BEST POLLINATION MANAGEMENT

Mar 2011

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Although much of the U.S. was covered in snow at one time or another this year, this ground cover is the sweetness of almond blossom petals, as the biggest honey bee pollinated crop in the world approaches the final petal fall. The rest of the season and the success of the crop depends on nut set, and quite simply, nut set depends on bees and the weather. But almonds are only the beginning of the pollination season...check out the Pollination Best Management Practices article this month because what bees and blossoms both need is becoming more and more important in food production everywhere. (Photo by Christi Heintz, Project Apis m.)

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Bee Culture

FEATURES . . .

DEPARTMENTS & COLUMNS

Science Of Bee Culture

Vol. 3 No. 1 - Center Section

Bottom Board Cover

While reading in the 34th edition of *ABC & XYZ of Bee Culture* regarding buildings at remote apiary, I found the following paragraph on page 29.

"Other items which might be left in the beeyard are excluders, bee escapes where they are used, pallets for loading and moving supers and bottom boards and covers. Many beekeepers are switching to a combination bottom board and cover which will serve as either and means fewer 'extras' must be kept available."

I haven't seen this in any of the beekeeper supply catalogs, so I built my version – a migratory cover with a 7/8" high stop on the sides and back.

This one piece of equipment does many things. It can be used any place the cover or bottom board would normally be used plus all the other places – covering supers removed from the hives, protecting stored hives, etc. It also works great for dividing a two-story hive into a two-colony hive.

Best of all, it is so simple to make!!!

Walt Dahlgren
Jamestown, NY

Shipping Woes

I was just going thru some old *Bee Culture* magazines and reread your article on shipping. I currently ship queens and packages thru UPS and have the same problems with the customer receiving the bees on time and in good shape. Currently I loose about 5% due to lost packages and late deliveries. I try to ship by second day air and now tell customers that the bees are not insured. I have shipped with UPS for five years because they are the only game in town that will consider handling bees. Even so, I must have two layers of hardware screen with a gap between them to help reduce the possibility that the bees might escape and sting someone. I wish you luck with your shipping.

Tess Arnold
Knoxville, TN

Certified Honey

I applaud the efforts of those who would protect our bees and beekeepers. They need all the help they can get.

There a couple of points I would like to bring up. One is that the article neglected to mention that illegally imported honey can also bring new diseases to our already endangered bees. If a country is willing to ship products here illegally, they obviously do not police such things in their own country. All it would take is for one person to throw away some of that honey and some of our bees to find it. Is that not how most of the current crop of diseases got started here?

The other is that our government has dropped the requirement that a package state the country of origin. Just look at the products in your local grocery store. Many no longer give the country of origin, even when made here in this country. And further, it is no longer required that the exact ingredients of any product be listed on the label. You will not find any product that admits to using lard from hogs in the product. Yet they put on the label, 'animal shortening' which COULD be beef drippings or butter. But since those are more expensive, most manufacturers use the cheaper hog lard and try to put one over on their customers by changing the name. A person has to contact the company to learn exactly what is in a product.

I hope this is helpful.

Ray Norton

Letter To BBKA

Since 2001, the British Bee Keepers Association has been receiving in the region of £17,500 per annum from pesticide manufacturers Bayer, Syngenta, BASF and Belchim in return for the BBKA's endorsement of several insecticides as 'bee-friendly.'

The BBKA policy of accepting money from such corporations, taken without consulting the membership, has been condemned by many of its members, other European bee keeping associations and some NGOs as unethical.

While the Executive seem now to have changed their mind again and have dropped the direct endorsement of pesticides, there are still some very important questions that need to be answered.

And – importantly – they have not ruled out accepting money from the pesticide manufacturers under other pretexts.

We call on the BBKA to sever all financial ties to manufacturers, sellers and promoters of any substance known to be or likely to be toxic to bees or other insects.

Phil Chandler, et al
www.naturalbeekeeping.org

Check Your Insurance

I wanted to pass along to you my short story so that beekeepers around the country are aware of an insurance issue I am currently going through. I feel that everyone should know that this can and does happen.

About a month ago I asked my State Farm agent to look-in to seeing if my renter's policy covers my bees like any other personal property since it is only a hobby at this point and we were looking at increasing my policy anyway due to life changes – they did.

Last week State Farm's Underwriting department sent me a letter canceling my renter's policy (with State Farm it would not have mattered if I had a Homeowners policy) due to an increased risk with honey

beehives on the property!

I called my Agent who has been very good through the years to my family. Keep in mind I have ZERO auto or renters claims and a perfect driving record. He began a week long search and battle with the underwriters, their supervisors, and State Farm Corporate.

However, State Farm has an "Underwriting Guideline" specifically against insuring property with honey bees since they cannot be controlled when they swarm and thus is seemingly more risky than a known dangerous dog (which they will insure assuming you have signs and a fence). So my policy WILL be canceled and not renewed.

I was told that State Farm would HAVE covered a claim if I ever had one, IF they didn't know about the hives, but it would have been a onetime thing and I would then be canceled after they settled.

So NEVER mention to your agent you have bees, give them honey, etc.

On a lighter note, Farm Bureau WILL give me a renter's policy at a very similar price even knowing I HAVE bees, so there are options out there. However, once I sell honey or bees it will be a business and no longer covered even for one claim – so you must have a business policy if you sell honey or bees or you stand to be personally liable.

So the moral of this story and my journey is: DON'T ASK DON'T TELL !!!!

Doug Ladd
Buckingham, VA

The Right Truck

Thank you for the article 'Get the Right Truck' from last month's issue. Neil had many poignant considerations on the topic and reaffirmed what my mentors told me as I started beekeeping, '. . . well first you'll have to get a truck . . .' Now, I am years into my first truck and am forfeiting to realization of needing a larger one. However the article focused only on one type of beekeeper. Although a large truck adds convenience to a larger-scale beekeeping/homesteading operation, other vehicles provide the style and finesse lacking in a 2011 Chevy Silverado. In the enclosed photo my friend Nick demonstrates that beekeeping in a 1990 Mazda Miata 1.6 L. inline four is not only fun and fashionable, but smooth.

Peter Rountree
Boulder, CO

Queen Rearing

The January 2011 issue, page 15, *A Closer Look*, briefly touches on the subject of queen rearing temperatures, which was interesting

I believe there are quite a few of us out here who would like to see an article devoted to small scale queen rearing. I have been doing this for the last few years but I have to just kinda feel my way along.

When is the best time to har-

vest queen cells? How long can queen cells safely be out of a hive without attendants?

The *Inner Cover* in the same issue also touches on the subject of queen rearing.

I started 11 splits in one outyard in 2010 and they all took. So I can't say my formula doesn't work, but we should always try to learn more, right? I know, I know, there's books out there that cover this more in depth, but we need a reminder every once in a while. I expect to sell more nucs this Spring.

Keep up the good work.

Enos Miller
Ogdensburg, NY

Editor's Note: *Yes, there are several good books, but we know this is an important topic and we'll be exploring it more this year.*

The Editor.

CCD Solution?

In 2007, when I first heard about CCD, I thought about it for about 30 seconds and came up with the answer. I never bothered to publish my findings, since it was so obvious that I never imagined that years would pass without a solution.

Why are bees disappearing? Beekeeping, and the agriculture that depends on it, are under threat worldwide. Why can't the experts come up with an answer to this crisis? Because they are asking the wrong questions, and searching for the wrong things.

First, let's rule out some possibilities. The fact that one hive collapses while one a few feet away remains healthy is the key. We can rule out sprays, predators, and diseases immediately. Any of these would deplete all of the hives by varying amounts. There is no sign of sick or dead bees in the affected hives. Asking questions about a disease or poison is useless if there are no sick or dead bees.

The right question is "Why do bees leave *this hive* and not another? The answer lies in bee behavior.

If a bee finds something dangerous or neutral the hive is unaffected. What about something *good*? She returns to the hive and recruits other bees. She doesn't recruit bees from other hives, even if they are only a few feet from her own. If she finds something that tastes good, but isn't nutritious, her hive *and no other* will collapse as the workers futilely buzz back and forth to no effect. It can't be a poison, or something that makes bees get confused or lost, at least not right away.

What new chemical hit the market in 2006 that has the necessary qualities? It has to taste sweet, be non-caloric, non-toxic and widely distributed, yet it can't be

something that is sprayed (which rules out agricultural chemicals).

Research is needed to determine how this new chemical affects bees. Several modes of action are possible:

Does it bind to the bees' taste receptors, making everything taste sweet, leaving them unable to forage effectively?

Does it bind and then block, having the same effect?

Do the bees simply starve?

Notice that I don't name the chemical. I'm 99.9% sure that I know what it is, but I'd rather set people looking in the right direction than name a suspect, be wrong, and discourage further research in the right direction.

If you could send me your splendid publication I'd appreciate it. I have always found bees to be splendrous, and it riles my spleen to see them wiped out. I don't know if or how much you pay for articles but one thing is certain: If I solve this crisis I don't expect to ever have to spend a dollar on honey again.

Robert Richter
Dannemora, NY

Good Book!

