part of it all was that although friend B. has hives 20 or 40 of them in use, in which the frames could be used just as well one side up as the other; he never reverses them at all. He says he does not believe in it. Aren't we human beings "funny" any way?"

Mrs. Harrison gives a vivid account of the convention in Syria; which put my curiosity at ease, until much to my surprise when I was just putting it all to rest one February day, I was going through some 1885 *American Bee Journals*, and found a story written by Frank Benton, "A Bee Convention in Beirut, Syria". The story appeared in the September Issue of The Weekly *American Bee Journal* 1885…

*A Bee-Convention in Syria*
*Frank Benton*

"We had a bee-convention in Syria; or, rather, we have been having a series of them here recently. This may seem rather surprising news to people of the Western World, who suppose Syria is beyond the pale of civilization. But though the country is in many respects behind Europe and America, modern methods of bee culture have now taken permanent root here. Of the seven or eight different languages represented by the members of the convention, four had to be employed in the talks on bees: namely English, French, German and Arabic. Perhaps some of the friends in other countries, who find but with one official language in their conventions, it is still difficult to get on harmoniously, will wonder what we could do with such a babble of tongues. Nevertheless we got along quite well, and interchange of ideas will, no doubt, prove of great value to many of the participants.

The most important work done by the convention was the adoption of a standard frame for Syria, to be known as the "Syrian Standard Reversible Frame." All beekeepers in countries where several sizes of frames have come into use, will comprehend at once the wisdom of such a step while moveable comb beekeeping is yet in its infancy in these parts. Among other topics, which were discussed at our meetings, migratory bee keeping (already largely practiced here) and hives adapted to it, received much attention; also the various bee-ranges of the country were discussed. Orange blossom furnishes the chief Spring harvest, though almond, apricot, cactus plants and other fruit blossoms are of importance. The late

harvest comes in mid-Summer from wild thyme, which is abundant in most of the hilly and mountainous portions of the country. It was agreed that where orange, cactus and thyme blossoms were abundant, with the usual minor yield, nothing would be gained by transporting bees to other pastures. The wintering problem did not get much attention, since there is no difficulty on that score here; nor did we devote very much time to a discussion of the relative merits of the different races of bees, as none but Syrians are kept in Syria. Altogether, a bee-convention in Syria may be considered an interesting and important event- interesting to the outside world as showing the progress already made. Our eyes are turned to America for light in bee-keeping matters."
- Beirut, Syria, May, 1885.

I have two stories now to go with the picture, of Frank Benton and his Comrades at the Syrian convention in 1885. Unless I come across more information, I can say I'm finished at this point with my research. My next search is to identify the men in the picture. I think I found three of them, but I'm still not 100% sure. It's a daunting task and one that might be impossible, but what a great pasttime!

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# The Story so Far on Amitraz Resistance in *Varroa*

Frank Rinkevich & David MacFawn

If you want to learn to be a good beekeeper, it is extremely important to learn about *Varroa* mites. You don't have *Varroa* mites because you're a bad beekeeper; you have *Varroa* mites because you are a beekeeper! Whether you're a multi-generational beekeeper or a beginner, commercial manager or hobbyist, use "conventional" or "natural/organic" methods, *Varroa* will find a way to wreak havoc on your bees. There are few things more disheartening than seeing a strong honey bee colony wither and die because of uncontrolled *Varroa* populations.

Often times, miticides are used as the primary tool to manage *Varroa* populations, mostly due to their ease of use and effectiveness. It is easy to get into the routine of using the same miticide every year because "It worked in the past so it should keep working this year" and "If a little bit works, then a little more should work better." However, this kind of approach to miticide use creates conditions that can lead to miticide resistance. In fact, that is exactly what happened with Apistan® (tau-fluvalinate) and Checkmite™ (coumaphos) and why they are not widely used any more[1,2].

The development of miticide resistance is the expected evolutionary outcome of a selection event (miticide application) that leads to differential reproduction (dead *Varroa* don't reproduce) in which their offspring possess the means for survival (miticide-resistance genes). Miticide resistance in *Varroa* is not unique or unusual as resistance to a diverse array of pesticides is very common in many arthropods[3].

Amitraz resistance in *Varroa* was first reported in the United States more than 20 years ago[4]. Despite widespread amitraz use since then, there have been few reports of resistance in the USA in the scientific literature[5] and amitraz-control failures were mostly rare and anecdotal. It is our hypothesis that it is due to a few factors. Amitraz and its toxic breakdown product, *N*-(2,4-dimethylphenyl)-*N*-methylformamidine (DMPF), does not accumulate to extremely high concentration and prevalence in the wax in the manner that tau-fluvalinate and coumaphos do[6,7]. The high concentration of tau-fluvalinate and coumaphos in wax provide constant conditions for strong selection of resistance. Amitraz tends to reach high concentration in the colony when the strips are applied and declines rapidly after they are removed. Under this scenario, amitraz does not continuously select for resistance. However, constant amitraz application where strips are removed and immediately replaced throughout the year may provide adequate conditions to select for amitraz resistance. It is possible that widespread amitraz resistance has not developed because there may be a trade-off or a fitness cost to amitraz resistance, especially in the absence of amitraz exposure. Fitness costs can manifest in lower reproduction, reduced survivorship, altered behavior, or a variety of other detrimental conditions. Fitness costs have been observed in amitraz-resistant cattle ticks[8], so a similar condition in amitraz-resistant *Varroa* is plausible. These statements are still just hypotheses and current and future research will provide much needed answers to the how and why of amitraz resistance.

Our interest in amitraz resistance in *Varroa* began about five years ago after having many conversations with beekeepers who had the same recurring experience that amitraz did not provide adequate *Varroa* control as it used to. There were a number of explanations about why amitraz was becoming ineffective, but the only consistent explanation was that amitraz resistance was developing in *Varroa*. Amitraz resistance was first reported in the USA more than 20 years ago[4] so it is likely becoming more widespread after years of use.

Beginning in the Spring of 2019, two different approaches were used to detect amitraz resistance. The first approach was to test for amitraz toxicity using pure amitraz in the glass-vial bioassay[4]. Small jars (20 mL) were treated with different concentrations of pure amitraz to determine the $LC_{50}$ (the concentration that is lethal to 50 percent of the population or the concentration that has a 50/50 chance of killing an individual *Varroa* mite). This approach allowed for toxicological comparison between *Varroa* populations. The second approach was to perform the Apivar® efficacy test in which a sample of bees are exposed to a square of Apivar® in a plastic container and the number of *Varroa* on those bees that survive the treatment indicates if those *Varroa* are resistant or susceptible[9]. By using these two complimentary methods, we determined that reduced Apivar® efficacy was due to reduced amitraz sensitivity as determined from the glass-vial bioassay, thus confirming that reduced Apivar® efficacy is due to amitraz resistance[10]. This is an important observation because it demonstrates that resistance is due to the active ingredient of pure amitraz, so it is unlikely that product formulation is a factor. In that first year of limited sampling, we found that most beekeeping operations had low to moderate amitraz resistance and only one operation was experiencing a *bona fide* control amitraz failure at the colony level.

Amitraz resistance monitoring was a large part of our research efforts in 2020 and 2021. While restrictions on research travel during the COVID-19 pandemic may have dampened our research efforts, it was an opportunity for innovation which dramatically improved the scope of our monitoring efforts. Amitraz resistance monitoring kits were shipped free of charge to beekeepers, apiary inspectors, and scientists who were interested in performing the test. The results and *Varroa* samples were sent back in the mail. We were able to double the number of apiaries and colonies sampled each year so that

after three years of monitoring, we have worked with 44 beekeepers in 62 apiaries for a total of 674 colonies sampled. Work will continue with this expanded amitraz-resistance monitoring network in 2022 and our goals are to cooperate with 50 beekeepers across 70 apiaries and sample 1,000 colonies. It's an ambitious goal but entirely feasible with external cooperators performing resistance monitoring with kits we will provide in concert with on-site sampling. With this abundance of data, we can start to make well-supported trends and observations that we hope to publish in the Summer of 2022.

Despite a number of alternative explanations for why amitraz applications fail to control *Varroa*, amitraz resistance is the most consistent factor in *Varroa* control failures. In nearly every instance of where beekeepers reported that amitraz application failed to control *Varroa*, the *Varroa* from those apiaries showed low levels of Apivar® efficacy.

Another interesting observation is that amitraz resistance varies from colony to colony within an apiary. For example, out of a sample of 10 colonies within an apiary, five may have no amitraz resistance (i.e., 100% Apivar® efficacy), three may have low levels of resistance, and two may have high levels of resistance. This is mostly consistent with a common anecdote from beekeepers where they said, "The treatment worked in most colonies, but there were a few where it didn't work at all." These "islands of resistance" may be due to 1) founder effect where the *Varroa* population within the colony is derived from a small initial *Varroa* population which included a few amitraz-resistant individuals, or 2) mutations that confer amitraz resistance arise spontaneously and independently in *Varroa* populations in each colony.

We hope to provide answers to these questions through a collaboration with Arian Avalos, who is the geneticist at our lab. We are sequencing nearly 500 individual *Varroa* genomes to identify DNA markers and determine the population genetics of amitraz-resistant *Varroa*. We hope this research will be published later in 2022. Some beekeepers ascribe the colony-to-colony variation in amitraz resistance to application error. While application error tends to be very infrequent, it is possible. In our experience, the most common miticide misuse is using only one strip per colony and making efficacy observations before the treatment is completed. It is understandable that application costs may result in only one strip used per colony, but it's a much better economic strategy to invest in a proper treatment program than replacing a colony that was lost due to high *Varroa* infestation. Amitraz does not act instantaneously upon exposure at the colony level, and it takes a few brood cycles to control emerging *Varroa* that were under capped brood when strips were first applied. It is important to wait until the end of the treatment period to make a final assessment about treatment efficacy. Your patience will be rewarded!

Preliminary results indicate that miticide rotations are another valuable strategy to impede or overcome miticide resistance. In 2020, we worked with a number of beekeepers who had amitraz-resistant *Varroa*. After discussing the results, many of them used oxalic acid vapor on their amitraz resistant *Varroa* and documented the treatments and efficacy. When we went back to those apiaries in 2021 in hopes of studying the amitraz-resistant *Varroa* populations, we were unable to identify any

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amitraz-resistant *Varroa* in nearly every instance. The theory behind this phenomenon is that the probability of developing resistance to any single miticide is very low (e.g., 0.001%). Therefore, the probability of developing resistance to two miticides is essentially zero (e.g., 0.001% x 0.001% = 0.000001%). In fact, large-scale multi-state beekeepers that utilize amitraz with an organic acid or thymol treatment experienced reduced colony losses[11]. The effectiveness of miticide rotations is important to beekeepers who may have amitraz-resistant *Varroa* because a non-amitraz treatment may provide adequate control and allow the colony to survive rather than euthanizing the colony to prevent the spread of amitraz-resistant *Varroa*. However, much more work is needed in this area to make more confident recommendations.

