Nov 2013

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Bee Culture

The Magazine Of America eekeeping

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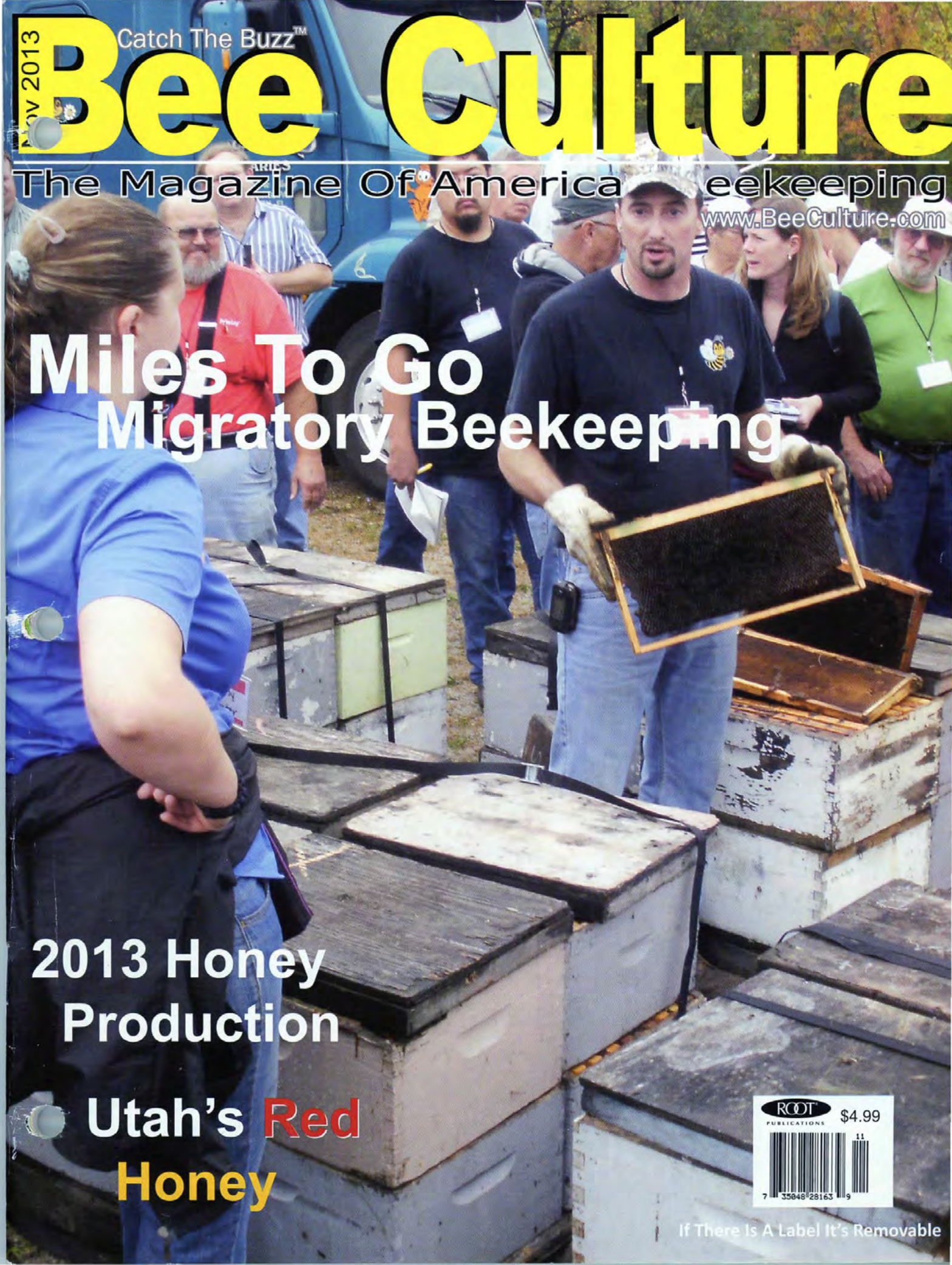

Miles To Go Migratory Beekeeping

2013 Honey Production

Utah's Red Honey

ROOT PUBLICATIONS $4.99

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If There Is A Label It's Removable

Features . . . Culture . . . The Rest

What Is Natural?

Really enjoying the July issue, some great articles there. Particularly like Jennifer Berry's article "Is Natural Really Natural?" Her comments on "natural" beekeeping, the importance of finding good information and on feeding hit the nail on the head. One of the most frequently asked questions I deal with concerns whether to feed. Jennifer's comments are good advice, well written. I plan to use the article as an example of the value of having a subscription to *Bee Culture*.

Bob Hooker
Ohio

Mite Life Cycle

Thank you for your very interesting, informative, and enlightening article by Jennifer Berry in the September issue of *Bee Culture*. I appreciated the way you urged people to feed their bees, and treat them for mites. I especially appreciated the detailed description of the mite life cycle, something I knew very little about before your article. Keep her articles coming!

Jeanne Hansen
Madison, WI

Manuka – Not The Best?

Alan Harman wrote an article titled "Manuka May Not Be The Best – Heather Honey From Scotland Scores." Please pass on a few key bits of information so that he has a complete picture of the situation that the story covers. (See **home.ezezine.com/1636-move-overmanuka.**

The first key consideration is what exactly the Scottish honey is being compared with. There is so much misrepresentation of manuka honey that what they purchased may have little or no antibacterial activity. Then there is the issue of producers heating the honey to get it to its maximum activity, at which point the activity level is in decline when the honey is in transit or on the shelf.

If the Scottish researchers used the genuine medical products registered for use in wound care, these are made from manuka honey with a non-peroxide activity rating of 12, because higher activity is not needed. (The activity of these honeys too could have been in decline if the supplier of the honey is not aware that the activity can be pushed too far).

Another key consideration is that in laboratory testing honeys with activity due to hydrogen peroxide can be found with an activity rating higher than the non-peroxide activity found in most genuine active manuka honey. But if blood (or any other animal tissue, I would expect) is included in the bacterial culture medium then a lot of the antibacterial activity due to hydrogen peroxide is destroyed and the honey's activity rating is then quite low. This is because all cells in the body contain a very active enzyme, catalase, which converts hydrogen peroxide to water and oxygen.

I made a short movie to illustrate in presentations I give at medical conferences the rapid destruction of hydrogen peroxide when it comes in contact with cells in the body. The 'fizz' is due to the oxygen being formed from the breakdown of hydrogen peroxide. You can view it on **https://dl.dropboxusercontent.com/u/37728340/hydrogen peroxide mpeg 1.mpg.**

I fully agree that honeys other than manuka can be effective in treating wounds – there is a vast amount of evidence of that published in medical journals. What I do not agree with is statements that these honeys have a better antibacterial activity than that of (genuine) manuka honey. A few weeks ago there was a similar story, in the Daily Mail newspaper in the UK, about work in Southampton with Chilean honey.

A large amount of information on the use of honey to treat wounds, and a fuller explanation of the difference between manuka honey and other honeys, is on a website I produced for public education: **http://waikato.academia.edu/PeterMolan/Papers.**

I would be happy to answer any questions I may have raised.

Peter Molan
Hamilton, New Zealand

Enjoys Bee Culture

The September issue looks much more substantial than usual, lots and lots of varied reading matter which will keep me occupied for several evenings. Some journals I can read in half an hour which is very unsatisfying.

I love Kathy's home page, which adds a new dimension to the magazine and moves slightly away from beekeeping itself, which helps put the craft into perspective.

I found the piece on urban beekeeping of interest. Caution, responsibility, adequately trained beekeepers are all important factors. I was opposed to the large scale promotion of city beekeeping in London a few years ago when people wanted to do their bit to improve honey bee colony numbers by taking up beekeeping – I had various reasons for this including novice beekeepers being unable to control swarming and the chaos this could cause; the high cost of courses and beekeeping packages being offered by not always the best qualified beekeeping teachers; the fact that the heavy pollution in many parts of the city would be harmful to bees through the pollen fed to the brood; the limited amount of forage which would have a negative effect on the number of colonies at that time as well as native pollinating insects. I envisaged a sky scape of rooftop hives being more numerable than satellite dishes. I see that the BBKA has recently released a statement on city beekeeping warning of caution and more or less saying that its promised harvests of honey are not likely to occur. I think this is a timely statement as several books have been written and become popular which encourage roof top beekeeping.

John Phipps
Greece

Editor's Note: *John is the Editor of the* Beekeeper's Quarterly.

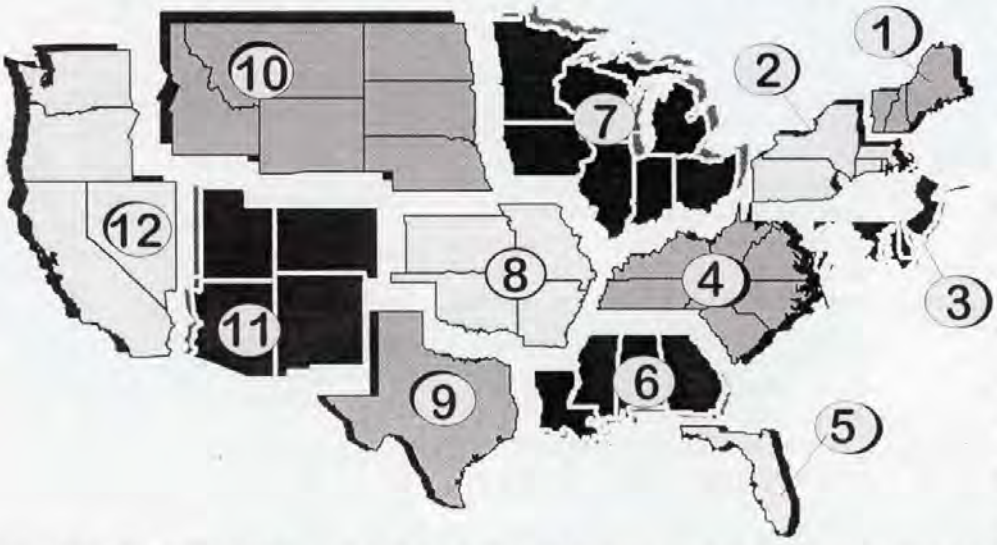
Good Job, Ross!

Ross Conrad really hit a home run with his article in your August 2013 edition. All our testing of man-made chemicals is "a farce and a sham." (Read the article and weep.) I don't know what inning we are in, but without some monumental changes which are most unlikely, the game is over.

The major factor that Ross (and Randy Oliver) continue to omit is the growth of world population, which is instrumental in forcing our hand in food production. As large cities continue to grow they must be fed and the agriculture of huge monocultures is the only way to do so. We are adding about 80 MILLION people to the earth each year. This is not sustainable.

Tom Hill
Franklin, NC

NOVEMBER – REGIONAL HONEY PRICE REPORT



How Big Is The Crop This Year?

Once a year we try to come up with a prediction of the U.S. honey crop, and this is the month we do it. We poll our honey reporters of course and that gives us a pretty good estimate of the real world of honey production. But we check out what others in the business are hearing too, and we look at the weather in the places that count, especially the top 10 producing states. For several years we've asked our reporters for two numbers – average colony production for just those colonies they harvested honey from, and then, average colony production for all of their colonies whether they produced honey or not. Over the years we have been consistently low in our predictions when compared to the USDA NASS numbers that come out each February (last year it was later than that) because they sometimes count the same colonies morethan once. They are consistent in their technique, and we are with ours, so you can look at both and decide for yourself.

Last year we predicted total honey production in the U.S. would fall between 122.4 million pounds and 158.1 million pounds – those two figures we use, remember. Also, we have to estimate the number of colonies total to come up with that number – we don't have the USDA NASS count to use for the current year, so we look at last year's and figure an up or down number based on our research here. Last year we estimated 2.55 million colonies, and the final USDA NASS count was 2.62 million colonies, up even more from the previous year than we estimated. So, on both counts we were in the ball park and we feel comfortable with both our technique and results. We predicted a terrible crop…and it was a terrible crop.

This year, we think it will be worse. And so does everybody we talk to. Everybody. The top 10 producing states are all below their running averages – and some way below, and they produce more than three quarters of the honey every year. When they suffer, honey suffers. And they suffered this year.

We'll know more in February when the other set of numbers come out, but this year the average production of all colonies that we counted came to 35.6 pounds per colony. If you work with only those colonies that produced honey, leaving the 0 producers out of the equation, the average moves up to 48.8 pounds per colony. Now – how many colonies? We're going to go out on a limb here because of what we've been hearing and our estimate is that when honey was harvested this year beekeepers had right about 2.7 million colonies. But everything we hear since then tells us that number is down to 2.4 million, maybe less. It was a hard year on bees – look at the honey – and our sources tell us that a lot didn't even make it to winter, let alone through winter. The count come almond time this year will be interesting to watch.

Given the counts we have then, the U.S. honey crop, according to *Bee Culture* magazine's sources, will fall between 96 and 132 million pounds – without doubt the smallest honey crop recorded, ever.

	REPORTING REGIONS												SUMMARY		History	
	1	2	3	4	5	6	7	8	9	10	11	12	Range	Avg.	Last Month	Last Year
EXTRACTED HONEY PRICES SOLD BULK TO PACKERS OR PROCESSORS																
55 Gal. Drum, Light	2.17	2.25	2.17	1.84	2.20	2.05	2.25	2.20	1.80	2.20	1.92	2.40	1.74-2.75	2.10	2.02	1.87
55 Gal. Drum, Ambr	2.06	2.00	2.06	1.80	2.05	1.85	2.18	2.20	1.60	2.06	1.98	2.28	1.60-2.60	2.02	1.88	1.73
60# Light (retail)	201.00	177.50	162.50	174.33	180.00	180.00	198.50	160.00	150.00	198.00	171.67	206.25	150.00-270.00	184.38	168.70	158.93
60# Amber (retail)	184.67	172.50	162.50	170.17	180.00	175.00	185.00	160.00	130.00	150.00	157.00	201.25	130.00-270.00	174.06	169.00	152.90
WHOLESALE PRICES SOLD TO STORES OR DISTRIBUTORS IN CASE LOTS																
1/2# 24/case	72.22	75.46	62.80	65.05	71.25	60.00	52.78	71.25	71.25	51.84	73.67	103.00	43.20-104.00	68.89	70.13	63.58
1# 24/case	115.80	114.75	84.00	90.50	132.00	110.80	88.50	102.00	106.94	98.16	104.94	126.00	48.00-168.00	105.88	104.38	101.46
2# 12/case	108.19	98.63	102.60	85.73	90.00	90.28	85.81	105.00	100.00	97.44	111.00	109.75	73.20-144.00	98.51	95.25	89.57
12.oz. Plas. 24/cs	105.96	85.35	71.40	76.77	74.40	76.00	67.41	87.60	81.93	74.40	90.39	89.60	48.00-115.00	82.36	82.20	80.31
5# 6/case	134.88	104.76	100.54	90.75	114.00	119.81	97.63	112.50	119.81	102.30	106.67	122.50	83.10-180.00	108.06	106.71	105.81
Quarts 12/case	149.00	144.96	122.56	117.92	120.00	107.43	131.84	111.00	122.56	115.32	133.00	144.50	60.00-177.60	126.32	126.84	118.35
Pints 12/case	84.00	77.98	96.00	80.60	72.00	64.33	93.84	60.00	60.00	78.20	68.10	84.00	42.00-117.60	76.60	79.12	75.01
RETAIL SHELF PRICES																
1/2#	4.33	4.27	2.92	3.92	4.23	3.50	3.31	3.00	4.23	3.80	3.63	5.50	2.50-6.75	3.84	3.89	3.65
12 oz. Plastic	5.33	4.71	3.75	4.39	4.50	4.38	4.19	4.51	5.01	4.96	5.12	5.15	2.99-7.75	4.66	4.73	4.57
1# Glass/Plastic	6.42	5.96	5.54	6.11	7.25	6.56	5.16	5.88	6.31	6.13	5.94	8.83	3.00-10.00	6.13	6.19	5.88
2# Glass/Plastic	11.59	10.12	8.26	9.32	11.00	9.96	9.15	12.00	9.00	9.15	9.95	15.00	5.90-18.00	10.20	1.47	9.54
Pint	8.67	8.20	8.80	7.77	7.50	6.64	8.81	7.80	6.00	7.92	6.98	10.73	4.00-14.00	8.13	8.29	7.62
Quart	15.25	13.31	10.82	13.29	13.00	11.45	14.08	14.88	13.97	14.52	11.28	18.33	7.00-22.00	13.44	13.40	12.45
5# Glass/Plastic	26.90	21.56	21.35	21.88	35.00	23.69	20.68	28.00	23.69	19.75	20.89	30.00	14.89-35.00	22.44	21.63	20.43
1# Cream	9.50	7.34	9.13	7.58	8.64	8.64	6.51	8.64	8.64	6.22	7.47	11.00	4.90-14.00	7.83	7.42	6.85
1# Cut Comb	10.30	9.10	9.13	7.98	9.10	5.50	7.82	8.00	9.10	10.00	9.75	12.00	5.00-14.00	8.71	8.43	8.63
Ross Round	9.75	7.95	8.25	6.25	8.75	8.75	8.00	10.00	8.75	8.75	9.00	7.20	6.00-12.00	8.49	8.28	7.67
Wholesale Wax (Lt)	5.75	5.32	5.88	4.51	3.20	4.93	5.20	7.50	5.63	6.00	3.63	4.75	2.30-10.00	5.10	5.26	4.57
Wholesale Wax (Dk)	4.63	5.85	5.88	4.25	3.00	4.35	4.81	7.25	5.19	5.19	2.60	4.00	2.00-9.50	4.62	4.67	4.08
Pollination Fee/Col.	90.00	68.33	90.00	61.17	90.00	45.00	53.00	85.00	88.30	80.00	90.00	96.50	35.00-174.00	72.11	74.04	78.58

INNER COVER

For the past two years the good folks at Mother Earth News have invited me to participate in one of their 'Fairs' held during the Spring and Summer. They have one out in Washington, one in Kansas and another in Pennsylvania. Travel and deadlines have kept me from the west and central events, but I've made it east twice. It's held at Seven Springs Resort and Conference Center in the central part of the state. All Winter it's a ski resort, and all Summer it's a conference center and a grand place to hold a meeting if you need to be outside and inside. We've had EAS meetings there a couple of times over the years, with bees right outside the back door. You have probably seen Mother's ads on our pages all Summer promoting the fairs, the speakers and the venues. They do a great job of running a meeting such as this for the over 20,000 people that attend during the two and a half day weekend.

Mother Earth sends more than 30 people to run this machine. They have their regular staff of course – Editors, artists, writers, ad folks, designers and promotional people - but like lots of beekeeping groups spouses get drafted to come and help – travel to beautiful Seven Springs, work hard, have fun and somebody else picks up the tab – not a bad deal. Some of them act as moderators for the many rooms they have talks in – oh, I forgot – there's something like 200 lectures and demonstrations going on starting Friday at noon, and finishing Sunday at 5:30. They have rooms inside and tents outside and there's four, five maybe 10 people somewhere all the time at the same time telling you something you absolutely needed to know – information you simply can't get anywhere else and absolutely need to know and why you came in the first place.

They also have about 200 vendors attend selling any and everything you can imagine in the Mother Earth Universe – from compost toilets to yerts, from organic llama fertilizer to garden seeds, from olive oil to chocolate to organic cheeses, from bumper stickers to tools to clothes to organic anything you can eat to chicken plucking machines to hand made and homemade anything that can be handmade or homemade, from vegetables to garlic bulbs to pigs, chickens and goats and alpacas, from topbar and regular beehives to hand carved utensils to solar and wind powered machines to just about anything you can think of. But especially – books.

I do all three activities at the fair – I get to speak about bees and beekeeping, I have a booth selling, what else, our books and magazine subscriptions, and of course I shop around for all those things you simply can't get anywhere else – or at least can't get in person anywhere else. I got an alpaca winter hat with ear flaps – warm and fuzzy and very, very cool. And I found a new bumper sticker I've not seen before. It is a takeoff on an old saying about knowing what you can change and what you can't and the difference between – I like this one better – I am no longer accepting the things I cannot change. I am changing the things I cannot accept. There's an attitude readjustment for you.

Who were those more than 20,000 people? It'd be hard to categorize the whole of the crowd because it was so diverse, but if I were going to very much generalize, I'd say there were fewer what I'd call middle age folks there, but there were a lot of them, too, but maybe more older folks – like myself – and younger folks with small kids. One of the people I was talking to summed up the crowd like this – old hippies with hip replacements, and their grandkids. That may be a stretch but it gives you a picture.

But back to the books. Several major publishers show up at this event as vendors with their titles screaming at you as you walk by. Quarry Press, who publishes my beekeeping books had a big display with all three of the books front and center, and Black Dog was there, represented by Storey Publishing (a big player in the good information publishing business), who publishes Marina's and my most recent honey book showing off both their latest titles and their best sellers from years gone by. That can give you kind of a heady feeling when you see it, but then you go and see what the Mother Earth folks are doing with books and humble in the extreme returns.

The Mother Earth book store, which is surrounded by a fence of sorts to keep people somewhat contained, takes up the whole center of the biggest room in this conference center. They have two checkout lanes to handle the all the books being sold. They had 28, eight foot tables to hold all the books they have, with one stack per title, and essentially no extra space on any of the tables. I can't imagine how many titles there are, but with four rows of stacks on each table and about 12 books/row – nearly 1000 maybe close.

Mother Earth News Fair. Miles To Go.

Topics? Even more diverse than what the vendors were selling. Much, much more diverse. Mostly because every subject had two, three maybe a dozen titles covering the topic. Certainly several beekeeping books covering different hives, styles and techniques, chicken books, gardening books, animals of all kinds books, home improvement and independent energy books (I picked up one of these because I've been toying with the idea of some kind of solar something, and I got to eat supper with the author one evening), of course there were spiritual and ethical titles, along with a whole slew of how to do it yourself books on how to do, I think, absolutely anything you'd care to do. I am quite sure that the knowledge contained on those tables would enable you to live comfortably anywhere on the planet with no input from anybody, ever, and thrive.

And here's the most appealing part, at least to me. I must have walked by that display a dozen times during the weekend and there were never fewer than 25, and several times more than 50 people shopping for books in the make-shift book store. I don't think I saw the line idle even once, and sometimes there were five or six people waiting to get checked out. It rained all day Saturday unfortunately, especially for the vendors in tents outside (we were outside last year and it rained and was cold then too, but it didn't stop people too much because every vendor is kind of close to one of the many stages the speakers are constantly on so there's always traffic), but it did push folks inside more than not, and the individual book stores were five deep all day long.

I know the day of digital books is approaching, and there's not much we can do to stop it...but it is certainly comforting to see that kind of enthusiasm for the information, knowledge and entertainment that a paper, feels-heavy-in-your-hand-with-a-shiny-embossed-cover, smells-like-a-and-can-flip-the-pages-of book still brings to people. I like many am home with a book in my hand. I almost hope I don't live long enough to see that vanish.

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Elsewhere in this issue is more on the Migratory Pollinator meeting Bee Culture sponsored in October, the MILES TO GO show. Wow. What an experience that was. I'm not sure it was a first, but it's certainly not common for a meeting like this to take place. It was a good idea back in July – bring in experienced migratory beekeepers including Dave Hackenberg with his son Dave, and Jim Doan who work the east coast, blueberries, and Winter in Florida, and Dave adds in California Almonds. John Miller from the Midwest and west coast was there; and growers were represented by Gordon Wardell from Paramount Farming. So were colony brokers for almonds with Denise Quails of Pollination Connection, and risk management and insurance was covered by Howlett McDowell represented by Roger Starks. Certainly a big piece to the puzzle was honey bee health covered by the National Pollinator Protection Fund with Michelle Colopy on hand. We covered pretty much the whole spectrum of migratory pollination in two days.

But back to the first day – Dave Hackenberg and his son Davey brought in a large truck full of palletized double deeps, strapped and netted. They brought their BobCat Track forklift and Brian Kulling from A & O forklift brought one of his machines to help. So, just like the ads said we'd do we unnetted, unloaded, spread out, power washed and took care of the load. Then, we put it back together, loaded it up, strapped it down and netted it in – and then it rained. A lot. So we retreated inside for a bit and talked bees and beekeeping and all the things going on out there where the hives and forklifts were for about an hour. Then, it quit raining and we went back out and loaded it up and put it back together – and then it rained some more. So we wrapped it up for the day – but it was a day to remember. But still, we got to look at pallets, covers, boxes, moving bees, forklifts, smelled diesel fuel, power washed pallets – the whole nine yards. That was Saturday.

Sunday was all inside, and pretty intense, but in the end it was the best collection of good information for anybody who moves bees now, or is thinking of moving bees in the future. Know what you are getting into, be prepared for everything that will go wrong, know what to do when it does, know your costs, licenses, permits, inspections, fees, rules and regulations, laws and outlaws that will bite you everytime you don't pay attention – I think the take home message was that people who successfully move bees for a living are some of the sharpest knives in the drawer because they make it work with almost everything in the world trying to stop them. I already had a great deal of respect for those beekeepers. Now, I have a whole lot more.

Mother Earth News Fair Book Store.