I read your book, *Backyard Beekeeper* with great profit. I appreciate that you gave specific advice, not the generalities usually given. It is very educational and really useful.

I second your recommendation on frequent washing of beesuits, but would add that unscented laundry detergent and dryer sheets be used. Clothesline drying is best. My family uses these products, and I often smell the perfume on others. I am sure that the bees do to.

Gregory Stoddard
Gansevoort, NY

Pest Or Cure

I read your article with interest. The thing I like about beekeepers is that they tend to be counter-culture types. If one starts talking about bio-control of pests, one MUST either be in the counter-culture, or – leave this country. I once knew a guy from NC State who discovered a bio-control for Annosus root rot of pine. EPA wouldn't approve so he moved to Finland. I'm in the same situation with a fungus that controls Formosan termites, citrus insects and – the Mountain Pine Beetle. I'm in a crack between FIFRA, which allows the un-labelled use of this kind of thing – and EPA which would never, NEVER approve it for use and sale in the U.S. Oh, incidentally, members of Hymenoptera are completely resistant to it and I put it in my beehives to control other pests – along with non-chemical cultural tactics. But, since I'm not connected to a University, have no patent protection and fear regulatory pressure, I need to STAY in the counter-culture. From here, agricultural pesticide regulation makes this country look like the Soviet-States of America – a one-party system. It's approved and paid-for chemicals – or else! How can we be so naive!

Adrian Juttner
Abita Springs, LA

Harbinger

It got cold; it got colder, then 12 below zero –
Enough cold for all but a cold-weather hero.

I went out in the arctic for a New York minute,
To check on the beeyard and see what was in it.

It was the mid of the day with no temperature rise
I struggled in goose-down, right up to my eyes.

Through two feet of snow I rambled again
I'd tripped here before but that was when

This gift from heaven had dropped from the sky
And needed some clearing from hives gone awry.

With entrances cleared; but covered so deep
The heat from the cluster was easy to keep.

The landing area with a gust from the air
Was magically/wonderfully/thankfully clear.

I'd seen enough and was turning around
When something bade me: "look down, look down."

On the front porch, alone on the shelf
Was a quivering bee, all by herself.

She was cleaning house; clearing the floor.
The husk of a sister she'd dragged out the door.

Research has proved (to their self-involved faction,)
...That bees are like robots; just in reaction.

Now Mr. Researcher, I want you to say
What motivated that bee, to act that-a-way?

The warmth of the cluster she left to the rear
And braving the 20s came out in the air.

I don't think she made it back to the swarm
She had only a memory of having been warm.

But she worked till the end without a complaint
What made her do that; work like a saint?

Like my old-country gram down on the floor
One knee was a toothache, the other hurt more.

Science is good but it can't wash away
The miniscule miracles, that make up the day.

by Dick Marron

INNER COVER

I met Bob Smith about 20 years ago or so. Jim Tew introduced us at one of his Tri-County meetings in Wooster. Steve Taber was the speaker that year, and Bob was there to get his talk on tape.

Bob became a beekeeper when his son left his bees behind for college. When I met Bob that day he had a few colonies but he wanted to know a lot more. And like a lot of beginners he wanted to share his passion with as many people as he could. And he could. You see, Bob was the manager of the Public Radio and TV Station in Toledo, Ohio. His background was in producing educational programs for NET (National Educational Television), so he had the skills to do a great job, and being in charge of both television and radio . . . well, he had the tools and the opportunity to get the word out.

Then a kid ran a stop sign and broadsided Bob's car on the driver's side. There was serious head trauma. A lot of hospital time. Recovery was slow, with some subtle personality and behavior changes. His ability to manage his station was challenged and after awhile it was apparent early retirement was in the cards. It was a hard time in Bob's life. I can't begin to imagine what it must have been like. Life isn't fair.

But Bob still had his bees. For awhile that was all he had that was the same as before. A Nature Center called the 577 Foundation in Toledo found him. They needed bees and Bob needed a purpose in life. This gave Bob a place to go – one of the greatest needs for some people who retire unexpectedly – and timely tasks to complete. But Bob's greatest challenge was to just say No. He had been a doer all his life, raising his hand to help out, to get things done. It felt natural to be in charge, to take control. He was a leader. His consultants, his doctors, his family and friends all helped . . . step back they advised. Steady goes the ship. Handling lots of things at once had been a way of life for Bob before the accident. Handling only a few things was his life now. Life isn't fair.

All this happened between the first time I met Bob and a little more than a year later when we next met at a bee meeting. We talked a bit, he told me this story. That was the day I met the only Bob Smith I ever knew.

That's about the time my first Bee Boss Eric Erickson started his Fire Department Training for dealing with African Honey bees out in Arizona at the USDA Honey Bee Research Lab there. Spraying with surfactants, protective gear, spray patterns...the whole works. But he could only visit one fire department at a time. A training video could be everywhere all the time. This necessary information could reach every fire department. Easily.

I called a local volunteer fire department with my idea. They thought it was great, but they had to train me in how all this worked. I got to hold the hose – a very macho thing to do I found out later. I called Bob . . . I said we'd set up a swarm situation, an abandoned hive situation, and an accident with bees and an injured person involved situation, and we'd film it all with our fire department people doing their good deeds, and we'd make a training video for fire departments. He got excited about that, I'll tell you.

Actually, I didn't have a clue what I was doing – no scene sets, no script, no practice – we did everything once and filmed it – I drove Bob crazy that day because he assumed I knew what I was doing and what to expect as a camera man. I didn't but he kept up anyway. Then Bob and I sat down in front of his analog editing equipment and made a video out of some of the most disjointed, unorganized, really great film you've ever seen. We hired an artist to draw some of the stuff we didn't get on film – did voice overs, still shots – and, at the end of a lot of hours making it work – it was a wrap. It was the best we could do with what we had. Bob was a bit disjointed with his role – cameraman and director – and, like I said, I didn't really know how to organize these things. But it was the best we could do . . . and it was the only one out there.

Bob knew a video reproduction company and we were off. Today, I understand that every fireman in the country knows the techniques we taught on that film. It's the standard for Honey Bee Emergencies. I'm still proud of that work. And it was only the first.

Over the next 20 years we teamed up to do a whole lot of how-to films. We brought in Jim Tew – funny how things work out – and a few other people. We did shows on putting equipment together, finding and marking queens, harvesting and extracting honey, artificial insemination (Jim and Bob did that one together), reading frames and examining colonies, lighting smokers, we organized a half day symposium at one of the

Bob.
Peace Corps.

national meetings on migratory pollination problems and filmed it, and we put together several promotional tapes for EAS over the years. We did an audio tape of Richard Taylor where he tells of his beginnings in beekeeping and his philosophy in keeping bees and making comb honey. I especially treasure that experience, and that tape.

All this time Bob was running a small part time business taping family events for people, special meetings, making training videos, and keeping bees at the 577 Foundation and some of his own. He was selling honey locally, supplying mead makers with product, making candles and enjoying as much as he could of what life had given him.

Though his accident diminished his short term memory skills, his long term memory was excellent, and over the years we spent hours talking about his experiences making NET films, running his station – he supervised the building of a huge tower there that was a triumph of organization – his experiences with the politics and business of National Public Television and National Public Radio, running the annual auction, dealing with extremely creative young people who tended to routinely flaunt the traditions and values of the establishment and exercise their own set of rules, working with unions, and being, as he put it, the eternal supplicant to the monied powers that live in his community that continued to support his projects. His was a world I had only imagined, and he made it look simple.

When we were working on a project much of the field work that needed to be done on location or with someone else was done during the week to fit their schedules, but most of the filming we did without other people and the editing was done on long weekends. I'd drive over to Toledo on Friday night (usually rehearsing lines on the drive over), and we'd work late into the night. Then it would be early Saturday morning with a hearty breakfast – Bob couldn't boil water right most times, but I'm pretty good in the kitchen – then work, either shooting in a beeyard or honey house somewhere, or editing what had been done earlier, until supper time – another hearty meal and then maybe just a little more work to finish the day. Then we'd go get a movie. I introduced Bob to some work he would have never explored I think – he all the time questioning my sanity (science fiction was never a favorite of his, until he met me), and his choices – the old classics – were useful for me. We both like to see how people tell stories, so almost anything worked. Sundays, and sometimes into Mondays we sat at the editing machine and made minutes of film out of hours of shooting. Sometimes it was obvious that what we had done earlier was not going to work . . . lines flubbed, a plane overhead, forgetting to do something we'd planned on doing but didn't write down on the script sheet . . . a host of things go wrong when you have an inexperienced editor in front of the camera, and a slightly forgetful old guy behind the camera, and they all did at one time or another. So, we'd have to go out and do it again. Take 5, and rollllllllling.

The technology Bob used continued to evolve, and by the time we closed shop he was using some pretty sophisticated digital equipment. The films we made kept getting better and better because of that, and our experience in knowing what people wanted in a film, and our skills in getting what they wanted to work.