Miticides should not be considered a silver bullet for all of your *Varroa* ailments. Rather, miticides should be used as part of a multifaceted *Varroa* management program. Using different approaches build redundancy in the system to ensure that if one strategy fails, another will be there to ensure efficacy. Selective breeding efforts and investigations of naturally surviving honey bee colonies have identified a number of hygienic behaviors honey bees may utilize to control *Varroa*[12]. Overwintering of honey bees at indoor storage facilities can take advantage of the brood break that is induced by cold temperatures while modulating carbon dioxide levels and fumigating with formic acid or oxalic acid can further reduce *Varroa* levels[13]. Caging queens or splitting colonies to induce brood breaks are effective strategies to slow down *Varroa* reproduction. Screened bottom boards and trapping *Varroa* in drone brood may also reduce *Varroa* populations.

To be good product stewards, it is imperative that miticides are used according to the labelled instructions to provide adequate control and reduce the probability of resistance development. In the case of Apivar®, that means one strip for every five frames covered with bees, strips placed in the brood area or cluster, and leave strips in for at least 42 days and no longer than 56 days. Refer to the label for more detailed instructions. Taking notes on *Varroa* infestation before and after treatment will document and quantify efficacy. The loss of miticide efficacy due to resistance is a squandering of technology for which our honey bees will suffer the consequences.

If you are interested in participating in the amitraz-resistance monitoring program in 2022, please contact me at **Frank.Rinkevich@usda.gov** with your contact information and the amount of supplies you are requesting. I will ship supplies, protocols, and datasheets for you to test colonies at your apiaries (10 colonies/apiary). At the end of the test, you simply mail me the datasheet and *Varroa* samples that you collected from the test in a prepaid mailer. We will go over the results with you by the next day and discuss the potential efficacy of amitraz treatments. I look forward to another year of amitraz-resistance monitoring and working with all of you in the effort.

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# The Importance of Early Diagnostics in the Treatment of Honey Bee Viruses

**Roger A. Moore, Ph.D. & Dave Wick, CEO BVS, Inc.**

Accurate and cost-effective rapid detection of viruses, including variant or engineered strains, requires novel approaches. It is essential that beekeepers have access to technology for monitoring colony health, giving them an early warning of emerging outbreaks. BVS, Inc. has made these capabilities available to beekeepers nationwide thanks to direct funding from the beekeepers themselves. Honey bees are essential to securing the global food supply due to their role as pollinators of critical agricultural products[1]. According to the EPA, pollination is a critical part of more than half of the 29 billion dollar per year U.S. agriculture industry[2]. Pollinators today are under an unprecedented amount of stress, ranging from pesticides and loss of habitat to changing environments. Additionally, honey bees are plagued by a multitude of pathogens, including bacteria, fungi, protozoa, mites, small hive beetles and viruses[3]. Disease prevention and control plays a huge role in the success of our agricultural industry and most of that burden is shouldered by the beekeepers.

Single-stranded RNA viruses are the largest class of honey bee infecting pathogens[4]. For example, the Sacbrood virus infection shown in Figure 1 is a common problem among

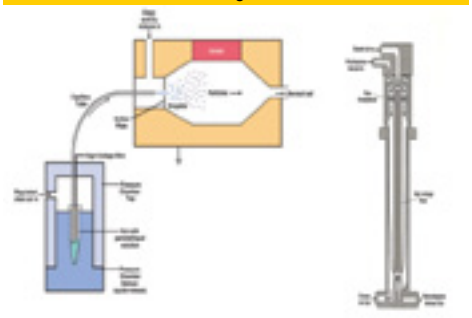
**Figure 1:** Sacbrood infection on hive.

North American hives, with multiple repercussions. Viral infections are notoriously associated with devastating colony losses that threaten the quality of agricultural crops. Most of these viruses are either exchanged between bees or transmitted from pests like the infamous *Varroa destructor* mite. Early identification of any virus present in a colony can be a critical aspect of the beekeeper strategy to avoid more serious problems down the road. In this article, we discuss the available methods for virus detection and identification.

There are a limited number of methods for identifying specific viruses in honey bees. Polymerase chain reaction (PCR), which is a highly sensitive method for detecting a very specific viral sequence[5], is currently the most widely used technique. PCR was used extensively in the Covid-19 pandemic. If a virus is present, then their DNA or RNA has to be there as well. The PCR method requires certain enzymes, chemical reagents, and an instrument called a thermal cycler. Researchers are limited using PCR methods who must know the identity of a virus in order to find that specific virus. If specific genetic sequence is unknown, this makes identification of an unknown virus difficult with the PCR method. Viral identification is typically completed by isolating genetic material from a sample and then sequencing the sample. Viruses can be difficult to isolate, discovery of new viruses is a complicated research project that requires funding, laboratories, genetic sequencing and experts with sophisticated software. Some honey bee viruses have never been discovered and remain undetectable by current PCR methods.

The Integrated Virus Detection System (IVDS) offers an alternative approach to the detection of honey bee viruses. It was originally developed and patented by the United States Army in order to rapidly detect and quantify all types of viruses and virus-like particles[6]. The goal was to create a robust, straightforward approach to virus detection that was not dependent on chemical reactions and could operate as a mobile unit. This goal has been accomplished and demonstrated ever since it was first commercialized by BVS, Inc in 2007 specifically for honey bees. The IVDS system, as shown in Figure 3, has

**Figure 3:** Major components of the IVDS system; Electrospray Ionization to deliver ionized particles, a neutralizer, and differential mobility analyzer to separate individual particles according to size.



a number of advantages that other methods lack. Identifying particles with IVDS is done based on physical methods without the need for any chemicals or biological reagents. Virions are first physically separated based upon the well-established techniques of filtration, ultrafiltration and centrifugation. Once isolated, particles are counted based upon their individual densities, movement through an air flow, and their unique sizes. The lack of dependence upon expensive biochemical reagents enables a lower cost structure and higher resilience in this new era of supply chain disruption. For this reason, the IVDS system provides a reliable and accurate method that can be independently utilized or combined with other available techniques. In the event that a honey bee colony is infected with an unknown virus, the IVDS instrumentation can nonetheless make a detection, even in cases where PCR is blind due to the lack

**Figure 4a:** Representative example of IVDS data showing no significant viral infection.

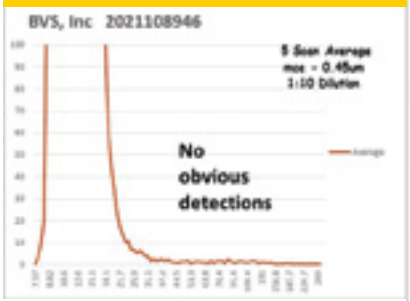
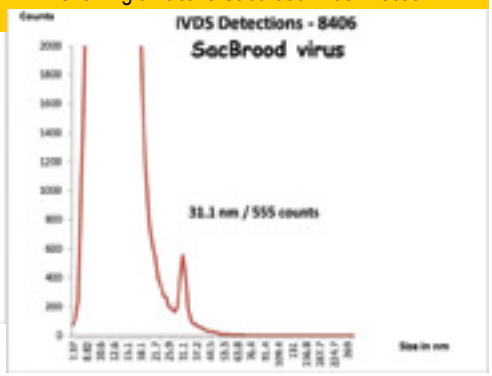


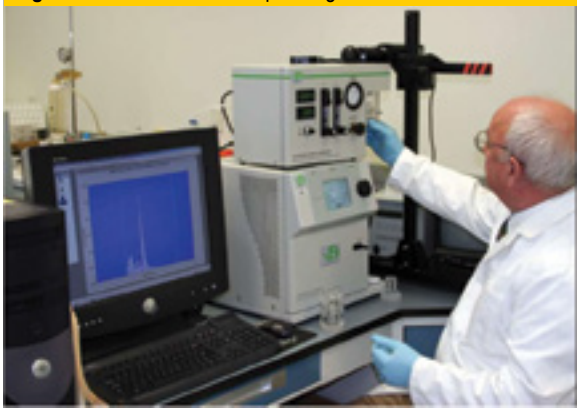

**Figure 4b:** Representative example of IVDS data showing an active Sacbrood virus infection.




of a known genetic sequence. This ability to detect unknown or mutated viruses is a significant step forward in bee health.

The IVDS system is based upon proven technology. Charged particles from the sample preparation are formed using electrospray ionization, a technique that received the Nobel Prize in chemistry[7]. As shown in Figure 3, particles travel through an electrically charged tube that measures the relative mobilities of those particles, which are then correlated to a specific size. Quantification of sized particles is simply achieved using a particle counter. This technology has other applications as well. For example, it is widely used to monitor particulates in smokestacks and automobile exhaust[8]. Dr. Charles Wick invented and patented this technique for detecting and quantifying virions[9]. BVS, Inc. has since licensed this invention from the United States Army and utilizes the technology towards identifying honey bee viruses, including Acute Bee Paralysis Virus (ABPV), Chronic Bee Paralysis Virus (CBPV), Israeli Acute Paralysis Virus (IAPV), Sacbrood virus (SBV), Kashmir Bee Virus (KBV), Lake Sinai Virus-2 (LSV), Deformed Wing Virus (DWV), and *Varroa Destructor* Virus-1 (VDV), among others. We are here to help you keep your bees strong and improve your bottom line, it is up to you to test your bees to keep them healthy! **www.bvs-inc.us**

**Figure 2:** Dr. Charles Wick operating the IVDS instrumentation.



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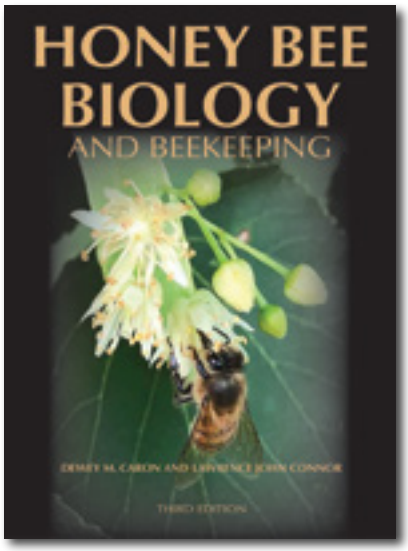


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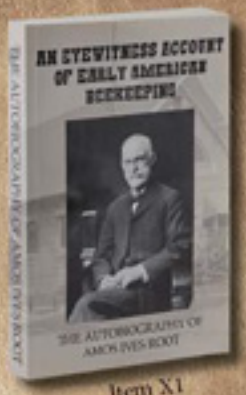


Item X1

One day in August 1865 a stray swarm of bees passing through the air attracted his attention. That evening, after hiving the swarm, other books and papers had to be laid aside in favor of anything pertaining to bees and bee culture. From that time on he was a student and breeder of the honey bee. It has been said that he did more than any other man in America to commercialize beekeeping. Take a step back in time and follow his journey and see how his quest for knowledge and profound religious conviction helped shape American beekeeping.