It's Summers Time –

September and October have been pretty crazy here in Northeast Ohio. In mid-September we travelled to Pennsylvania for the Mother Earth News Fair at Seven Springs Ski Resort. This is an amazing event. Seven Springs is huge and this fair spreads out over almost the whole area. There are lectures and vendors on everything organic, natural, gardening, agricultural. And books on every topic imaginable – I got a book on composting, of course a new book on chickens, and a book on solar energy, something Kim and I have been discussing. Outside there are goats, chickens, alpacas – and every shape and size of people you can imagine. Old people, middle-aged, young couples, babies, kids, folks in wheelchairs, rich people, not so rich people. Everyone was represented there. Most of my time was spent behind the table selling books and talking about bees and beekeeping. It's amazing how many people have questions and are curious about the bees. We gave away about 300 *Bee Culture* magazines and signed up a lot of new folks for subscriptions. Beekeeping seems to be staying on the popular side right now.

Kim at our Bee Culture *booth at Mother Earth News Fair.*

It was a long three days, but well worth it. If you enjoy anything about the outdoors, gardening, canning, anything natural I encourage you to try and go to one of the four Mother Earth News Fairs that will be offered next year – one in Washington state, again in Pennsylvania, Kansas and next year a new site in Asheville, NC. Watch in *Bee Culture* for information and dates.

The weekend after Mother Earth Kim and I travelled to Duluth, MN. My first trip there. We went for the wedding of one of Kim's nephews. Travel was interesting because Kim had thrown his back out just the day before. So we took advantage of those carts that travel around the terminals which got us where we needed to be much faster than we could have walked. And did you know that when you have a cane and are hunched over in extreme pain, they let you on the plane first? We took that advantage also.

It was wonderful to spend time with Kim's family – both brothers and both sisters and assorted in-laws, nieces and nephews including the newest Flottum girl – Ruby Rae born July 5. Kim's daughter, Jessica flew in from Oregon. We had not seen here in at least a couple of years so that was the most wonderful treat. It was a short visit, there's never enough time and then back home and on to the next event. So I really can't tell you much about Duluth, except the hotel and the airport.

Check out Kim's Inner Cover and the two-page spread near the end of this issue for a wrap-up of our "Miles To Go" event. It was incredible. People from far and wide came to Medina, Ohio to be a part of this event. We had just short of 100 people including speakers. Thanks to *Bee Culture*'s own Peggy and Amanda all of the details got taken care of – keeping track of how many, ordering food, organizing hotel rooms for the speakers and even an extremely late night airport run to pick up one of our speakers. All of the details got handled and everyone went home happy. Thanks ladies for all of your help. Job well done! This was Kim's vision and he managed with just a few phone calls to get all of these incredible speakers to come to Medina. The rest was a team effort.

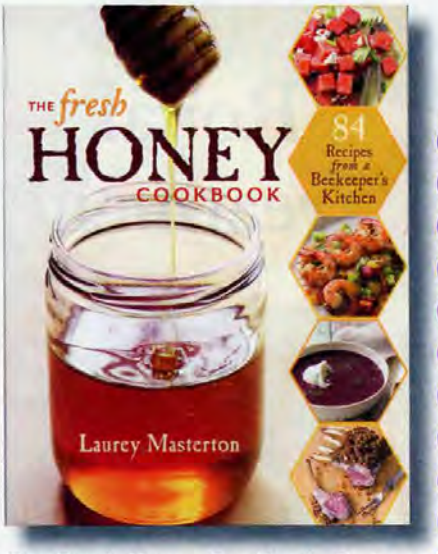
We're down to 11 chickens. We came home one day last week just about bedtime for them. It looked like everyone was in and perched and ready for bed. I did a head count and there were only 11. I went out to the pen thinking she was just enjoying one last minute of daylight, but couldn't see her anywhere. I whistled, still nothing. Looked all over the yard, whistling and calling – the goat and the pony following along the fence answering me, but couldn't find her anywhere. We checked the fence around the pen and coop and didn't see any signs of violence or disturbance. I even went out a bit later before my bedtime and called and whistled again on the off chance she might have wandered back up, but no luck. The next day my neighbor told me she saw a pile of dark brown feathers way back in her field where she walks her dogs. I think she must have gotten out of the pen and either wandered back to the field and a fox or raccoon got her, or she got out of the pen and a hawk got her. Another neighbor that is home in the daytime said he's been seeing the hawk a lot over the last few weeks. It would really be almost impossible for a hawk to snatch one right out of the pen because of that amazing Red Osier Dogwood.

They are molting right now, really just coming out of it and so eggs have been few. Kim gives them a lecture each time he's out there. "Two eggs, 11 chickens, what's wrong with this picture?" Molting can be very disturbing the first time you see it. They look as if something has gotten a hold of them and torn all their feathers out. Lots of bare skin around the neck and tail feathers missing, but they're getting through it.

I'd like to wish you all a wonderful and happy Thanksgiving. It's that time of year – holidays and cold weather, here in Ohio, friends and family everywhere.

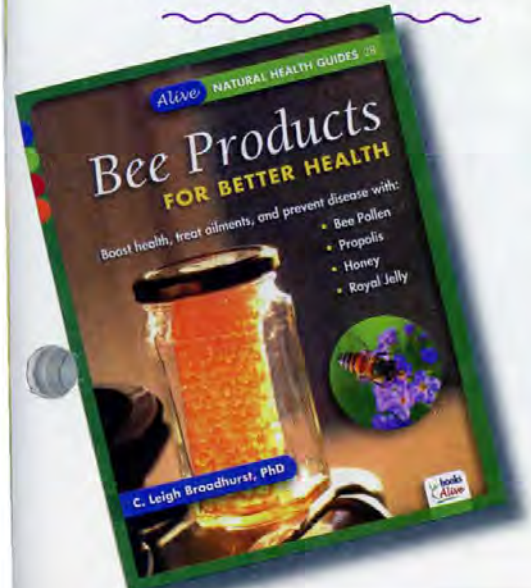
Kathy Summers

Something New To Read –



The Fresh Honey Cookbook. By Laurey Masterton. Storey Publishing. 7" x 9". 208 pgs. Full color. ISBN 978-1-61212-051-5. Soft cover. $14.95.

This is, for all intents and purposes, a beekeeping cookbook. The author is a beekeeper and runs a cafe, and works with the National Honey Board. The book is organized around the seasons and the months, and each month has a special varietal honey to use in one of the 84 recipes in the book, which are organized by course. Plus there's info on tasting honey, common foods pollinated by honey bees, finding honey varietals, and lots and lots of beekeeping notes, tips, photos and information. Each honey varietal has notes...color, smell, taste and aftertaste, and there's a flavor wheel, much like the one in *The Honey Connoisseur.* A useful addition to your honey recipe book collection.



Bee Products For Better Health. C. Leigh Broadhurst, PhD. 6.5" x 8". 62 pgs. Full color. ISBN 978-1-55321-048-3. Soft cover. $11.95.

Beekeepers sometimes take our charges, and especially the products they produce for granted. Yes, honey is better than sugar, propolis is good for skin problems, pollen for energy, and what's next. That's too bad because our bees really do have a lot to offer. Leigh Broadhurst is one of those people who doesn't take our bees for granted and in this small, but fact fill book she reminds us just how special bees, or their products anyway, are.

Leigh and I worked together on a project involving honey bee products several years ago with CC Pollen. This was sort of a home coming for her as she had been a grad student in Arizona years before and had come into contact with Royden Brown, founder of CC Pollen.

She starts with pollen as a food, containing proteins, vitamins, trace elements, fats (both saturated and unsaturated) and a diverse list of phytochemicals – carotenoids, phenolics, flavonoids, and phytsterols. She also looks at harvesting and storing the product and how and when to use it.

Next is propolis, an extremely potent antioxidant and anti-inflammatory agent, helping to relieve a host of health issues, plus having significant antibacterial, antifungal, antiviral and oral protective uses.

Royal Jelly, too, contains vitamins, proteins, enzymes, immune complexes, antioxidants and even nucleic acids. These are helpful for infections and improved immunity, lowering cholesterol and triglycerides, and blood pressure. Harvesting storing and using this substance is tricky, but can be accomplished.

Honey, too is discussed at length as an antioxidant, skin dressing and a host of other healthful uses. All in all a very useful book on uses of these products. It does not, however, go into preparation of these products for use.

Mr. Bee Man. The Story Of Lorenzo Lorraine Langstroth. Rosalie M. Gattert. 8" x 10". 32 pgs., color throughout. ISBN 978-1-4787-1243-5. Hard cover. $20.00.

This is a children's book, looking at the life and discoveries of LL Langstroth. It is richly illustrated and tells in simple language the life story of LLL. Matt Redman, a Langstroth historian (and major contributor to our series on LLL back in 2010) says of the book...

"I know of no other children's book that details Langstroth's career and accomplishments. Rosalie's text and the illustrations by Sheila Jarkins are more than just faithful to LLL's lifelong path as a naturalist. In order for young minds to fully understand Langstroth's legacy they much read, or be read, this book."

This is the book to get to pass along the story of modern beekeeping to your children, grandchildren and to get into schools and classrooms so the story is not forgotten.

Salt Sugar Fat. How The Food Giants Hooked Us. Michael Moss. 446 pgs. ISBN 978-1-4000-6980-4. $28.00.

This book has been out for a bit, and then once I got it, it took a while to get through, but it was worth the time. I originally wanted to see what they had to say about honey, which it turns out is only mentioned one time – along with maple syrup – as being essentially no part of the sugar industry in the U.S. That may sound harsh, but when you get done reading what is said about that industry, you won't want to be any part of them.

But overall, this is the story of the processed foods industry and the roles these three key ingredients play in our diets. It traces the rise of obesity in this country, and now the world, the health issues surrounding overweight, excess calories in the diet, what kids are eating, what food companies are selling to kids, to time-stressed parents and to everybody who craves chocolate, sugar, bacon, salty processed meats, crackers, chips, cheeses, sweet beverages, and all the other foods we instinctively know are not good for us, but that we eat, routinely.

The value of this story, however, lies less in why these foods are bad for us, and they are very bad for us, but rather, in how the food industries that produce, advertise, and sell them get us to continue to eat them, no matter what the government studies say about health. The basic argument they all use should sound familiar...it was used by the tobacco industry regarding smoking, the pesticide industries regarding environmental damage, and now, even regarding honey bee health.

They argue, quite convincingly, that obviously there is more than simply oreos, or bacon, or kids cereal contributing to the problems we are experiencing. Lack of exercise, sitting in front of a computer all day, and a TV all night are just as guilty, say the food people, and it's obvious that we need more study to say for sure just what is going on. More research, more research...and more time spent not fixing the problem. Like I said, sound familiar?

The tricks used to get us to eat this stuff are well examined too. Advertising to children that cereal is fun...one popular kid's cereal is 55% sugar – and sets you off from your parents who don't eat this – be independent, make your own decisions – have some more sugar. But ads to moms short on time and long on stuff to do are just as bad – take good care of your family, fix food fast so they are happy – one popular frozen meal contains a week's worth of salt...one meal, one week.

This is what this book is about. The food industry has indeed fooled us all – making processed foods too good to stop eating. For instance, and as just one example, there's the Bliss point for sugar. If you keep adding sugar to, say an Oreo cookie starting from scratch, the more that's added the more we'll eat. But there's a point where we'll pull back because there's too much. But back off the sugar just a tiny tad, and we'll never stop eating them – the satisfaction is never reached – we just eat and eat and eat. Like the potato chips – Betcha Can't Eat Just One – salty, fatty chip. We are hooked.

For the finisher – we eat, on average, 71 pounds of caloric sweeteners every year. That's 22 teaspoons of sugar, per person, per day. If you include honey in that mess, it accounts for only 1.25 pounds per per person per year.

Salt Sugar Fat. Bon Appitite.

All books reviewed by Kim Flottum.

A Closer LOOK

HEMOLYMPH

Clarence **Collison**

Hemolymph distributes nutrients throughout the bee and the immune components contained within it form one of the primary lines of defense against invading microorganisms.

Hemolymph of the honey bee is analogous to blood in higher animals that have a closed circulatory system (blood travels through blood vessels). Hemolymph fills the bee's entire body cavity (hemocoele), in an "open circulatory system." The various organs and tissues are surrounded by it and get all their requirements except oxygen from the hemolymph by direct diffusion. The hemolymph does not contain hemoglobin and is not involved in the distribution of oxygen. Hemolymph is colorless or a pale straw color, which is composed of a fluid (plasma) in which float many nucleated cells called hemocytes. Hemolymph is about 90% water (Morse and Hooper 1985).

The circulation of hemolymph is achieved by a four-chambered heart and a single tube, the aorta that carries hemolymph forward to the head. The heart, positioned dorsally in the abdomen, has a series of muscular chambers, each with a pair of openings (one-way valves called ostia). When the heart muscle is relaxed, hemolymph enters the four chambers from the abdominal cavity. These openings close when the heart muscle contracts and the hemolymph is forced forward through the aorta to the head. Once in the head, the hemolymph spills out into the body cavity near the brain. It sloshes around percolating backward to the abdomen where it again is sucked into the heart to repeat its circuit (Caron 1999). Muscles attached to a dorsal and ventral diaphragm are used to pump the hemolymph throughout the body and back to the heart (Winston 1987).

The main functions of the circulatory system are transporting nutrients from the midgut to the body cells, removing waste material from cells and returning it to excretory organs (Malpighian tubules), lubricating body movements and providing defense against pathogens by means of hemolymph cells that attack invading organisms (hemocytes). The hemolymph also provides turgor support to the body through hydrostatic pressure. This is demonstrated in the pressure required to evert the endophallus of the drone during mating and is also used to expand the wings as the bee emerges from its brood cell and to cast off the old exocuticle during molting. The hemolymph is also the main means by which heat is distributed around the bee's body (Morse and Hooper 1985). Hemolymph carries sugars, amino acids (building blocks of proteins), fats, minerals, vitamins, proteins, hormones and all the other nutritional requirements of the bee (Winston 1987).

"The circulation of hemolymph is achieved by a four-chambered heart and a single tube, the aorta that carries hemolymph forward to the head."

Each honey bee caste has different energetic and metabolic requirements and each differs in its susceptibility to pathogens. Hemolymph distributes nutrients throughout the bee and the immune components contained within it form one of the primary lines of defense against invading microorganisms. Chan et al. (2006) applied qualitative and quantitative proteomics to gain a better understanding of honey bee hemolymph and how it varies amongst the castes and during development. Unexpectedly large differences in hemolymph protein composition, especially between larval and adult bees and between male and female castes were found. Differences were also seen between adult workers and queens. The number of proteins found in the hemolymph of workers was (204), drones (252), queens (183), worker larvae (228) and all castes combined (324). Proteins found only in drones numbered (49), queens (18), workers (15), drones and workers (51), queens and drones (27), queens and workers (13) and queens, workers and drones excluding worker larvae (125). The overall overlap between proteins expressed in adult queens, drones and workers was 42% (125). Among the proteins of highest abundance were vitellogenin, apolipophorin precursor and hexamerins.

Key proteins in all adult hemo-

lymph include transferrin (Kucharski and Maleszka 2003), an iron transporter; apolipophorin (Robbs et al. 1985; Shipman et al. 1987), a lipid (fat) transporter; and vitellogenin, a major nutrient storage protein in females thought to serve as a nutrient reserve and lipid carrier (Wheeler and Kawooya 1990, Barchuk et al. 2002). The fluid also contains components of the innate immune system, such as macrophage-like cells (hemocytes) (Lavine and Strand 2002), antimicrobial peptides (Chan et al. 2006) and prophenoloxidase for the encapsulation of pathogens (Lourenco et al. 2005).

In queen honey bees the free amino acid content in the hemolymph clearly depends on the physiological function and social environment of the individual. In drones and workers the content of free amino acids increases after emergence until it reaches a peak in five-day-old individuals and decreases afterwards. The amino acid content in queens reaches its highest level (>60 nmol/microl hemolymph) with the onset of egg laying at about 10 days of age. This level is about 2.5 times more than the highest level found in workers. Queens maintain this high level also when they are older (>30 days) and continue to lay eggs in colonies. As in drones and workers, in queens the predominant amino acid is proline, which accounts for more than 50% of the total content of free amino acids in egg-laying individuals. When 10-day-old queens are prevented from mating and do not lay eggs, their amino acid content is significantly lower compared to laying queens of the same age. Also the social environment influences the contents of free amino acids in queens. When virgin queens were kept for six days with 20 worker bees with sufficient honey and pollen in an incubator, they had significantly lower concentrations of amino acids than virgin queens living for the same period with about 8000 workers in a colony. Likely, the high amino acid concentration in the hemolymph is the basis for the high protein synthesis activity of laying queens (Hrassnigg et al. 2003).

Honey bee colonies in temperate zones produce either summer bees, which have a lifespan of 15 to 48 days, or Winter bees, which emerge in late Summer and live up to eight months. Winter bees develop unique

"In queen honey bees the free amino acid content in the hemolymph clearly depends on the physiological function and social environment of the individual."

physiological conditions characterized by changes in protein composition that appear to be major determinants of honey bee lifespan. Erban et al. (2013) analyzed winter honey bee worker hemolymph using a proteomic approach. Many of the identified proteins corresponded well with extended lifespan. Vitellogenin subunits (mainly~180 and ~100 kDa) comprised the major portion of the proteins; however, vitellogenin dominance repressed the signals of the lower-abundance proteins.

The major sugar circulating in the hemolymph of insects is the disaccharide trehalose, but although this is present, glucose and fructose are more important in honey bee hemolymph and are present in unusual quantities, compared with other insects. The sugar content of the hemolymph varies with the individual's age, caste, and the work it is doing at the time, from 1700-3700 mg per 100 ml, being 30-40% fructose (Morse and Hooper 1985).

Hemolymph sugar levels in bees have been reported to change in response to the concentration of sugar solution imbibed (Crailsheim 1988; Abou-Seif et al. 1993), season (Crailsheim 1988) and behavioral pattern (Bozic and Woodring 1997). Several investigations of hemolymph sugar levels in honey bees have reported very different results, probably because different experimental conditions affected the bee activity levels. Blatt and Roces (2001) investigated the dependence of hemolymph sugar levels in foraging honey bees on metabolic rate and whether the hemolymph sugar level is regulated. Free-flying foraging bees were trained to collect controlled amounts of sucrose solution of different concentrations (15%, 30% or 50% sucrose w/w). Immediately after feeding, metabolic rate was measured over a given time depending on the sucrose concentration, then crop-emptying (honey stomach) rate and hemolymph sugar levels were measured. Bees exhibiting a wide range of metabolic rates were compared to establish whether the observed differences in hemolymph sugar levels were due to limits in the supply of sugars from the crop or in the rate of trehalose synthesis in the fat bodies. Independent of the concentration of the sucrose solution supplied, hemolymph trehalose, glucose and fructose levels were constant for metabolic rates from 0 to 4.5 ml CO_2/hour. At higher metabolic rates, trehalose concentration decreased while that of glucose and fructose increased, with the exception of bees fed 15% sucrose solution. As the supply of sugar from the crop via the proventriculus was sufficient to support even the highest metabolic rates, the observed pattern must result from an upper limit in the capacity of the fat body to synthesis trehalose. The maximal rate of conversion in the fat body of glucose to trehalose was calculated to average 92.4 µg glucose/minute. However, for bees fed 15% sucrose solution both the rate of conversion of glucose to trehalose and the rate of sugar transport from the crop to the midgut were limited, together resulting in a decrease in total hemolymph sugar levels for metabolic rates higher than 5 ml CO_2/hour.

Hemolymph protein measurements in adult workers were used to determine the efficiency of protein diets as pollen substitutes. Groups of 120 newly emerged worker bees were kept in small cages in the laboratory and fed on bee bread or unprocessed pollen (natural protein diets), soybean/yeast or corn meal (alternative protein diets) or a sucrose solution (nonprotein diet), from adult emergence until six days later. The protein content in hemolymph was determined in these bees at 0, 2, 4, and 6 days of adult life. Additionally, vitellogenin (a major protein in young adult worker bees) titer was measured in the hemolymph of six day-old bees. A significant and progressive rise in protein titers was observed from 0 to the 6th day of adult life in the hemolymph of bees fed on bee bread, soybean/yeast, or pollen. However, a significant protein reduction was recorded in bees fed corn meal or sucrose only. The protein titer of six-day-old bees gave the best discrimination between diets. Protein titers were highly correlated with vitellogenin levels in six-day-old

bees, when the different diets were compared. The protein values reflected the quantity and usability of the protein in the diets and not the consumption, which was similar for all protein diets used. Both total protein measurement and vitellogenin level determination proved to be objective methods for comparing the effectiveness of protein diets; however, the former is faster and less expensive and could easily be used for routine analyses.

De Jong et al. (2009) compared two commercial diets with bee collected pollen and acacia pod flour (pollen substitute used by beekeepers in some parts of Brazil) by measuring their effect on hemolymph protein contents of young bees exclusively fed on these diets. The commercial diets included a non-soy-based pollen substitute (named Feed Bee®) and a soy-based diet, named Bee-Pro®. The diets were each given in patty form to groups of 100 Africanized honey bees in hoarding cages, maintained and fed from emergence until six days of age. Sucrose, in the form of sugar syrup, was used as a protein free control. Feed Bee®, Bee-Pro®, pollen and acacia pod flour diets increased protein titers in the hemolymph by factors of 2.65, 2.51, 1.76 and 1.69, respectively, over protein titers in bees fed only sucrose solution. The bees fed Feed Bee® and Bee-Pro® had their hemolymph significantly enriched in protein compared to the controls and those fed acacia pod flour and to titers slightly higher than those fed pollen. All four proteinaceous diets were significantly superior to sucrose alone. BC

References

Abou-Seif, M.A.M., V. Maier, J. Fuchs, M. Mezger, E.F. Pfeiffer, and M. Bounias 1993. *Fluctuations of carbohydrates in haemolymph of honeybee* (Apis mellifica) *after fasting, feeding and stress.* Horm. Metabol. Res. 25: 4-8.

Barchuk, A.R., M.M. Bitondi and Z.L. Simões 2002. *Effects of juvenile hormone and ecdysone on the timing of vitellogenin appearance in hemolymph of queen and worker pupae of* Apis mellifera. J. Insect Sci. 2: 1-8.

Blatt, J. and F. Roces 2001. *Haemolymph sugar levels in foraging honeybees* (Apis mellifera carnica): *dependence on metabolic rate and in vivo measurement of maximal rates of trehalose synthesis.* J. Exp. Biol. 204: 2709-2716.

Bozic, J. and J. Woodring 1997. *Effect of activity on the haemolymph sugar titres in honey bees.* J. Apic. Res. 36: 33-39.

Caron, D.M. 1999. *Honey Bee Biology And Beekeeping.* Wicwas Press, Cheshire, CT, 355 pp.

Chan, Q.W.T., C.G. Howes and L.J. Foster 2006. *Quantitative comparison of caste differences in honeybee hemolymph.* Mol. Cell. Proteomics 5: 2252-2262.

Crailsheim, K. 1988. *Regulation of food passage in the intestine of the honeybee* (Apis mellifera *L.*). J. Insect Physiol. 34: 85-90.

Cremonez, T.M., D. De Jong and M.M.G. Bitondi 1998. *Quantification of hemolymph proteins as a fast method for testing protein diets for honey bees (Hymenoptera: Apidae).* J. Econ. Entomol. 91: 1284-1289.

De Jong, D., E.J. da Silva, P.G. Kevan and J.L. Atkinson 2009. *Pollen substitutes increase honey bee haemolymph protein levels as much as or more than does pollen.* J. Apic. Res. & Bee Wld. 48: 34-37.

Erban, T., P.L. Jedelsky and D. Titera 2013. *Two-dimensional proteomic analysis of honeybee,* Apis mellifera, *winter worker hemolymph.* Apidologie 44: 404-418.

Hrassnigg, N., B. Leonhard and K. Crailsheim 2003. *Free amino acids in the haemolymph of honey bee queens* (Apis mellifera *L.*). Amino Acids 24: 205-212.

Kucharski, R. and R. Maleszka 2003. *Transcriptional profiling reveals multifunctional roles for transferrin in the honeybee,* Apis mellifera. J. Insect Sci. 3: 1-8.

Lavine, M.D. and M.R. Strand 2002. *Insect hemocytes and their role in immunity.* Insect Biochem. Mol. Biol. 32: 1295-1309.

Lourenco, A.P., M.S. Zufelato, M.M. Bitondi and Z.L. Simões 2005. *Molecular characterization of a cDNA encoding prophenoloxidase and its expression in* Apis mellifera. Insect Biochem. Mol. Biol. 35: 541-552.

Morse, R. and T. Hooper 1985. *Haemolymph, In The Illustrated Encyclopedia Of Beekeeping. pg. 161.* Edited by R. Morse and T. Hooper. E. P. Dutton, Inc. New York, NY.

Robbs, S.L., R.O. Ryan, J.O. Schmidt, P.S. Keim and J.H. Law 1985. *Lipophorin of the larval honeybee,* Apis mellifera *L.* J. Lipid Res. 26: 241-247.