But we eventually closed shop. Bob was not quite 20 years older than me, so we had an unusual relationship. He was somewhat father and mentor, but also just a friend in bees. I, to him, was a beekeeping mentor and constant connection to that world that he thoroughly enjoyed being a distant part of. We fit well together I think. He was a bit cranky sometimes, especially when his disability rose and challenged him. I tend to be pretty easy going and his frustration didn't get to me. He was very instrumental in bringing me up to speed in a business world I didn't understand well, and in making me think like the story teller I needed to be to make the videos we did. That skill transcends video certainly, and it helped shape the way I write, and even think. And we both shared a common goal – we were both, he in his past life and me currently – determined to make information available to people who wanted it to make their lives better. Public television and radio certainly do that, and we keep trying with the magazine and books we publish and the videos we used to make. We are, Bob said, Missionaries. Amen.

When health issues became troublesome Bob moved to Kendal At Oberlin, a retirement village quite close to me here in Medina. There he still had access to all of the classical music he could ever want and he loved so well at the college there, a host of friends who shared similar life histories and enough assistance to make living rewarding. He visited many times, over holidays and when the itch to put on a bee suit became too much and he had to get a hit from the smoker and stung at least once. At Kendall he became the resident electronics repair, replace and build person because of his skills and because he was needed. That's important in life, isn't it?

He passed in January. Cancer, diabetes and a long troublesome heart problem finally got the best of him. As certain as something will get you and I.

If you can't tell, I miss Bob. And you will too, in a way, even if you never met him. There's one less in the group of good guys now. One less teacher, mentor, film maker and Missionary. And one less friend of man. Thanks Bob. Amen.

•

This month is the anniversary of the founding of The Peace Corps. Hundreds of volunteers over the years have been involved in teaching beekeeping to people in other countries in order that they could acquire a skill that could earn them an income. Beekeeping requires a minimum of money, equipment and absolutely no land. It was an untapped resource for many and the production of honey, bees, brood and wax proved a way out of poverty of thousands of people for generations to come.

If you were one of those hundreds of volunteers who taught beekeeping in the Peace Corps, or maybe someone who benefited from this training, send along a couple hundred words on your experience. We'd like to gather as many as we can and we'll put them together later this year. It should be a fantastic story.

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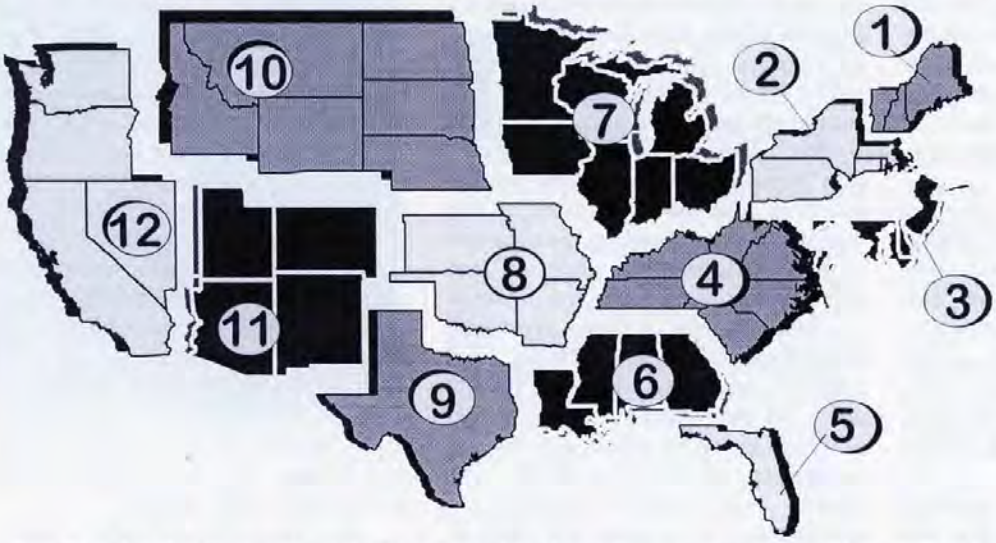
Continued on Page 78

MARCH – REGIONAL HONEY PRICE REPORT



Everything but the Buzz, and even that if we could figure out how to harvest, process and sell it.... that's the feeling of a lot of beekeepers who keep bees for both fun and profit. But how to make money keeping bees when it seems that all you do is put money into that box, and don't seem to get nearly as much out?

Our reporters seem to be making it work, and they're doing it by making and selling everything and anything they can glean from the bees, and the beehive. Our chart lists most of the harvestable products from bees that beekeepers can make, use and sell. And the numbers show the percent of our reporters who are doing just that. We now have 2 years worth of data and you can see already the slight changes our reporters are making.

There's no doubt that producing and selling value added products is one way to go, and for a small scale producer it's probably the best way to go. Using beeswax for candles, ornaments, lotions, potions and creams takes a commodity product and doubles or triples its value. Specialty honeys...cremed, comb and the like sell for more than honey in a jar, so consider those, too when making that product.

The sideline jobs...producing queens, packages, nucs, pollination, selling supplies of all kinds, and even buying product from other beekeepers and reselling, something like honey stix, isn't a bad idea.

There's more than one way to get the buzz out of your bees, and you don't have to squeeze so hard it hurts the bees in the process.

	Candles	Ornaments	Wax Blocks	Honey Stix	Pollen	Propolis	Bee Supplies	Packages	Queens	Bulk Wax	Lotions	Soap	Creme Honey	Liquid Honey	Comb Honey	Chunk Honey	Nucs	Pollination	Bee Feed	Other
% Reporters Selling																				
2010	28	17	54	28	28	13	20	9	15	48	20	10	35	90	66	38	28	-	-	-
2011	39	20	53	39	35	21	21	10	15	42	19	11	35	90	67	40	26	37	10	18

REPORTING REGIONS	1	2	3	4	5	6	7	8	9	10	11	12	SUMMARY Range	SUMMARY Avg.	History Last Month	History Last Year
EXTRACTED HONEY PRICES SOLD BULK TO PACKERS OR PROCESSORS																
55 Gal. Drum, Light	1.72	1.85	1.72	1.52	1.55	1.73	1.76	1.65	1.72	1.55	1.62	1.65	1.52-1.85	1.67	1.65	1.54
55 Gal. Drum, Ambr	1.56	1.75	1.56	1.48	1.50	1.53	1.67	1.65	1.56	1.56	1.53	1.47	1.47-1.75	1.57	1.56	1.45
60# Light (retail)	130.00	160.00	130.00	103.00	120.00	170.00	137.60	141.67	109.69	139.80	135.00	175.00	103.00-175.00	137.65	141.89	131.75
60# Amber (retail)	130.00	150.00	130.00	127.00	120.00	157.50	134.60	140.00	135.00	145.56	133.80	161.48	120.00-161.48	138.75	139.49	127.09
WHOLESALE PRICES SOLD TO STORES OR DISTRIBUTORS IN CASE LOTS																
1/2# 24/case	55.20	71.65	53.20	52.87	69.11	71.00	67.54	69.11	10.15	48.00	56.53	87.20	10.15-87.20	59.30	58.33	58.74
1# 24/case	83.06	99.23	90.00	71.68	76.00	92.64	76.29	89.20	72.00	99.84	75.47	104.10	71.68-104.10	85.79	77.87	81.01
2# 12/case	61.25	81.85	73.50	64.50	69.00	77.70	69.53	81.00	63.00	81.00	71.25	84.60	61.25-84.60	73.18	72.55	68.15
12.oz. Plas. 24/cs	68.16	88.28	61.20	66.50	52.50	70.50	62.38	78.40	66.00	60.60	76.70	74.60	52.50-88.28	68.82	68.04	64.20
5# 6/case	91.00	93.98	88.50	71.50	84.00	99.00	78.04	91.50	72.00	75.60	65.45	99.00	65.45-99.00	84.13	78.90	75.82
Quarts 12/case	119.11	129.70	142.80	98.90	96.00	91.17	92.00	103.00	119.11	120.06	98.86	124.00	91.17-142.80	111.22	105.67	108.70
Pints 12/case	71.49	82.98	81.60	63.33	68.00	62.60	71.36	68.40	71.49	70.20	57.67	86.50	57.67-86.50	71.30	69.39	64.65
RETAIL SHELF PRICES																
1/2#	3.00	4.15	2.83	3.49	3.39	3.00	3.50	1.79	4.06	3.15	2.95	5.50	1.79-5.50	3.40	3.32	2.97
12 oz. Plastic	3.50	4.94	3.25	3.80	4.55	3.58	3.54	3.85	3.50	3.75	3.75	4.66	3.25-4.94	3.89	3.95	3.85
1# Glass/Plastic	4.99	5.79	4.92	4.88	5.94	5.27	4.79	4.99	4.99	5.63	5.04	6.44	4.79-6.44	5.30	5.24	4.93
2# Glass/Plastic	8.00	8.49	8.86	8.23	9.20	8.21	7.97	8.90	8.99	9.40	8.30	10.75	7.97-10.75	8.77	8.46	8.06
Pint	9.93	7.61	8.00	6.40	6.60	7.25	6.89	7.85	18.00	7.55	7.50	8.75	6.40-18.00	8.53	7.81	8.69
Quart	17.41	12.30	14.00	11.36	12.00	11.60	10.17	12.58	16.25	13.43	9.98	16.00	9.98-17.41	13.09	12.12	11.63
5# Glass/Plastic	18.50	18.24	20.86	18.00	19.45	22.00	16.47	19.50	21.00	16.95	17.21	22.50	16.47-22.50	19.22	18.60	18.12
1# Cream	5.99	6.86	6.50	5.93	5.99	5.75	5.05	5.19	5.99	6.22	5.75	6.63	5.05-6.86	5.99	5.76	6.24
1# Cut Comb	6.50	6.61	6.50	6.35	8.11	6.80	6.75	6.00	8.11	10.00	7.30	11.00	6.00-11.00	7.50	6.89	6.76
Ross Round	6.84	5.98	6.50	5.75	6.84	5.75	6.00	6.50	6.84	6.84	6.90	7.75	5.75-7.75	6.54	6.44	6.77
Wholesale Wax (Lt)	2.25	4.60	2.75	2.85	5.50	3.03	4.58	4.50	4.75	5.00	2.94	4.00	2.25-5.50	3.90	3.79	3.68
Wholesale Wax (Dk)	2.25	3.98	2.75	2.65	3.58	2.50	3.25	4.00	5.00	3.60	2.50	3.80	2.25-5.00	3.32	3.14	2.81
Pollination Fee/Col.	90.00	106.67	70.00	39.33	92.50	77.50	55.00	75.00	92.50	92.50	89.00	125.00	39.33-125.00	83.75	83.99	79.91