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Photo: Richard Rickitt

# Immunity in the honey bee

Celia Davis NDB

Originally printed in the March 2022 Issue of BeeCraft.

**_Apis mellifera_ lives in large communities with many little bodies confined in a nest (or hive) in an atmosphere which is both warm and fairly humid – ideal conditions for the multiplication and spread of pathogens. Notwithstanding _varroa_ mites, how do most colonies manage to stay reasonably healthy most of the time? Keeping bees in hives is an artificial situation and can upset the balance that exists between bees, environment and pathogens. By what methods does the colony as a whole unit, and the individual bee, stay healthy? What factors can impact on this?**

## Colony-level immunity

**Honey bees are very efficient at maintaining the colony in a fit condition providing certain requirements are met. Several factors are involved.**

**CLEANLINESS** is very important in controlling the spread of pathogens, and honey bees are particularly clean animals. Everything in the hive is swabbed down with a salivary solution which contains small quantities of hydrogen peroxide, produced as a breakdown product of glucose, using the enzyme glucose oxidase. This is a mild disinfectant and bees pay particular attention to the cells where the queen is going to lay. Worker bees can use their tongues almost like mops in this process.

**BREEDING** rates of bees can be very rapid, particularly in the early part of the season and a colony can often outbreed an infection such as nosema. At the same time that new bees are being produced, many are dying and, as a result, many pathogens are removed.

**THERMOREGULATION** can control some pathogens, particularly chalkbrood fungus (*Ascosphaera apis*) which needs a temperature of about 30°C for its spores to germinate. As the hive temperature is normally maintained at about 5°C above this, the fungus is unable to take over. Small or unbalanced colonies, particularly nuclei, are at risk as they are not always able to maintain a constant temperature.

**REMOVAL OF INFECTION** from the colony is achieved in several ways. Most foragers die in the field and there appears to be an altruistic effect so that sick bees may leave the colony. Any bees that die in the hive are removed by other worker bees. Changes in behaviour can also help: the sacbrood virus is carried in the hypopharyngeal (brood food) glands of adult bees and overwinters there. They exhibit no symptoms, but their development is accelerated so that they transition to foraging at a much younger age than normal and rarely collect pollen when they are foraging. Fewer bees can therefore pass the virus on to the larvae.

**BARRIER METHODS** serve to keep some individuals separated from others. The obvious case example is the larvae, each of which is reared in an individual cell. There is normally some separation of adults: nurse bees and queen in the central part of the brood nest, older receiver bees and

Photos: Richard Rickitt & Celia Davis

1 Colonies with a variety of pollen types tend to be healthier
2 Each larva is kept separate from other larvae, so minimising spread of pathogens
3 Propolis is a valuable aid to combatting many micro-organisms
4 An intruder – a snail – being encased

food processors towards the outer part. Foragers bringing in nectar do not enter the brood nest and those bringing in pollen drop it in cells adjacent to and near the brood. However, this pollen is processed by mixing gut contents with it, so rendering it safe by the time the nurse bees consume it and feed it to the larvae. Obviously, this is not a complete separation of bees in the nest but there is a gradual move from the centre outwards as a bee ages. Food coming in from outside, which may be contaminated with pathogens, tends to be kept away from brood and queen.

**HYGIENIC BEHAVIOUR** in its simplest form involves grooming of nest mates by the bees. This can remove some ectoparasites. The true meaning of hygienic behaviours is applied to those bees that can detect dead or diseased larvae and pupae and remove them. This is not a simple process and is dependent on the sense of smell, which is better developed in some bees. Oleic acid, the 'death pheromone' given off by dead larvae/pupae, is undoubtedly a key trigger for hygienic behaviour, but it is not the only one.

**ANTIMICROBIAL SUBSTANCES** are produced by the microbiome, bacteria and fungi which live in the bee's gut. These substances are added to bee bread (preserved pollen) and brood food and helps to protect the larvae.

**PROPOLIS** is a substance which bees love and beekeepers hate. It is gathered by the bees from plants, which produce it to protect themselves from attack by micro-organisms. Because it comes from various plants its composition varies, but it consists of a number of resins and balsams together with essential and aromatic oils. A wild colony living in a tree will coat all the internal walls of its nest and around its entrance with propolis so that it forms an envelope and confers considerable protection. There is work being done, experimenting with using roughened wood on the insides of hive boxes, to induce the production of this envelope. Another use is to coat foreign objects which gain access to the hive and might decay, thereby causing problems. Mummified remains of mice and snails are sometimes found. In areas where the small hive beetle (*Aethina tumida*) is found the bees may imprison the beetles in a 'cage' made from propolis.

## Individual immunity

**One of the simplest ways to combat pathogens is to prevent them from gaining access to the body. The commonest ways in are through the body wall and from the gut.**

**THE CUTICLE** is the first line of defence. It is impermeable to water and is quite tough, providing that it is undamaged. The protection becomes compromised where there is damage to the cuticle from broken hairs or due to the damage caused by the *varroa* mite. The spiracles also provide openings. Mostly they have valves, which protect the openings, but the spiracle on the second thoracic segment (mesothorax) has no such protection and here we see that *Acarapis woodii*, the parasite that causes of acarine, can get into the breathing tubes (trachaea) causing disease.

**THE GUT** is an obvious means of entry and has several defence mechanisms. The proventriculus, the one-way valve which connects the crop and the ventriculus, is able to filter out many small spores and micro-organisms along with pollen grains. These are then passed into the ventriculus as a food bolus. This part of the gut is not a welcoming environment as it is acidic and contains digestive enzymes. It is lined with a single layer of cells, called an epithelium, which limits the passage of substances and micro-organisms through it into the

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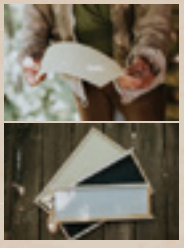

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surrounding haemolymph. This epithelium is the structure targeted by nosema, which damages it and makes it vulnerable to the passage of some viruses as well as affecting the production of enzymes and limiting the bee's ability to digest pollen. Finally, the peritrophic membrane, which is secreted continuously along the whole length of the ventriculus and surrounds the food bolus, acts as a barrier to prevent some pathogens from passing through into the haemolymph. Unfortunately it takes a short time to develop in both the larva and the adult bee and this leaves a newly emerged larva vulnerable to attack by organisms such as *Paenibacillus larvae*, the bacterium causing American foulbrood.

**THE HAEMOLYMPH** circulates round the bee's body and bathes all the internal organs. It is the site of a number of immune responses and these are triggered by the structural patterns on the outside of pathogens. These are recognised by proteins in the haemolymph and the binding of the two together triggers the various responses:

- Plugging a wound by some of the haemocytes (blood cells), which migrate to the wound. Melanin is then produced to form a permanent repair. This is rather like a scab in us.
- Phagocytosis effected by other haemocytes called granulocytes. These surround the invader, and the nodule which is formed by plasmatocytes is later melanised.
- Production of phenoloxidase. This is an enzyme, which is essential in the formation of melanin and is produced in haemocytes which are circulating freely but is present in the inactive form of prophenoloxidase. Once an injury or invading pathogen triggers a response, a cascade begins to convert it to phenoloxidase.

All of these responses are not constant during the life of a bee. Granulocytes peak in eight-day old larvae but decrease in young adults up to about five days when they dropped still further. Plasmatocytes have not been observed in larvae and are most abundant in young adults. These also decline in older adults. Queens appear to retain these cells. Phenoloxidase, apparently, may increase with age.

Finally, and taking slightly longer, antimicrobial peptides are produced by the fat bodies in response to chemicals produced by the haemolymph. These are able to inactivate the pathogens and persist after the invaders have been defeated. There are several of these and they are not specific to a particular pathogen. They can be passed between bees and added to royal jelly.

**VITELLOGENIN** is a precursor of some yolk proteins and, although it has many other roles in the honey bee, this original function has been retained. If a queen has micro-organisms in her body, particles of these become attached to the vitellogenin molecule which will be incorporated into the yolk. This can induce an immune response in the larvae hatching from these eggs.

**FINALLY, iRNA** (interference ribonucleic acid) is the major method used to prevent viruses multiplying. This interrupts the mRNA (messenger RNA) which conveys the blueprint for more viruses from the virus to the nucleus of the cell it has attacked.

## Problems which may arise

**Clearly, although immune responses can be overwhelmed, the bee has quite sophisticated methods for dealing with pathogens. However, some external factors can have a big impact and all kinds of stress can give the pathogens the upper hand.**

NUTRITION and most importantly provision of pollen from mixed sources, is fundamental. Protein is a major constituent of pollen and is needed for the production of enzymes and antimicrobial peptides among other things. Pollen is also the source of lipids but the role of these in immunity is not well understood.

*VARROA* feeds on the bee's fat bodies, thereby affecting their function, and inhibits some of the genes controlling immunity. Even very good feeding after emergence cannot replace protein lost during pupal life.

CHEMICALS used in agriculture, particularly some of the neonicotinoids, have been shown to lower the immunocompetence of honey bees. Neonicotinoid pesticides have been removed from general use in the UK, but it will be some time before they disappear completely from the environment and we are not clear on the effects of other chemicals.

To sum up, immunity in honey bees is a complex of interconnected processes combining both colony level protection as well as the innate system of the individual bee. Various and combined stresses, particularly resulting from nutrition and from *varroa*, can have adverse effects leading to even more problems. We should aim to reduce the stress on our bees as far as possible.

**Celia F Davis** NDB lives in Warwickshire and has had a lifelong interest in insects and gardening. She taught pure and applied biology and has written two acclaimed *BeeCraft* books: *The Honey Bee Inside Out* and *The Honey Bee Around and About*.



5 Many bodies crammed together give ideal conditions for the spread of pathogens

6 The *varroa* mite affects the imunocompetence of bees in several ways

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# The global COLOSS network – Do it like the bees – Do it as a team!