Shipman, B.A., R.O. Ryan, J.O. Schmidt and J.H. Law 1987. *Purification and properties of a very high density lipoprotein from the hemolymph of the honeybee* Apis mellifera. Biochemistry 26: 1885-1889.

Wheeler, D.E. and J.K. Kawooya 1990. *Purification and characterization of honey bee vitellogenin.* Arch. Insect Biochem. Physiol. 14: 253-267.

Winston, M.L. 1987. *The Biology Of The Honey Bee.* Harvard University Press, Cambridge, MA, 281 pp.

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Managing Blue Orchard Bees In Pollination

Stephen Peterson

In this article, we'll take a look at the blue orchard bee, its biology, management, and progress towards its use as a managed pollinator for almonds.

The blue orchard bee or orchard mason bee, *Osmia lignaria*, is a solitary bee that is native to North America. It belongs to the family *Megachilidae* which includes mason bees, leafcutting bees and carder bees. It was first recognized as a potential crop pollinator in the mid-1970s (Torchio, 1976). It visits and pollinates apples, pears, plums, peaches, apricots, almonds, cane berries, rape, canola and meadowfoam (Bosch and Kemp, 1999, Torchio, 1979, Torchio, 2003). It is a modest generalist, visiting some 34 families of plants (Bosch and Kemp, 2001). It has a single generation each year and flying bees are seen for about six weeks in the early Spring. With no queen or hive to defend, they are quite docile and protective clothing is not needed to work with them. They do, however, have a stinger, and may choose to use it if they become trapped in your clothing or pinched in a hand. Females are dark metallic blue or blue-green and are usually little larger than a honey bee. Males are quite a bit smaller than a honey bee and can be recognized by their white hairs on their faces and longer antennae.

Biology

As with many insects that evolved in a temperate climate, these bees have a Winter diapause, the insect version of hibernation. Many diapausing insects spend Winter as immatures, and take some time to reach adulthood when warmer weather arrives. Blue orchard bees though spend Winter as fully formed adults inside their cocoons. This adaptation allows them to take advantage of the earliest Spring blossoms.

For blue orchard bees, when temperatures begin to warm, diapause ends and the bees begin chewing out of their nest using their well developed mandibles. A short time after emergence, the bees excrete a light tan droplet of feces (meconium). Males emerge first and soon begin to search for flowers with nectar. They then spend time patrolling nesting sites, looking for females. At this time they can be seen pouncing on other males or any dark colored object that is about the right size. Females take a few days longer than males, and require a minimum of 20°C (68°F) to emerge. The females give off a distinct odor, apparently a sex pheromone that adds to their attractiveness. Mating takes a few minutes, on the ground, on a branch, or on a flower. The male clings to her back while buzzing his wings and stroking her antennae. Females will often try to dislodge the male. Males do not die after mating, as with honey bee drones. Some other aspects of blue orchard bee reproduction are just like honey bees. For instance, females can mate several times, sperm is stored in a spermatheca in the female's abdomen and males arise from unfertilized eggs.

Females make a zigzagging first flight, presumably to visually remember their natal nest environment. Some females never return to their natal nest site, but many do. After some six months in a cocoon with no food, finding nectar right away is of utmost importance. Females spend the next few days feeding

Male and female blue orchard bees.

A mating pair on sour cherry blossom.

A female blue orchard bee gathering pollen from Phacelia tanacetifolia.

on nectar and some pollen as their ovaries develop. They may sleep in potential nesting cavities, but may not necessarily nest where they are first found sleeping. After a few days have elapsed, nest-site selection takes place. During this time, females will inspect many potential cavities for suitability. Sometimes females will tussle over a choice cavity, loudly buzzing at each other. (A note about terminology: a "nest" is what the bee builds; where she builds her nest can be called a "nest-site," "cavity," "hole," etc.) Cavities of various sizes will be accepted, but those that are 7.5 to 8 mm in diameter and 15 cm deep are well accepted and produce a normal sex ratio (two males: one female). Once a hole is selected the female will begin her work. She will use mud as a partition between cells and as a plug for the completed nest. A mud partition at the back of the cavity is usually made first but is sometimes omitted. Females will seek moist soil and will often mine deeply into the soil to find the right moisture level. They appear to prefer soil with some clay content. They carry a small ball of moist soil back to their nest and carefully mold it with their mandibles to make a partition. They do not line the walls of the cavity, but will fill in any deep crevices.

Next, pollen is gathered as a food source for offspring. Each morning, if it is not too windy or raining, a female will start foraging as soon as temperatures are above about 11°C (52°F), and will keep foraging until sunset if the temperatures remain above that threshold. Females will visit flowers for both pollen and nectar on the same visit. Pollen is rubbed into the brush-like hairs (the scopa) on the underside of the abdomen. (In the pollen gathering (i.e. non-parasitic) members of the family Megachilidae, pollen is always carried on abdominal scopa, there are no scopal hairs on the legs.) The pollen is *not* moistened while the bee carries it and so as she visits other flowers, pollen grains can easily fall off (or be attracted by electrostatic forces). This makes these bees highly efficient pollinators. Once the scopa is loaded, often after visiting some 75 flowers (Bosch and Kemp, 2001), the female returns to the nest-site. She then goes into the cavity head first and deposits a droplet of nectar; she then needs to turn around to brush the pollen off (Torchio, 1989). In a tight fitting cavity, this means she will back out, turn around, and then back her way into the hole. (This turn-around-and-back-in behavior is easily observed at nesting sites.) After a minute or two of unloading pollen, she will emerge for another trip. A typical foraging trip, with plenty of floral resources available will take four to eight minutes. A trip for mud will only take a minute or two.

*A blue orchard bee nest in a reed (split open) showing pollen (*Phacelia tanacetifolia*), eggs and mud partitions.*

When the loaf of pollen and nectar have reached the appropriate size (about 300 mg for females and 150 mg for males) the female will lay her egg on it. The blue orchard bee egg is much larger than a honey bee egg. (This makes sense, as the blue orchard bee will only lay one egg per day, whereas a honey bee queen can lay well over 1000 per day.) On a good day, a female can provision one cell and lay an egg. If a female offspring is intended, as the egg travels down the oviduct, the spermatheca will release some sperm to fertilize it. Female cells are placed towards the back of the nest, and males towards the opening. After six to nine cells are made, a thick mud plug is molded at the opening of the cavity.

A honey bee worker develops from egg to adult in 21 days whereas a blue orchard bee takes several months to reach adulthood. It takes about a week before the egg hatches (eclosion) and feeding begins. Over the next two weeks, the larva feeds, grows and molts (ecdysis) three times. (The first molt takes place inside the egg, for a total of four molts.) The larva then spins a silken cocoon which is waterproof and remains in a prepupal stage for about 30 days. The next molt leads to the pupal stage which lasts three to four weeks and finally, there is the last molt into the adult stage. The adult is soft and damp at first and needs another two to three weeks before it is ready for Winter temperatures. Once Winter sets in, the blue orchard bee is prepared to stay in diapause for five to seven months. The intensity of this diapause is strongest during the first 100 days (Sgolastra et al., 2010). In other words, if they are exposed to warm temperatures during this time, it will take an extended period of time for them to emerge. After about 100 days, the intensity of diapause weakens and after around 175 days have elapsed, a warm Spring day will stimulate them to chew their way out of their nest rapidly (Bosch and Kemp, 2003).


A female applied mud to the entrance of a nest to form a plug in a grooved wooden board nesting structure. Other completed nests have been painted to show what week they were completed.

(a) Bundles of new unlined paper tubes with wax backing; smaller bundles on top are reeds with nests ready to emerge. (b) completed nests in paper tubes. Plugs have been color coded with poster paint by nesting week.

A five-acre screenhouse planted with Phacelia tanacetifolia *for blue orchard bee production.*

Management

Managing these bees is quite different from honey bees. Where they are released, three things should be considered. These are flowers, cavities and mud. **Flowers:** The bees must be released in an area with abundant floral resources. An orchard of suitable trees will work well, but remember, that the bees will forage for three to five weeks. This may be longer than the orchard will provide flowers. It is helpful if there are other blooming plants nearby that can provide flowers after the crop is done blooming. **Cavities:** There are several options for providing nesting sites. Paper tubes are readily accepted when provided in the correct dimensions. There are several paper tube companies that can make tubes and liners. The bees need a cavity that is blocked at one end; they will not nest in a tube open at both ends. Paper tubes can be sealed with gaffers tape, corks, or even melted wax. Phragmites reed segments also make excellent nesting substrates. These can be harvested in the Winter and cut with a band saw to the appropriate length, with a node at one end. Nests can also be made using grooved wooden boards. These have a high initial cost, but can be used for many years, so over time, they become quite economical. The ability to easily open several nests at once for inspection and cleaning is a distinct advantage as well. Nesting sites need to be protected from rain, so some sort of roof is a requirement. Nest-structures can be hung directly in trees, placed in a free standing box, or attached to an existing shed, barn or house. **Mud:** The bees need to have a source of moist soil. A nearby creek, canal or pond will work well, but if that is not available you may need to create a source of moist soil. Leaving a tap cracked open to dribble on the ground is a good idea or a five gallon jug of water with a pin hole can work well also. If you live in a climate that receives regular rainfall in the early Spring, moist soil may not be an issue.

Depending on your location, you may need to bring the nests into a controlled environment once nesting is completed. A shady barn may work fine in many areas, but if you live in a hot climate, it may be best for the bees to be held indoors or in a cold-storage unit that can be brought up to warm temperatures. For Utah bees, an ideal temperature regime for the Summer is 14°C at night for eight hours, and 27°C(81°F) during the day for 16 hours (Bosch and Kemp, 2001). If that is not possible a constant temperature of about 25°C(77°F) is adequate. Obviously, the bees are adapted to withstand a wide range of conditions during the Summer, but will develop faster or slower depending on temperature. During Summer storage it is best not to open the nests, except for sampling, so that parasitic wasps cannot get to the cocoons.

When the bees have reached adulthood, they will need to be cooled down. If you are working with a local population of bees, they are already adapted to your conditions and can simply be held outdoors in a protected area. However, if you have obtained your bees from a climate different than your own, the bees will benefit from controlled conditions. It is important to know when the bees have reached adulthood. This can be done by sampling the population weekly and sacrificing some males to determine the stage of development. (Alternatively, a sample of bees can be x-rayed in a cabinet x-ray machine. An exposure of 25 mV for 30 seconds works well.) When a sample of males is all adults, you will need to open some female cocoons to ensure that they are adults as well. After your sample is all adults, wait another two to three weeks for the bees to harden for Winter. At that point they can be dropped to Winter temperatures. A gradual drop in temperatures is less stressful for the bees. A step-wise drop in temperatures, such as one week at 15°C(59°F), one week at 10°C(50°F) and then to 4°C(39°F) for the Winter, works well.

Once the bees are in wintering mode, the nests can be opened (parasitic wasps are no longer active), inspected and parasites and pathogens can be removed. Cocoons should be checked periodically to ensure that the temperatures are being maintained and that the cocoons are in good condition. Humidity should be moderate, but if mold is found growing on the cocoons, it is likely that the air is too moist. Good air circulation is important so that all cocoons experience the same temperature and to discourage mold growth.

A few weeks prior to bloom and bee release, a sample of males can be warmed up and checked for emergence time and health. If they emerge in a couple of days, your population is ready. If they take more than four

A grooved wooden laminate nesting-site for blue orchard bees in an almond orchard. Corrugated plastic provides protection from rain.

days, you might consider warming the temperature to 7°C(44°F) for the last few weeks. This will help to end diapause and cause them to emerge rapidly.

Bees can be released in cardboard trays, paper or plastic tubes, or even paper bags. Simply make a hole big enough for several bees to easily fit through and they will find their way out. If releasing bees from undisturbed, natal nests, check regularly to see that they are chewing their way out of the nests. It is very important to not expose natal nests or cocoons to direct sunlight. Make sure they are well shaded and protected in case of rain. If you want to know how emergence is progressing, a sample of cocoons can be placed in a vial or jar and placed in the same environment as the rest of the cocoons. Again, be sure they do not have any direct sunlight on them. Check the vial once or twice per day and release the emerged bees, and you will have a good estimate of the percent emerged. It is quite common for five to 10% to not emerge. If you get 1 or 2% not emerging, you have done very well in caring for them.

Every organism has its parasites, predators and pathogens and the blue orchard bee is no exception. Fortunately, none of the natural enemies of the blue orchard bee are the same for the honey bee. There are several parasitic wasps that will attack blue orchard bees. The most important are two species of *Monodonomerus*. These are small (3-4 mm), black wasps with a 1 mm ovipositor. This wasp can insert its ovipositor through paper or wood, but as long as the nesting substrate is over 1 mm thick, the wasp cannot reach it. These wasps are active when blue orchard bees are in the larval to pupal stage and 10 to 15 wasps can develop on a single bee cocoon. It is important to protect developing larvae and pupae from these wasps. *Monodontomerus* wasps only oviposit on cocooned prepupae or pupae. A blacklight over a pan of soapy water or vegetable oil will attract and kill the wasps.

Sapyga spp. is a yellow and black wasp commonly seen in blue orchard bee nests. This species finds where nests are being constructed and while the female is out foraging, lays its egg on the provision. The larvae hatch rapidly and consume the egg or larva and the pollen provision (a cleptoparasite). The pupae of these wasps are smaller, darker and more elongated than blue orchard bee cocoons, and can be manually removed in the Fall.

In humid climates, such as in coastal Oregon and Washington, hairy-fingered mites, *Chaetodactylus krombeini,* can be a problem. These mites are also cleptoparasites with multiple generations per year. They attach themselves to emerging bees and can be transferred to new nests. Infested cocoons can be removed individually or cocoons can be washed in a bleach solution to remove them. Bringing the nests in from the orchards soon after completion and exposure to warm (81-90°F), dry (30-40% rh) conditions can greatly reduce their populations (E. Sugden, personal communication).

Blue orchard bees also have their own species of chalkbrood (*Ascosphaera torchioi*). This fungal pathogen infects developing larvae, killing them in the late larval stage. An infected larva is black and is filled with billions of spores. When an emerging bee behind one of these cadavers has to chew their way out of the natal nest, it becomes coated with spores which then can contaminate new nests. This pathogen may someday become a serious threat to the management of blue orchard bees, but so far it has remained at low levels (<1%). Careful inspection and cleaning of nests is required in the Fall to minimize levels of chalkbrood.

For more information on managing these bees see Bosch and Kemp (2001), which is now available as a free PDF on the internet and also see the Orchard Bee Association website (**www.orchardbee.org**).

Use in Almonds

The enormous almond acreage in California (now up to 800,000 acres) is demanding almost 2/3 of honey bee colonies in the U.S. The blue orchard bee is a species that pollinates almonds well, but so far there is not a big enough supply of them to have an impact on the crop yet. Several companies, including AgPollen, Paramount Farming and Pacific Pollination, are pursuing the commercialization of the bee with the help of the USDA-ARS bee lab in Logan, Utah, and have made important strides in recent years. To address the limited supply, we've found that bees can be raised in an enclosure on wildflowers, particularly *Phacelia tanacetifolia*. Obviously, when raising bees in an enclosure, a year of orchard pollination has to be given up, but increases of up to 4.5 fold have been achieved this way.

Blue orchard bees have been demonstrated to improve pollination in almonds. In a recent study, fruit set in almonds was highest where blue orchard bees and honey bees were together compared to either species alone (Brittain et al., 2013).

The early blooming of almonds, starting around February 15, makes this crop challenging to pollinate, even for honey bees. With blue orchard bees, the natural timing of emergence needs to be advanced by about a month. This can be accomplished by speeding immature development as much as possible (Bosch et al., 2000). As stated earlier, a constant 25°C(77°F) or a fluctuating 14-27°C(57-81°F) regime works well to get the bees to adulthood as soon as possible. The bees can then be stepped down to wintering temperatures. The standard wintering temperature is 4°C(39°F), but towards the end of wintering, this can be increased to 5-7°C(41-44°F) to end diapause and encourage emergence.

When releasing bees in an orchard, we've found that incubating the bees ahead of bloom, storing the emerged adults cold and releasing bees when there is about 5% bloom works very well. Dispersal can be an issue in this type of release, but we've found that dispersal can be high in any type of release system. To improve establishment, many small nesting sites (e.g. nine or more per acre) are better than a few large

ones (Artz et al., 2013). Also, the USDA and AgPollen have developed a nest attractant that can be sprayed onto nests (U.S. Provisional Patent Application No. 62/779,290) to help females find and select them (see Pitts-Singer, 2007). Cocoons can be incubated in the orchard with a portable heated incubator (Pitts-Singer et al., 2008).

Pacific Pollination LLC has developed a Remote Field Incubator (patent pending). Built as a trailer, it is easily loaded, moved and dropped in an orchard. The unit is stocked with dormant bees in their cocoons and deployed in an orchard in advance of bloom. As bloom approaches, the heating unit is switched on (this may be controlled remotely). The unit reduces labor costs and eases the bottleneck when handling large numbers of bees for multiple orchards simultaneously. Another innovation from Pacific Pollination is a low-cost, but effective Hivetop Incubator (patent applied for). This may be used in orchards where honey bees are also present, and relies on the fact honey bees maintain a brood nest temperature of 33-36°C(91-97°F). The Hivetop Incubator is an insulated box with the same dimensions as the top of a beehive, and has a screened base placed between the lid and the hive body (fig. 10b). The heat generated by the honey bee brood nest incubates the blue orchard bee cocoons. There is little if any interaction between the two species of bee and one Hivetop Incubator can accommodate enough bees to pollinate five acres of almonds. For details see **www.pacificpollination.com**.

Probably the biggest obstacle for successful reproduction of the bees in almonds is the short duration of bloom relative to the life of the adult bees. Usually almond bloom takes about three weeks (and the middle week is the best). The females, however, live four or five weeks and when almond bloom is finished there is often very little for the bees to forage on. Growers could greatly help blue orchard bee reproduction (and honey bee reproduction as well) by not mowing or spraying weeds during or immediately after almond bloom. It is important for growers to have a weed free orchard floor towards the end of Summer for harvest (the nuts are shaken off the trees onto the ground), but when they hold off on these operations until the blue orchard bees are done and the honey bees are gone, they can help ensure that these bees have alternative food sources when the almond bloom is gone.

The Remote Field Incubator (a, patent pending), and the hivetop Incubator (b, patent applied for), by pacific pollination.

Taking this idea one step further, growers could really benefit bees by planting some flowering species on ditch banks, roadsides or other unfarmed areas to boost the amount of food for the bees. Mustards work well for this, as do clovers, poppies, *Phacelia spp.*, and other wildflowers. Project Apis m has been distributing free wildflower seeds to almond growers to encourage them to plant these areas and help the bees. The Integrated Crop Pollination Project (**www.ICPbees.org**), a coordinated agricultural projected funded by USDA and the Specialty Crop Research Initiative is a multi-state, multi-crop project that is exploring the value of native bee species in crop pollination and the possible benefits of planting floral enhancements for crop pollination.

Almond growers also need to be careful about any pesticide sprays during bloom. In most of the almond growing region, rains will fall during bloom and this moisture can encourage fungal diseases of flowers and leaves. Fungicides are frequently used prophylactically against these diseases. Usually adjuvants and foliar nutrients are added to the sprays. Fungicides, while non-toxic to adult bees by themselves, may have odors that cause bees to avoid orchards, and little is known about how mixes with foliar nutrients affect bees. I have witnessed blue orchard bees stop foraging when a spray was applied during the day, and in other cases, disappear all together. I have also seen sprays put on at night and seen no apparent affects on the bees. When supplying bees for an orchard, it is a good idea to find out if and what the grower plans to spray and how they spray. If they must spray while bees are present, encourage them to make the application at night. Some growers (e.g. Paramount Farming) have found that when they stopped fungicide sprays, they did not see an increase in disease incidence, and they save a lot of money by skipping the operation.

The blue orchard bee is a species that is well suited to domestication and the materials and equipment needed to manage them are easily obtained. With its ability to pollinate several high value orchard and berry crops, commercial use of this bee as a pollinator should increase in the future. BC

References

Artz, D.R., Allan, M.J., Wardell, G.I. & Pitts-Singer, T.L. (2013). *Nesting site density and distribution affects* Osmia lignaria *(Hymenoptera: Megachilidae) reproductive success and almond yield in a commercial orchard.* Insect Conservation and Diversity doi: 10.1111/icad.12026

Bosch, J., and Kemp, W. P. (1999). *Exceptional cherry production in an orchard pollinated with blue orchard bees.* Bee World 80(4), 163-173.

Bosch, J., Kemp, W. P., and Peterson, S. S. (2000). *Management of* Osmia lignaria *(Hymenoptera: Megachilidae) populations for almond pollination: methods to advance bee emergence.* Environ. Entomol. 29(5), 874-883.

Bosch, J., and Kemp, W. P. (2001). *How to manage the blue orchard bee as an orchard pollinator.* Sustainable Agriculture Network. Beltsville, Maryland.

Bosch, J., and Kemp, W. P. (2003). *Effect of wintering duration and temperature on survival and emergence time in males of the orchard pollinator* Osmia lignaria *(Hymenoptera: Megachilidae).* Environ. Entomol. 32(4), 711-716.

Brittain, C., Williams, N., Kremen, C., and Klein, A.-M. (2013). *Synergistic effects of non-Apis bees and honey bees for pollination services.* Proc. R. Soc. B. 280:20122767.

Pitts-Singer, T. L. (2007). *Olfactory response of megachilid bees,* Osmia lignaria, Megachile rotundata, *and* M. pugnata, *to individual cues from old nest cavities.* Environ. Entomol. 36(2), 402-408.

Pitts-Singer, T. L., Bosch, J., Kemp, W. P., and Trostle, G. E. (2008). *Field use of an incubation box for improved emergence timing of* Osmia lignaria *populations used for orchard pollination.* Apidologie 39(2), 235-246.

Sgolastra, F., Bosch, J., Molowny-Horas, R., Maini, S., and Kemp, W. P. (2010). *Effect of temperature regime on diapause intensity in an adult-wintering Hymenopteran with obligate diapause.* J. Insect Physiol. 56(2), 185-194.

Torchio, P. F. (1976). *Use of* Osmia lignaria *Say (Hymenoptera: Apoidea, Megachilidae) as a pollinator in an apple and prune orchard.* J. Kansas Entomol. Soc. 49(4), 475-482.

Torchio, P. F. (1979). *Use of* Osmia lignaria *Say as a pollinator of caged almond in California.* Md. Agric. Exp. Sta. Spec. Misc. Publ. 1, 285-293.

Torchio, P. F. (1989). *In-nest biologies and development of immature stages of three* Osmia *species (Hymenoptera: Megachilidae).* Ann. Entomol. Soc. Am. 82(5), 599-615.

Torchio, P. F. (2003). *Development of* Osmia lignaria *(Hymenoptera: Megachilidae) as a managed pollinator of apple and almond crops: a case history.* In *"For Nonnative Crops, Whence Pollinators of the Future?"* (K. Strickler and J. H. Cane, Eds.), pp. 67-84. Entomological Society of America, Lanham, Maryland.

THE NATURE OF HONEY

Pollen Analysis isn't Enough

Gudrun **Beckh**

Bees have the tendency to forage mainly on one nectar source once it has been recognized as attractive and flowers are abundantly available, thus producing monofloral honey. Of course the honey is unlikely to contain 100% nectar of one plant species unless under experimental conditions. Therefor the market needs a definition when a honey can be called monofloral[1].

Monofloral honey almost entirely from one floral source is of higher commercial value than a polyfloral honey in the U.S. as well as in Europe. For correct labeling a monofloral honey must be proven to originate wholly or mainly from the indicated source and possesses organoleptic, physico-chemical and microscopic characteristics of the source[1,2,3]. Therefore it is necessary to define clear criteria for the required characteristics in order to harmonize quality control of importers, packers and officially authorized EU inspection bodies – approx. 50% are imported from third countries into the EU.

The legal basis for the Definition of Honey including quality parameters and labeling rules in Europe is Council Directive 110/2001EC. This Directive is implemented in national law in the member's states with the possibility to add national specific requirements especially in labeling.

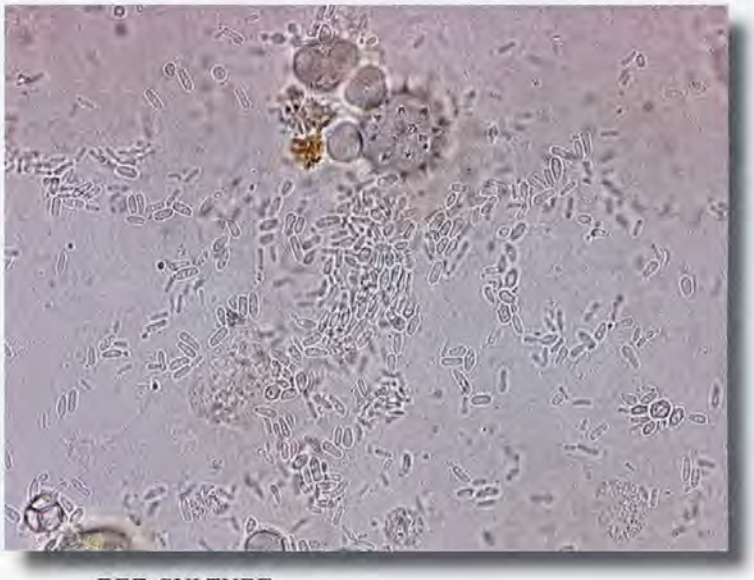
For correctly labeling the botanical and geographical origin expertise is necessary. Detailed specifications setting limits for accepting a honey as monofloral are not part of EU-legislation but quite common business practice. In Germany a first attempt has been made to publish recommendations for the main honey types on the market with so called "Deutsche Leitsätze für Honig" in official Food Law like existing for other food products. Other EU-member states have established similar official criteria for national monofloral honey types but there is no harmonization on EU-level.