Managed Pollinator CAP
Coordinated Agricultural Project

Best Management Practices (BMPs) For Beekeepers Pollinating California's Agricultural Crops

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Project Apis m. And CAP Have Teamed Up

1. Best Management Practices for Nutrition

Honey bees require food as an energy source.

Why is nutrition important to Honey Bees?

Vigorous well-nourished colonies are able to withstand bee diseases and parasites better than poorly nourished colonies. Scientists have emphasized that malnutrition may be playing a key role in the decline of colonies due to Colony Collapse Disorder (CCD). Honey bees can suffer from a compromised immune system related to poor nutrition.

Natural Forage

- Healthy bees require a diversity of natural pollen.
- Placing bees on locations with abundant and diverse floral resources will help them stay healthy.
- Locations vary in their carrying capacity, and experience will suggest optimum densities.
- Placing too many bees in one location will result in inadequate floral resources, robbing, drifting and the spread of bee diseases and parasites.

Supplemental Feeding

- Forage can be limited in late Summer and Fall. When floral resources are inadequate, feeding bees sugar syrup and pollen substitutes can improve colony survival and performance.
- Supplemental feeding is critical to build bees for early almond pollination by February 1st.
- Provide protein pollen patties.
- Pollen substitutes should have three (3) essential properties:
  - Consumable - honey bees should be readily able to eat and consume the supplemental feed;
  - Absorbable - honey bees should be able to digest and absorb the supplemental feed, and;
  - Nutritious - it should contain the necessary and vital ingredients for bee health.
- Place pollen patties between brood boxes or on top of hive frames.
- It is critical to provide supplemental feed when colonies arrive for almond pollination; dearth is a factor prior to and after bloom.

Water

- Provide plentiful and abundant water.
- Pesticides, fungicides and fertilizers may drift into water sources; locate colonies near colonies near accessible clean water.
- Drought causes honey bee stress. Work with your grower on identifying a potable water source for bees to avoid dehydration.

The Beekeeper's Goal

Provide bees a diversity of natural pollen.

When possible, locate natural forage for your bees.

Fall is a critical time to build bees for almond pollination.

Provide supplemental feed, especially protein, to build strong, 8-frame colonies by February 1st.

Water is just as important as food; keep your bees well-hydrated with clean water.

2. Best Management Practices for Pest/ *Varroa* Control

Controlling pests, particularly Varroa, is a critically important management practice.

Why is *Varroa* harmful to Honey Bees?

Varroa mites reduce individual bee and colony vigor by feeding on their haemolymph. In addition, they vector viruses and facilitate infection by other bee pathogens.

Manage for *Varroa* control

- *Varroa* control should be a primary activity in your beekeeping operation.
- Requeen with mite resistant stock. Using stock selected for resistance may aid in slowing down the growth of *Varroa* populations.

Do your colonies have *Varroa* mites?

- Monitoring is important, early detection is key.
- Check often, every two to three months.
- Conduct a random sampling of hives.
- Follow regional guidelines for action thresholds.

How to check for *Varroa*

- Sticky Boards for an accurate mite count
- Alcohol Wash
- Sugar/Ether Roll

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How to treat for *Varroa*

- Use biotechnical methods to suppress mite populations if action is necessary when surplus honey is being produced.
- Drone brood removal
- Powdered sugar dusting
- Screened bottom boards
- Use thymol-based products before or after the honey flow. Use organic acid-based products (some organic acid-based products can be used during the honey flow, others can only be used before or after the honey flow), when appropriate.
- Exercise judicious treatment and soft chemicals.
- Follow the recommended label instructions.
- Rotate treatments to prevent resistance.
- *Varroa* mites have exhibited resistance to some varroacides in some regions. Check with your local cooperative extension office or apiary inspector to find out which varroacides are most effective in your area.
- Be aware that strong colonies in mid-Summer can be highly infested with *Varroa* and even strong colonies can crash in population in late-Summer and Fall.

Are your treatments working?

- Recheck for efficacy; don't assume your treatments are working.
- *Varroa* is a community problem. Work with your beekeeper neighbors to be sure that all beekeepers are keeping *Varroa* at low levels.

Minimize toxin exposure

- Honey bees have a limited capacity to metabolize toxins, including beekeeper-applied varroacides, and some toxins can accumulate in beeswax combs.
- Be aware of crop pest control practices near your apiary; know the risks and have a plan for protecting colonies.
- Varroacides can tie up bees' detoxification capabilities and render them less able to deal with other varroacides and chemicals used on crops.
- Avoid treating bees with varroacides when they are likely to be exposed to crop pest control chemicals.
- Renew beeswax combs by replacing a few combs from each hive annually

The Beekeeper's Goal

A good management program pays close attention to mite levels.

Varroa can rebound quickly; watch your threshold levels closely.

Constant monitoring and timely treatment is critical for healthy hives.

3. Best Management Practices for Disease Control/Nosema

Evidence suggests that presence of Nosema is contributing to honey bee health problems.

Why is Nosema harmful to Honey Bees?

Scientists agree that *Nosema ceranae* is the most prevalent and economically damaging of the honey bee diseases. In serious cases of Nosema, the colony may eventually die.

Do your colonies have Nosema?

- It's important to monitor your bees for Nosema (*N. apis* and *N. ceranae*) - early detection is key - and treat to reduce levels if warranted.
- Monitor Nosema levels and colony condition.
- Check often, ideally monthly.
- Random sampling of hives

How to check for Nosema

- Collect live or fresh dead bees from the hive entrance or from top bars of the frames.
- On-site microscopic examination of honey bee gut for spore count.
- When levels exceed one million spores per bee, colonies can exhibit dwindling, but this will not always be the case.

How to treat for Nosema

- Chemical control with Fumagillin
  - Practice judicious treatment.
  - Follow proper preparation, storage and application.
- Hygiene
  - Clean comb
  - Clean or replace contaminated equipment.
- Nutrition
  - Good "Fall Flow" of natural or wild forage, proper nutrition eases stress.
  - Strong immune system = healthy bees.
- Treat based on your risk assessment and previous experience.

Are your treatments working?

- Recheck for efficacy
- Don't assume

The Beekeeper's Goal

Watch your Nosema levels; Nosema can appear quickly.

Be aware that Nosema in the presence of high mite levels can compromise colony health.

Constant monitoring and treatment are critical for healthy hives.

4. Best Management Practices for Hive Equipment

A well-maintained and orderly apiary can translate into a successful beekeeping operation.

Why practice diligent hive maintenance?

Beekeepers agree that the most important piece of equipment in the apiary is the beehive, the home of the honey bee.

Hive Maintenance

- Proper maintenance extends the life of the hive.
  - Check apiary for hive condition.
  - Inspect for rotten, loose or broken boards and frames.
  - Reconstruct, tighten or replace frame parts.
  - Paint supers with light colors to beat summer heat.
  - Take advantage of the Winter months to do maintenance and prepare for the new season.
- Check bee attire.
  - Repair clothes, veil, gloves and bodysuit.
- Inspect your essential two (2) pieces of equipment.
  - Smoker and the hive or "universal" tool
- Maintain yard equipment.
  - Inspect and repair trucks, trailers, loaders and forklifts.
  - Repair bunkhouses, if applicable.
  - Eliminate trash in the apiary.
  - Practice fire safety when the bee smoker is in use.

Hygiene

- Practice good hygiene with hands, gloves, and other equipment to reduce transmission of pathogens between colonies.
  - Replace comb with new foundation to minimize residual chemicals in old wax.

- Develop a comb replacement schedule.
- Purchase equipment only if it has a history of clean health.

Hive Security

- Be aware that the probability of hive theft has increased with the increased value of pollinating crops.
  - Keep equipment simple to identify.
  - ID hives with a brand or name.
  - Secure a signed contract when entering into a "wintering deal."
  - Practice discretion when showing where your yards are located.