Anna M. Gajda[1], Gina Retschnig[2], Maria Bouga[1], Robert Brodschneider[1], Norman L. Carreck[1], Panuwan Chantawannakul[1], Raffaele Dall'Olio[1], Vincent Dietemann[1], Ales Gregorc[1], Lotta Fabricius Kristiansen[1], Daniela Laurino[1], Aslı Özkirim[1], Christian W.W. Pirk[1], Victoria Soroker[1], Geoffrey R. Williams[1] & Peter Neumann[1]

[1] COLOSS Executive Committee, www.coloss.org
[2] Institute of Bee Health, Vetsuisse Faculty, University of Bern, Bern, Switzerland

**Introduction**

Honey bee colonies are an essential provider of ecosystem services, and are among the most important productive animals worldwide. Unacceptable losses of managed western honey bee *Apis mellifera* colonies have been observed in many countries. It became apparent that countries cannot easily solve this problem individually, and that there was an urgent need to address the lack of comparable data on rising colony loss rates among and between different countries. As a result, in 2008 COLOSS (the prevention of honey bee COlony LOSSes network) was initiated, funded by the European Union COST Programme (Action FA0803) (2008-2012). After 2012, COLOSS was consolidated into an international, non-profit association headquartered in Bern, Switzerland, funded by: the Ricola Foundation *Nature & Culture* (the main sponsor); the Eva Crane Trust; Veto-Pharma; IBRA (International Bee Research Association), the University of Bern; and many local sponsors for individual events (Brodschneider *et al.* 2022).

COLOSS is composed of scientific professionals that include researchers, veterinarians, agriculture extension specialists and students. However, members cannot be involved in producing substances that are harmful to bees. To date, COLOSS has 1,857 members from 105 countries, and is still growing (Fig. 1).

**Figure 1:** A map of countries (in green) with COLOSS members.

**Mission and Goals**

The actions of the association are based on the realization that cooperation and open dialogue are key to a better understanding of the reasons why bee populations are threatened in today's world. The mission of COLOSS is to improve the well-being of bees (in particular the western honey bee *A. mellifera*) at a global level. To achieve this, COLOSS advocates for honey bee well-being, especially to government legislators and administrators. Moreover it coordinates international research, including the development of standard research methods and disseminates gathered knowledge related to improving the well-being of bees. Promoting youth development and gender balance amongst those studying, or those actively involved in promoting the well-being of bees is an important part of COLOSS's work. Since 2021, COLOSS annually awards grants to support the work of early-stage researchers, with a special focus on students from developing countries, to encourage young minds to dig deeper, and to promote innovative and sustainable beekeeping solutions. COLOSS is also a frame for networking of members for their research activities and global collaboration and establishing their complementary approaches.

The association works towards those goals by investigating themes of interest:

- Pests & Pathogens (e.g. *Varroa destructor* & viruses)
- Environmental effects (e.g. Pesticides & nutrition)
- Breeding & Conservation (e.g. Diversity & disease resistance)
- Bridging Research and Practice (eg. improved practices of research outcomes)

COLOSS achieves this through its Regional Representatives and

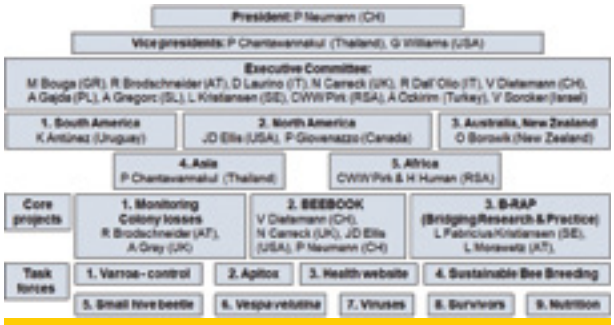


**Figure 2:** The structure of COLOSS.

its Core Projects and Task Forces – specific topics identified by the association to receive priority attention (Fig. 2).

COLOSS facilitates networking between its members through its annual international conferences (Fig. 3.), workshops, training schools, shared protocols, joint large-scale experiments and international monitoring programs. Since the outbreak of the Covid-19 pandemic, in person meetings were replaced by virtual ones. Local virtual / hybrid meetings have taken place in Africa, Asia, North America, South America and Oceania. In particular, COLOSS Asia has been a true success in Okinawa, Japan. The next Asian-Oceanian meeting is planned to take place in Hangzhou, China in 2022. With all the negative impacts of the Covid-19 on research and networking activities (D'All Olio *et al.* 2020), COLOSS adjusted its activities to fit Covid-19 challenges. Joining in person meetings with online ones allows many more members to take part, without the costs of travel or accommodation, which can sometimes be a large barrier to scientific networking, especially to young members from developing countries.

**COLOSS activities**

From the beginning of COLOSS, it became apparent that shared standard protocols are essential to enable the direct comparison of data between laboratories and countries. This led to the birth of the **COLOSS *BEEBOOK*,** a manual for standard methods in honey bee research. In three dedicated volumes to date (**https://coloss.org/beebook/**), international author teams explain research methods in a simple, step-by-step basis, enabling the generation of data that are comparable across laboratories. The *BEEBOOK* articles are freely available and continuously evolving, with regular updates occurring as new methods arise. Recently, the *BEEBOOK* has expanded to include research on the eastern honey bee, *Apis cerana*, and "omics" (genomics, proteomics, etc.).

A very important outcome of COLOSS's work has been the multitude of scientific publications deriving from international cooperation on different topics. This cooperation is best represented by three multi-country projects: the CSI (Citizen Science Investigation) Pollen study; the GEI (Genotype-Environment Interaction) experiment; and the Colony Loss Monitoring core project, which is ongoing with yearly data collection since the creation of COLOSS.

**CSI Pollen** has been the largest pollen sampling experiment in history (Brodschneider *et al.*, 2021). It significantly helped to understand the diversity of pollen forage available to honey bees. In this study, 750 citizen scientist beekeepers from 24 countries collected almost 18,000 pollen samples, which they recorded for color diversity. These results measured by beekeepers were analyzed by the Task Force members, who found that pollen diversity is posi-

**Figure 3:** Group photo from the COLOSS Conference held in Cluj Napoca, Romania in 2016.

tively influenced by 'urban' habitats or 'artificial surfaces', respectively. This was shown with the help of many beekeepers, and in contrast to other targeted studies, for established apiary sites and over a very wide geographical range covering large parts of Europe. Finally, this activity for the first time introduced citizen science to the broad honey bee science community.

**The colony loss monitoring project** includes more than 30 participating countries, and the number of member countries is continually increasing (Gray *et al.*, 2020). Many thousands of beekeepers take part each year, a great example for crowdsourcing; the voluntary participation of many beekeepers enabling much wider scale data collection than would otherwise be possible. Each country carries out an annual survey of beekeepers by questionnaire, with the aim of collecting information from a nationally representative sample of beekeepers. This makes it possible to compare Winter colony loss rates between countries, and to use the international data collected to better understand the risk factors for colony loss. To enable proper comparisons, a standardized beekeeper questionnaire was developed and is updated each year by the group for use by each country. The publications resulting from this project not only produced internationally comparable loss rates of honey bee colonies for the first time, but have also used advanced statistical modeling to investigate risk factors.

**The pan-European Genotype-Environment-Interactions Experiment** aimed to estimate the importance of genotype-environment interactions on the vitality and performance of honey bees (Meixner *et al.*, 2014). It ran between 2009 and 2012, and the experiment included 621 colonies from 16 different genetic origins belonging to five *A. mellifera* subspecies (*carnica, ligustica, macedonica, mellifera, siciliana*). It took place in 21 locations managed by 15 COLOSS partners in 11 European countries, ranging from Scandinavia to the Mediterranean, and across Central Europe to the Balkans. The study provided an insight into the complex mechanisms of adaptation and the relative importance of environment and genetic origin on colony vitality. The data collected in this experiment demonstrated that "local" bees survive better than bees introduced from elsewhere, and also permitted a preliminary view of disease presence in several European countries. Overall, this experiment showed that it is worthwhile to continue work towards the conservation of locally adapted honey bee populations.

**Bridging Research and Practice (B-RAP)** as a core project within COLOSS was established to translate research outcomes into beekeeping. Analysis of colony loss has often indicated gaps in knowledge transfer between science and apiculture. Bridging research and practice is thus one major goal of COLOSS. B-RAP is a core project composed of both extensionists and scientists from many countries who are working towards understanding the local needs and ways for improvements in information transfer.

It is vital that outcomes and conclusions of COLOSS activities are transferred in a clear way through channels most used by beekeepers. In order to determine the best way to reach them, the B-RAP Core Project members conducted a global survey that focused on where beekeepers obtain information, on different aspects of beekeeping practice and which sources of information they prefer. For this, an online questionnaire was created, which was available in 25 languages between May 2020 and February 2021. A total of 11,351 beekeepers from 98 countries answered the online questionnaire. Preferences for the type of information source differed significantly between continents. A deeper understanding of where information is most frequently retrieved by beekeepers allows beekeeping advisors and bee researchers to adapt their communication strategies accordingly. We believe this will result in improved and more effective communication between researchers / advisors and beekeepers on a global scale, and thus facilitate the adoption of new techniques and knowledge in various beekeeping sectors, for improved honey bee management and health.

The outcomes of research are translated and explained to beekeepers during numerous training courses, conferences and other beekeeper-oriented events. COLOSS members author many popular articles in beekeeping journals (both national and international) with the same purpose. COLOSS also distributes bee health news, events, jobs, and scientific articles that are relevant to to stakeholders via the web, e-mail, and Facebook®.

Many joint projects have been realized, and numerous collaborations have developed across national borders. This successful development of COLOSS in recent years, and the great response the network has received from the scientific community, is a huge opportunity for the field. It is a great example that only together can we find sustainable solutions to improve the well-being of bees.

If you want to know more about our activities, take a look at the freely available Bee World Special Issue on COLOSS (Bee World, Volume 99, Issue 1 (2022)).

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# Off the Wahl Beekeeping

## INCREASING YOUR HIVE COUNT

Richard Wahl

Once you have caught the bug (pun intended) of bee management there is the urge to increase your hive count in the coming year, particularly if your first hive survived the Winter. I know of several beginners that started with one hive and if they failed to get them through the first year, go out and buy another package of bees to try again. I have also known a few who just gave up on the idea of keeping bees. For those just starting out I would recommend two hives, or even better, two nucs so that a comparison of the two can be observed. It is much easier to notice an anomaly in one of two hives if they are performing differently than to figure that something is not quite right with only one hive to observe.

**Packages**

The sale of three pound packages of bees keep many commercial bee businesses in operation. There is nothing wrong with that, but I find most beekeepers like to be frugal with their spending and would avoid buying new replacement packages each year if they could.