Worldwide quality control in the laboratory must consider all mentioned criteria whereas for the consumer the main and only test criteria are the organoleptic characteristics: taste, smell, appearance, consistency, color.

Organoleptic testing is quite subjective whereas a real sensory description is complex and needs well-trained assessors and harmonized vocabulary. Anyway the organoleptic characteristics are the main decisive ones. If taste and smell fail, it is not possible to declare the honey as monofloral even if the other parameters comply with the international or national specifications.

Official methods for physico-chemical parameters are laid down worldwide in the Codex Alimentarius as well as in Food Law in Germany (§64 LFGB based on DIN-methods) e.g. electric conductivity, pH value, acidity, sugar analysis and enzyme activities as well as color gradation and detection of source-specific components(see also [4, 5, 6]).

For the microscopic analysis which is still the only method to determine botanical and geographical origin – an important fact also for the US customs – unless we have filtered honey where the natural pollen content is removed there are as well official methods and a lot of publications worldwide. The importance of



Honey type: **Clover** (Trifolium sp./Melilotus sp.)		
	„Target range"	Tolerance
Pollen%	>70	>60
	Pollen normal represented	
Electric conductivity mS/cm	<0,20	<0,40 (N. Zealand, Argentine)
Fructose/Glucose ratio	<1,20	<1,25
Color mm	<35	
Organoleptic		
Color	White to light yellow	
Smell	Mild aromatic	
Taste	Mild aromatic, floral	
additional	Quick crystallization	

Honey type: **Basswood**/Linden (Tilia sp.)		
	„Target range"	Tolerance
Pollen%	>20	>10
	Pollen underrepresented	
Electric conductivity mS/cm	>0,30 (approx. 0,65)	
Fructose/Glucose ratio	>1,05	>1,00
Color mm	11-55 approx. 33 (IHC)	
Organoleptic		
Color	Light amber	
Smell	medical-mint	
Taste	Strong, woody, long persistency, little bitter	
additional	Low pollen content corr. with higher el. conductivity; pH value >5,0 possible	

Honey type: Orange resp. **Citrus** (Citrus sp.)		
	„Target range"	Tolerance
Pollen%	>20	>10
	Pollen underrepresented	
Electric conductivity mS/cm	0,1-0,5	
Fructose/Glucose ratio	>1,10	
Color mm	10-70	
Methylanthranilate	>2	>1,7 (Pollen% >20)
Organoleptic		
Color	White to light amber	
Smell	Aromatic, floral, Orange blossom	
Taste	Intense floral	
additional	Low in enzyme, sucrose max 10% according to honey directive	

the pollen analysis was recently exposed in this magazine by M.E.A. MCNEIL[7]. She introduced Vaughn Bryant who has worked in the field for many years. Vaughn Bryant described the procedure for pollen analysis in the U.S. which is similar to the European methodology but not identical. The main difference is that his methodology with acetolysis destroys the sediment particles of honey, like yeasts, wax, and feeding material which gives us more information about the quality of honey than only the acetolysed pollen grains. Some pollen types with a more sensitive pollen wall might be destroyed as well.

Increased yeast content e.g. might indicate fermentation[8,9], feeding material or other contamination not natural to honey means that the beekeepers did not follow good beekeeping practice. High counts of starch grains may indicate adulteration. Honeydew elements like spores, hyphae, algae are important for honeydew honey. The official method in Germany (§64 LFGB L-40.00-11; DIN-10760:2002) defines a microscopic test for counting the pollen. Pollen percentages then must be interpreted carefully in terms of nectar percentages considering naturally over- and under-represented pollen due to flower morphology, pollen size as well as beekeeping practice leading to over- or underrepresentation. No official and harmonized European or international (e.g. Codex Alimentarius) rules are approved up to now for interpretation of pollen counts in terms of nectar percentages. Experimental attempts have been made in order to define coefficients for some plants but it is impossible to define these figures for worldwide nectar sources plants.

BECKH and CAMPS[1] collected literature data as well as statistical data from daily lab routine and summarized these as specifications (including Pollen%) of monofloral honeys (blossom and honeydew honeys labeling) in a publication. Based on this survey the German Food Commission established the already mentioned Guidelines in Germany which are recommended to be followed by the market and official controls.

In the U.S. it is common practice to "filter" honey in order to remove pollen from the honey for the purpose of stopping crystallization and keeping the honey liquid. As mentioned before it is not possible anymore to trace back the botanical or geographical origin by pollen analysis which may lead to fraud. In Europe it is mandatory to label the geographical resp. country of origin (EC-Honey Directive 110/2001, Article 2, 4.) It is also not allowed to label a filtered honey as monofloral e.g. clover or sage. For blends the packer may use the labeling EC and/or non EC. In order to control traceability of honey for importers, packers, retailers in EU it is routine to test honey for pollen analysis which gives them the chance to control their suppliers. Of course method is limited if pollen spectra of regional areas are quite similar due to the same vegetation covering more than one country. In this case new developed methods e.g. trace elements or isotopic elements can help if there is enough data on authentic honey available. Since food safety and consumer protection is one of the main objectives of EU-legislation traceability is mandatory for food business operators (see also[10-15]).

The benefit of filtration, e.g. long-time texture is disproportioned to other quality features. Focusing on diversity of nature as well as maturity of consumer it is necessary to let the customer decide which honey he prefers – he is the expert on the favored taste in the end. QSI established in 1954, is the expert for pollen analysis, honey labeling and the other mentioned features as well in Germany, who is in charge for customers all over the world. BC

References:

(1) G. Beckh and G. Camps: Neue Spezifikationen für Trachthonige, DLR, Feb, 105-110 (2009)

(2) T. Wiezorek, G. Beckh, C.Lüllmann and K. Speer: Analysis of amino acids and metabolites with GC-MS for the determination of monofloral honeys; Poster Presentation Apimondia, Buenos Aires, Argentina, 21. –25.Sep (2011)

(3) T. Wiezorek, G. Beckh, C.Lüllmann and K. Speer: Identifica-

tion of marker proteins for the determination of monofloral honeys; Poster Presentation Apimondia, Buenos Aires, Argentina, 21. –25.Sep (2011)
(4) S. Bogdanov, C. Lüllmann, P. Martin: Harmonised methods of the European Honey Commission; Apidologie APIFGS5, Extra Issue, ISSM 0044-8435 (1997)
(5) S. Bogdanov, C. Lüllmann, P. Martin: Honey Quality, Methods of Analysis and International Regulatory Standards: Review of the Work of the International Honey Commission; Mitt. Lebenm. Hyg. 90 (1999)
(6) C. Lüllmann: New Regulations and their influence on the Quality Management of Honey Quality Control 38. Apimondia Congress, Ljubljana, Slowenien; 25. Aug. (2003)
(7) M.E.A. Mc Neil: Meet Vaughn Bryant, honey sleuth; Bee Culture, Oct, 30-34 (2012)
(8) G. Beckh, C. Lüllmann: Natürliche Bestandteile des Honigs - Hefen und deren Stoffwechselprodukte, Teil 1: Hefegehalt; Deutsche Lebensmittel-Rundschau, 95 11 (1999)
(9) G. Beckh, P. Wessel und C. Lüllmann: Natürliche Bestandteile des Honigs: Hefen und deren Stoffwechselprodukte – Teil 4: Aus der Honigmatrix isolierte und identifizierte Hefespezies; Deutsche Lebensmittel-Rundschau, 101, 8 (2005)
(10) K. Beckmann, G. Beckh, C. Lüllmann and K. Speer: Ultrafiltration of honey – effects on enzymes, Chloramphenicol and HMF; Poster Presentation European Conference of Apidology Eurbee, Prag, Tschechische Republik , 11. – 15. Sep. (2006)
(11) K. Beckmann, G. Beckh, C. Lüllmann, K. Speer: Einfluss einer Ultrafiltration auf die Proteinfraktion des Honigs; Lebensmittelchemie, 61 (2007)
(12) K. Beckmann, G. Beckh, C. Lüllmann, K. Speer: Entfernung von Antibiotikarückständen aus Honig durch Ultrafiltration;

Lebensmittelchemie, 61 (2007)
(13) K. Beckmann, S. Englisch, G. Beckh, C. Lüllmann, K. Speer: Einsatz der Elektrophorese zur Untersuchung filtrierter Honige; Posterpräsentation Deutscher Lebensmittelchemikertag Nürnberg; 10. – 12.9. (2007)
(14) K. Beckmann, G. Beckh, C. Lüllmann, K. Speer: Auswirkungen einer Filtration von Honig (Anl. 1 Honigverordnung); Lebensmittelchemie, 62 (2008)
(15) K. Beckmann, G. Beckh, C. Lüllmann, K. Speer: Characterisation of filtered honey by electrophoresis of enzyme fractions; Apidologie, www.apidologie.org, 6 (2010)

McKenna **Princing**

Science With Bees

As honey bees around the country are dying off at concerning levels, a group of researchers at the UW's beeyard are working to maintain and protect honey bees and other pollinators by using non-artificial methods.

Researchers said one contributor to recent large die-offs is Colony Collapse Disorder (CCD), which occurs when worker bees suddenly vanish from the hive.

"The evidence is no evidence," said Evan Sugden, UW professor of biology and instructor for the biology department's popular 'Science with Bees' class.

However, colony collapse is not the only major problem bees face, although researchers said it is perhaps the most perplexing. There is no known, single cause of CCD; scientists believe a combination of chemicals, mites, viruses, and unsustainable beekeeping practices, among other factors, contribute to the disorder.

Sugden said rather than trying to address the vague, invisible illness that is colony collapse, he feels addressing each of these factors is more productive to restoring bee health.

"We might just find that, without a real pointed effort at colony collapse, we nevertheless make a pretty good dent in preventing it just by cutting some of these other problems out of the picture one-by-one," Sugden said.

Currently, Sugden and his students are trying to build a simple, inexpensive solution in the UW's beekeeping yard, also known as an apiary, that attempts to use unconventional methods to rid beeswax of impurities, such as harmful traces of pesticides.

While many pesticides don't kill bees outright, chemicals can slowly weaken them. Maryland researchers found that honey bees exposed to pesticides were more likely to develop the gut parasite *Nosema ceranae,* suggesting the pesticides made the bees more vulnerable. Pesticide buildup in beeswax can affect multiple generations of bees. Researchers said the purification process is important for maintaining bee health because currently controlling the hives from mite infestation is nearly impossible without using any chemicals.

The UW researchers plan to use a carbon filtration method to extract pesticides from beeswax. The filtration process, which is commonly used to filter water, involves 'activating' carbon, or initiating a chemical reaction by heating it. Chemicals that flow through the activated carbon will then latch on to it, so when the carbon is removed, the chemicals will also be taken out. This method works best to filter out carbon-based impurities, and some chemicals do not chemically react to the carbon.

Sugden said he has not heard of anyone else attempting this method to clean out hives. The project cannot begin, however, until the researchers receive funding to have contaminated hives tested for levels of pesticide buildup. Once that step is accomplished, the researchers can use those hives as a baseline from which to test their purification process.

One of Sugden's students, recent evolution and ecology graduate Alyssa Suzumura, has been working on another research project that addresses what Sugden calls the "biggest problem" modern beekeepers face: *Varroa* mites.

Suzumura said bees attacked by mites often develop deformed bodies or wings due to viruses *Varroa* mites carry, such as deformed wing virus. Bees not infested with mites can pick the virus up elsewhere, even on flowers, and pass it along to other bees without showing any symptoms of the virus.

"The virus can multiply within the mite, so when the mite bites a bee, [the bee] gets a huge dose of the virus," Suzumura said.

Suzumura keeps track of the mites and logs the data, which in the future can be used to look at patterns in mite infestation over time. She also tests different, natural ways of getting rid of mites, such as employing an unexpected recipe: sugar, a jar, and live bees.

"We also do sugar shakes, where you take about 300 bees and put them in a jar," Suzumura said. "You put powdered sugar [in the jar] and you shake it up, and the powdered sugar makes the mites fall off."

Suzumura said the sugar, though unpleasant for the bees, does not harm them and can be easily cleaned by the bees themselves.

Daniel Dawson, a fifth-year biology major and bee coordinator at the apiary, regularly monitors the gut virus *Nosema ceranae* in honey bees, much in the way Suzumura monitors mites.

"I've been sampling bees and testing them for Nosema every quarter," Dawson said. "I treated them during the Winter by putting medications in the syrups we feed them."

Ultimately, the goal at the apiary is to promote what Sugden refers to as scientific beekeeping, a modern way of keeping bees that involves a great deal of problem-solving.

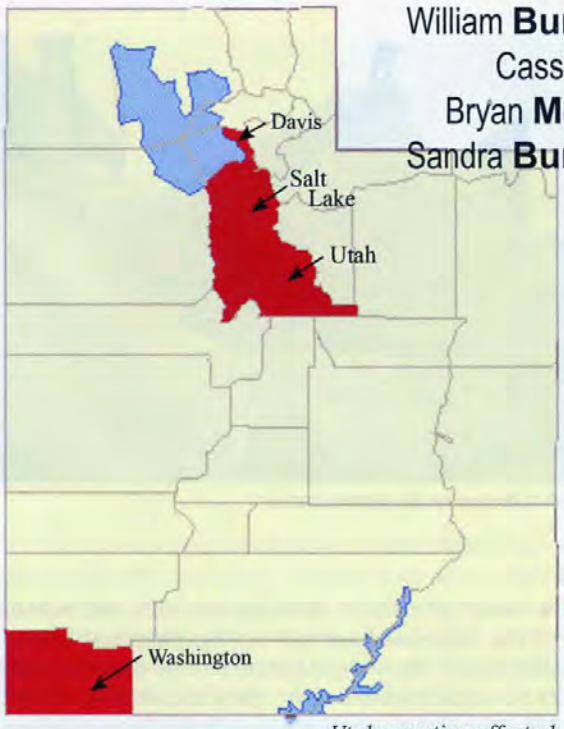
"A beekeeper has to really be able to anticipate problems and know how to deal with them, how to identify them," Sugden said. "It's not that you have to be a scientist to do beekeeping, but you have to learn how to look at things objectively." BC

Evan Sugden. (photo by Joshua Bessex)

UTAH'S Red Honey

It isn't Red Honey after all!

William **Burnett**
Cassi **Lee**
Bryan **Merrill**
Sandra **Burnett**



Utah counties affected.

In late June of 2013, beekeepers started noticing bright red candy-colored nectar in their hives. State and county officials collaborated to determine if any natural vegetation could be causing this widespread red-colored nectar. State apiarists from other states were also consulted regarding the condition. The general consensus was that no natural nectar sources were available to produce the red nectar. Throughout the Summer, numerous beekeepers continued to contact officials about this apparent contamination. By early September, the red contamination in honey had been observed in four counties in the state: Davis, Salt Lake, Utah, and Washington Counties. In addition to managed honey bee colonies, red honey was found in a feral honeybee colony that was extracted from a tree.

Uncapped red honey on a frame.

Identifying the Source

Starting in early July, the red honey came under much speculation by the beekeeping community of Utah. Unfortunately, none of the speculation helped to quickly identify the source or resolve the issue. Comments on beekeepers' discussion boards expressed feelings of worry and anger. Some beekeepers even dismissed the problem. Early speculation about the source of the red contaminant ranged from hummingbird feeders to snow-cone shacks to red fire retardant used to quench regional fires.

In late August, a commercial beekeeper contacted a county honey bee inspector to reveal that crushed red candy byproduct had been fed to bees across the state of Utah. The candy was dispensed in beeyards using open feeding techniques and appeared to be the epicenter of regions within the state where beekeepers were observing red contamination in hives.

The Fears

Beekeepers gave various descriptions of the flavor of the red contaminated honey. Reports of flavors included cherry, peppermint, and coconut. Some beekeepers de-

Full frame of red nectar.

Capped red honey on an entire frame.

Extracting red honey. (photo by Sara Edgar)

scribed a bitter aftertaste. Beekeepers with red nectar in their hives expressed outrage at the potential loss of marketable honey. They were concerned by the color and taste of the contaminated honey. They also worried about whether the honey was perhaps unsafe for human or bee consumption.

Many beekeepers noted that bees in contaminated hives were bright red, just like the contaminated honey. A beekeeper that breeds queens was concerned about his hives' exposure to the red honey. He reported that sperm samples from bees in his affected hives were also red colored. He was concerned about the potential long-term effects on his breeding stock. The breeder noted that brood counts were lower in his hives after the appearance of red honey. Other beekeepers also noticed reduced numbers of bees in hives with access to the red feed.

Early observation of bee activity provided anecdotal evidence that beeyards located near the open feeding operations may have experienced lower honey yields per hive than comparable hives located out of range of the open feeding. For example, one beekeeper had four hives, all of which had red nectar at some point during the Summer. These four hives only yielded a combined total of 34 pounds of honey (an average of 8.5 lbs per hive). Yet a single hive located two miles further away with comparable water and vegetation yielded 96 pounds of honey. This productive colony was a new Spring package that started with an empty hive and had not experienced any red honey. The traditional yearly average for honey production in the rocky mountain region is 66 lbs of harvested honey per hive per year compared to the national average of 59.6 lbs per hive in 2011. Brigham Young University (BYU) had seven hives located within a large botanical garden but within one mile of an open feeding location. Visible detection of red honey was observed in at least two of the seven hives. The honey yield for all seven BYU hives together was 85 pounds (12 lbs per hive), when a moderate production from these hives should have totaled 280 lbs. These and other accounts are perhaps an indication that the honey production in affected hives may have been compromised by easy access to the pit feeders or perhaps ingredients contained in the feed.

The Facts

Based on the definition of honey (which must originate from flowers and other plant sources), the Utah

Department of Agriculture and Food (UDAF) determined that the red substance could not actually be called honey or sold as honey. One initial concern was raised regarding the safety of the red 'honey' for human consumption. The crushed red candy feed listed sugar, corn syrup and red 40 dye as some of its ingredients. The presence and concentration of lead in the contaminated honey was in question because red 40 dye may have up to 10 parts per million of lead. The UDAF laboratory tested samples of contaminated honey and found that they contained less than one part per billion of lead, which is below detectable lead levels and is considered safe for human consumption.

Further investigation is needed to determine possible health implications for the bees. Dehydrated or heated sugars, including corn syrup, can result in the formation of a chemical known as hydroxymethylfurfural (HMF). HMF is a known toxin to honey bees. In caged bee studies, bees fed HMF were not as healthy and had lower bee counts in the hive. HMF is toxic at very low levels. For instance, when bees were exposed to HMF at 150 parts per million, 59% of the bees died in 20 days. Since the candy byproduct fed to the bees was a hard candy produced by boiling sugar syrups, HMF is likely to be present in elevated levels. If lab results detect toxic levels of HMF, it would readily explain the low honey production and decreased bee colony sizes reported by many beekeepers in the region. Since the red honey was also found in feral hives, it is unknown what the long-term effects will be on native and feral bee populations within the contaminated areas.

An Attempt to Make Amends

While open feeding is not specifically codified as illegal in Utah, the law does define that any practice resulting in a feeding frenzy is illegal. Open feeding can be attractive to the large industrial beekeeper as a way to quickly deliver a food source or specific supplement to a large number of hives at one time. The hazards of open feeding include access of other bees to the feeders and the generation of feeding frenzies. In this case, the open feeding exemplified a further problem because of the selection of feed.

Red honey versus normal honey in eppendaf tubes.

The beekeeper claiming responsibility for the red contamination in honey circulated an anonymous public letter of apology and initiated a honey exchange program. Local beekeeping organizations facilitated the exchange of contaminated red honey for non-contaminated honey. Not all beekeepers planned to participate in the exchange program. Some beekeepers expressed that the honey exchange would not give them the ability to sell their honey as 'local' if they received exchange honey from an unknown location. Others expressed concern for greater damages than the loss of honey, such as the potential for overwintering problems if the bees were compromised by eating the feed.

Avoiding Man-Made Problems

The issues generated by the red feed may not be completely resolved and the consequences not yet fully manifested, but we can learn a valuable lesson as beekeepers. We are not independent of one another – one beekeeper's choice can affect a large number of other beekeepers. Wherever our hives may be, our bees are working together to pollinate, provide, and do their duty. We must do the same by responsibly caring for our bees. From this we realize the importance of individual attention towards the health of our bees and bee communities. BC

A Museum For WASPS!

Lorraine **Williams**

To most of us, wasps are those pesky creatures that find your food within seconds of setting out your picnic lunch. Usually every summer we have to fumigate one or two fledgling nests from under our eves-troughs before the colony got itself firmly established. We usually do this at night with a wasp nest spray, under the cover of darkness, followed by a mad dash for safety inside our dwelling.

My opinion and respect for these "enemy" insects was radically changed after a recent visit to what well may be the only Wasp Nest Interpretive Centre in the world. It is located in the tiny village of Laverlochere, (728 population) on the east side of Lake Temiskamingue in the north-western section of Canada's Quebec Province.

Here, in a modest looking bungalow is housed the collection of the late Gerard Gagnon, a collector of wasps nests since 1974. The first nest he collected was one he found on a hydro pole. His museum was entered into the Guiness Book of World Records in 1995. The entire basement of his home is now a modern, beautifully designed and professionally lit museum that displays over 700 of the exquisite 1000 or more wasps nests in his collection. There is clear labelling, though most of it is in French. However, the guide will translate in English for visitors. Notice, I have used the term "exquisite" when describing the wasps nests. There is no other word that captures the delicate beauty of most of them. Did I ever realize that wasps nests were varicoloured? That pale pastel ribbons of pink and blue ran through many of them? That they could be configured into as many shapes and sizes as was necessary according to the materials to which they were affixed?

As important as was the discovery of these remarkable edifices of nature, as a layperson when it comes to insects, I also appreciated an introduction into the world of the wasp. Although fairly knowledgeable about the life of bees, I knew nothing of the wasp's life cycle. I assumed it was somewhat similar – although a wasp never produced anything as delectable for human consumption as honey! As explained in the Centre's written material and our guide's narration, here is what I learned – and it was all news to me:

Although both bees and wasps are of the order Hymenoptera and suborder Apocrita, they are neither a bee nor an ant. In fact, every agricultural pest species has at least one wasp species that preys upon it and parasitizes it. Wasps are much more aggressive than bees. Honey bees die after they sting someone. Wasps do not because their stinger does not remain in the skin of the person they attacked. They can sting several people. In fact, they give off a scent which attracts other wasps to the victim, resulting in multiple stings. Wasps are attracted to the smell of human food, especially sugary beverages and beer. That explains their fondness for picnics or patio parties!

As readers of *Bee Culture* know, bees love areas where there are flowers so they can collect pollen, sup on nectar and even drink water. On the other hand wasps are beastly predators who love to feast on other insects especially caterpillars and flies. Occasionally they will sip in nectar.

We humans won't have much trouble distinguishing between bees and wasps. Their appearances are quite dif-

ferent. Bees have hairy bodies and legs, their legs are flat and wide and their abdomen and thorax is round. Wasps have a smooth body and legs, their legs are round and waxy and abdomen and thorax are cylindrical.

My curiosity was aroused by the variety in shape, size and colour of the nests I was observing. Most nests on display are from the social wasp category. They build larger paper nests whereas solitary wasps tend to build smaller mud nests. Because the social wasps have no wax producing glands, they create a paper-like substance primarily derived from wood pulp.

Each Spring, an overwintered, mated queen begins the nest on her own. She makes a soft rope and sets comb cells in it. These cells will be the rearing cradles of the next generation. Once it reaches the size of a walnut, sterile female workers (daughters of the queen wasp) take over the construction. The wood fibres they create are made from local weathered wood, softened by chewing and mixing with the wasp's saliva. (It was in 1719 that physicist and naturalist Rene Antoine Ferchault observed the wasp's technique and suggested that tree barks be used for making paper). Even scrap cardboard can be utilized by the wasp to produce the "paper." Other materials used can be mushrooms, or flower petals which give the nests a blue or salmon-colored tint. Grey comes from coniferous trees, brown from cedar trees, beige or yellow from aspen and white from birch bark. Such nests can be constructed anywhere – on trees, in attics and under eaves. The size is generally a good indicator of the number of female workers in the colony. Social wasp colonies often have populations exceeding several thousand female workers and at least one queen. (In a four seasons climate, there is always only one queen.)

Wasps aren't all bad. Like every part of creation, they serve a useful function. As predators, they help control the balance of nature by feasting on other insects. They also provide food for mammals such as skunks, racoons, birds and spiders. Next time I see one, I hope I remember the good they can do in our world before I run away, terrified of being stung – repeatedly! BC

For more information contact **www.abitibi-temiscamingue-tourism.org** *or 1-800-808-0706 or* ***info@atrat.org***.