The Beekeeper's Goal

Keep equipment in good condition.
Good maintenance prolongs the life of hive parts, clothing, vehicles, and other equipment.
Good hygiene reduces the incidences of pests and diseases.
Hive security can minimize economic losses.

5. Best Management Practices for Colony Management

Successful beekeepers employ practices that are tested and proved to be profitable.

Exert you energy wisely

- Invest time, money and energy on your healthy colonies.

Practice judicious methods

- Maintain a reserve; don't commit all your colonies to contract.

Monitor colony strength

- Cull weak colonies.
- Use diagnostic services for objective colony assessment.
- Check frames of brood for intended strength to coincide with almond bloom.
- Be mindful of colony placement to minimize stress.
- Do not combine weak collapsing colonies with healthy colonies.

Managing Stock

- Maintain genetic quality to meet your objectives:
  - Maintain stocks that are productive and disease and pest resistant.
  - Encourage high drone densities to provide well-mated queens and genetically diverse colonies.
  - Discourage stocks that are excessively defensive.
  - Select stock by propagating colonies that prosper when other colonies exhibit symptoms of stress.
- Requeen colonies, at least annually.
- Package bees typically exhibit low Varroa and virus levels during the year following installation. Consider making colony increases by shaking package bees from your own colonies.

Water

- Consider water access when transporting colonies and when placing colonies in the orchard.

The Beekeeper's Goal

Work towards strong eight-frame colonies for almond pollination by February 1st.
Invest your energy in the expectation of future returns and benefits.
Use discretion to avoid waste.
Employ genetics, diagnostic services and placement of hives to ensure healthy colonies.

6. Best Management Practices for Business Management

Beekeeping is an evolving profession.

Be professional in your beekeeper/grower interactions

- Use a Contract (See a Sample Pollination Contract at **http://www.ProjectApism.org** under 'Downloads').
- Determine pollination fees that are realistic relative to your operation costs.
- Use well-maintained equipment.
- Be dependable with the timing of hive drops and pick-ups.
- Be visible to your growers.
- Develop contingency plans for the unexpected.

Be efficient

- Streamline your business to manage resources wisely.
- Keep good records to improve practices.

Keep learning

- Successful beekeeping is a rapidly changing art and science.
- Join local, state, regional and national organizations.
- Attend conferences.
- Access the internet, watch for reliable sources of information.
- Subscribe to bee journals.
- Regularly check the CAP project website for new information at **http://www.beeccdcap.uga.edu/index.html**.

Give back

- Beekeeping needs ideas and leadership to build a prosperous future.
- Mentor new and young beekeepers.
- Support and contribute to bee research to ensure a sustainable pollination industry.

7. Best Management Practices for Almond Growers Renting Bees

Growers can help beekeepers in the pollination process of their crops.

Nutrition

- If possible, help your beekeeper locate flowering forage prior to and after almond bloom.
- Plant a cover crop on adjacent land:
  - At perimeter of orchard
  - Within younger orchards
  - On fallow land
- Good examples of alternative food resources are mustard, clover or vetch.

Water

- Water is important to prevent dehydration.
- Provide abundant and potable water, free from contamination.
- Landings and screens make water accessible and prevent bee drownings.

Access and Placement

- The distribution of colonies should be accessible and convenient at all times.
  - Beekeepers need to place, service and remove hives routinely.

- Orchard roads should be maintained and graded for easy access.
- Allow hive placement in areas not prone to flooding or shade.
- Eastern and southern exposures are better for sun and warmer temperatures and encourage bee flight for pollination.
- Let bees do their job, place hives as to limit human and honey bee interaction.

Agricultural Sprays

- Let your beekeeper know the agricultural products used for crop protection, including tank mixes.

Application and Timing

- Honey bees come in contact with agricultural sprays in different ways:
  - Bees may fly through the spray.
  - Sprays may drift to hives via wind.
  - Bees may collect and bring into the hive pollen that contains chemical residue.
- Management practices to minimize contact are:
  - Spray when bees are not flying.
  - Spray when pollen is not being produced by the tree.
  - Time applications at night or when bees are not flying.

Communication

- Keep in contact with your beekeeper, especially prior to almond bloom.
- Inquire about supplemental feeding through the winter.
- Ask about colony collapses, Varroa infestations, honey crop, over-wintering.
- Location, transportation and other factors can positively or negatively affect the strength of the colonies.
- Negotiate rental fee, number of colonies per acre, frames of bees per colony, and payment schedule.
- Discuss timing of hive placement prior to bloom and pick up after bloom.

Pollination Contracts

- A signed contract protects both grower and beekeeper.
- Visit Downloads at **http://www.ProjectApism.org/** for a pollination contract template.
- Secure contracts early for the following season so beekeepers will make the investment in colony health and strength.
- When colonies arrive in the orchard, check colony strength; 8 to 10 frames is optimum.
- An objective third party inspection of colonies will confirm if contractual obligations have been met.
- Allow your beekeeper time and opportunity to provide additional colonies if needed.
- Walk your orchard during honey bee flight hours to make sure you see plenty of bee activity. BC

A Closer Look

HUMAN ALCOHOLISM

Clarence **Collison**
Audrey **Sheridan**

When we consider how much they will consume, honey bees outshine humans; they can consume the human equivalent of 11 liters of wine in one sitting.

For the past 20 years, scientists have been investigating the honey bee as a possible model for human alcoholism research. Previously, mammals have been used for this purpose, but arthropod subjects present a few advantages over mammals: they are cheaper to procure and maintain (Abramson et al. 2000), and there are fewer ethical complications with using invertebrates for research. *Drosophila* (known as the "fruit fly") has been the popular choice of an arthropod model because it readily ingests ethanol and demonstrates inebriation in its simple motor responses; but this is the limit of the fly's behavioral repertoire (Abramson et al. 2005). In addition, the insect's small size makes observation of its behavior rather difficult. Honey bees may be a more suitable model than *Drosophila* due to their larger size and mammalian-like behaviors. Bees are capable of performing complex associative learning tasks, for which bioassays have been established through years of research. They have a social structure and language that resemble, in many ways, human systems. Initial investigations showed that honey bees will self-administer alcohol in water or sucrose solution. And when we consider how *much* they will consume, honey bees outshine humans; they can consume the human equivalent of 11 liters of wine in one sitting (Abramson et al. 2003). Perhaps the most important qualification of honey bees is that much of their genetics, physiology and behavior is already elucidated. This gives scientists a great advantage to determining similarities between the effects of alcohol on humans and honey bees.

Maze et al. (2006) designed experiments to measure the spectrum of effects that ethanol consumption has on honey bee motor behavior. They found that acute ethanol ingestion affected the amount of time spent walking, grooming, flying, and apparently disrupted the ability of bees to right themselves when they fell on their backs. Ethanol concentrations of 0%, 5%, 10%, 25% or 50% in 1.0 M sucrose were fed to bees in 9 µl doses. Hemolymph (blood) samples were taken from the bees at intervals of .5, six, 12, 24 and 48 hours to measure the absorption rate of alcohol into the blood, and to correlate this with the observed behaviors in the locomotion tests.

The results showed that hemolymph ethanol content were dose and time dependent; recovery from inebriation was also shown to be dose and time dependent. Results from the locomotion assays also indicated a dose and time effect, observed as a decrease in most of the recorded activities both over time and at increasing ethanol levels.

Mustard et al. (2008) found that honey bees given a 5%, 10% or 25% ethanol solution prior to proboscis extension training with odors had a difficult time associating an odor with a food reward. The effect was dose-dependent: compared to a 91% response rate in the control group, only half of the bees given a 5% solution learned, and only 3% of the 25% ethanol bees learned. However, in bees that were trained before given ethanol, only the group given the

"Acute ethanol ingestion affected the amount of time spent walking, grooming, flying, and apparently disrupted the ability of bees to right themselves when they fell on their backs."

highest dose had difficulty recalling what they had learned. Bees asked to distinguish between two odors – one of which was paired with a reward – had difficulty at the 10% ethanol level. The sucrose response threshold is not affected by ethanol consumption, but a possible explanation for low responses in the high ethanol groups could be appetite reduction or arousal/attention suppression. Furthermore, ethanol consumption in vertebrates leads to the release of the neurohormone dopamine, which is involved in aversive olfactory learning and appetitive olfactory learning in both honey bees and *Drosophila*.

Foraging and in-hive dance behaviors were shown to be sensitive to 1%, 5% and 10% ethanol solutions (Bozic et al. 2006). Marked foragers were trained to feed at a station located 250 m from the hive. The sucrose feeders were then replaced with 1% , 5% or 10% ethanol feeders. The number of visits and returns, and feeding duration were recorded at the ethanol feeders; the number of trophallactic encounters, waggle dances, tremble dances, self-cleaning and other interactive behaviors was recorded for the same bees inside the hive. The return times for 1% and 5% ethanol treatments were significantly longer than the non-ethanol treatments, but the number of visits was only reduced in the 5% and 10% ethanol groups. Some bees consuming 10% ethanol had difficulty flying back to the hive. In general, ethanol consumption increased tremble dance activity and decreased waggle dancing. Bees feeding on a 10% ethanol solution showed an increase in trophalaxis over the other treatment groups, and also engaged in trophalaxis while tremble dancing, a previously unknown behavior.