One way to accomplish this is to buy a spare queen and split that initial three pound package into two halves. If this is done it is best to initially put each half in a smaller five frame nuc rather than a large ten frame deep.

That lesser number of bees still need to keep the queen and any newly laid eggs warm so reducing their initial space will help them get off to a good start. I know of several beekeepers in my area of SE Michigan who have done this successfully on more than one occasion. I would also suggest that if using this method a later nuc/hive insertion is better than getting bees as early as possible. Temperatures will be warmer for the later package deliveries and this will be less stressful if a package is split. Another consideration is to be sure the extra queen can remain in her cage for a few days so the half package she is joined with will have time to acclimate to her new pheromones. The package bees during transportation will have adjusted to the original queen that came with the purchased package and so the other half will need time to adjust to a different queen. Acclimation to a new queen should not take more than a day. It will normally take the bees more than two days to chew through the candy plug and release the queen. I have successfully started new nucs with just three deep frames, a ten frame deep split into three sections with separated sections and entrances for each three frame nuc even if only using two of those sections.

A ten frame deep could easily be split into two sections as long as the

A ten frame painted deep split into three, three frame nucs with separate entrances on three sides above a snelgrove board also split into three sections with entrances not on the same front entrance side of the main hive below.

Three pound wood package with queen cage normally used by southern commercial dealers.

Three pound plastic package cage normally used by western commercial dealers.

Two four frame nucs and inner covers sit on a divided ten frame bottom board and fit under a standard ten frame outer cover.

sections are completely separate and have separate entrances.

It should be understood that a three pound package is obtained when the commercial beekeeper shakes bees from several different hives into the package to ensure a good selection of bees. The queen most likely comes from an even different laying queen nuc source and all have to acclimate to each other during their journey to a new location. There is an even better way, although a bit more expensive, which is to purchase a locally produced nucleus hive.

**Nucleus Hives**

A nucleus hive (nuc for short) will normally consist of five frames with a mated laying queen that is the mother of most of the bees in the nuc. Two or three of the frames will already have eggs, larva and brood on them possibly with some stored pollen and/or nectar on the outer frame edges as well. One or two frames will have stored pollen and nectar or honey that is the nuc food source. The fifth frame may be partially empty or have some portion of pollen/nectar/honey stores. The advantages of a nuc are that it is a small established hive.

Since there is a laying queen with some capped brood and larva it gives a head start over a package as new bees will hatch out in a matter of days (worker bees stay as capped pupa for about 12 days). In the event a package came with an unmated queen that adds another eight to 10 days for that queen to mate and a day or two more before she even starts to lay eggs. If a beekeeper can be found in your area who sells nucs, those bees will most likely have come from stock that has overwintered and therefore be more acclimated to your area climate. This increases the following Winter chance for overwintering success. If the weather cooperates there may even be the chance of the hive growing to the point where an added honey super or two might be taken in late Summer or Fall. This is less likely to occur with an installed package as those bees and queen, as stated above, need longer to build up to the point where a honey super is added.

Five frame wooden nuc box; an established small hive.

**Swarms**

Swarms can occur anytime from late Spring through the Fall. A normal cause of swarming is the bees becoming overcrowded in their allotted hive space. This can occur when an ongoing strong brood buildup is coupled with a good nectar flow.

Swarming may also occur due to poor hive ventilation, excessive mite build up or just the natural instinct to reproduce. The space issue can be monitored by the beekeeper such that when brood, pollen, nectar and honey cover 75% to 80% of the available frames a new super with empty or drawn comb frames is added. The beekeeper can also monitor ventilation by raising one end of the outer cover or even offsetting an upper super a quarter inch or so between supers to allow a small space for air flow. Mite loads should also be checked about once a month and appropriate treatments applied if needed, as an excessive mite population can be a cause for swarming. Even with all these precautions a hive may decide to swarm as the urge to procreate and reproduce is a universal trait among all living things.

With this in mind the conscientious beekeeper is wise to have a spare hive and/or nuc available. Once there is a hive or two established in the apiary the likelihood of a swarm incident increases tremendously. I never saw a swarm for twenty years living in the same location. But after my first swarm catch thirteen years ago, from my third year of beekeeping to present, I have had two to six swarms appear each Summer, most of which have been captured. This may be partially due to at least four other beekeepers within five miles of my small apiary. I have successfully brought a second week of August swarm catch through the following Winter. The key is to feed a two to one sugar syrup mix until the weather consistently gets below freezing and then switch to a candy board or sugar feeder through the remainder of the Winter until going back to syrup feeding the following Spring.

**Splits**

Another way to increase your hive count is to split a strong hive

My split temporarily with a third queen in the honey supers.

that has a good queen and ample brood population. This will be most advantageous if it can be done with a hive that has come through the Winter with last year's queen laying a solid brood pattern on three, four or more frames.

If the hive has two deeps and there are eggs and three to six day larva next to the eggs in both top and bottom deeps, there is a very easy way to make a split. Simply insert a queen excluder between the two deeps and make sure the inner cover entrance hole is down, or next to the top deep frames. Although the bees will continue to work both deeps, there is an 80% chance the one without a queen will make a new queen and continue working in combination with the older queen above or below. Separating the two deeps each given their own individual bottom boards, inner and outer covers increases the likelihood that a new queen will be raised in the queenless deep to near 100%. Last year I had a hive where there were five to six frames with brood by early Summer. I did a three way split evenly dividing the brood frames between three hives. Each of two brood frames pushed together in the center of new hives were also bounded on either side by pollen/nectar frames with remaining space filled in with newly waxed frames on the outer sides. I did not worry about which hive the queen remained in as that became apparent a few days later with eggs showing up in one of the hives. The other two naturally needed the bees to raise new queens. These hives had a good brood break (a mite control method) and resulted in the newly raised queens mating and starting to lay eggs about a month after the split. This is what is known as a walk away split. Of course new queens could have been purchased for the two without queens, but that would have required me to initially locate the hive with the original queen, which I never saw and was only evidenced when new eggs were almost immediately spotted in one of the three hive splits.

Purchasing new queens would have begun the start of egg laying about a month earlier and would have increased the possibility of collecting more honey from those hives later in the season. I was curious whether I could speed the possibility of collecting a bit more honey than usual from the newly split hives and so tried a different approach. I moved the two newly queened hives right next to each other touching on a common side after adding a second deep. I placed a queen excluder over the right and left halves of the adjacent hives and used five frame nuc covers to cover the remaining halves. I also used some four frame inner covers that I had made for some four frame nucs on the outer halves of the brood deeps with five frame nuc covers over those. (Two, four frame, side by side nucs fit nicely under a ten frame hive outer cover.) On the inner halves over the queen excluder I placed a honey super that was now being worked by bees in both hives. The bees seemed to get along just fine even with bottom openings both on the same side, possibly due to the two queens being sisters and probably having similar pheromones. I soon needed to add a second honey super, sooner than they would have been added if each hive were sitting separately. While this was going on I also used some eggs from the same parent hive to graft several queens which were placed in nucs next to these adjacent hives. It was not long before I noticed the queen in the nuc, closest to the touching neighbor hives, did not have eggs or signs of a laying queen. I simply assumed that queen did not return from a mating flight. A week or two later I was curious as to how the second honey super on the adjacent hives was doing. I peeked in and pulled a few honey frames to find a third queen with several frames of eggs and brood now in the second honey super.

A quick check revealed that neither queen below had found its way into the honey supers. My assumption is that the sister queen that should have gone back to her nuc, instead returned to the upper entrance of the honey supers jointly above the hives below. I soon moved her and the brood frames along with the remainder of her nuc into their own hive where she continued to do as well as the newly split queens in the adjacent hives below.

**Conclusion**

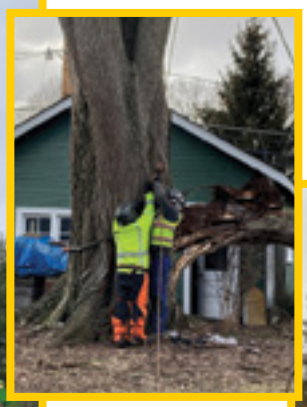
These are some of the ways I have increased my hive count. Four or five years ago I decided that I knew enough about bees that I could increase my hive numbers without buying new packages as they seem to continually get more expensive. These techniques have worked well for me, but your beekeeping experience could vary based on your environmental conditions, experience or state of your hives. Give one of these techniques a try as there is more than one way to increase your hive count besides the option of always purchasing new packages. BC

**Correction**

Learning to write for a magazine is much like learning beekeeping, sometimes mistakes are made. In the April issue the subtitle should have been "The Bane of Mites" instead of the subtitle carried over from the March issue. Also the reference to new bees "hatching" from capped brood should have used the term "emerging" as only eggs hatch. Also the picture labeled as "oxalic dribble in progress" should have been credited as "photo by Randy Oliver."

# Avoiding Tree - Bee Calamities

Ulma Falls



On Thursday, February 17 at 9 pm a large section of my giant American elm tree split and fell, crushing my neighbor's trees, while landing on their garage and landing on the electric lines in the alley, snapping five utility poles under the weight of the massive limbs. Several blocks were without power for ten hours until new poles could be erected, and new lines connected.

In 2012, Urban Foresters from Ohio Dept. of Natural Resources measured the regal tree at 184" circumference (4.5 feet from the ground), 90 feet tall, with an 83-foot crown (reach of the branches) and listed it as the 3rd largest American elm tree in Ohio. A few years later the second largest was hit by lightning so my elm moved to Number 2.

The branches and a third of the trunk not only took out the electric and the fence between my neighbor and I, but it also landed on three of my bee hives, knocking one on its side, with branches forced through the outer cover. Two colonies absconded after the shock, the one on its side was angry, with combs broken loose from the frames and honey oozing when the temperature rose later in the day. No one could access the hives due the number of heavy limbs that covered the area, so I waited until the tree care company could remove them.

Of course, the colony was incredibly heavy and was falling apart as we tried to lift, shove and drag it away from the workers. We used tiedowns to hold the hive together (sans broken cover) and a hive carrier to move it away from the damage. Smoke helped to keep the cold (28°F) and shaken bees out of our faces.