BUILD A HUMMERBEE

Brian **Kulling**

Beekeepers need forklifts for all manner of tasks!

As a beekeeping operation grows in size, the beekeeper looks for ways to make their business faster, more efficient, and more flexible. Whether the main focus of the business is pollination or honey production, palletizing hives has been a time-saving breakthrough. With the use of palletized colonies comes the necessity for a machine to help move the bees quickly and smoothly without adding stress to them. The articulated, rough terrain forklift has become the tool of choice for loading and unloading hives from the truck and for hive placement in beeyards, orchards, and fields. The Hummerbee rough terrain forklift, manufactured by A&O Forklift in Edmore, MI, is the most popular articulated four wheel drive forklift for beekeepers on the market today.

What does "articulated" mean exactly? Articulation refers to how the forklift steers. The machine bends in the middle, meaning the entire front end and front axle turns relative to the rear axle of the machine. This has some distinct advantages over a skid steer type machine. First, it allows the operator to turn the forklift in tight spaces, such as an orchard, without doing any damage to the ground underneath. This has made the Hummerbee the machine of choice for land owners with bees on their property. Also, the articulation saves the beekeeper time, as they don't have to perfectly line the forklift up with the pallet before picking it up. They are able to move their machine in on a slight angle, and the pallet will naturally be straightened out by the forklift as it is being picked up.

There are several other features on articulated rough terrain forklifts that have helped beekeepers save time and money and have helped people expand their beekeeping businesses faster.

The entire chassis or body of the forklift is made of steel in order to stand up to the harshest conditions that a beekeeper will face.

Welding.

The paint used is a urethane-based industrial coating that stands up to the test of time and all weather conditions.

Articulation Joint.

Paint.

Assembly stage.

After the paint is dry, the parts are moved to the first assembly area where the major components are first installed on the body. All of the electrical work is also done at this stage.

Engine.

The Hummerbee uses a Kubota diesel engine as its power plant. It meets all of the current emission regulations in all 50 states.

Hydraulics

The hydraulic pump and motor provide the fluid flow to run the forklift at full throttle while still providing the power necessary to carry a heavy load on the mast.

Attachment.

The hydraulics are high flow capable in order to run a variety of different attachments which allow the operator to use his forklift for a variety of different jobs.

Axles.

The Hummerbee uses heavy duty Dana axles that stand up to any abuse you give them.

Wheels and tires.

After the axles are hung, the wheels and tires are mounted. The high flotation type tires are foam filled so there's no flats.

Assembly stage 2.

Mast.

The steel mast and carriage are hung next to ensure the load can be moved safely for the beekeeper and the bees.

Load cushion.

The mast is supported by two heavy duty cylinders as well as heat treated chrome bar stock. In addition to moving up and down, the fork carriage can also tilt forward and back, and shift side to side.

The mast hydraulics are fitted with a nitrogen charged bladder that acts as a shock absorber for the forks.

After everything is assembled, each forklift goes through an inspection and testing procedure to ensure that everything functions as it should.

If you are looking to expand your bee business and palletize your hives, purchasing an articulated rough terrain forklift is an investment that you eventually may make. With all of its features, the Hummerbee is a machine specifically designed to make the beekeeper's life easier. Whether it's sending truck loads of hives out to California for pollination, or finding the best forage for your bees for honey production, the forklift is an important tool for your operation. BC

Some Things I Thought I Knew About Bees

But learning about bees never ends.

The mystery of the three ocelli

Somewhere during my early university years, I was distinctly taught that the three ocelli on the vertex of a bee's head were to "*set the bee's biological clock.*" If not that exact function, then the ocelli were surely critical in helping the bee orient with the light of the sun. These simple eyes do not perceive distinct images, but they do readily allow light to penetrate. Most authorities agree on this one point.

All those years ago, my mental picture of the ocelli was something like three opaque skylights in a big box store that allowed ambient light into the building through the roof, but prevented me from seeing clouds, blue sky or birds flying above the store. Even now, these old hypotheses make some kind of *near- sense.* These simple eyes – in some way – use light to triangulate and/or to set internal clocks. While not totally wrong, apparently, that information is less than correct.

Not only is the true functioning of the ocelli a bit mysterious, but there are *three* of them. That seems to me to be an odd biological number. Both bees and I are *bilaterally symmetrical.* One half of me mirrors the other half. Spilt a bee laterally and the same phenomena happens – one half mirrors the other half of that split bee. So I always saw the three ocelli as being an oddity. And why is hair covering one of these? In fact, in my photo, the most forward ocelli is nearly covered by hair. Do the simple eyes perceive the entire visible color range or do you suppose that ultraviolet light plays a role? I don't know.

It was within this murky area that I was recently requested to present a discussion at the Alabama Master Beekeepers' Certification program on the topic of honey bee anatomy. In Stell's text *Understanding Bee Anatomy: a full color guide*[1], he stated that the large diameter nerves were capable of sending rapid signals from the simple eyes to the bee brain; therefore, it is thought that the structures are instrumental for flight stabilization. They almost sound like biological gyroscopes. For Master Beekeeper class purposes, I went with that opinion rather than the older opinions that I have presented many, many times in past years.

Presently, it is thought that these three simple lens structures use light sources – possibly from the horizon to stabilize the flying bee while she is in motion. I'll bet you that these structures will be revisited again as time passes. *(Go ahead. Suggest closing the ocelli off with paint or dye. If that experiment is done, the handicapped bee can still function, but not as well.)*

But threes do occur elsewhere

As I discussed this triad of simple eyes that the bees have, an engineer within the Master Beekeeper group pointed out that individual ommatidia from the compound eye are six-sided as are individual comb cells. If divided into equal parts, these naturally occurring hexes become six three-sided triangles. I had to admit that if the bee was cut laterally, there would be three legs on each side. So, multiples of three do occur in our bees. While that has little effect on the quasi-mystery of the function of the ocelli, the presence of threes in the bee's life is interesting. If you know of other "3s" in the bee's anatomical makeup, let me know about them.

The mystery of empty cells within an otherwise solid brood pattern

Well, it makes sense. Within the dark crowded hive, the rambling queen just happens to miss a cell here and there. Possibly, something was wrong with the larvae the queen produced and the workers removed the improper baby bee leaving a cell available for the queen to try again. No great harm done, but beekeepers like to see a beautiful solid brood frame. Why are there always a scattering of empty cells. For this discussion, I drew heavily from Jürgen Tautz's informative work cited below.

Tautz[2] writes that about five to 10% of the cells are intentionally left open for brood heating purposes. That percentage of open cells will vary in different climates and at different times of the year. No more than 20% of the cells should be left open. One early idea was that the metabolically active brood gave off heat. Adult bees on the comb were simply there to warm themselves. Apparently – not so.

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[1]Stell, Ian. 2012. *Understanding Bee Anatomy: a full colour guide.* The Catford Press. 106 pp. Color images.

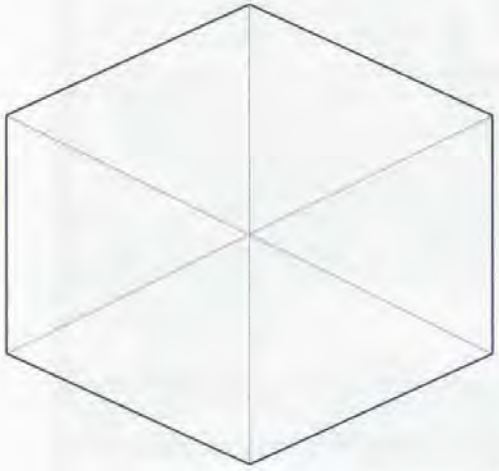
[2]Tautz, Jürgen. 2008. *The Buzz about Bees: Biology of a Superorganism.* Springer-Verlag Berlin Heidelberg. 284 pp

Honey bee ocelli.

Heater bees on cappings

There are two types of heating bees. *Heater bees* press their thorax against the combs and vigorously perform micro-vibrations of their thoracic muscles to generate heat. A bit like putting a car in neutral and then revving the engine to warm it, bees can disengage their flight muscles as though they were in a neutral gear. Heat-sensitive photography has documented the heat that these bees can produce. The work they perform is only surpassed by the energy required in strenuous flight. These bees are NOT simply relaxing on the pupal cappings. They are on the job. This arduous task is not an age-dependent task. Tautz reports that heater bees range in age from three to 27 days old.

This heated thorax concept is common both within the insect world and specifically the honey bee world. The working bee crouches onto the pupal cappings surface for periods up to 30 minutes long. Their antennae are consistently held against the comb surface ostensibly to monitor brood temperature. At some point, the individual heater bee either exhausts herself, or the pupa reaches the desired temperature. When she moves away from the heated spot, Tautz, using a heat sensitive camera, was able to capture photos of "hot spots" left on the pupal cappings. A single heater bee only heats a single pupa. At first glance, it would appear that heat is lost from the other surfaces of the working bee making the process appear extravagant and inefficient. But as is always the case, the bees have a plan. Depending on heat needs, other non-heater bees stand "shoulder to shoulder" in/around/on the pupal cappings and serve as heat sinks. These thickly spaced bees serve as an insulator shield. An easy way to detect this energy production is to put your hand on the glass covering of an active observation hive. It will clearly be warm.



Reducing the hexagonal comb to thirds.

Heater bees in empty cells

Remember those cells described above that were left open? A second type of heater bee – one that appears to be more efficient – is one that occupies empty cells and heats surrounding developing pupae. Yes, it's true. Most of us (me, too) have always thought that these bees were just relaxing or indirectly producing heat for the brood nest. These "in-cell" bees dash about on the comb surface to acquire muscular heat. These exercising bees can build up thoracic temperatures to more than 109°F (43°C). After becoming heated, they enter the empty cells head first and lie quiescent, with abdomens rapidly pulsing as they cool down. It appears that many parameters are highly variable. How much heat is needed? External and internal colony temperatures vary. The availability of food is important and the contribution of surrounding comrades is critical. The working bee may take a bit of a break every few minutes or she may allow another heater bee to take over. This is hard work. The range of heating activity is about three to 30 minutes.

No, it is not just a few empty cells that the queen missed the first time around. These cells are indices of a sophisticated heat-producing system that is only maintained by hard work and dedication on the part of the heater bee.

The mystery of deaf bees

You know the drill. A tree falls in the forest and no one is there to hear it, does it make a sound? Thirty-five years ago, it was tediously explained to me that bees do not have a tympanic hearing structure. So – no – bees do not hear, as such. Yes, they can experience substrate-borne vibrations and respond to them, but is that actually *hearing*? I'm still not sure.

Johnston's organ (sometimes called Organ of Johnston) is a collection of sensory cells found in the second segment (the pedicel) of the antennae of insects, including the honey bee. Bees seemingly perceive electric field changes via the Johnston's organs in their antennae and possibly other mechanoreceptors. Bees appear to use the electric field coming from a dancing bee for distance information. But others have reported that bees actually respond to the auditory frequently emitted by dancing bees.

In honey bees, Johnston's Organ consist of about 300–320 basic mechanoreceptor structures (*scolopidia*) connected with about 48 cuticular "knobs" around the circumference of the pedicel.[3] These structures are sensitive to stimuli of 265–350 Hz frequencies. The honey

[3]Tsujiuchi S, Sivan-Loukianova E, Eberl DF, Kitagawa Y, Kadowaki T (2007) *Dynamic Range Compression in the Honey Bee Auditory System toward Waggle Dance Sounds*.PLoS ONE 2(2): e234. doi:10.1371/journal.pone.0000234

Components of heat producing system within the colony.

An enlargement of the antennal pedicel. (photo from Tsujiuchi, etal.)

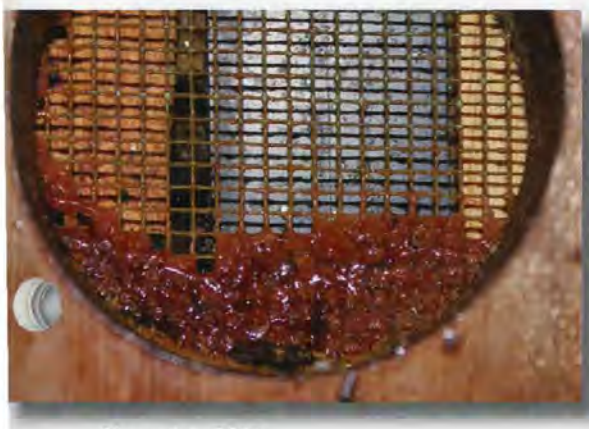
bee flagellum is a sensitive movement detector responding to 20 nm tip displacement, which is a stunningly small distance. At a very close range, bees do seem to be able to *"hear"* the buzz information contained within the dance language using air borne waves and not just surface vibrations.

Interestingly, the function of the bee's Organ of Johnston seems to be age-dependent which would mean that dance communication is only possible between older bees. Present understanding indicates Johnston Organ neurons are best tuned to detect 250–300 Hz sound generated during the waggle dance at a close range. In other glandular activities, bees show a strong tendency toward age-dependent development. Wax glands, brood food glands, and venom production are all age related in the honey bee's world, but these are glands – not organs. Additionally, bees move through their lives going from one job to another (polyethism) – but these age-related tasks are once again not organs. Anyone know of another honey bee *organ or physiological system* that is age-dictated?

Yes, it now appears that bees have a unique hearing system that is very remotely comparable to human hearing, but it surprisingly appears that the ability to hear comes later in the bee's life. No doubt more discoveries will be teased from this stunningly complex organ.

The mysterious propolis collector

On the surface, there seems to be little to no mystery here. As such, bees don't collect propolis. They collect components (gums and resins) and add wax and manipulate it into the unique hive product that is called propolis.



Freshly formulated propolis being used to close a perfectly good observation hive vent hole.

Propolis only exists within the colony – not on the buds and gum producing structures of plants. Yes, bees will store propolis at various places within the hive for future use. Yes, propolis collectors will vigorously work discarded propolis left lying about by the beekeeper, or they will eagerly re-gather propolis from old bee equipment. Under those conditions, bees are actually collecting propolis. While plants have been conclusively shown to produce pollen and nectar to entice bees to visit their blossoms, plants (presently) seem to have missed the boat on producing gums and resins for the bees to use within the colony for propolis production. Precious-little gum/resins are produced by flowers. So there is the mystery. Have bee-loving plants spent all their developmental time on just nectar and pollen? But wait.

What's with the odor of propolis? It would make some sense that both pollen and nectar would be highly odoriferous. Why would propolis have its distinct, persistent odor? I think it is the smell of propolis that pervades our bee lives. The honey house smell, the smell in old (and new) equipment and the strong odor around a productive hive are all places where propolis seems to contribute a strong odor ambience. In fact, are the plants doing what they can to help with gum gathering by giving it a smell label? In nature, few things just happen for no reason. Even the smell of a freshly mowed lawn may be the grass's way of treating the wound caused by mowing (or grazing). Propolis has an odor for a reason(s). I don't know what it is.

Stand by. No doubt in the future, a researcher will be able to show that there are plant/bee relationships not yet understood and that the resins needed to produce the mysterious product – propolis – have not been biologically ignored.

I'm out of word space. I wanted to vent a bit about the mystery of bees insisting that they replace (late June) a seemingly perfect good queen and now (September) be so far behind productively as to assuredly die this Winter. They really hated that queen. Was it worth it to them? BC

Dr. James E. Tew, State Specialist, Beekeeping, The Alabama Cooperative Extension System, Auburn University; ***tewbee2@gmail.com; http://www.onetew.com; http://www.facebook.com/tewbee2; twitter@onetewbee; http://www.youtube.com/user/onetewbee.***

Mastering Beekeeping: Years Two And Three

Larry **Connor**

Quite frankly, if not done during the first season of keeping bees, the second and third year are the years that set the course for many beekeeper's success or failure. Once the first year is completed, beekeepers are either challenged to start over for a variety of reasons: package bee failure, queen failure, general colony neglect, ignorance of basic bee management practices, failure to recognize problems with queens, diseases and mites, and countless other issues. Or, through a combination of luck and good training and self-study they have managed to keep their colonies alive and are ready to grow their colony numbers or increase production through better management.

At the end of a beekeeper's third year, we would expect that he or she will have mastered all of these areas and perhaps dived into queen rearing, specialized honey and hive products, teaching beekeeping, equipment-bees-queen sales, and more – If they did not start some of these activities in their first season. It is always amazing to see inexperienced beekeepers jump into something others consider too technical and come out smelling of great success.

There are beekeepers that take the minimalist approach to doing as little as possible with their bees during the first three years, so I need to say that it has been my experience that this is somewhat risky for their overall success in long-term beekeeping. Without a solid basis of knowledge, it is harder for beekeepers to sustain themselves over the years using their good luck as their primary asset.

It is often repeated that a second year beekeeper is the most dangerous beekeeper in the apiary and classroom because they have all the answers. Certainly those who were blessed with positive experiences and good luck with their bees are quite often adamant about their 'proficiency' as a beekeeper. They have often not learned the challenges of a difficult beekeeping year, of growing mite levels, and exposure to pesticides and the growing threat of disease infestation. While we do not want to minimize the importance of second year beekeepers as teachers of first year beekeepers – they are closest to the experience – they still require monitoring by more experienced beekeepers. Therein lies the conflict, finding a balance between learning and growing with bees versus a large area of inexperience.

After a few years of beekeeping East Texas resident Mike Rappazzo became interested in queen rearing and growing his bee business. There are many new, highly charged beekeepers with a mixture of successes and failures – the second and third years often are the seasons that determine a long-term beekeeping career.

What should a second and third year beekeeper be able to do?

Here are some of my thoughts of the many areas they should master during the first three years of keeping bees:

Bee Anatomy – Full knowledge of the parts of the bee, both internal structures and internal anatomy, coupled with a good understanding of what each part of the bee does in the life of the individual bee and colony function. They should be able to teach this to other beekeepers.

Floral Anatomy – They should be able to identify the parts of common flowers, how nectar and pollen are produced, the keys to pollination of key plants for their region, and be able to teach this to neighbors, growers and other beekeepers.

Bee Venom and Stings – More experienced beekeepers should be able to recognize a local reaction as compared to life threatening anaphylactic shock. The experience of these beekeepers is critical when working with both new and established beekeepers, as we all hear of those who have suffered a major scare following a bee sting. Second and third year beekeepers should always error on the side of caution, but be able to determine if a bag of ice is the best treatment, or when to phone 9-1-1 with a possible emergency.

The Beekeeper Annual Cycle – Starting either in the later Summer or in January, a beekeeper should be able to review in some detail the key changes that take place during each month of the year in the area where they keep bees. They should be able to show how different seasons produce different results in pollen and nectar production, and how this impacts colony management. This cycle should be broken into several themes:

Population Cycle – Following the Winter/early Spring decline, beekeepers should be able to discuss the increase of brood and bee populations as the seasonal buildup leads to stronger hives and robust forager populations. In his writing Dr. Dewey Caron reminds beekeepers that the key to successful bee colony management is through proper bee population management, and all teachers and mentors need to remind their students of this.

Swarming Cycle – These beekeepers must attempt to master the Spring and late Summer/early Fall swarming cycles, adapted for the regional area where the beekeeper keeps bees. Methods of swarm prevention and swarm control should be strongly established within the beekeeper's skill set. Methods of swarm capture and management are suitable at this or an earlier level. While not all beekeepers should be able to perform colony removals – it requires non-beekeeping skills not all beekeepers possess – but the second and third year beekeeper should be able to work with a well-protected carpenter or another beekeeper to remove a colony using various techniques, and be able to tie up combs into empty frames or onto top bars (in frameless management systems).

Honey Cycle – Know when to super, when and how to harvest honey, and how to deal with honey processing-storage-bottling-sales. I am always amazed at the number of two to three year beekeepers who are overwhelmed when their colonies produce surplus honey and they do not know what to do with it. Excuse me, why did you start a dozen colonies of bees?

Disease Cycle – The use of the word cycle applies mostly to *Varroa* mites, as true diseases follow a more random pattern of infection based on contamination exposure. But chalkbrood and nosema are both known to follow certain highs and lows as influenced by the weather and seasonal influences. *Varroa* mites will increase in numbers as related to levels of mite tolerance, mating accuracy, drone production and other factors stimulate mite development within colonies in an apiary. Depending upon the region where a beekeeper keeps bees, the mite population cycle may take a year or more to be fully expressed.

Disease, Pest and Pesticide Detection – Every third year beekeeper should be able to determine if a colony, or a sample from it, should be checked by a qualified laboratory, like USDA-Beltsville, for American foulbrood, European foulbrood, chalkbrood, nosema, tracheal mites, *Varroa* mites and pesticide damage. The best of all beekeepers will be able to do much of the recognition work at this stage, but all third year beekeepers should be able to determine if they should have a colony sample checked by qualified individuals or services.

American foulbrood – By this time a beekeeper should be able to inspect old beekeeping equipment to look for AFB scale left from a previous dead out from American foulbrood. The beekeeper should be able to perform a field exam for AFB killed larvae in the late larval stage by checking for a strong sour odor and ropiness.

Varroa mites – Using a standard sampling method using powdered sugar, ether, or a full screened bottom board and powdered sugar, a third year beekeeper should be able to measure the mite level in each colony in a small apiary and compare that data from colony to colony and apiary to apiary. This should become a preliminary aspect of determining if the colony needs to be treated for mites, using any number of treatment options.

Miticide and chemical Use – Beekeepers should be able to read the label of any chemical and examine it for its risk to honey bees and other pollinators. Apiary pesticides should be carefully studied before being selected for use. The beekeeper must follow treatment procedures and safety concerns. If a residual strip or artifact remains after treatment, its correct removal and disposal should be followed. All efforts should be to provide safe application to the bees without causing bee mortality and contamination of honey and hive products.

Beekeepers in their second and third years often build their own equipment. This is a home-made extractor from Ed Simon's book Bee Equipment Essentials.

Equipment and Terminology – Take the glossary from a good beekeeping book and see if you can identify at least 80% of the terms and items of equipment listed there. Know the key leaders in the development of American beekeeping, and study global beekeeping development as well. Using that 80% standard, you should be able to identify most items in a commercial or sideline beekeeping operation, even those producing package bees or queens. Much of this will come with normal curiosity with bees and beekeeping.

What is Honey? – Does filtering convert honey into non-honey? Does heating at 160° do the same? This is a fuzzy, grey area for a lot of beekeepers, and all must know what the law and marketing rules say about putting Pure Honey on a jar, as compared to Funny Honey

or some other label. While there is a great deal of misinformation out there, get the facts and follow them. Is there a legal description of Raw Honey? More to the point, every beekeeper should be able to look at a container of honey and point out any mislabeled items, such as lack of weight, location of source and producer.

Comb Analysis – Third year beekeepers should be able to identify the content of each cell on each frame in a hive. This includes ALL stages of brood, stored nectar, stored honey (sealed and open), loose pollen, new bee bread, water and propolis-covered cells. The beekeeper should be able to rearrange a set of frames into the natural position that the bees would produce without beekeeper interference.

Other Hive Products and Handling – Third year beekeepers should be able to produce honey, pollen, beeswax and propolis. They should know the best practices to use for the harvest, processing, storage and marketing of these products. Knowledge of labels, limits on claims of product properties and general legal issues concerning these products fits the third year level. They should have submitted at least one of these items of their own production in a local fair, honey judging event or have their product evaluated by a trained professional.

General Entomology – By third year, beekeepers should be able to identify common non *Apis* bees, wasps (including yellow jackets and hornets), flies and bee mimics typical to the area where the beekeeper operates. They should understand the system of naming insects, starting with a common name, and followed by the Latin name. They should be able to identify regional pollinators and stinging insects and their mimics by common name.

During the fourth and fifth year of keeping bees, most beekeepers perfect their skills, and be actively involved in honey and hive sales, pollination, and teaching new beekeepers. BC

The Voice Of The South

Can Sometimes Be Annoying

I annoy many Mississippi beekeepers when I say that the Small Hive Beetle (SHB) is not a killer of honey bees unless colonies have been weakened by other diseases or conditions. My argument is based on my own experience in which almost all my colonies that were slimed out by SHB larvae were known to suffer from high *Varroa* mite infestations or from my bad management. Some folks have claimed that SHB have killed their strong colonies. I have yet to see this happen, but I acknowledge it is possible, especially if conditions in a hive allow SHB to lay eggs in places where the bee space has been reduced, and workers can no longer police the comb.

I saw this occur once in which a heavy honey comb had been pushed too close to the wall of the hive body. SHB laid some eggs in the restricted space, and I discovered the problem while looking for a queen. The first and second instar larvae of the SHB were sliming the side of the comb which had faced the wall, and the worker bees were already being repelled by the feces of the larvae. This was a very strong colony, but I could envision how the area of slime and undulating SHB larvae could spread and eventually force even a strong colony to abscond a hive. Of course, I intervened and prevented the loss. I am now using nine drawn combs evenly spaced per hive body, even for brood chambers, and this seems to prevent the squeezed bee space problem from occurring.