Foraging honey bees exhibit a behavior called "flower constancy", wherein they show preference for a particular type or color of flower, and return exclusively to those flowers. The effects of ethanol on the flower constancy of honey bees was measured in a free-flying forager assay (Abramson et al. 2005). Nectar foragers were exposed to artificial flower patches consisting of a mixture of blue and yellow flowers ("flowers" were painted squares of Plexiglas with a well in the middle to hold the sucrose solution) or blue and white flowers. Three treatments were assigned

"Bees did not exhibit flower constancy for either the ethanol or sucrose groups when given a choice between blue and white flowers hving the same reward."

to the flowers in four independent experiments to test foragers' responses to changes in quality and quantity of the reward. In one treatment, both colors of flowers had the same nectar reward. In the other two treatments, blue flowers supplied a different concentration of sucrose (1 M or 2 M), or a different quantity of sucrose syrup (4, 6, or 8 µl) than the other color flowers. Prior to each experiment, bees were trained to fly a distance of 50 m to a clove-scented sucrose feeder, after which point the feeder was replaced with an artificial flower patch containing one of the three treatments. The experiments were run on each group of bees with sucrose and again with a 2.5% ethanol solution serving as the "nectar" in each flower. Results showed that bees did not exhibit flower constancy for either the ethanol or sucrose groups when given a choice between blue and white flowers having the same reward. When rewards differed, bees chose the flower with the higher quality or quantity of sucrose in the non-ethanol trials, but the choice was random in the ethanol trials. Results from the blue/yellow flower experiments showed that most bees, once making an initial color choice, maintained flower constancy for all treatments, regardless of quality or quantity, in both the ethanol and non-ethanol trials. However, the effects of ethanol were evident in the lack of selectivity of foragers in the blue/white flower experiments; ethanol apparently reduces the perception of difference in reward.

The effects of ethanol on queen bees were observed in a preliminary study using two sister queens of same age (Cakmak et al. 2009). One queen was fed a large dose (20 µl) of a 10 % ethanol solution, and the other queen was fed the same dose of 2.0 M sucrose solution. The two queens were replaced in their original colonies and observed for two weeks for differences in acceptance by workers, egg-laying and appearance of larvae and pupae. Both queens were readily accepted, but the ethanol queen was superseded after two weeks. Egg-laying ensued at least one day later for the ethanol queen than the non-ethanol queen, but the resulting larvae and pupae were not visibly different for either queen. The royal offspring of the two treated queens were also evaluated. The queen replacing the superseded ethanol queen was noted to lack vitality, and appeared "old." She also produced a smaller brood area than the daughter of the non-ethanol queen. The results from this preliminary investigation suggest a deleterious effect of ethanol on queens, and possibly on their offspring.

Worker bees from different stock with unique temperaments were assayed for genetically-mediated sensitivity to ethanol vapors (Ammons and Hunt 2008). Bees from "defensive" and "gentle" European stock were backcrossed to produce mixed progeny. Workers from these three lines were assayed for behavioral changes when exposed to ethanol vapors. According to preliminary observations, several behaviors occur before a bee is completely sedated from ethanol exposure; full-length proboscis extension and grooming were the two behaviors immediately preceding sedation. Two bioassays were performed for each line of bees: a flow-through vapor assay and an "inebriometer" assay. In the first assay, a trial consisted of two bees of known age – one each from the gentle and defensive lines – contained in a glass tube and exposed to an airstream carrying ethanol vapors. The bees were exposed to the vapors until they exhibited a full extension of the proboscis. The ethanol sensitivity of each bee was measured in the time required for a proboscis extension to initiate. In separate trials, backcross workers were evaluated individually for proboscis extension time. The "inebriometer" assay was designed to measure a bee's loss of postural control as ethanol vapors flowed through a tube. The progression of inebriation in bees was determined by the way bees fell through layers of wire mesh.

Using ethanol vapors has certain advantages over feeding ethanol in a

sucrose solution for behavioral research. Vapors pass through the spiracles directly into the hemolymph, while ethanol ingested in sucrose is stored temporarily in the crop (honey stomach), where it is released into the stomach in response to metabolic demands (Bozic et al. 2007). According to the results reported in Maze et al. (2006), hemolymph ethanol levels remained high for one or two days after consumption in resting bees. The fact that bees have control over the amount of ethanol absorbed into the bloodstream makes it difficult to quantify the effects of ingested ethanol on honey bee behavior. Ethanol sensitivity was highest for defensive bees, intermediate for backcrosses and lowest for gentle bees. The intermediate sensitivity of backcross bees suggested that ethanol sensitivity has a genetic component, although it was not elucidated in this study.

The equivalent structures to a liver in honey bees are the "fat bodies", located predominately in the abdomen. This is where the metabolic decomposition of alcohol to carbon dioxide and water occurs. The drug disulfiram (Antabuse®), used to treat alcoholics, is believed to interfere with the action of alcohol dehydrogenase in converting alcohol to its byproducts (Abramson et al. 2003). An experiment was designed to assess whether honey bees can be used to test the efficacy of drugs to treat alcoholics (Abramson et al. 2003). Antabuse® is an emetic drug that causes the user to become nauseated and develop a psychological aversion to alcoholic beverages. Harnessed honey bees were observed for effects of Antabuse® both on ethanol consumption and on classical conditioning of the Proboscis Extension Response (PER). In the first series of tests, bees were fed one of three concentrations of Antabuse®, or a control of distilled water. After 10 minutes, bees were offered one of five ethanol solutions (0%, 1%, 5%, 10%, or 20%, all mixed in 1.8 M sucrose solution) for five seconds. Bees that consumed the droplet were assigned to one of two groups and offered the same solution every one minute or every 10 minutes, according to the group, until they would drink no more. Bees in the one-minute group consumed more ethanol than bees in the 10-minute groups, but there was no significant dose effect of the Antabuse® on ethanol consumption. However, the next test showed that honey bees fed Antabuse® and then offered ethanol solution do not follow a normal pattern of Pavlovian classical conditioning of the PER when compared to bees that were not treated with Antabuse®. In this case, bees were not assessed for the consumption of the offered ethanol solution (0%, 1% or 5%), but for the willingness to consume an ethanol droplet, made apparent by the extension of the proboscis when given a feeding cue. Clearly, bees that were treated with Antabuse® before the test began showed a decrease in PER response to the feeding cue when offered 1% or 5% ethanol solution, but no decrease in response to a 0% ethanol solution. BC

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COLONY MANAGEMENT

Larry **Connor**

What is colony management?

Some beekeepers want a management plan that consists of doing absolutely nothing in order to keep a colony of bees. Once a fully established hive is delivered to their location, the bees would be allowed to follow a natural pattern of life and live freely. Unfortunately, nowadays, they will probably die within a year or two from mites, diseases, poor nutrition or some other disaster.

On the opposite extreme other beekeepers want to have a scheduled colony management work schedule where the colony is checked every three days, each frame carefully inspected, and the colony's growth and decline meticulously recorded. There may be more decline than growth with this intense inspection plan. It may document the colony's decline until it dies from so much intense manipulation by the beekeeper, and most likely from queen problems!

Good colony management obviously is positioned somewhere between these two approaches. It is simply providing the colony what it needs when it needs it, and nothing more. Very often fewer visits are better than a lot of visits, but those visits must be based on expected development of the colony, and never random. True, new beekeepers need to learn from their bees, so their colony management is often quite a bit more rigorous than a more experienced operator. An alternative to 'over-visiting' a colony is to have a nucleus hive and/or an observation hive for making frequent observations. Finding that balance is the real challenge of any new beekeeper.

An observation hive will give you the ability to make continuous observations – you might even think about setting up a video camera and watch recorded activity in high definition on the large screen television (perhaps set at 10x speed). Watch a queen cell being constructed, brood being fed, or monitor the color shift in the pollen as the day advances. Advances in technology certainly change beekeeping.

Management is observation?

The first lesson to learn in colony management is to make a quick but careful set of observations on the bees and their work. Check to see if there are eggs in the worker cells, as this is an indication that the queen is present and active. Look at the amount of brood, comparing it to other colonies in the apiary. If you found multiple eggs in every cell your queen may be dead and the workers are doing the egg laying, producing drone larvae. Or the queen is producing drones in worker cells, indicating that she has depleted her sperm supply and the eggs she is attempting to fertilize are not, and are drones.

Look at the work of the bees. Is there nectar? Did your shoes or sandals get wet from nectar dripping, falling out of the comb? Then you are on a flow. Are there open cells at the corners of every brood frame where honey should be stored? Has the brood been trimmed (removed and eaten) – with just sealed brood and no eggs and larvae? That probably means that the colony is close to starvation. Is there new comb construction, plenty of newly stored honey? Are there queen cells? Have they hatched? Is the colony going to swarm? Has it already swarmed? (Do you know the difference?)