The point to this story is that we don't know when disaster is imminent. The elm appeared to be healthy and showed no signs of splitting. It had been under the care of a good arborist for at least 20 years. The insurance company did not cover the loss of the bees or damaged equipment (or the removal of the rest of the tree), which added to the sorrow of losing this magnificent tree. Some lessons learned from this disaster are as follows:

- To avoid damage to your colonies, note the health of trees and the direction that they are leaning. Estimate the distance of the colonies from the tree(s) when placing colonies.
- Remember that strong winds, ice storms and vehicles out of control can alter the direction that trees/branches may fall.
- Always keep a smoker, hive tools and protective clothing near any colonies and/or in your vehicle. Tie downs and a device to move hives are also a necessity.
- If the colonies are away from your home, make sure that your contact information is posted near the colonies (and registered in your state).
- If the tree(s) is on your property, maintain it. Keep records of any care that is completed in case the insurance company needs proof that it was not a hazard tree.
- Maintain good relations with your neighbors. Tree/branch damage to property is always stressful, however good neighbor rapport helps to dispel some of the tension.

The loss of this beautiful tree is heartbreaking and the costs crippling, however overall, my neighbors and I were very fortunate as no one nor any homes were damaged. At least one colony survived to be split and placed in new hive boxes. I learned some important lessons and hope that you can avoid a similar disaster.

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# Bee Driven Mid-Life Crisis, Part 7
# The Financial Side

James Masucci

I had thought that by this time I would be summarizing my building experience and what I learned along the way. But the floor is still waiting to be poured, meaning nothing has happened on the interior of my new honey house. That story will have to wait.

I was delivering some honey to a local hardware store a couple weeks ago and they had a sign up that went something like this: "If everyone in the area spent just one dollar at a local store instead of a large box store, it would pump three million dollars into the local economy." That sign should resonate with all of us who sell local honey. Think about it, most of us who sell to retail stores are selling to small, local stores who support local businesses, or to restaurants who pride themselves on buying from local producers. They all have access to cheap honey, but they see the value in supporting local endeavors.

My experiences over the last year, as I transitioned to a full-time beekeeper and growing my business, has given me a great deal of respect for the local businessperson. I got a flavor of the risks these businesspeople take to start and run a business. When I worked as a scientist for a large corporation, I got a paycheck whether I succeeded or failed and whether the economy was good or bad. When business drops for a local shop, the owners don't get a paycheck, and/or they can't pay their employees, suppliers or rent. Gosh, the pressure must be incredible. It costs a lot of money to start and maintain a business. As a hobbyist, the costs were right there in front of me: bee equipment, food, medicine, jars, labels. As I expand, I'm learning that a lot of other costs come into play.

Here are some of my take-aways regarding the financial aspect of going into the bee business. This is not a guide, or how-to. Only my experience thus far and what I am learning from it.

**Initial investments**

The initial investments were the most obvious costs when I decided to grow my business. I knew I needed a building for storage and a truck for efficiency. These allow me to be a larger scale beekeeper. I've written about this in previous *Bee Culture* editions. I purchased two acres of land and am in the process of putting up a 40x48 honey-house/storage facility. I got a used F450 ambulance from my son-in-law and just recently picked it up after having a flat-bed and lift gate put on it (see picture 1). I am like a kid in a candy store with my new "toys." Those costs were significant and I have to sell a lot of honey to pay for them. I reason they are long term investments and, when I retire, I will get my money back. I was able to plan for this and there are various loan programs to which you can apply for help.

There were also the investments associated with expanding the size of my operation. These shouldn't come as a surprise for a beekeeper. If you go from 100 colonies to 200 colonies, you will need the woodenware for those extra 100 colonies. You can easily plan for that too. You need to make the decision for consistent equipment (i.e. pallets or bottom boards, single or double brood boxes, deeps and/or mediums, etc) and buy or build what you need. Don't forget about the supers, the queen excluders, the feeders, etc. Also, don't forget the extra costs associated with hive maintenance. These include medications, food, and even the gas, since you will be driving to a lot more out yards than you are used to.

**The easy to forget investments**

The saying goes, "the devil's in the details." That's true for the cost of starting my business, too. In my last article I described my plans for the inside of the building. I want it to have a certifiable commercial kitchen. I have my plan, then I saw the cost of the supplies. More than I expected. For example, electrical wire is around $0.50 a foot and I need around 1000 feet. 2x4s needed for framing the wall are between six and seven dollars each and I am going to need 150 of them. Then, there is the drywall, etc. Plus, the cost of three sinks, a stove, a refrigerator, a washer/dryer, toilet, shower, dishwasher, heater and air conditioner.

The above expenses are not unexpected, just more than I thought. Another area of expenses is the equipment to handle materials. Honey supers are heavy, so is sugar or sugar syrup. Then there are pallets of materials as you start buying in

**Picture 1.** My new bee truck. The heavy-duty truck will allow me to do large scale beekeeping more efficiently. The lift gate on the back will minimize heavy lifting.

**Picture 2.** My home-made gantry crane and a 2400-pound pallet of sugar. This will be used to get heavy pallets off my truck and onto the floor where I can move them with a pallet jack.

bulk. How do you handle all this in a way that will prevent back injuries? I broke down material handling into two categories: in the field and in the honey house. Most commercial guys have forklifts, which can do double duty. However, I can't tow a forklift into the field because my yards are too tight for a bee truck hauling a trailer. I decided instead to have a lift gate installed on my truck. That allows me to move supers and bees using a cart in the field. I can place them on a half pallet onto my truck, then use a short-forked pallet jack to maneuver on my truck. I already have the cart. I still need to build the pallets and I need and purchase the pallet jack. I also need to purchase several rachet straps to make sure everything is tied down. Then I need something to cover the load to keep bees out of supers. Except for the lift gate, everything is under $500. But, many items at $500 adds up.

There is a lot to consider for handling material inside the building. The first is how to unload my truck. For loads under 2000 pounds, I can use my lift gate. To move heavy pallets off my truck, like the 2400 pound pallet of sugar I am picking up today, I figured I need a gantry crane. The ones for sale have an inside clearance of 7.5 feet. The truck bed is eight feet, so I built one using lumber, an ATV winch, and some heavy-duty pulleys (see picture 2). It allows me to lift pallets off the bed of the truck, move the truck, put the pallet on the ground and move it with a pallet jack. Maybe not the most efficient method, but I won't have to do this often.

The main material I will be handling is honey. Extracting aside, I need to store it, liquify it, and bottle it. The obvious question when expanding is whether the current equipment can handle the expansion. I currently extract into five gallon buckets, and I have a system where I can liquify three buckets at a time. But when I bottle, I can go through five or more buckets at a time. I need to think about storage tanks, heating units to liquify what's in the storage tanks and mechanisms to fill the storage tanks. At 60 pounds a bucket, I want to lift those as little as possible. I am looking into getting either a U-cart or a hydraulic lift cart (see picture 3) to move the five gallon buckets from the storage area to the kitchen. Both are roughly the same cost. An automatic bottler would facilitate the bottling step, and that comes with its own expenses. The bottom line is that I must plan and execute an efficient handling system that minimizes the amount of material that I physically lift. I still need to figure out how to store the honey. Heavy-duty shelving minimizes the footprint of the honey but requires a lot more lifting without a forklift. I'm still working on that.

Then, there is the business side of things. There is a TV commercial for an accounting software that really hits home. I know a lot about bees, but very little about business. I've always done my taxes by myself. But now, I'm an S-corporation. I not only need to track sales and expenses but to classify them. I need to deal with sales tax. I need to think about commerce laws and labeling laws. Someday I may need to do payroll. I now have an accountant to help me out. I do my record-keeping on a spreadsheet but was informed by my accountant that it may be time to get that online accounting software. Not huge expenses, but they all add up.

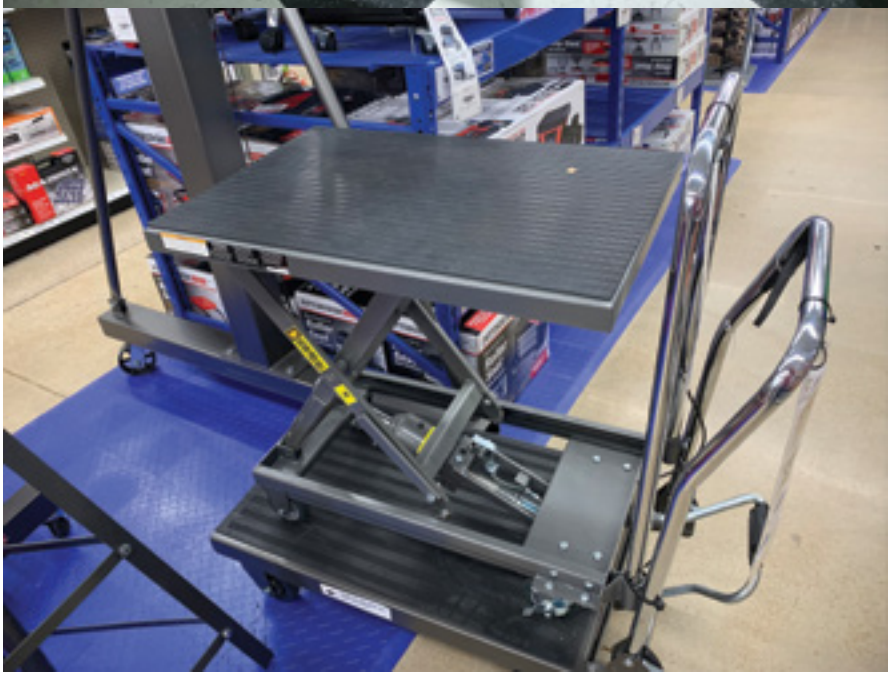
**The continued expenses**

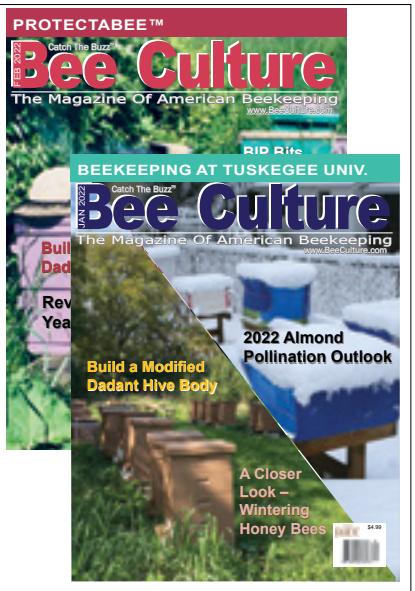
There are a series of other costs that I really didn't think about. These are the maintenance costs of the operation. The things you are billed for on a regular basis. Because I bought the land for the honey house, there is property tax. I had liability insurance for the company, but now I need to insure the building and the truck. I will have electricity and sewer costs associated with the building. I don't have the final numbers, but these will likely cost several thousand dollars a

year. Again, I need to sell a lot of honey to pay for these expenses. This has a large impact on my business model. Last year, I shared how I was trying to figure out how big I want to get. As I grow bigger, so do my expenses. Where before, I didn't have property tax, and bee truck insurance and maintenance costs; now I do. I may have forced myself to grow bigger just to cover these additional expenses.