I am not saying the SHB are not a problem. They certainly create havoc in the honey house and in the queen mating yard where colonies are kept small and relatively weak. If nothing else, they will quickly scavenge colonies before a beekeeper discovers that he or she even had a problem. Freshly laid eggs of the SHB can hatch within 24 hours in our late Summer. The loss of combs can be expensive, and cleaning up the mess is time consuming.

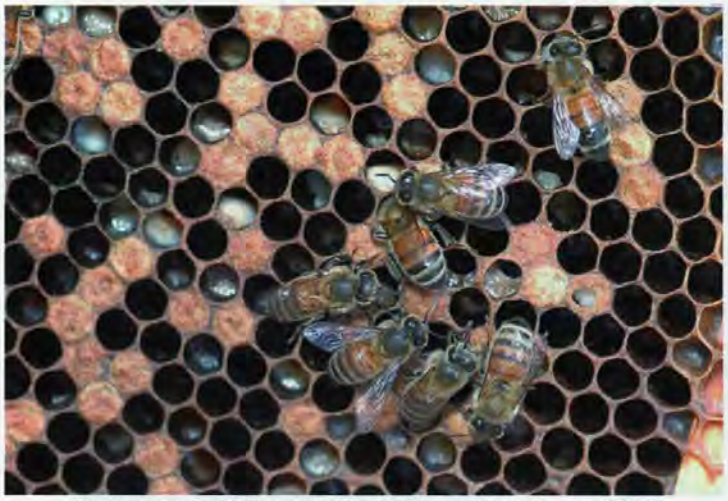
The image of the slimed colony so disturbs many beekeepers that they become overly fixated on the SHB problem. Many are willing to do anything to eliminate adult beetles from their hives. Some put illegal insecticides within colonies to control these critters, and you know how I feel about that practice from my previous articles. What really bothers me is that some of these people will do anything to reduce the numbers of SHB in colonies (especially in August and September when numbers of adult beetles in hives peak in this area), but the same people either are unaware or simply do not know how to handle the primary killer of bee colonies, the *Varroa* mite.

I present my experience this year as a typical example of my many years of experience with both *Varroa* mites and SHB. I started 92 colonies from nucs that were purchased from several suppliers this year. We had a cold and rainy March/April which slowed bee population growth for most producers of bees, and most of my colonies were started later than I would like. My last set of 25 nucs were not even received until May 31, which is really late for growing a nuc to be large enough to build up any stores during the main honey flow. All nucs were started on foundation, so we fed bees during the dearth just to draw comb. Queens were purchased from about 25 different sources, and we chose not to treat for *Varroa* mites until August/September. The reasoning here is what separates researchers from beekeepers – we needed mites for research purposes.

My technician (Audrey Sheridan) and I visited all of our colonies about five to six times during June-early September. During these visits we evaluated the health status of each colony, and did whatever beekeeping was necessary to keep colonies on course for typical growth. By the end of July, we started seeing signs of medium to high *Varroa* infestations in several colonies. This is one of those situations where you should do as I say not as I did. We should have intervened and controlled the mite populations when we first noticed problems, but University life has a way to keep one out of the field when it really matters most. It was during the first week of September before time was dedicated to mitigating the mite problem.

Here is the summary of our losses: We found four colonies overrun with larvae of the Greater wax moth, five colonies slimed out by larvae of the SHB, and another

"I use PMS to refer to the sick brood of a colony known to be dying from viral infections caused by high Varroa populations and IBDS to refer to snotty brood conditions in colonies with low mite infestations."



Snotty brood of Idiopathic Brood Disease Syndrome (IBDS).

A worker pupa probably infected with a virus (from a colony with low mites and IBDS).

10 colonies showing signs of either parasitic mite syndrome (PMS) and/or a condition that is now called idiopathic brood disease syndrome (IBDS), or snotty brood. Idiopathic means that the cause of the condition remains unknown or at least a specific cause is difficult to determine because several confounding factors cannot be separated. It is not clear if PMS and IBDS are different versions of the same disease syndrome, but I use PMS to refer to the sick brood of a colony known to be dying from viral infections caused by high *Varroa* populations and IBDS to refer to snotty brood conditions in colonies with low mite infestations.

We had not sampled for *Varroa* mites yet, but we had noted either seeing *Varroa* mites in broken drone brood or seeing workers with wings damaged by Deformed Wing Virus (DWV) during previous visits to 17 of these colonies. We concluded that these losses stemmed from lack of adequate control of the *Varroa* mite. The remaining two colonies were interesting; they were known to be low in *Varroa* mites and yet they displayed symptoms of IBDS (see photo). The bottom line from our story is that we had *Varroa* mite populations grow to high levels within four months of starting colonies from nucs, and most of our losses were caused by the resulting high virus loads. If we had not taken notes throughout the season, and we were inexperienced, we might have concluded that larvae of the Greater wax moth and the SHB killed almost half of the lost colonies. The fault is ours for not controlling the mites.

I recently talked with a friend of mine who told me an interesting story about how stubborn some folks are to accept mites as a possible cause of death. The beekeeper claimed to have a *Varroa*-resistant stock of bees that did not need treatment; however, he complained that somebody needed to investigate IBDS because it was occurring in many of his colonies. The man never sampled his own bees for mites, but he sold a nuc to a woman who had my friend sample them for mites. My friend also noted the brood disease in her nuc, and he found > 45 mites from a 300 bee sample. That level of mites is extremely high and well above the economic threshold for mites for late Summer when the sampling had occurred. So, at least in this case, the man's bees are probably suffering from PMS related to high *Varroa* populations.

I am not suggesting that IBDS does not occur; I am only suggesting that when you first see signs of this kind of disease, sample for mites to eliminate that possibility. It is the most likely candidate for a brood problem that appears to be PMS-like. Our two colonies showing symptoms of IBDS (snotty brood in the larval stages; young pupae with fluid and necrosis on the body – see photo) were known not to have *Varroa* mites.

All of that said, I wanted to summarize a paper published by Dennis van Engelsdorp and co-authors this year (van Engelsdorp *et al.* 2013). The research team followed the fate of a random group of 62 colonies that were being used in migratory pollination service among three different beekeeping operations (n = 20, 24 and 18 colonies). Each operation ran colonies from Florida to New Jersey or Maine and back to Florida between March-2007 and January-2008. Generally, the team randomly chose colonies, tagged them and marked and clipped all queens in these colonies at the start of the experiment.

They examined and sampled all colonies at the start of the experiment and every 50 days until the end of the test. Their goal was to try and assess those measurable factors that were the best predictors of colony mortality. For example, if a colony had a lot of chalkbrood mummies in

> *"Another study suggested that even when acaricides are used, virus loads can continue to grow in bee colonies, and it is these high viral titers that can kill bees in late Autumn or early Winter."*

the brood at one observation period, was it more likely to be dead at the next period 50 days later?

The team measured colony size, quality of the capped brood pattern, presence of the marked queen, and clinical symptoms of chalkbrood, European Foulbrood, American Foulbrood, sacrbrood virus, deformed wing virus, and IBDS. They also sampled slightly more than 300 bees for a *Varroa* mite load estimate and 30 workers for measuring Nosema spore levels. They called a colony as having experienced a "queen event" if it had emergency or supersedure queen cells, contained a virgin or unmarked replacement queen, or if it was queenless without eggs and larvae.

Over the entire 10-month period, 56% of all marked colonies died (35 out of 62 colonies). The team used epidemiological statistics to determine the relative risk that having one or several of the risk factors had on the chances that a colony would die. The two biggest single risk factors were the presence of IBDS and the occurrence of a queen event. If a colony was seen with IBDS, it was 3.8 times more likely to be found dead 50 days later than if not. Similarly, if a queen event occurred, a colony was 3.1 times more likely to be dead. No other single factor had a relative risk above 1.6 (including *Varroa* mite level).

The team also found that the presence of multiple factors greatly increased the chances of a colony being lost. This fuels the idea that in situations with high colony mortality, it is likely multiple factors acting in concert that kills colonies.

Interestingly, the symptoms of IBDS were independent of the level of *Varroa* mites in colonies at the time of the brood symptoms. This suggests that the two may be completely unrelated. However, it may also be that the IBDS is caused by viruses that are vectored by the mites during a previously high mite infestation period. This also suggests that viral diseases can run a course independent of the mite populations once the mites have vectored them into bees. Another study suggested that even when acaricides are used, virus loads can continue to grow in bee colonies, and it is these high viral titers that can kill bees in late Autumn or early Winter (Francis *et al.* 2013). The queen events in this study may also be related to viruses. Another recent study showed that the reproductive system (e.g. ovaries) of queen honey bees deteriorate as the result of infection by the DWV (Gauthier et al. 2013).

It seems that IBDS is likely caused by viruses. The question will be whether mites initially instigate the disease (as with PMS), or if this is a new viral progression that really is independent of *Varroa* mites. Scientists simply do not know the cause of IBDS.

Returning to my beekeeping year; the remaining colonies seem strong and growing fairly well in response to our Autumn flow which began in late August. Every single colony had 30-40 SHB adults running around on the top bars during our recent inspections. None of these stronger colonies show signs of actively feeding larvae of the SHB. However, the presence of the adult SHB constantly reminds me that my poor management style can be exposed very quickly. BC

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References Cited

Francis, R. M., S. L. Nielsen and P. Kryger (2013) Varroa-*virus interaction in collapsing honey bee colonies.* PLoS ONE 8(3): e57540. Doi:10.1371/journal.pone.0057540.

Gautheir, L., M. Ravallec, M. Tournaire, F. Cousserans, M. Bergoin, B. Dainat, and J. R. de Miranda (2011) *Viruses associated with ovarian degeneration in* Apis mellifera *L. queens.* PLoS ONE 6(1): e16217. Doi:10.1371/journal.pone.0016217.

Van Engelsdorp, D., D. R. Tarpy, E. J. Lengerich and J. S. Pettis (2013) *Idiopathic brood disease syndrome and queen events as precursors of colony mortality in migratory beekeeping operations in the eastern United States.* Preventative Veterinary Medicine 108: 225-233.

Got A Question?

Ask Phil

Phil **Craft**

He Knows!

Send your questions to Phil at
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www.philcrafthivecraft.com

(Note to Bee Culture readers: this question was emailed to me in July of this year.)
A beekeeper in Virginia writes:

I have a question. I have six stands of honey bees, however recently I have noticed a curious thing taking place with two of my hives. They are carrying out fully formed drone bees that have been taken out of the cells before the drones have hatched on their own. The drones are not the normal color as the ones hatched on time. Some are quite light in color near white. Some are still alive when I find them. I seem to find them in the morning which seems to indicate they are carried out at night. My question is, is this a normal behavior? or is something else taking place?

Thanks a lot.

Phil replies:

The answer to your question is *both*. This is normal behavior, and it is taking place in response to something that is going on in the hives. Those two colonies are probably stressed, either by disease, parasites (*Varroa*), or a shortage of food resources.

Honey bees will often remove larvae or pupae which are diseased or infested with *Varroa*. We call this hygienic behavior. It is not uncommon to see it manifested by colonies suffering from chalkbrood, a fungal disease which attacks honey bee larvae about the time that the cells are capped. Due to the fungal nature of the disease, we often see it in early Spring when the weather is cool and damp. Infected larvae die leaving small, typically white, dried remains, which beekeepers descriptively call chalkbrood mummies. Often, the first indication of a chalkbrood outbreak is the evidence of mummies which the bees have removed from the brood area and deposited at the hive entrance. Most chalkbrood outbreaks are minor and colonies are not seriously affected, though more severe instances of the disease do sometimes occur. The removal of infected larvae is one example of hygienic behavior, a positive trait which all bees possess, but to varying degrees. Honey bee breeders, however, can breed selectively to enhance this characteristic to a high degree. The resulting strains of honey bees are referred to as hygienic, and have a superior ability to resist outbreaks of brood disease, such as chalkbrood and even American Foulbrood. Some queen lines have also been developed which use hygienic behavior to resist *Varroa*, such as the Minnesota hygienic (developed at the University of Minnesota) and the varroa sensitive hygienic (VHS) line from the USDA Baton Rouge Bee Lab.

Chalkbrood mummies in broodframe. (photo by Jon Maybriar)

While it is possible that what you are seeing in your hives is a hygienic response, I think, due to the season, that it is more likely food related. Honey bees will also remove both larvae and pupae – especially that of drones – when food resources run short. They respond to not having enough resources, either stored or available in the field, by reducing the number of mouths they have to feed. It is the same reason that weak colonies often fail to rear drones in the first place. In a colony struggling to survive, drones are a luxury not to be indulged in. The instinct to save scarce resources for essential members of the colony is also in evidence later in the Fall when drones are expelled from the hives. The goal of the colony at that time of the year is to store sufficient food for Winter. Queen production would be on an emergency basis only, so unneeded drones get booted from the hives to die, or are killed if they resist leaving. I try to be a little more productive around the house every fall, so as not to be considered a surplus drone. Here in Kentucky, and probably in Virginia as well, we are seeing a mid-summer dearth of nectar caused by seasonal conditions. I think it most likely that the bees in your two hives are responding to these conditions.

Why these hives and not the others? Possibly they had less stored honey to start with and feel more stressed as a result, or there may be other factors. *Varroa* mite numbers peak in mid-Summer, affecting the population of heavily infested colonies, leaving them without enough foragers, and making them more sensitive to reduced

nectar flow. I would recommend checking the hives for food stores. There should be at least three frames of stored honey in the brood boxes at any time (even in Summer) to get the bees through periods of reduced or no nectar flow. It is possible that you have sufficient honey stores and that the bees are only responding to a shutdown of the nectar flow, but make the check. A survey for *Varroa* would also be a good idea at this time of year, for all your hives – not just those two. One last comment on the color of the removed pupae; I think this is simply due to their age. Pupae darken as they mature, so those which are more nearly white were removed at an earlier stage in their development.

A beekeeper in Virginia writes:

I have read that when a bee takes in sugar water, an enzyme converts this sucrose to glucose and fructose, more easily digestible. Seems to me that these products are essentially nectar and can be reduced by the bees into honey. Is that so?

Thanks for your contributions to beekeeping and Bee Culture.

Phil replies:

As all beekeepers know, honey bees forage and collect nectar from the flowers of plants. Nectar is primarily composed of water and sugar, along with a unique blend of other, minor components which impart a distinctive taste and color to the resulting honey. The sugars found in nectar are primarily sucrose, glucose and fructose, the relative percentages of which depend upon the flower from which the nectar originated. However it is not unusual for sucrose to dominate, or even to be the only sugar involved. Whatever the original composition of the nectar, as the bees collect and move it into cells in the comb of the hive, they add to it enzymes, produced in hypopharyngeal glands located in the bee's heads. The enzymes promote the chemical conversion of sucrose into the simpler sugars glucose and fructose. The result of the processes of breaking down the sugars in nectar and of reducing its moisture content to 18% or less (crucial to preventing fermentation) is what we call honey.

The breakdown of sucrose takes place regardless of whether the source is nectar or sugar syrup provided by beekeepers. The bees do not care; both provide the fuel they need. However, the term honey refers ONLY to the product of natural nectar collected from flowering plants. Though the process is the same, what bees produce from sugar syrup is still only sugar syrup – more highly concentrated and with altered sugars – but sugar syrup.

Syrup being fed.

That means that when honey supers are on a hive, we should never feed syrup to the colony. We do not want to take a chance of sugar syrup's ending up in frames from which we extract honey to consume and/or sell. I am even cautious about feeding weak hives or nucs (that is, feeding hives which do not have honey supers) during a nectar flow when I have supers on my stronger hives. While robbing is much less common during a strong nectar flow, I do not want to take the chance of strong hives' foraging at syrup feeders on weak or new colonies. I never use entrance feeders, and only feed inside the hive and above the brood box, which makes robbing – by stronger hives with honey supers – much less likely. I also use entrance reducers or anti-robber screens in hives that are particularly weak and vulnerable in order to further lessen the chance of robbing.

Honey is a remarkable substance, the properties of which have been valued by people for millennia. It has been a food, a supplement, and an antibiotic among other uses. In these health conscious days, many people prefer it as a more natural, digestible, and healthy alternative to sugar or corn syrup. When I put "Pure, Local Honey" on the jars from my apiary, I want to make sure that the contents live up to the label.

A beekeeper in New York writes:

I keep bees, so does my neighbor. He just extracted some of his frames from which came very light watery honey, almost the consistency of nectar. This may not be surprising considering the damp rainy spring and summer we have been experiencing here in upper New York State. I know the specific gravity of honey varies due to myriad factors, but what is a normal range of viscosity, and what does one do with honey that is clearly too thin?

Phil replies:

When honey is as thin as that which you describe, we have to be concerned about fermentation, a chemical process which may occur when yeast spores (which are abundant in the air and environment) combine with honey (sugar) high in moisture (water). Therefore, instead of being concerned with viscosity or specific gravity, we measure water content, and the cut-off point we are aim for is 18%. Honey is a very safe food which will resist spoiling for many years, as long as the moisture content is below that threshold. At 18% or less, there is insufficient moisture for yeast cells to grow. In practice, I have never had problems with honey between 18 and 19%, but I do not suggest selling any which has a percentage above 18.

The moisture level of honey can be accurately determined with an instrument called a refractometer, which may be purchased from beekeeping suppliers – they start at about $80 for inexpensive models. Most beekeepers, however, don't own one or, like me, don't use the one they do own most of the time. If the bees have capped at least 90% of the cells on a frame, the moisture content should be low enough. *The bees know* – without the aid of instruments. With some experience, beekeepers can also learn to judge when honey is thick enough by tilting

the bottle or turning it upside down and noting how long it takes for the air bubble to float up.

High moisture is more of a problem in some years than in others and, in parts of the country at least, this is one of those years. Hot, wet weather makes it difficult for the bees to bring honey to the desired consistency, with the watery result your neighbor is experiencing. In the Southeast, which includes my old Kentucky home, it has been a very wet summer with high humidity and record or near record rainfalls. From what I read, precipitation in New York this year has been a matter of both highs and lows depending on what month it is. The relevant time for this discussion, of course, is the weeks after the nectar is collected.

What is to be done if the honey is too thin after it's removed from the hive? While it's still in the comb, the moisture level can be reduced a couple of points by putting the supers in a room with a dehumidifier for a couple of days, stacked to allow dry air to circulate around the frames. Another method is to cover the supers with a tent of plastic and blow dry air into it. In this type of operation, a refractometer does come in handy for gauging progress. Warm dry air is capable of removing more moisture from honey than cool dry air, but it's important not to let the temperature get too high. Above about 100°F, the comb will soften and may collapse – especially under a tent arrangement. I know, because I have done it! I once lost about eight boxes of drawn comb by not keeping a close eye on the air temperature while I was trying to lower the moisture content of the honey in the supers. After a lot of filtering, I was able to separate the honey from the wax, but the comb was lost.

Honey from tank. (photo by Mary Parnell Carney)

Once the honey is extracted, some beekeepers try to concentrate it by heating it in an open bottling tank in a dehumidified room, sometimes putting a towel over the tank to absorb moisture. I have never attempted this; it sounds like too much work for too little result. I am certain the moisture reduction is minimal. After extracting honey, I never try to reduce its moisture content. I use the thin honey myself, or give it away to friends and family (explaining that it could ferment and should be eaten soon.) Watery honey can be heated to kill yeast cells and reduce the chances of fermentation (no yeast equals no fermentation), but this is not a permanent fix. Whenever a jar of honey is opened, it may be re-exposed to yeast spores. Also, the fact that honey is too high in moisture does not mean that it *will* ferment - just that it will be more likely to. The fermentation process requires the combination of high moisture honey and sufficient yeast cells and does not occur immediately when it does happen. In the Craft household, we can dispose of a lot of thin honey quickly. It's good on pancakes . . . or on ice cream. BC

FLOOD!

Miles **McGaughey**

The day dawned gray on September 11 and the light rain increased greatly. As the hours passed it became clear that this storm was like none other we had ever experienced. What originally appeared to be a continuation of a cycle of rain we had enjoyed all Summer, (leading to one of the biggest honey yields in recent memory) it turned into a torrent that washed away more than just the honey crop. That evening I comforted my youngest daughter as she cried about the intensity of the rain and lightning.

Our prevailing weather patterns are generated in the Pacific and travel to this region of Colorado from a Northwesterly direction. This weather system backed into the front range of the Rocky Mountains from the South-East and stalled over the canyon country so typical here in the West. From the Poudre Canyon in the North, to all the small drainages south past Denver, with the worst being depended on where you were, many thousands of families were displaced and many bridges and roads were completely wiped out. To date, seven people have been found dead with many more unaccounted for. Our hearts and prayers go out to them and their families.

Hit especially hard were many beekeeping operations due to their proximity to creeks and river drainages. These storms came on so fast that many hives were lost due to rising water and loss of access. As president of the Boulder County Beekeepers Association, I was getting reports from other beekeepers about losses, but couldn't get to my own yards, until my oldest daughter Ruth reminded me of the latest addition to the company. At the state beekeeping meeting this Summer in Silt, CO, Nancy Limbach, the wife of Paul Limbach the owner and operator of Western Colorado Honey sold me

Tom Theobald.

an inoperable six-wheel amphibious ATV from the 1960s. With a lot of work and tinkering over the Summer we got it running and it turned out to be just what the doctor ordered to examine flooded beeyards.

Some yards are still unapproachable but the ones we could get to are either untouched or obliterated! I don't mean simply drowned, I refer to the absence of all woodenware, bees, bear fences, fence posts, even landmarks. I have found brood boxes mangled beyond recognition, but nothing of my own. Tom Theobald, founder of the BCBA, found several boxes of his own outfit without frames or bees downstream from one of his yards.

One of our most productive yards was on Left Hand Creek just below the Niwot cemetery. We were most concerned about the owners of the property, Mimi and Doug, friends of many years who run a horse boarding and training operation as well as a heavy equipment company. Doug must have taken a machine and dug a trench around their house because most of the water appeared to have missed! The only high ground nearby was the cemetery and I got there late that evening and could go no further due to the rushing waters. With binoculars I could see the land where the beeyard was, and realized it was a total loss. Despondent, I hung my head and turned back to the ATV, and noticed that we were not alone in the graveyard. All the game animals and some others had discovered that the hallowed ground was the only dry land in the vicinity and had crawled under cover to avoid the rain. A smile came across my face as I thought that nature would waste no time recovering from the storm that had become such a large disaster. And neither would we.

For 15 years my family and I had enjoyed the increased honey yields when we began to seek locations with creek drainages due to their humidity and extended blooms. Now these decisions were proving to be a mistake. As we pick up the pieces and pull the meager honey crop, we are humbled by the out pouring of sympathy and prayers. We vow as a family to come back from this catastrophe stronger than before. This is not the first time we've come back from the abyss. In 2005 the neonicotinoids showed up and took us from 120 hives to just 12. A 90% loss. This will be a more difficult recovery because of the loss of equipment but we're already making plans for spring 2014. It appears the key component to successful beekeeping is a tenacious ability to come back from adversity.

After a short drive with my youngest daughter to survey the damage south of town, we were stunned with the scope of the disaster and I tearfully reminded her that she had tried to warn me of the impending doom days earlier and I had suggested that she not listen to her own fear. Now, in light of the facts, I plan on paying more attention to that little voice, not less. BC

Miles McGaughey is a beekeeper and president of the Boulder County Beekeepers Association as well as the Colorado director of the Western Apicultural Society.

BIGGER PICTURE

Jessica **Lawrence**

Kids Are More Expensive Than Bees

Normally, I like to grow a fairly large garden where I have enough left over to give to the neighbors or try some crazy recipe without wasting something necessary for "real" meals. This includes the experimental section to grow a few varieties unbeknownst to the garden previously, like the graffiti cauliflower or the spineless burgundy okra. I've been keeping a spot open for some glass gem corn for a few years but I can't ever seem to get my hands on any seeds!

While I do take pride in my growing skills, I never believed I did enough to make an impact in my food costs to really amount to anything, especially with the ridiculous amount of seed packs delivered to my door. I had enough this year to dole out a few hundred seeds to friends and have enough left over for next year as well. What happened this year was that with the Great Power Outage of 2013, I couldn't water or take care of my garden and it pretty much fell apart. Not only did I miss out on my gardening time, but I lost the convenience of grocery shopping in the yard and the nutritional value and the background knowledge of my food, plus the lower cost.

I also lost over 50 chickens to predators this year. Yes, okay so maybe I ate a few of them, but I raised three batches of eggs from my favorite hens and my favorite rooster, only to have the Great Chicken Massacre of 2013 (which included my guineas and my peafowl). I lost all of my chickens but one, who shall henceforth be named "Lucky" except he turned out to be a rooster. My crossbow took care of a possum and a raccoon, but the warning to the local predator family ended up with my last 14 chicks being put out after a two-week "clean" period and being killed without being eaten. I haven't had fresh eggs in months, and I really miss playing with the birds.

To continue the onslaught of bad luck, my bees were cursed with an un-attendant beekeeper last Autumn and were ransacked by *Varroa* mites going into the Winter, so most of them didn't make it to the Spring. I wasn't able to harvest any honey this year . . . not that I would have had time anyway. I think I am down to only seven hives from the nearly 50 I had at the peak of last Summer. That's not to say that I haven't racked up a good few hundred hours of quality beekeeping time this year going through hives; it's just that those bees weren't mine.