The key to all of this is simple – new beekeepers must learn an enormous amount of information in a very short time period. They must learn to look and remember what their mentor or teacher has shown them. It is very hard to work alone and learn beekeeping.

Queen, Brood, Food. Those three subjects are on your mind when you open a hive. If there are single eggs in the bottom of the brood cells, the queen has been laying in the past four days. If there is an abundance of brood, (eggs, larvae and pupae) on the brood frames then the entire colony is doing its job. If there is honey and pollen in the corners of each brood frame, and outside frames filled with honey and pollen, your colony is less likely to starve. If the honey supers are filled with new nectar, congratulations – your bees are making you look like you know what you are doing!

Look for disease automatically as you examine the brood. Sunken cells, darkened cells, cells chewed out, deformed larvae, funny colored larvae, fuzzy white, fuzzy dark or grey larvae, Varroa mites, wax moths, small hive beetles – these are things you should both note and respond to as you work. Some of those signs are red flags for big problems!

Queen Management

You have observed that the queen is laying and has a great pattern resulting in many frames of brood as any other colony, and the rate of brood development has increased during the pre-nectar flow, and been reduced after the flow. Unless you need to replace the queen (can it wait?), your queen management is finished for this hive.

If you do not find eggs and larvae your queen may not be alive, or has been replaced (or is being replaced) by a daughter in the supersedure process, and she has not finished her development. If you can find the old queen and the daughter you can install your own new queen or a queen cell.

This queen in a Texas colony shows the importance of having a large queen, one with fully developed ovaries and the ability to move around the frames with ease.

You may find a colony where the queen has really slowed down, or maybe she has not done much this season. Time to replace her, and get a new queen into the colony. If there are so many bees that the bees may swarm, then the colony might be split. If you find queen cells that are fully sealed, lots of sealed worker brood, and bees covering it, there is a chance that the colony has already swarmed and new bees have emerged to cover the frames so you really cannot see the difference from the last inspection. If the queen cells are new, and not sealed, the bees are about to swarm. Make nucleus hives with the queen cells, or cut cells and make comb honey – either way drastic action is required. Or just let the bees swarm and watch your honey crop fly out of the colony. Each swarm removes about 60 percent of the bees in the hive, so a colony that swarms twice is very much weaker when the process is over. Such colonies will grow and produce enough honey to survive the winter, but they will not be strong enough to share with any beekeeper.

Brood Management

Brood frames may be carefully shaken or brushed and added to other colonies to boost bee populations. Since these are nurse bees you are removing, you can add them too, but just make sure you do not add a queen in the process. A strong hive may be switched with a weaker hive to equalize populations. Many beekeepers try to keep all the colonies in an apiary at the same approximate strength. Others take the strongest hives for honey production and split to make increase nuclei, using swarm cells, purchased queens or queens they have produced themselves. That is one of your big management decisions, based on your personal situation and beekeeping business plan (if you have one).

Check out *Increase Essentials* for more discussion on making increase hives, a.k.a. nucleus hives, nucs, nuks, nooks, splits, divides, set-offs, etc. Basically this is a very simple act of removing one, two or three frames of brood and bees from a strong hive and putting that brood and the adhering bees into a new box with a reduced entrance. If you only move nurse bees, those that have not flown, you can leave the hive in the same apiary. Or move them to a new location – especially if you have already overloaded the one you are using. The key is to put them into a smaller hive for better energy conservation, and reduce the entrance to reduce robbing.

Disease management, if detected, needs to be done. A high level of chalk brood, European foulbrood and sac brood are good reasons to remove the old queen and install one with some disease resistance, especially hygienic behaviors. Plus, a break in the brood cycle reduces the visible part of the disease.

With American foulbrood, on the other hand, you need to act quickly and follow local required control methods (if any are in effect), such as killing the bees and burning the equipment. DO NOT mess around with AFB, thinking you will make it go away with drug treatment. That only hides the problem and forces you to medicate that hive as long as you own it. If any of this equipment is sold, it becomes a ticking time bomb ready to kill every colony where hive parts are installed! The appearance of mite parasites, small hive beetles and colony collapse disorder have caused many beekeepers to loose sight of the danger of having American foulbrood in their operation. You don't want it, and if you find it, use a conservative approach to get rid of it. Period.

Food Management

When the brood frames are surrounded by pollen, this is good. When the brood area on the frames is surrounded by honey and nectar that is good. If there is reserve food in outside frames and supers, your work may be done.

Or maybe not. If it is early in the season you may need to move food frames from one hive to another to make sure the hungry hives do not starve just a few days before the first flora food is available. It is an irony that the strongest hives are likely to die just before the season kicks in, and that is a waste of both human and bee effort. A few frames of honey, or supplemental pollen/syrup feeding are a small insurance payment to make that a good colony will produce for you in the new season. New beekeepers are wise to feed as often as they can when there is no nectar flow. If the bees do not need the food they will not be likely to take it down. But if they need it, and it is not present, your bees will go into a pre-starvation shutdown behavior. Old time beekeepers said that colony behavior changes when the have less than three frames of food in the hive. They are less likely to take chances, and more likely to grow slowly if at all.

These concentric bands of brood indicate that the queen and the colony are performing well in the spring, expanding the brood area in the center (when little nectar was available and capping wax was being reused) to an open brood area, into a larger band of younger sealed brood where the bees had fresh nectar to use for wax cappings. When a beekeeper sees good brood there is rarely need to physically find the queen.

The irony is that not too much later you will need to add supers for nectar gathering. Once the colony gets into its huge buildup rate, the number of bees and the amount of sealed brood will explode in a good year. There is good data showing that spring plants are flowering earlier and earlier, so work once done in May needs to be done in April. Adding boxes of drawn comb provides a colony with a stimulus for honey storage (a pheromone is produced by the drawn combs). The additional space will help the colony slow any swarming urge, giving them plenty of room for expansion. Colonies that are given supers must be strong and able to care for all this additional real estate. Weak or small colonies are not well prepared for this task. BC

Dr. Connor will again offer a queen rearing course at the family farm in Galesburg, MI, on June 17, 18, and 19. For an registration application and details, email him at ***ljconnor@aol.com****. Details will also be posted on* ***www.wicwas.com****.*

Brood frame with sealed honey at the top of the comb. It appears that the colony expanded into frames of sealed honey, and have consumed honey to produce the energy for new brood production. By the next brood cycle this band of honey will likely be eaten as well, and the entire frame will be brood. Outside frames with pollen and nectar will then supply the food needs of the colony. If not the colony will be out of balance and may starve in a period of flightless weather.

Keeping Bees – As Best We Can With What We Know

James E. **Tew**

Lots Of Questions With Few Real Answers

Keeping bees in the gap

An interstitial space or interstice is an empty space or gap between spaces full of structure. For the past 26 years we have been keeping our bees in the interstice formed between mites not being in our bees and mites being in our bees. Presently, we know mites are in our colonies but we do not yet have conclusive control procedures to rid our bees of the problems they cause. We know the question – "How do we effectively control mites?" – but we don't yet have the final answer.

In what will soon be three decades, we have tried a plethora of remedies. None have positively risen to the top of the "control procedures" pile. Though it has been the goal of scientists worldwide, nothing has been found that will let us routinely keep bees as we did in the 70s. Frequently, today's bees seem lethargic and weak. Replacement queens don't seem great. Why? I don't know. Welcome to bee life in the gap. It's disconcerting.

A frustrated beekeeper

The beekeeper on the phone was upbeat and energetic but was clearly frustrated. He had several hundred hives going into Winter of 2010-2011 that were strong and heavy. By late January, half were already dead. The fate of the living was uncertain. Sure, he had had winter kills in the past, but not this many this early in the Winter. Through the years, I have heard many variations on this theme but this guy seemed to know what he was talking about. In just about a decade, he had gone from two colonies to more than 400. In many instances, only a few dead bees were still present – not like the old-fashioned starved colony of miteless years past where entire dead clusters remained within the hive. Sometimes honey was there and sometimes the colony was already surprisingly light in stores. Nosema[1]? CCD? Old combs? Nectar from GM plant sources? What in the world was causing this high Winter mortality and what in the world could he do to stop the remainder of his colonies from dying? In answer to his own questions, he suddenly said, *"But if you knew the answers, you would be very popular and very wealthy!"* Wow! Was he ever right on that score! I'm neither.

Another frustrated beekeeper – me

During the second week in January, snow had fallen and was crunching beneath my feet as I returned from my storage barn. It was bright day so it was easy to see the little black spot on the brilliantly white snow. It was a dead bee that I duly noted. *"Humph."* A few more crunching steps and yet another black spot. *"Whoa!"* In fact, there were dead and dying bees everywhere. Many were dead but just had nôt finished dying. *What in the world is going on?* My three beehives were near the storage barn. They were from packages in the spring and had built up nicely. I had given them full frames of capped honey (as has been discussed in innumerable previous articles). I provided fully drawn combs on which they could initiate a brood nest. They accepted the new queens without signs of supercedure. They exhibited good flight all Spring and Summer. Now, this. Where were all these dead bees coming from?