For everyone out there thinking about growing their beekeeping operation, think about this. It can be done. But for every action you take, there is a reaction. Think hard about how much your expansion will cost. Both the obvious and the non-obvious expenses. Then, determine if you have the passion for and the belief in your success to make those investments. That's what's needed to create a successful business. That's why I have developed such a deep respect for our local businesspeople. That's why you should buy local...

**Picture 3.** Two options for moving buckets of honey from storage to the bottling area. On the top is a U-cart. Simple, but minimizes lifting. On the bottom is a lift cart, that raises the load, so I don't need to bend over to lift it. (The picture is of a smaller lift cart on top of a larger lift cart. They were connected in the store so I couldn't separate them.)

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# New Product

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www.beesmartdesigns.com

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One of the most common and frustrating parts of beekeeping is looking for your hive tool, no matter how many you take out to the apiary they always seen to disappear. When wearing a bee suit or jacket, it is very difficult to put the hive tool in your back pocket and when you can it leaves wax, honey and propolis on your clothes, plus a hole in your pants. Now you can eliminate all of these problems and keep your hive tool handy and stored in a safe position.

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Unlike any other holders, the tough, hard Technopolymer is easily cleaned and sterilized to prevent the transmission of pathogens between apiaries; this is not possible with leather or nylon holders that accumulate gunk and are almost impossible to clean.

No matter how many hives you have and how you keep your bees, the Ultimate Magnetic Hive Tool Holder will make the work go smoother and faster since you will never have to worry about where your hive tool is; just think how great it would be not to misplace your hive tool ever again.

The Ultimate Magnetic Hive Tool Holder is available through bee supply dealers nationwide. Visit our web site at www.beesmartdesigns.com to get a full list of dealers and discover what all of the buzz is about with the Bee Smart system.


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# Beekeeping and Life - Looking Forward and Looking Backward

### Just recently and long ago

Last week, Grandma and I were essentially old wall ornaments at our youngest grandson's seventh birthday party. His entire school class was invited to his Ninja-themed party. So far as I could tell, everyone came. The amount of life's energy that those kids wasted at that event was staggering. And the noise – it was truly deafening.

As I sat there watching those youngsters run, jump, climb and crawl, I had ancient memories from my own childhood birthdays. As you read this, can you recall the eagerness, the excitement, the anticipation you felt on your special day? For me, while I ***can*** recall it, I simply ***can't*** get the intense feeling back. I know what the pure excitement is supposed to feel like, but it simply will not come back to me.

So, at seventy-three, again – just for me – birthdays are somewhat of a necessary evil. They are no longer a great source of excitement *(but hypocritically, I still want the acknowledgement)*. After my dad crossed over, as we were cleaning, clearing, and sorting his worldly possessions, we uncovered about ten new shirts – still unopened – duplicated gifts from numerous birthdays and Christmas gifts. Do not my dad's unopened gifts equate to faded eagerness? Did my father experience these same feelings that I am describing?

And Christmas? As a pre-teen, there was a feeling I had on the morning of December 25th. What was it? *Anticipation, eagerness, excitement, respect, mysteriousness*? In the predawn shadows of that special day, I felt all these stimuli – at once. I wonder if my grandkids have anything approaching my cherished memories. Now, my modern beloved memories are watching all my family members on that special morning. You see, at once, I can look forward and I can look backward.


### Beekeeping – Just recently and long ago.

*Careful, Jim. Be very careful here.* I just put you through all this birthday and Christmas business to get to this point. As the years pass, your beekeeping eagerness and passion will evolve. It will shift. In all things beekeeping – through the years – your passion will wane in some areas and wax in others. *Beekeeping as a personal endeavor is defined by the age and life's stage of the individual beekeeper.* Like watching my grandkids on Christmas morning, I enjoy being around new beekeepers as they discover the joys and solve the mysteries of beekeeping. Though I can remember my own early, exciting feelings as I stumbled through the initial phases of this craft, my introductory time has now passed. Though I still deeply love beekeeping, I wish I could feel – just for a moment – my original long-gone youthful eagerness for my craft.

Stop. Just a minute. After I write all of this – late last season, I had a bit of a bee yard epiphany. Essentially, I unintentionally reset beekeeping myself.

### I wrote about my experience – at painful length

In previous *Bee Culture* articles[1], I wrote about my experience to extents that could only be called, *"boring."* I won't do that again here. For decades, I had done *"Big Colony Beekeeping."* After growing old, I abruptly decided to go back to smaller scale colonies and implement *"Smaller Colony Beekeeping."* I like to think that – rather than quitting – I am adapting. Evolving. Relating to my earlier articles on smaller colony management, you wrote me various messages.

[1] December, 2021.

### You wrote me...

HD wrote: *I switched my beekeeping to single brood boxes last year. Knowing where my marked queen is has made* varroa *checking a lot easier. After removing honey supers, I keep a medium on above the queen excluder for the Summer and Fall (not much Fall flow here in central MD). I remove the queen excluder in November giving the cluster access to stores.*

LES wrote: *I am one year your senior, and I can relate to the thought that smaller might be better. I have 50 colonies in eight apiaries including one long Langstroth which I am still trying to warm up to. It has 30 deep frames, is divisible into thirds and has room to super upwards if that's what I want to do.*

*I still like a deep brood box, with a medium or second deep and medium honey supers. A one-block hive stand may be better for strong colonies than the two blocks I started with. You might have already thought of all 8-frame mediums?*

*My last suggestion is to start with half the colonies you would like, and just plan on splitting to avoid swarming.*

LES above mentioned moving to 8-frame equipment as well as his use of a long Langstroth (a Long Lang).

TK wrote: *I really enjoy and appreciate my long Lang hives. They are just a little over waist high. So far, they're working really well for me. As far as wintering, they've done well for me, the hive construction is 2X lumber.*

Others of you wrote to me suggesting I look at Warré Hive design. A few seasons ago, I bought the Warré Hive book[2], but I have not yet built one.

My ignorance arose again when MF suggested I explore the AZ Hive. As with the Warré Hive, I am still pondering the concept, but have made no move. MF wrote: *I've been following your column in* Bee Culture *magazine*

[2] Heaf, David. 2013. Natural Beekeeping with the Warré Hive – A Manual. Northern Bee Books. **https://www.amazon.com/Natural-Beekeeping-Warre-Hive-David/dp/1908904380** 104pp.

*and am just getting started this last Summer with AZ Hives / Slovenian Beekeeping. Have you heard of it? I ask because while three and even four deeps are becoming available, the traditional AZ Hive in Slovenia is only two deep - i.e. one brood chamber and a super. Through management techniques that philosophically work along the lines you discussed in the March issue of* Bee Culture *(that discussion was a more active manipulation of the brood chamber); this small AZ hive idea works well.*

**Figure 1.** An AZ Hive bee house (Mark Ferry photo) More information on the AZ Hive/Slovenian Beekeeping is available at : http://www.slovenianbeekeeping.com/suzanne.html

Advantages to this hive system is that there is no lifting to be done. The colonies are worked from behind within the bee house.

### I didn't see *that* coming...

To all of you who wrote me concerning this topic, I thank you, but honestly, I was expecting advice and comment on "traditional" beekeeping equipment use and management procedures. Instead, what I got was an educational update on alternative beekeeping techniques. It was unexpected, interesting and insightful. Clearly, beekeeping is evolving and is seemingly crossing national boundaries.

### But, here's my excuse...

I already own all of this *"standard"* equipment. It's the inventory remnants of my family's bee supply and pollination business. I suppose I could have something like a fire sale, move it all out, and begin again, but that feels stern to me. When I began this thread, I suppose I meant to change my beehive management scheme, but my timidity governs just how much change I can tolerate. For now, I will make traditional changes with traditional bee equipment, but I will be more aware that new bee housing and management options are already available.

### Back to where I started

In many ways, I am back to where I began. Since my initiation into beekeeping in the early 1970's, incredible changes have come along. It feels right to drift back to the simpler, smaller times in my present bee life. What follows is the beginning of my first season's plans for Jim Tew's new and improved scheme for convincing bees to stay in smaller hive bodies.

**Figure 2.** Hive sitting on traditional hive stands (1940)

## *An Evolving Small Colony Management Plan (Part 1)*

### Looking backward – Buy Nucs

When I got my first beehives, my uncle brought me single story splits. They were essentially small, queen-right colonies. Since then and through the passing years, I've been buying packages. In a significant change for me, in the upcoming season, I plan to buy queen-right nucs rather than my usual 3# packages. Please know this – I love packages and have installed hundreds of them. No doubt, I will again – at some point – go back to them. But this season, I plan to buy nucs and confine them to single deeps. As they outgrow the single hive body, I will make splits. Though they will initially cost more, I can grow and split nucs faster than I can grow and split packages.

**Figure 3.** The hive stands I presently use: BetterBee, BeeSmart and home-made short sawhorses.

### Looking backward and forward – Hive Stands

As have so many other beekeepers, I have tinkered with all kinds of hive stands. By the very fact that so many variations exist clearly indicates that the best models have not yet claimed the top spot.

Untold numbers of four piece hive stands have been sold and are still being sold. They are simple, efficient, too low to the ground, but provides a home by giving them a snug place to live beneath the hive. Also, cement blocks (8") are frequently used as hive stands. I have often used these blocks as standard hive stands.

I would like my hives about twenty-four inches from the ground and level. Through the years, in addition to standard hive stands and cement blocks, I have tried pallets, wheel rims and hive stands that I built from 2"x10" treated boards. None of them worked perfectly.

Even though I plan for my colonies to be smaller and lighter, I will want stable hive stands beneath them. The hive stands are for my aging back, and not so much for the bees.

### Looking forward and backward at bottom boards

I have a motley assortment of bottom boards – mostly old but some that are mostly new. About 50% are screened bottom boards and the other 50% is everything else. I use quite a few *BeeSmart* bottom boards. That's not an intentional advertisement. I just like them – especially the small pegs they have that aligns the hive body on the bottom board.

But none of my bottom boards are insulated. Is this an oversight?

In my eclectic collection of bottom boards, I have several prototypic electrically heated bottom boards. Is this the way to go? If I want to winter smaller colonies, do I start at the very bottom of the hive and make changes there? Is there some way to sit a colony on a block of insulation foam? Or do I just go *"different"* like Miller describes below?