I didn't realize how much I took for granted that I had a virtually unlimited supply of these items in my cooking until they weren't there anymore. It also cuts into my budget because not only do I have to buy food to pick up the slack, but I sold a lot of my honey and jams and such, and I gave some away as Christmas presents. I have to spend more money and I lost the money that I made previously, so I double lose. Now that I'm full-time cooking for six (maybe Bobby cooks more than I do, but he is an excellent cook so this is acceptable), it seems even more important to pay attention to what ends up on the dinner table and in the lunch boxes.

Time is of the essence when you are feeding a horde of hungry kids, and usually there is a lot of prep work that goes into getting that fresh food to the table in an edible fashion. Working until five and getting supper ready, homework finished, teeth brushed and baths before bedtime, especially on soccer practice nights. The big comparisons now are the balance of cost to expediency, and nutritional value as opposed to what will Picky George eat. This has led me to my most recent information expedition into good ways to pre-make food and the differences between what should you make yourself and

what should you just suck it up and buy at the store.

I would not consider myself a "prepper" although living in the Land Without Electricity may push me over the edge into that realm. However, a lot of their lifestyle choices just make sense to me, or seem fascinating. I like being crafty and giving foodstuffs as presents, so I started really getting into the idea of these mason jar meals. It's so neat to have most everything you need ready to go. As a book hoarder, I purchased a variety of reading material on the subject, ranging from the "just add water" mixes to the "here's the other 14 items you need to make this edible" meal. Unfortunately, I haven't grown anything this year that I can use in my jars, but if you make large batches of the same mix it's not too bad. This is my current solution for Christmas presents in lieu of honey and jam and it's something the kids can help make and give out as well. There's enough variety available to meet the skill level of most everyone and you can jazz up the jars if you are so inclined. Some require experimentation though, because they just won't taste the same as fresh-made food, but I suppose the point is that they are pre-made. The pancake or baking-type mixes are my favorite because they have the same convenience as the store-bought cake mixes, but you pre-mixed yourself. I don't like measuring out ingredients, so most of the work is already done when I get ready to use them. The downside to these is that they are normally all mixed together in the jar, which is not as pretty as the layers in bean or pasta meal-jars.

Here's a recipe for a family favorite:

Chocolate Chip Pancakes

Ingredients mixed in the jar:

3 cups all-purpose flour
1 cup chocolate chips (or more)
3 tablespoons sugar
2 tablespoons baking powder
1 ¼ teaspoon salt
1 tablespoon cocoa powder (optional)

Ingredients out of the jar:

4 eggs
2 cups milk
1 tablespoon vegetable oil
2 tablespoons honey

This will normally make about 12 pancakes, but you can make them bigger/smaller if need be. If you make these jars for other people, you need to always put a tag on the jar that has the list of the additional ingredients, and maybe the cooking instructions. I know some people that have never made pancakes from scratch, and I know others that would be insulted if I tried to tell them how to make pancakes. It's not a bad idea to list the ingredients IN the jar as well for people who might have allergies. If you are really interested in the mason jar idea, I'm sure you can find plenty of recipes online if you don't want to buy the books.

As for trying to figure out what should be bought and what should be made at home, some things are just no-brainers. I've never had homemade ketchup that suits me like a bottle of Heinz, and I doubt I ever will. The same goes for French's mustard. Usually, for me to make food from scratch, it has to be something that is going to actually be consumed by the kids (sometimes tasting different is not actually a good thing) and/or that I've tried somewhere and thought to myself "I could make this better" and been serious. One particular variety that is hit or miss 100% would be candy. It will be either a glorious confection or a terrible disaster. A particularly successful run of mine has been with chocolate truffles. I have bought them in candy stores multiple times because they are one of the few chocolate candies that I like. As a somewhat picky eater, I believe that everything is better when you can modify the recipe. I also try to use higher quality ingredients when I make truffles because chocolate is one of the places I think you can taste the difference. I also like them because I can use tulip poplar honey instead of the normal corn syrup people use, and you really can taste the difference in the final product. You could also use buckwheat, but sometimes that gives a little more of a strange flavor to the chocolate.

Ingredients

Truffles:

10 ounces bittersweet chocolate, chopped up (I use Ghirardelli)
3 tablespoons unsalted butter
½ cup heavy cream
3 tablespoons dark honey (sometimes light honey burns in it and gives a bitter flavor)
¼ cup brandy (if you want a bit of fruit flavoring, use apple, peach, or strawberry brandy)
½ teaspoon cinnamon
¼ teaspoon cayenne pepper

Truffle Coating:

8 ounces semi-sweet chocolate
½ cup of cocoa powder (for the coating, also Ghirardelli)

Melt the 10 ounces of bittersweet chocolate in a microwaveable bowl that's big enough to accommodate all of the ingredients. Then, simmer the heavy cream with the honey. After it's to a low simmer, pour it on the chocolate and mix it in well. This is also when I add in the cinnamon and the pepper. After the chocolate mix is smooth and creamy, stir in the brandy. Put it in the fridge for about an hour until it solidifies, then use a melon baller or a meat baller and make the spheres. Put those back in the fridge for another 30-40 minutes. In the meantime, I use a chocolate melter (for things like coating cake pops) to liquefy the eight ounces of semisweet chocolate. Alton Brown uses an ice cream scoop to hold the melted chocolate and rolls the chocolate balls in that for the coating, so that's good enough for me too. After they have a nice chocolate coating, roll them in the cocoa powder. I sometimes add a little bit of cinnamon to the chocolate powder, or a little bit of cayenne if I'm feeling frisky. I usually stick them back in the fridge to solidify the coating, but remember when you eat them that they taste better if they're not cold. BC

Miles To Go!

James Simonelli, one of our Medina Beekeepers, attended the MILES meeting and spent the day taking photos. Most of these are his.

We had two forklifts available. Hackenberg Apiaries brought the truck, the hives and their tracked Bobcat for the demonstration, and A & O Forklifts brought one of their machines. The differences are easy to spot...the Bobcat steers with a two handle operation while the other has a traditional steering wheel. The ease of use of the steering wheel enables even inexperienced drivers to be able to work the machine, while it takes a bit of trial and error to get comfortable with the other.

As the truck was being unloaded all of the speakers made comments on how to fold the net when it comes off...NOT inside out, and NOT folded. Lay it out on the ground, fold and fold and fold, roll the ends over and then roll the whole net. That way when it's dark, raining and ugly out at night you only need to unroll the net from the back of the pile of hives. The rolled net is about as wide as the truck, and by unfolding the sides simply fall over, and when you get to the end the net finished by unrolling down the front of the pile. Done right it looks easy...done wrong and you have a mess.

Power washing pallets before loading for California, or using new pallets, is absolutely essential for a smooth transition across the border. No grass, weeds, seeds, insects, or small animals are allowed in except boxes of bees. A delay will result if they find something. And always have a hose on the truck so if stopped you can hose down and cool off the load.

Nearly 100 folks enjoyed the meeting, from all over the country...grad students from Arizona, commercial beekeepers from several states, thinking-about-it bee-

keepers from all over, and just plain interested folks from all corners.

A final demonstration on entombed pollen was given by Davy Hackenberg...showing what it looked like and why you needed to get rid of it...wax covered pollen in cells is contaminated with pesticides and the bees won't eat it, and it takes up room in the brood nest. Scrap it off and discard. It's bad news for you and the bees.

Saturday was cut a bit short by a torrential downpour, so we gathered in the garage and talked some more...but real beekeepers don't stop for the rain... they have to keep on truckin'. BC

BUILD A STANDARD BOTTOM BOARD

Ed **Simon**

Building a bottom board requires some woodworking expertise and a minimal amount of tools and supplies. The "standard" bottom board has a solid bottom and can be made of about any type or thickness of wood. I use a local sign company's scrap wood from their wooden shipping crates for the ¾" wood. All it takes is a honey bear every so often to gain access to a company's scrap pile. The exterior latex paint is from the local recycling center and is free for the taking. The only direct cost is time and screws.

Parts (Thickness x Width x Length)

1. ¾" x 2" x 21⅝" – Side rails (2)
2. ¾" x 2" x 16¼" – Back rail (1)
3. ¾" x 15½" x 21⅝" – Bottom (1) (single or multiple boards)

One 1"x 8"x 8' standard board will supply enough material for one bottom board with a little left over.

Construction

Step 1: Cut a groove ⅜" deep and ¾" wide ¾ inches from the edge of the board for the length of the board. The groove must be wide enough to allow the bottom (part 3) to fit into. I use a router with a ¾" blade.

Step 2: Create the side and back rails by detaching the groove cut in step #1 from the board. Do this by cutting a strip of wood 2" wide which includes the groove cut in step 1.

Note: To make a reversible bottom board, cut the strip 2¼" wide.

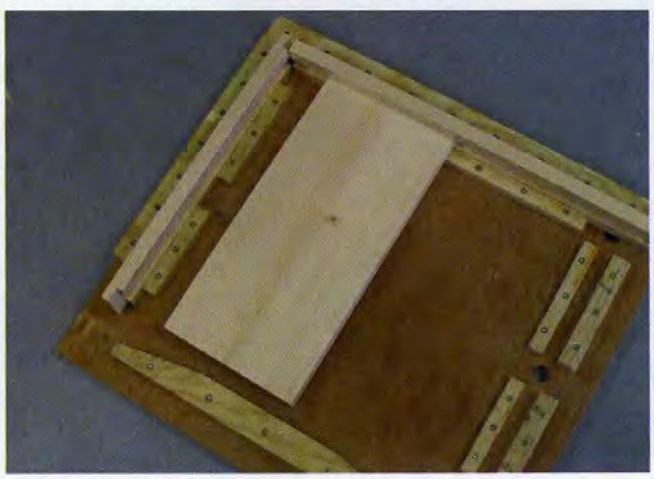
Step 3: Cut the grooved rail created in step #2 into to two 21 ⅝" pieces and one 16 ¼" piece (parts 1 and 2).

Step 4: Remove the edges that form the groove for ¾" from each end of the back rail (part 2). This allows the side rails to fit into the back rail without the groove showing.

Step 5: Create the bottom board (part #3) by cutting the large piece of wood left over from step #2 into 15 ½" lengths. The total width of the pieces should be a minimum of 22". Make sure the cuts are square.

Step 5b: To use a solid plywood base, cut the plywood into a 15 ½" x 21 ⅝" piece. Again make sure the cuts are square.

Step 6: Test fit the back and side rails to the bottom. Then disassemble the bottom board. If you are using multiple pieces of board for the bottom, trim the last piece to the correct width before installing it.



Hint: When using multiple pieces for the bottom, the piece that serves as the landing (front) should be wide enough that no joints are in the exposed landing area. You may need to swap the pieces around to achieve this purpose.

Hint: Bottom pieces may be difficult to slide into the groove. To ease assembly slightly bevel the edges of the boards.

Step 7: Reassemble the bottom board using glue and screws. Be sure the board is square when you finish.

Note: Drilling pilot holes for the screws will help prevent splitting of the rail.

Thought

If you would like to make a bottom board that can be turned over, then increase the width of the cut made in step 2 to 2 ¼". This will allow for a ¾" rise on both sides of the bottom board. You can then flip it over and use the underside when the first side gets unusable.

Not a bad deal, for the cost of one 1" x 8" x 8' board, some screws, glue and paint you have a serviceable bottom board.

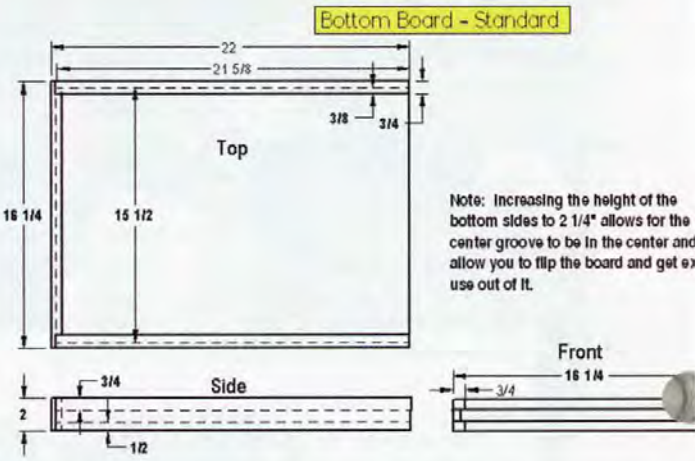
Alternate Standard Bottom Board

Here is an easier way to build a solid bottom board. However, the bottom board built with this method will not be as strong and durable as the one built by the first method.

Parts List – Alternate Standard Bottom Board
1.21 ¼" x ¾" x ¾" – Side rails (4)
2.16 ¼" x ¾" x ¾" – Back rail (2)
3.16 ¼" x 22" x ¾" – Bottom (1) (multiple boards)

Construction

This is an abbreviated step by step instruction since the construction is simpler. Keep in mind when you are assembling the pieces, the board must be square. This method of construction nails the separate top and bottom rails to the bottom, thus eliminating the requirement of cutting a groove in the rails.



Step 1: Cut pieces 1, 2 and 3 from the alternate parts list.

Step 2: Glue and nail the back piece (part 2) to one of the bottom boards. Align the edges.

Step 3: Line up the rest of the bottom boards next to the parts built in step 2.

Step 4: Glue and nail the two top side rails (parts 1) to the boards.

Step 5: Turn the bottom board over, then glue and nail the bottom rails (parts 2 and 1) to the boards.

Step 6: Painting the bottom board is more important with this assembly than the previous assembly because there is more end grain exposed. Make sure you give it two heavy coats of paint to prevent rot.

Notes

This article is the second in a series that will provide instructions on how to build a complete bee hive. Get a copy of Ed Simon's book *Bee Equipment Essentials* with detailed drawings, construction hints and how-to-use instructions for dozens of beekeeping tools and equipment from **www.wicwas.com**. Ed can be contacted through Ed@TheBeeShed.com. BC

Quick Blooming Biennials And Perennials For Bees

Connie **Krochmal**

Some varieties of perennials and biennials bloom the very first year when grown from seed. A number of these are excellent nectar and pollen plants. Quick blooming varieties for bees include some lavenders, purple coneflowers, blanket flowers, and others.

Ballerina Pinkball Sea-Thrift (*Armeria pseudoarmeria*)

Ballerina was named a 2009 Fleuroselect Gold medal winner. Also called sea pink, the species is a very common coastal plant in regions of Europe.

These plants form neat, dense, compact mounds, eight inches tall and almost equally wide. Ballerina features grass-like, medium green, evergreen foliage, an inch wide.

The flowers can be red or white, depending on the variety. The plant is named for the lovely, ball-shaped flower heads, borne on sturdy stems. Flowers begin appearing at least three weeks earlier than those of other sea-thrifts – around 3½ months from the time the seeds are sown. These continue blooming throughout the Summer.

A member of the plumbago or leadwort family, this heat tolerant species is hardy to zone six. It prefers a well drained, moderately rich, light, dry, sandy soil. Sea-thrift adapts to poor soils, salt spray, and drought. Full sun is best.

Soak the seeds in warm water for six to eight hours before planting. In the garden, space Ballerina plants a foot or more apart.

Sea-thrifts are excellent sources of nectar. They can yield surplus honey.

Blanket Flower (*Gaillardia spp.*)

Mesa Yellow blanket flower (*Gaillardia x grandiflora*), hardy to zone five, was named a 2010 All-America Selections winner and a Fleuroselect Gold Medal winner. Noted for its shapely growth habit and upright branching, this reaches slightly over 1½ feet in height with a slightly larger width. The mounding plants are compact.

Compared to similar blanket flowers, Mesa Yellow is fast growing, free flowering, and quick blooming – four months from the time the seeds are planted, which is about three weeks earlier than the others. In subsequent years, it will bloom continuously throughout the Summer. This offers an abundance of gorgeous, large, long lasting flowers in a novel shade of yellow on strong, upright flower stems.

Arizona Sun blanket flower (*Gaillardia aristata*) was named a 2005 All-America Selections winner. Hardy to zone six, the species is native to the Great Plains. Easy to grow, the low, mounding, compact plants are about a foot in height with a matching spread.

This quick flowering variety is noted for the large, three-inch-wide, starry flowers composed of mahogany red centers surrounded by yellow tipped petals. Blooms emerge throughout the Summer.

The drought tolerant blanket flowers thrive in full sun. These adapt to any well drained soil – even poor ones. While most other blanket flowers prefer hot, dry situations, Mesa Yellow also tolerates cool moist conditions.

Space blanket flowers about 1¼ feet apart. When planting seeds, leave them uncovered. These plants need little fertilizer.

Bees are very fond of blanket flowers, which yield nectar and pollen over a long period. They're major nectar plants in some regions. Surplus honey can result. Considered good quality, this can be yellow to dark amber.

Flamenco Red Hot Poker (*Kniphofia uvaria*)

A member of the lily family, this quick flowering perennial was named an All-America Selections winner. Hardy to zone five, the plants reach three feet in height with a matching spread. The long, narrow, blade-like foliage resembles grass.

This variety blooms four weeks earlier than other red hot pokers – in early to mid-Summer. Flamenco is noted for the early flowering, vivid blooms on tall, stately, thick stems, 2½ feet tall. The long, tubular blossoms are beautifully layered all along the length of the flower spikes. The flower colors include red, creamy white, yellow, or orange.

When planting, leave Flamenco seeds uncovered as they need some light to germinate. If planting early indoors, sow them in peat pots so the roots won't suffer damage during transplanting.

Dianthus.

Gallardia.

Plant red hot pokers about 1½ to two feet apart in the garden. They prefer a sunny spot with moist, rich, well drained soil. Unbothered by pests, these are tolerant of heat and humidity. A long-time favorite, this evergreen perennial is more floriferous if watered during hot dry spells.

Red hot poker blossoms are a favorite of bees. These plants are rich in nectar and pollen. The nectar is so plentiful that it drips onto the stems and makes the blossoms sticky to the touch.

Indian Summer Black Eyed Susan

(*Rudbeckia spp.)*

This variety of the ever-popular black eyed Susan is hardy to zone five. It was chosen as an All-America Selections and Fleuroselect winner. Indian Summer black eyed Susan reaches three to four feet in height with a two foot spread.

These vigorous, branching plants feature sturdy stems bearing golden yellow blossoms with slightly darker shading towards the center. The cones are chocolate brown. The large flowers are six to seven inches across.

Indian Summer black eyed Susan begins blooming about 3½-4 months from seed sowing. The following year, flowering will extend from mid-Summer into Fall.

Black eyed Susans are tolerant of most soils, even poor dry ones. However, they do best in a well drained, rich, moist spot. Adapted to full sun and partial shade, these heat-loving plants require minimal care. Space the plants one to two feet apart in the bee garden.

The black eyed Susans are major nectar and pollen plants in the Northeast, Southeast, and North Central U.S.

Lavender (*Lavandula spp.*)

A number of lavenders are quick blooming. **Lavender Lady** is a very reliable, early flowering variety. This has remained popular since 1994 when it was named an All-America Selections winner. Bred by Burpee, it is one to 1½ feet in height with an equal spread. Forming a compact mound, Lavender Lady can be grown in pots and confined spaces. The dense, attractive, frosty-toned, grayish-green foliage is lovely year-round. The plant survives Winters in zone five if provided with mulch and given a sheltered location.

Blooming heavily the first year, Lavender Lady blossoms begin opening about three months from planting time. It bears masses of lavender to deep violet, short, plump flowers on tall flower spikes.

There are several new early-blooming English lavenders (*Lavandula angustifolia*), hardy to zone five. These include **Ellagance Sky,** a 2006 Fleuroselect Gold medal winner. This improved variety of Munstead is early blooming and uniform. Quite stunning, the plant reaches 14 inches in height with a bushy, well branched, neat growth habit. The large, richly colored blossoms open on strong stems. This is the very first light violet-blue lavender that blooms the first year from seed.

Ellagance Purple, also a Fleuroselect Gold Medal winner, outperformed other lavender varieties in plant trials around the country. The free flowering, very reliable, bushy, uniform plants, about 2½ feet tall, are well branched and compact with greenish-gray, oblong foliage.

Holding their color well, the blooms are a vivid, intense, deep purple or purple-blue shade unlike that of other lavenders. Early to bloom, Ellagance Purple features large, lush, dense flower spikes throughout the Summer into Fall.

When sowing lavender seeds, leave these uncovered. An alkaline to neutral, rich, light, sandy, well drained soil is best. Space the plants about one to 1½ feet apart in the garden. These need full sun.

Bees love lavender blossoms, which yield lots of nectar. The flowers are also sources of pollen. Lavenders are major honey plants in some areas of Europe. These can provide a surplus honey crop of at least 45 pounds per colony.

Considered a premium herbal honey, this has a unique, pleasing flavor, usually mild but sometimes stronger. The mild aroma is similar to that of the plant. Varying widely in color, the honey can be white, gold, yellow, or any shade of amber. Often granulating, it becomes smooth and buttery with fine grains.

Pinks and Sweet Williams

(*Dianthus spp.*)

Some of the pinks and Sweet William varieties will bloom the first year. These are easy to grow. One that I particularly like is **Dianthus Supra Purple,** a 2006 All-America

Selections winner. The reliable, easy to grow, trouble-free plants are about a foot tall. It has attractive, evergreen, linear, grass-like foliage.

This variety bears masses of cheerful exquisite blooms with dainty, purplish-pink, lacy, fringed petals. One-half-inch wide, the blossoms are borne in clusters on tall, upright stems. These start emerging about 2½ to three months from the time the seeds are sown. They continue blooming sporadically throughout the season.

Dianthus Supra Purple has much to offer for it is heat tolerant and reliable. Although this is typically grown as an annual, mine survive Winters and behave as short-lived perennials.

Noverna Purple Dianthus *(Dianthus barbatus)* was named a Fleuroselect winner. Hardy to zone five, these upright, quick blooming biennials are 1½ feet in height. They begin flowering about 80 days from the time the seeds are sown and continue until Fall. This variety features large, lush, Sweet William-type blooms in a striking pinkish-purple.

Dianthus Hollandia Mix *(Dianthus barbatus)* is another type of quick blooming Sweet William. Hardy to zone five, Hollandia plants can reach 2½ feet in height. The sweetly scented blossoms in assorted colors can be bicolored, pink, red, purple, or white. These open about the same time as those of Noverna Purple Dianthus.

The quick blooming Amazon Neon Dianthus is similar to the Sweet Williams. Hardy to zone five, they're three feet tall and a foot wide. The very large, vividly colored flower heads are held beautifully against the deep green foliage. The bold blossoms appear on sturdy, thick flower stems with five to seven stems per plant. The flower color varies according to the variety.

Amazon Neon Cherry has bright red blossoms, while Neon Purple is violet-purple. Rose Magic has unique blooms that open white, gradually changing to pink and finally to deep rose. A flower head can display all shades at the same time.

All of the Dianthus plants prefer some afternoon shade in hot climates and full sun elsewhere. The soil should be slightly alkaline for pinks and sweet Williams dislike acid soils. A reasonably rich, moist, sandy, well drained spot is best. Space the plants about 1½ feet apart in the garden.

All of these pinks and sweet Williams are sources of nectar. Occasionally, there is a honey surplus.

Purple Cone Flowers (*Echinacea purpurea*)

Several of the purple coneflower varieties will bloom the first year the seeds are sown. I had especially good results with **Powwow Wild Berry**, an All-America Selections winner. Easy to grow, it is hardy to zone three. From 1½ to two feet in height and nearly 1½ feet across, the extensively branched plants are reliable and uniform.

Truly floriferous and living up to its name, Powwow Wild Berry bears lush flowers, up to four inches across. They open on tall, straight, robust flower stems, two feet in height. The blossoms are deeply intense rose-purple with vibrant golden brown centers.

Lavender Lady.

Other quick blooming purple coneflowers include **Cheyenne Spirit**, named a 2011 Fleuroselect winner. Hardy to zone four, these durable, reliable plants have a uniform growth habit. Upright and bushy, they're two feet in height and equally wide.

The exquisite blooms, up to 3½ inches across, display novel colors that include rosy red, cream, gold, purple, scarlet, orange, and yellow. They open over an extended period throughout the Summer into Fall.

Purple coneflowers are adapted to full sun and partial shade. Easy to grow, these are drought tolerant plants. They prefer deep, rich, well drained soil. The plants can be two feet across, so give them plenty of space in the garden. No deadheading is needed until after the goldfinches and other birds have eaten the thistle-like seeds.

I chill purple coneflower seeds for several weeks before planting them as this typically aids germination. An alternative is to direct sow them in the garden in the Fall so they'll be exposed to Winter chills. Cover the seeds to a depth four times their thickness.

The purple coneflowers are sources of nectar and pollen. Sometimes, there is a honey surplus. BC

Connie Krochmal is a writer and beekeeper in Black Mountain, NC.