C.C. Miller[3] described a deep bottom board – I mean this was a ***deep*** bottom board – two-inches deep. He said this bottom board was, *"a very nice thing for the Winter."* He went on to say that it was inappropriate when a nectar flow was ongoing. He recommended during those times to shove a *bottom rack* in the two-inch space. Essentially, Miller described the design of a slatted-rack and said, *"I value this bottom rack highly."* The highly respected apiculturist felt that this bottom-racked, deep-bottom board prevented overheating and thus prevented swarming.

**Figure 4.** Old style Slatted rack. Newer racks have slats running longways to allow *Varroa* to drop through


Many years ago, I found plans for a *"Bottom Hive Ventilator."* For the life of me, I cannot find my source for this device again. I built one and used it occasionally. Unfortunately, it was destroyed in the Tornado of 2010 that struck the Ohio State Bee Storage Barn. I only have the low-resolution photo that I have presented here. It was a simple build. In fact, the pictured unit is filled with bees at the time of the photo.

[3] Miller, C.C. 1915. Fifty years Among the Bees. The A.I. Root Company, Medina, Ohio. 319pp. (Available online or digitally)

**Figure 5.** A Bottom Hive Ventilator


As I recall, it was a simple 2½" rim with the holes that I bored and covered, on the inside with eight mesh screen. During nectar flows, this device would allow bees to build burr combs on the bottoms. A slatted rack above the ventilator would probably inhibit that behavior.

## A clumsy place to stop

For this month, this is an awkward place to stop, but I am out of *Bee Culture* space. Next month, I will be one month nearer to my Spring season – though you are probably well beyond that seasonal mark. I will continue to delineate my evolving plans. I have lots of them.

Thank you to all who have written. Please know that I have a difficult time responding to each of you. It's not that I don't care, but rather that there is not enough of me. Please continue to write. I promise I will try to do better.

## From the Honey Bee Obscura Podcast

Jacob asked: *"What is your favorite or most frequently used tool, that is not really meant to be a beekeeping tool?"*

Hey Jacob, thanks for asking. I admit that this is a question that is new to me. When I read your question, my iPhone immediately came to mind. I cannot imagine not having my electronic friend with me for emergencies and questions. But I suspect you were thinking more along the lines of equipment and devices.

From that category, one of my favorites (not necessarily the most frequently used) would be my Milwaukee Heat Gun. While I would love to use it in the field to soften stubbornly stuck frames, that is not practical, so I use it in my shop to soften hard propolis on nearly anything. I use it to clean wax and propolis from my extracting equipment. I used it to unseize stuck bearings in my old extractor before the season starts. I soften wax and propolis on the glass on my observation hive. I sterilize my hive tool, but an odd use is that I put a small chip of beeswax on the closed hinge of my pocket knife. Carefully holding the distal end of the knife, I heat the wax until molten wax seeps through the hinge mechanism of my pocket knife. For months afterwards, I get a nice, smooth action when opening and closing my knife. A heat gun as a bee hive tool – who would have thought?

Thank you. I hope to visit again next month.

Dr. James E. Tew
Emeritus Faculty, Entomology
The Ohio State University and
One Tew Bee, LLC

**tewbee2@gmail.com**
**http://www.onetew.com**
**www.go.osu.edu/may2022**

Weekly podcast at: **www.honeybeeobscura.com**

# Homemade Granola

Shana Archibald

***Ingredients***

□ 2 cups oats
□ ½ cup honey
□ ½ teaspoon vanilla
□ ½ teaspoon cinnamon
□ Flax seed
□ Chia seed
□ Almonds
□ Walnuts

These are just what I used. You can add goji berries, sunflower seeds, hemp seeds, etc. I also eyeballed the amounts. So, put however many your heart (or stomach) desires.

***Directions***

*Step 1*
Combine all your ingredients into a mixing bowl, and stir.

*Step 2*
Place mixture onto a baking sheet.

*Step 3*
Bake for 20-25 minutes at 350°F.

*Step 4*
Place in an airtight container and use on acaì bowls, in smoothies, yogurt, or just by itself.

# CALENDAR

♦ALABAMA♦

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

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

♦INDIANA♦

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

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

♦IOWA♦

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

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

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

♦MISSOURI♦

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

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

♦NEW YORK♦

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

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

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

♦OHIO♦

**The World Bee Day Celebration** will be held at Queen Right Colonies, in Spencer, Ohio on Satuday, May 21 from 10am - 4pm.

♦PENNSYLVANIA♦

**Master Beekeeper, Vincent J. Aloyo, PhD** is having his Queen Rearing Intensive Weekeend on May 14 - 15 from 9am - 4pm at Delaware Valley University in Doylestown, PA. A queen cell pickup will be on Tuesday May 24 from 4pm - 6pm.

This two-day course includes many opportunities including hands on experience. Each student will recieve a queen bar frame, plastic queen cell cups, and a grafting tool.

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

# CLASSIFIEDS

## FOR SALE

- North Carolina Italian queens $30 each pickup or shipped. 5 frame nucs available all Summer $140 each. Singles and double deeps for sale. Timmy Holt **336-710-4904**
- Larry's Backyard Bees Beekeeping Equipment: USA Made Hive Boxes, Package Bees, Beekeeping Tools, Smokers, Bee Suits and more. Order online at **www.larrysbackyardbees.com** or Call Toll Free **(844)561-BEES**. Newburgh, NY
- FOR SALE - motorized chain uncapper - excellent condition, used 2 seasons only. 5 frames per second, chain reels are adjustable, 110 volt. Currently at Mann Lake for $3329.95. Asking $2500.00. Interested call **508-385-5517. NO TEXTS.**

## JOB POSTINGS

- We require a master beekeeper who also has experience in writing to become a part-time writer for the team at **www.beeprofessor.com**. To apply, please email **hello@beeprofessor.com**

♦TEXAS♦

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

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

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

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

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

Registration opens in August.

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

♦WISCONSIN♦

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

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

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

## New on www.BeeCulture.com

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

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

## Display Advertisers



# New Contest - Bee Swarm Images

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

**How To Submit:**

Email your images to **Emma@BeeCulture.com**

Use the subject "Image Gallery"

Please include in your email:

- The image as an attachment (we will not consider it if it is embedded)
- Your First and Last name
- Your mailing address
- Your renewal code (if you know it)

**If your image is chosen:**

*For the Gallery:*

You will get three months added to your current subscription.

*For the Cover:*

You will get twelve months added to your current subscription.

As I write this in March, Kyiv is under siege. Mariupol has been flattened, 90 percent of its buildings destroyed, as Vladimir Putin pursues his war on civilization. Yet to this point outgunned Ukraine has outsmarted, outmaneuvered and outfought the mighty Russian army, bringing its barbaric invasion to a standstill.

The Ukrainians possess a weapon that Russia cannot manufacture. They have heart.

The war hit the gal Marilyn and me like a gut punch. Marilyn and I attended the Apimondia international bee conference in Kyiv in 2013, at the invitation of beekeeper and former Ukrainian President Victor Yushchenko and his wife Katya. They put us up, and they put up with us.

You remember Yushchenko – the West-leaning 2004 presidential candidate who survived poisoning by dioxin – a highly toxic substance found in the Vietnam War defoliant Agent Orange. The dioxin initiated a chemical condition called chloracne, causing Yushchenko's face and body to erupt in cysts and pustules.

This while he campaigned against Russian-backed Viktor Yanukovych. (Pay attention! These two names are so similar!) Yanukovych was initially declared the winner, despite every exit poll to the contrary. The Ukrainians weren't having any of it and poured into the streets in protest. Their supreme court ultimately ordered a re-vote that Yushchenko won.

The 2004 loser Yanukovych succeeded Yushchenko as president from 2010 until 2014, when he (Yanukovych) fled the country following pro-western demonstrations that toppled his government. But that's another story. He lives in Russia today. Good place for him.

At the time of our visit, President Yushchenko kept 300 colonies of bees and called them "God's favorite insects." He explained that beekeeping is a fundamental part of traditional Ukrainian culture. Mr. President informed me that 10 percent of his country's 45 million citizens kept bees. He and I had a lot to talk about.

All this being a way of saying that Marilyn and I developed a warm attachment to Ukraine and to the Ukrainian people. They got a taste of freedom after the collapse of the Iron Curtain. Now they're defending their liberty and their homeland against one of the most formidable armies on Earth.

So you think you have it tough? Count your blessings.

My bees so far look pretty good, as we emerge from a relatively cold Winter. My growers 65 miles down the road in Palisade want bees for apricot pollination on or about April 1. It's warmer and a thousand feet lower down there.

In our Colorado climate, winter bees can generally re-situate their cluster inside the hive, so as to stay in contact with their honey stores. A warm spell now and then helps. But if they stay cooped up long enough in cold weather, they can devour all the honey within and immediately surrounding their cluster and ultimately starve, even if there's more honey mere inches away. If it's too cold, the little darlings can't get to it.

I opened my colonies a month ago and fed a few dry sugar. I just take a peek under the inner cover. That's where the bees generally are. If I see stored honey, I call it good. If not, I put a sheet of newspaper on top of the bees, spritz it from a spray bottle of water and dump dry sugar on top of that. Then I spritz the top of the pile of sugar and close 'er up.

Long ago Paul told me he prefers to work Winter bees cold, and he's my guru. I rarely light a smoker. Just pop the top and get 'er done! Work fast and don't fuss. At least that's the way I do it.

But maybe there's such a thing as too cold. Lately it's been challenging to arrange clearance to get through the locked gates on the private road to my billionaire's bees. I finally got an appointment to get in to feed one colony the other day. I gave it dry sugar nearly a month ago. Then I re-checked the forecast. It was mid-20s in the afternoon (no problem) but followed by an overnight low of -8 with a wind chill of -20! In March! I postponed my plans at the last minute when I saw that overnight forecast. So despite what I just told you, I decided not to work 'em cold, at least not that day. My guess is that I could have gotten away with it, but I was reluctant to open the hive just prior to such an extremely cold night. I can't give you a scientific reason, but my gut told me not to do it. I'm a risk taker, because that's how you learn. But these aren't my bees. Now if the overnight forecast that night had been for eight degrees *above* zero with *no* wind chill, instead of minus eight with a wind chill on top of that, I'd go for it.

Gentle reader, in beekeeping, timing is everything. We do what we need to do, when we need to do it. I have no interest in killing bees by chilling bees, but I also can't let them starve. It's a balancing act, keeping God's favorite insects alive.

Now back to Ukraine, land of many beekeepers. It's one thing to feel disheartened, quite another to take action. A quick Internet search on *Ukraine humanitarian aid* would give you plenty of choices for how you could make a difference. Katya Yushchenko recommends **UnitewithUkraine.com**. And it never hurts to say a little prayer.

Thank you! May God bless Ukraine!

**Ed Colby**

***God Bless Ukraine!***

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b c d

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