Apistan, a Renewed Product. Few conventional chemistries are immune to the potential for resistance development. Resistance develops by selecting out the individuals that are susceptible to the agent leaving the more tolerant individuals to reproduce. Eventually, the entire population becomes tolerant to the control agent. Resistance development can be contained or possibly eliminated by proper management of mite control tools. An integrated approach is an option to stave off the resistance quagmire. In an integrated program other tools are used in conjunction with traditional mite control materials. The most important tool when managing resistance is to rotate mite control agents that have different modes of action Apistan® being one of those agents. Successful IPM Varroa control involves all tools necessary, including avoidance, traps and chemical controls. It is important to monitor hives periodically for mite infestations as part of good management practices. Apistan® will ensure proper control and will reduce the risk of tolerance development within mite populations when used in an IPM program.

I'll Have 'Take-Out,' Please

Ann **Harman**

Beekeeper meetings come in all sizes: local clubs (S), state associations (M), regional (L) and national (XL). The international one is Apimondia (XXL). Who attends these meetings? Beekeepers of all levels of experience and knowledge. But not all beekeepers attend meetings.

The beekeeper associations follow a pattern of meetings. The local clubs have many meetings a year – anywhere from about six to twelve. State associations tend to have one or two per year. These may be a one-day or a two-day meeting, with or without workshops and/or fieldwork with hives. The three regional ones – Eastern Apicultural Society (EAS), Heartland Apicultural Society (HAS), and Western Apicultural Society (WAS) have one multi-day conference a year with many activities. The two main yearly national meetings, the American Beekeeping Federation (ABF) and the American Honey Producers Association (AHPA), are multi-day with concurrent presentations and a number of breakout sessions. Apimondia is also multi-day with a number of concurrent sessions in specialized divisions.

One group seems to be underrepresented at larger meetings – those who have just started beekeeping. This group seems happy with their local association meetings. These beginners may have taken classes and had a mentor from their local club. Therefore, they feel comfortable at those meetings. Questions that they might ask do not seem so 'stupid' since other members of their class are in the audience, perhaps with the same question.

The local association meetings generally rely on speakers from within that association. From time to time an invited speaker will be on the program. Depending on the club's treasury that speaker may be from a close-by local club or from another club an affordable distance away. Those clubs close to bee research labs, whether a university or even the USDA labs, have an excellent close-by source of speakers. However presentations from these scientists might not be the best choice.

The local associations tend to focus on seasonal activities –swarming in Spring, preparing for Winter. Some clubs have various activities, such as an extracting-honey-day, picnics – sometimes with open-hive demonstrations – and workshops on making candles or soaps. Some states have a state apiarist or inspection service so local clubs may have a meeting to give disease recognition and information on treatments for diseases and pests.

One topic that seems to be the most popular today is raising queens. Experienced club members are frequently asked to give presentations, demonstrations and open-hive work. In some cases an invited speaker may be asked to give an all-day workshop on the various ways to raise queens. Club members can try their hand at grafting larvae into queen cups.

So we can see that local associations are giving their members timely management information (prevent swarming), the opportunity to learn a new craft (beeswax candles, mead), and try their hand at various beekeeping activities (extracting, queen rearing).

Now the beekeepers, newbees or experienced, can go home and practice their newly-discovered skills. That is what they want. Take-home information. Practical and useful.

State association meeting programs can vary widely depending on how many per year and the season for them. State association treasuries are generally larger than those of local associations, but not necessarily. State associations can charge a registration fee to cover the expenses of the meeting venue and those of invited speakers.

The main speaker, or speakers, is frequently drawn from the scientists at universities or the USDA laboratories. The venue may be suitable for workshops and open-hive work may be possible. Those beekeepers who read the two beekeeping journals have favorite authors that are very frequently asked to be speakers. Beekeepers, local to the state, with special skills, such as making creamed honey, cosmetics from honey and wax, or mead may be giving workshops. So even if some of the presentations are not of great interest, others will be appreciated. Although the newbees are not usually familiar with the majority of these speakers, newbees may attend the state meeting for other reasons: venue close to home, a way to learn something new, or their mentors invited them and offered carpooling.

Although invited speakers may come from far away, usually state meetings offer their beekeepers information suitable for that state. In addition, because some of the speakers are local, at least within the state, those beekeepers can be contacted with questions or comments – a sharing of information that is critical to keeping bees healthy. Here again – information and skills to take home. Useful, yes, but beekeepers might have to wait for the appropriate season to apply the information.

The regional meetings (EAS, HAS and WAS) will have speakers from around the U.S. and at times even invited international ones. The regional conference may open with an invited keynote speaker who may

not be a beekeeper but someone in a relevant field, such as agriculture. Since the regional meetings are multi-day a wide variety of topics can be presented. Depending on the venue and time of year, open-hive work can be scheduled. Workshops, with and without demonstrations, are a popular format. Concurrent sessions provide something for both the newbees and the experienced beekeepers.

Evening socials, such as picnics, are popular with regional conferences. These socials give beekeepers from different parts of the area a chance to talk informally and share bee problems and silly swarm-catching stories. The socials also provide a chance for the beekeepers to chat with the speakers. The beekeepers value that opportunity since it is a way for them to clarify some of the information presented. Perhaps more take-home information is exchanged during the socials than at the lectures. Beekeepers always are thinking of and trying a better way – to stop swarming, to feed colonies, to requeen, and to keep their bees alive and well.

Beekeepers will find more vendors at regional meetings than at state meetings. Certainly the large equipment suppliers will have a big display and sometimes special prices on certain items. Beekeepers can certainly see new equipment and discuss its merits and usefulness. Small companies and those with specialized items will also attend the regional conferences. The vendor area is always crowded with both lookers and buyers making this aspect of regional meetings one of the more important events. A common sight is a stack of woodenware or an extractor being wheeled out on a cart to the beekeeper's truck. In its own way the vendor area provides a take-home experience.

The two national meetings are held in the first part of January each year, a quiet time for beekeeping. Although some may think that these two, ABF and the AHPA are only for large commercial beekeepers, that is not their purpose. These multi-day conferences are for all beekeepers. The programs of both of these associations are changing and expanding in order to reach the growing number of newbees who own just a few hives.

In general both national associations feature several scientists as principal speakers. Other speakers will be recruited from specialists, both local and national, to give workshops or presentations at breakout sessions. Beekeepers of all types, from newbees to experienced commercials, should review the programs of the national meetings to consider attending. Expense is a consideration since these conferences are held in hotel conference centers. Transportation to them from far away also adds to the costs.

If beekeepers were hoping for open-hive work at the national conferences they may be disappointed because of the time of year. Trips away from the meeting venue will be scheduled to provide a social time for sharing information with beekeepers from across the country.

The vendor areas are huge and accommodate displays of large equipment. However, mixed in with those will be small local suppliers offering a wide variety of bee-related items. So the vendor displays are similar to those at the regional meetings. Since these conferences are held at the beginning of the year, new equipment is frequently featured – definitely providing take-home information. New improved designs in veils and beekeeper clothes can be examined; new shapes of hive tools keep appearing; new ways of combating small hive beetles are demonstrated. The time spent in the vendor area is considered valuable for practical information.

Let's stop for a few minutes and see what is happening in bee science. Biology today is light-years ahead of what it was just a few years ago. Most people who had to take high school biology probably remember a few things from the course – perhaps dissecting a smelly frog (and wondering what it had to do with reality) and how to spell photosynthesis. Today biology is different – it is the world of Molecular Biology and Genomics – both with their own special language.

Unfortunately some of the research scientists, when asked to speak at a state, regional or national meeting unearth a presentation given to other bee scientists and, speaking that special language, present it to beekeepers. It is a powerful Power Point with slides filled with graphs – purple lines intersecting with yellow and red ones, towering or squat bars in blue and yellow. You do not have to attend the presentation to know that it simply flew over the heads of the attendees. All you have to do is watch them exiting the auditorium with a glazed, puzzled look. Walk behind them and listen to their comments. 'I didn't understand a word of it' seems to be the most popular comment.

However, there are those researchers who can take their scientific information and present an interpretation to beekeepers. Here is useful material perhaps giving a better understanding of honey bee problems and what is being done that helps beekeepers.

So what **do** beekeepers want? For whatever reason, open-hive work may top the list of favorites. Just 'messing about in hives' is fun. Yes, beekeepers inspect their own hives but the allure of someone else's hives holds fascination. For some, especially at state and regional meetings, the opportunity to buy equipment from vendors is important; those purchases save shipping costs and beekeepers are notorious penny-pinchers. A common-sense speaker, heard a few years before, is a definite draw. But above all else the beekeepers want 'take-home' information that can be put into use in the real world of their bees. BC

Ann Harman organizes and attends meetings all over the world and close to her home in Flint Hill, Virginia.

DOWNTOWN

What To Do When Things Go South

Urban Beekeeping Bolt-Holes

Mother nature and human nature can collaborate beautifully, but the random is the rule whether you are downtown or in a rural area. In the country, there is usually a bit more space around your bees, and therefore larger physical margins for error should your beekeeping situation suddenly change. In any North American city today, there are beehives tucked onto much smaller rooftops, porches, backyards, garages, and more: an inspiring and reassuring demonstration that green living belongs everywhere. In just ten years and in just one city, however, we have seen super storms, earthquakes, structural fires, building rehabs, condo conversions, neighbor meltdowns, landlord transitions, zoning changes, and high water threaten beekeeping sites. If you have less than a quarter acre to play with, where do you go?

There is also a lot to be said for an out yard when you need one: say you need to make a quick split or hive a swarm, and you don't have space or want to ensure success by placing it a couple of miles away. Or maybe you are getting a new roof next week, but your bees are welcome back after that. We also find it handy to have some space when deconstructing a bee tree, which is hard to manage on a sidewalk or in a public park. Having good options means making better choices for your bees.

Urban beekeeper peace of mind may come in the form of pre-arranged bolt holes: bee friendly locations or arrangements where you can temporarily place a colony or two while you find your long term apiary. If you are a go-it-alone beekeeper, this is an extraordinary feat to pull off in the middle of storm prep, a landlord ultimatum, a contractor deadline or threatened litigation. If you already participate in a club or a network, you have probably already taken the first few steps. If autumn and winter are quieter times for your beekeeping projects, this might be a great moment to make this kind of friend.

Ongoing and Strategic Preserves

Here in Washington, we have two major refuges: a large religious facility and a cemetery, each with many acres of space, decades of community connection, and ideals that prioritize the long term future. If we looked farther afield, we could probably locate additional community gardens, wildlife preserves, green space set asides, and even empty sites under city ownership that would work really well.

But ongoing access means an ongoing relationship and friendship – not a sudden phone call from out of the blue – and these ties need attention on both sides and some serious tending. Therefore it pays to choose key locations, and to take care of your choices.

In the case of the religious institution, the DC Beekeepers were lucky enough to be called in, and to learn about all this the easy way. Religious orders of all kinds have a long, beautiful history in beekeeping (the bees inspire the best in all of us) and in this case, the gardens needed some pollinator support. Not enough figs and pomegranates in the Bible Garden! From the beginning, we partnered with the garden volunteers to meet their goals – more vibrant gardens, honey bee education workshops, community programs, honey sales – and they have been our mainstay for beekeeper emergencies and opportunity for eight years.

Key components of making this work include:

- Understanding how the site is already used, and making sure the bees do not interfere;
- Identifying contributions which additional bees may make to existing site goals and programs;
- Asking for what you need, like after hours access or permission to build hive stands, before you face a crisis;
- Working out, ahead of time, permitted and forbidden activities;
- Having good contact information on both sides should a problem arise;
- Checking in frequently to ensure that no unforeseen difficulties are developing; and

Interestingly, Historic Congressional Cemetery's population of gravesites is about the same as the average number of bees in the hives there.

- Taking meticulous care of any bees on site, permanently or temporarily.

In year one, we were just getting to know each other, so it was a time of giving workshops, attending garden guild meetings, volunteering for the Spring fundraiser. By Year Three, we were holding community honey harvests in the main building. By Year Eight, we had enough trust that we were able to use the facility as a staging area for the arrival of 20 nucs into DC, bees that eventually went to universities, individual beekeepers, a queen rearing program, a food bank . . . and the Cemetery.

The Cemetery is new this year, but many of our beekeepers had been dog walkers (the grounds are maintained with dog walker fees), docents, and garden volunteers there since the 1990s. This time, with relevant collaborative experience behind us, we made the call and were welcomed. We are still in the workshop-and-honey sale phase, but our new partners want even more already. And one beekeeper with a new baby and a wife who wants him off the roof has moved in.

Bee-Sitting Partners

If you are not into institutional relationships, maybe cutting a deal with another beekeeper across town is one way to go. On many of the commercial buildings around here, green roof conversions take place from time to time, and usually the contractor asks that the bees be removed for the duration. But green roofs are terrific for bees, and it would be a pity to lose a prime downtown apiary location to a permanent move. In a case like this, it might help to have a bee-sitter.

Finding a bee-sitter means finding someone with room in their apiary about three miles away – in a best-case scenario. Admittedly, this means signing up for two hive moves – one off site, one back – but you should have at least two beekeepers involved (maybe more if you ask around) and both of you know that someone has your back on that inevitable day when things don't go according to plan.

Helpful things to do in advance include:

- Joint site visits to both apiaries to work out hive locations and access issues;
- Comparing beekeeping philosophies to identify potential deal breakers in advance (i.e. Obvious bee health issues? Robbing screens appropriate? Use of chemicals on site?);
- Setting clear time lines for move-on and move-off; and
- Communication details and expectations for the duration.

Out of Town Buddies

While we are proud to be urban beekeepers, the truth is that our suburban and rural buddies tend to have a lot more space, and legal leeway. In fact, many of us probably learned beekeeping at a suburban club, and already owe these colleagues a profound debt of gratitude. But let's not let that good deed go unpunished! Let's keep those contacts going in case either one of us gets into a jam.

Beekeepers here are integrated into a regional network of people who recognize that population density is only increasing, and our permission to keep bees downtown is a useful fact to which out-of-town beeks can point when local zoning gurus attempt to reign in their apiaries. And plus, our suburban buddies are awesome.

Not long ago, we had a completely legal beekeeper here run into a weenie-esque conflict with a neighbor. Despite conscientious beekeeping practices, a truly cool hive placement, and numerous attempts to remediate, it was move the bees or face a lawsuit. Even if you win, you lose in a situation like that.

For a long time, we downtown types have had more experienced outside beekeepers on speed dial. For some reason, they keep taking our calls. Pat Haskell, an EAS Master Beekeeper in Northern Virginia, offered a temporary hive placement 90 miles out of town to my buddy Karl. Another beekeeper here in town helped Karl move the hive. The Cemetery offered a new downtown placement come spring.

It doesn't take a village; it takes a Standard Metropolitan Statistical Area.

Emergency Collaborations

When we teach hive siting here, we always mention that the bees can end up in a less-than-perfect location because people have to come first in the city. This means, in some cities, beehives end up in places that can be socked by high winds, flooded by high water, or in the lee of a fire threat.

Clearly, different cities have different vulnerabilities to this kind of thing. In DC, we think about hurricanes. In the Midwest, it is probably wind. Wildfires might frighten SoCal beeks. If you know that many hives in your town are in precarious locations, it might help to set up temporary mass refuges. I know, *I know*, but it can work.

This is a place where a club is essential: a group who can approach

the owner of a parking lot or an empty field with an organizational track record and an insurance policy in hand. It might also help to reference recent media on the plight of bees and to mention knowledge of local members of the press who would be, well, impressed with such green-mindedness.

If your downtown club has never thought about emergencies, you might want to just kick this one around a little. All beekeeping is local, and all locales have a different mix of risk and reward. If you ever need a refuge, however, having worked on this in advance can save dozens of hives.

If you decide to think about this, first steps to consider include:

- Identifying likely scenarios, and likely safe havens;
- Making sure that someone is watching the horizon, and has a pre-existing channel of communication when the clouds gather;
- Letting members know that such a program is in place, and giving them contact info should they identify the need; and
- Setting participant expectations: if a beek wants in, can they contribute cash for insurance, volunteer hours for set up, vehicles to move hives, help to other beekeepers in trouble?

And there must be a dozen more. This one is not easy.

Common Themes

In almost any field, study after study indicates that choices made in haste and under pressure are of lower quality and enjoy more meager results than those made with time and consideration. One great way to benefit from almost infinite time is to build healthy long term relationships with strategic partners who can offer you and your fellow downtown beeks a safe harbor for a day, for a season, or potentially forever.

Your partner could be a park, a community institution, or just one person on the other side of town or a few miles out. There's a price to be paid, like communicating early and often, and probably forking over a bunch of honey. But I really enjoy the ability to sleep at night, regardless of the forecast, and I bet you would, too. BC

The Franciscan monastery of the Holy Land is as committed to connecting DC residents with the beauty of green spaces as our local beekeepers.

Toni Burnham keeps bees on rooftops in the Washington, DC ara whee she lives.

GLEANINGS

NOVEMBER, 2013 • ALL THE NEWS THAT FITS

OBITUARY

Many of you are already aware that Jim passed away quietly in his sleep August 30th.

Jim was the Washington State Apiarist for more than 25 years, then worked in the Pesticide Investigation Section at WSDA until his retirement in 2005. Since then he has remained active in the beekeeping industry he loved so much -- running his own bees, acting as mentor and teacher anywhere he was needed, providing a website where beekeepers could ask questions, inspecting colonies going into certified seed pollination projects in Washington, Montana and North Dakota, and serving on the board of both WSBA (secretary) and the Western Apicultural Society (treasurer). His commitment to the industry was absolute.

The suddenness of Jim's passing has hit all of us hard, both family and friends, and it will be a while until the world comes right side up again. Despite that, he would want no long faces and so I encourage you all to honor his memory by your cooperative efforts to better the industry. Some of you have asked if there is a charity you can donate to in his name. The charity of his choice would be beekeeping. There are programs needing funding that can benefit everyone. Any of them would be a fitting beneficiary of those gifts. A lot is happening right now and funding will be vital. Think about it.

The kindness of the entire beekeeping community, the cards, emails, calls and memories you have shared have been a wonderful tribute to my husband. I appreciate it and so would he. On behalf of myself and our family, thank you.

Fran Bach

KIWI BEE SECTOR WINS BIG RESEARCH GRANT

New Zealand's beekeeping industry has won a six-year NZ$7,200,000 (US$6.03-million) research grant to boost a sector under siege from *Varroa*.

The NZ Institute for Plant & Food Research will use the government grant to develop new ways of delivering pollination services, including increasing populations of unmanaged pollinators, managing wild bumblebees for pollination, and improving honey bee performance by manipulating their behavior.

The aim is to give growers increased yields and reduced costs and generate more than NZ$219 million a year in benefits by 2029.

The research project, called From Bee Minus to Bee Plus and Beyond, was developed because while export revenue generated by New Zealand insect-pollination dependent industries is worth more than NZ$5 billion (US$4.2 billion) a year, the continued reliance on managed honey bees constrains further growth of the export earnings of these industries.

"Honey bees are under increasing threat from *Varroa*, which will increase pollination costs and may restrict the availability of strong hives for pollination," the institute says.

"Honey bees are also less efficient pollinators compared to other species for many crops, limiting potential crop yields. Insect-pollination dependent industries need new solutions if they are to improve their competitive advantage."

Going from "Bee Minus" – where the over-reliance on honey bees places industries at risk, the institute says, to "Bee Plus and Beyond" – the future state of enhanced yields through the use of a diversity of highly effective pollinators, will require a radical change in pollination systems to ensure future growth in NZ's productive sectors.

Alan Harman

GIVE FIVE FOR THE HIVE, A SUCCESS

From left – Jack Thomas, Marla Spivak and Betty Thomas.

Mann Lake presented a check on July 12, 2013 to the University of Minnesota's Dr. Marla Spivak as part of the Minnesota Honey Producers annual meeting held in Walker & Hackensack MN.

Mann Lake is a longtime supporter of Dr. Marla Spivak and the University of Minnesota's Bee Lab, primarily through donations of beekeeping equipment and supplies. This year Mann Lake increased their efforts and launched a new program aimed at enlisting broader support for the bee research. The Give Five for the Hive program donates $5.00 for every beekeeping kit sold this year to the University of Minnesota Bee Research and Discovery Center. The $10,000.00 gift represents the first six months of the yearlong promotion.

Mann Lake had the goal of raising money and awareness for the important research being done at the University of Minnesota. The project is highlighted in the Mann Lake catalogue and their website. "By tying our support of the Bee Research and Discovery Center to the sale of new hive kits we can involve the whole beekeeping community in supporting honeybee research," said Thomas.

About Mann Lake Ltd.

Jack and Betty Thomas started Mann Lake in 1983 because they couldn't find the quality beekeeping supplies they needed for their own beekeeping hobby. They began selling supplies out of their garage on Mann Lake, but quickly found a lot of others who were underserved as well. Realizing the need was bigger than their garage they moved the business from their home to the city of Hackensack. Since then, buildings have gone up in Minnesota and California as the company has grown.

We're an ESOP (Employee Stock Ownership Plan) company and 100% employee owned. As owners of our growing company we know that if we don't serve you, we not only won't have a job, we won't have a company. That's why we do our best to exceed your expectations for quality and service. We consider it our job to make your life as a beekeeper better and if you can think of ways we can do that, please let us know!

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Migratory beekeeping done right was the theme and the show at Bee Culture's *Miles To Go Conference held in October. Read and see more on Pages 12, 15 and 71.* Photo by James Simonelli. *Davey Hackenberg explains why entombed pollen has to go.*

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Of a dreamy Summer's afternoon I labored 'midst my little darlings. Here at my remote Colorado Flat Tops apiary, on private property, behind a locked gate, an hour from home, I felt like I might be the last person on Earth. So I was surprised when my gal Marilyn came roaring up in her little Saturn.

"Some truck driver named Johnny says he's up in Aspen picking up shipments, and he's coming down our way to get your honeybee pollen – like in three or four hours. I can't get cell service up here. You'd better get home!"

"No way!" I said. "The pollen isn't even packed for shipment. I can't do it. Not on four hours notice. What are they thinking?"

"You can do it! Just head home and get on it!"

Marilyn chuckled. "When I told him you don't have a cell phone, he wasn't pleased. He said, 'Lady, this is a modern operation!'"

Back in civilization, I called Johnny. After a few rings, a voice boomed into the receiver – "Yeah!"

I explained my plight but ventured that I might be able to get my 700 pounds of product boxed and ready for shipment that afternoon. I still needed to buy tape. I had boxes to assemble, pollen to weigh. But I knew my new buyer was keen to take possession.

First Johnny wanted to know if the load would be "palletized."

When I asked what size pallet he required, he shouted, "What size? Standard shipping pallet! Forty by 48! I've got 17 on board. I suppose I could give you one."

My hearing is not so great, but he was so loud, it sounded like he was inside my ear.

"You got shrink wrap, right?" he continued.

I said, "Johnny, this is not an industrial outlet. I'm just a guy with some pollen in his freezer. We're talking about fewer than 20 boxes."

Then the kicker: I said, "I'll give you directions to my place. What time do you think you'll be here?"

He said, "Sir, this here's a tractor trailer, and we don't assume no liability. We don't go down nobody's drive."

"It's an easy driveway, and I'm close to the Interstate," I countered.

"Company policy. And I'm on a schedule. I gotta pick up peaches in Palisade."

"How about the entrance to McDonald's in New Castle?" I said. "Semis park there all the time. You could call me when you leave Glenwood."

"Yes sir!" he screamed into my ear. We had a rendezvous.

The post office didn't have packing tape for sale, but the grocery store did. The cardboard shipping boxes went together pretty quickly. Then they didn't seem quite sturdy enough, so I taped them again.

I had the pollen stored in 3 mil plastic bags, which were supposed to fit inside the boxes, and they did, but the weak link was the bags. I had some blowouts until I figured out I needed to impose a 40-pound limit. So I scooped from one bag to another, until none was too full. I tried to keep meticulous records, but of course I forgot to record one box, and I wound up searching and counting, again and again.

All this time the clock was running. I thought, "If I don't finish by the time Johnny calls, I can always send the leftovers with the next shipment." I asked myself if I might be crazy trying to get this done, because when I hurry, I always seem to regret it. But he was running an hour late when he called, and I had the flatbed packed and ready.

I was parked in front of McDonald's when Johnny showed up. He might have been 50 or 55, all tattooed up with cartoon characters like Donald Duck and Woody Woodpecker. His T-shirt had a big ol' horned toad riding a motorcycle on it. Underneath it read, "Horny Toad Harley Davidson, Temple, Texas." Johnny was a talker. And he was in a hurry.

His monster-tattooed partner was more the sullen one, and mostly he was in the way. Whenever he tried to help, it was wrong, according to Johnny. My shipment got loaded in no time.

Johnny said, "Long day. There's nuthin' in this sorry excuse for a town. We're gonna find us a motel in Rifle. He flashed me a rotten-toothed leer. I might want . . .

And here, gentle reader, I must spare you. Children could read this! But let your imagination run. Yes, that's exactly what he said!

"You might have to go Junction for that," I laughed.

"Junction? That town's full of drug addicts!" This was news to me. I guess it depends on the crowd you run with.

Finally I said, "I thought you were in a big hurry. You said you had peaches to load in Palisade!"

"Oh, that," he said. "That's tomorrow afternoon. We're gonna party tonight and sleep in tomorrow."

As they pulled away, I sighed and counted my blessings. Got 'er done!

Ed **Colby**

Get 'er Done!