In fact, they were coming from the middle hive of my three hives. It was 28°F outside on a bright, still day. Yet the hive was alive with frantic bees at all entrances and a small pile of dead bees accumulating on the ground. They appeared agitated and frantic; as though they were all trying to leave at once. They seemed absolutely eager to die. As I stood there, watching in confused amazement, a few bees departed on suicide flights. *What was going on?* Nosema? CCD? Old combs? Nectar from GM plant sources? I don't know.

Some thoughts on unexplained die-offs – both yours and mine

Reusing old combs

The frustrated beekeeper mentioned his reuse of old combs to establish replacement colonies. That is a common procedure throughout beekeeping. Most beekeepers recycle old combs as they manipulate their colonies. The potential problem with this procedure is a low-key subject that is periodically brought up by various scientists and beekeepers. Beeswax is a chemical blotter. It seems that any chemical that comes near it is partially absorbed by this wax. It has been postulated that, at some levels, harmful levels of residues are reached that negatively affect developing brood. Testing combs is impractical for nearly all of us. How long to use combs; when to replace; and how to replace are some of the common unanswered questions in this area. This is one of those partially answered questions in beekeeping. We know that chemicals accumulate, but when is too much too much?

[1]General overview of Nosema: Tom Webster. *Nosema ceranae The Inside Story* **http://www.extension.org/pages/Nosema_ceranae_The_Inside_Story**

All seemed quiet, but the middle hive has serious problems.

As has been the case with most gap beekeepers, the concerned beekeeper kept records comparing packages initiated on combs compared to longevity of colonies begun on foundation. He could see no difference so he will continue to recycle combs. This event was not analytical science. It does not speak to all of us, but in his case, it speaks to him. For the present, he will not destroy old combs.

Package bee costs and availability

My frustrated caller flatly stated that it was presently worth the money for him to replace dead-outs with early Spring packages. Last season, his package bees built up in time to produce tons of honey. He installed packages during cool weather in March, something he had never done before. He worried and tossed that night, but all went well. He has made some interesting observations. Installing packages during cold weather restricts excessive bee flight. Honestly, I never knew what truly happens to all those randomly flying bees that fill the sky when multiple packages are installed at the same time and installed near to each other. I would like to think that they all find a hive somewhere but I know that some (even many) are lost forever. As I have written in the past, installing packages on warm days gives the bees a chance to take cleansing flights and to position themselves on combs, but they do drift toward the end colonies. No big deal – later in the Summer equalize the colonies and all is back on course. But installing earlier (and colder) would eliminate a colony equalization procedure and would get the bees on the job earlier. *(I wonder how successfully packages could be installed at night? I know someone has tried it. Do you recommend it?)*

Dead bees from last Spring packages.

As we talked, and as I have talked to others, we lamented the fact that Winter-kill percentages are significantly higher than 20 to 30 years ago. In "the good old days", less than 10 percent would perish during the Winter. Now, 40 to 50 percent is not unheard of and the survivors are weak. It seems inconceivable, but will the early Spring day come when we find that all colonies have died? *"Well, we would just have to buy more packages."* How will the package producers keep their bees alive if ours are all dying in significant numbers? Then what will happen to our bee enterprise? Like rotting fruit on a leafless limb, that question just hung out there somewhere in phone land. This discussion was nothing more than a friendly "pity-party" and neither of us was predicting that such Winter loss events will come to pass. But once we talked and laughed about it, our light-heartedness left me with a threatening taste. It was the same feeling I had as a kid when I tossed stones at wasp nests. Started out funny but didn't always end that way. *"Nah . . . that'll never happen to beekeeping."*

Even so, too many colonies die during Winter months

So, if we agree that we have plenty of questions and not enough answers, what are we to do here in the gap? Like New Year's Resolutions, each Winter/early Spring, I make a list of things I will do differently this upcoming season. I am now leaving plenty of honey – plenty. That is a change from seasons past. In fact, I commonly have honey left on the colony for the splits/packages that I will be installing next Spring. But for six years or so, some of the most unexpected colonies have died, and on occasion, some of the weakest colonies survive. Go figure. Am I just mis-remembering? Decades ago, did populous colonies sometimes die and I have just forgotten? Even so, I want to address this abnormal winter flight that some of my colonies have exhibited for several (even many) years. Even if the effects of Nosema are not the only problem, I suspect that it may be part of the problem. I suspect that Nosema has been some part of my bees' problems essentially every year for many years.

Fumadil-B tends to be hard to feed sometimes

But here's the true truth – I have always found the process of feeding Fumadil-B to be a hit/miss procedure. Some colonies would take the medicated syrup while others either ignored it or could not figure out how to make the feeder work. The fumagillin powder would clump and the product was a bit pricey. Time and again, I threaten to put it on the following Fall or Spring. But officially, Nosema treatments are on my "to-do" list. This is not the first time that Nosema treatments have been on that prestigious list. Somewhere in Maryland, many years ago, I visited a beekeeper who was feeding sugar syrup in plastic bags into which he had cut clean slits with a very sharp knife. I was certain that the syrup would all leak out. It didn't. That idea is now being used by some to supply Fumadil-B medicated syrup in Spring or Fall. Individuals using this procedure do not have to store feeders and problems with mold growth are eliminated. No doubt, I will have stories about busted bags of syrup for future articles.

While listening to the frustrated beekeeper explain the unfolding mystery, my memory drifted back to one of my earliest academic years in beekeeping – 1976. I was at the University of Maryland, working for Dr. Dewey Caron. I had wintering colonies fecal spotting the whole area so I was using a hemocytometer to count Nosema spores to determine if the University bees were suffering from Nosema. At the time, Dr. Basil Furgala, University of Minnesota, was actively promoting Nosema as the unseen illness of the bee world. Though I really can't remember, I feel certain that some level of *Nosema apis* was present then and that it is still very much present today.

Now here I am – 37 years later wondering if I should be looking at Nosema once again for being the current bane of my bee colonies. This time, I will be expecting to see *Nosema ceranae* rather than *Nosema apis* but the treatment will still be the same – Fumadil-B[2]. I abruptly realized that *"gap beekeeping"* is not restricted to mite problems. We have actually been keeping bees in the gap in regards to issues such as: Nosema, American foulbrood, chalk brood and now small hive beetles (SHB). I snapped back to the conversation with the frustrated beekeeper with the refreshed realization that many of these issues are like old, familiar enemies. While we have not defeated a single bee enemy, we – and our bees – are still here. Our bee industry is much like the plight of Andrew Barton,

"I am hurt, but I am not slain;
I will lay me down and bleed a while,
And then I will rise and fight again.[3]

Time and again, our industry has been hurt, but after a while would rise to fight again. So whatever is killing my frustrated beekeeper friend's bees is certainly making him, and many other beekeepers bleed, but we will continue to find ways to keep our bees (after we rest for a while.) BC

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[2]Material Safety Data Sheet: Fumagillin: **http://datasheets.scbt.com/sc-200377.pdf**

[3] From the *Ballad of Sir Andrew Barton*, Child Ballad, number 167.

DenverBee's Beginning

No, I Won't Be Removing Those Bees

Marygael **Meister**

Before The Beginning

The year was 2003; it seems like such a long time ago, eight years if you're fumbling with your digits. I was slated to pick up a friend from the airport. My anticipation, high from my seemingly awkwardness with the meet and greet hugging that's ad nauseam at airports, tossed my thoughts around like a dog in the back of a pick-up truck. The airport trip would place me smack dab in the middle of rush hour traffic. I flinched not at the notion of taking on the nightly migration.

You see, I take great pleasure, as I'm sure many people do, in driving the colorful back route roads. Be it urban, suburban or rural, they're the wonderfully circuitous routes that defy logic and expedite you to your destination. I couldn't wait for departure time as I knew just the route through mid town.

It was time to leave; I grabbed my keys and was in full stride, side gate in plain view when out of my periphery I saw my mother's head poking out from the engulfment of a 16 ft. rambling rose. I liken my mother to lighting and thunder. You see the flash, trapezoids tighten, and then the deafening clap. This particular clap came in the form of "I've not seen nor heard the mellifluous sound of one single bee this Spring. Ms. Adelaide d'Orleans is just plain sick from the dearth of their absence."

My response was quick, audible and slathered in placation, okaaaaaaaaaaaaaaaaay will doooo. The car door was in sight when I heard, " a couple of those boxes, oh for cryin out loud where'd she go now, the Meister's had them at 9800, hurry, bees are nasty at dusk," with the engine turning over I lurched out "got it, love ya mom" Honey bees would be an enormous detour.

As I rounded the corner I was greeted by a police officer standing akimbo midst a fender bender. Quickly and sternly he seized my gaze as he growled" move right, right now: his voice trailing off with laughter and "keep going you're not alone." I slowly merged onto the highway, my fail safe route had been encumbered, and all three lanes were a stand still. I found myself in the middle of the hoi polloi on the common route. I looked up only to see a big silver Cadillac with the license plate QBEE. I would come to find out that she lived four city blocks from me. My mother always has the last say, I laughed.

I had been detoured from my detour.

The Beginning

In 2008, again, the thunder clapped. I responded by looking for bees, bee people and all the accoutrements that go with. The city of Denver has a nifty number you can call about general zoning/governmental type questions. I called and asked the very general question. "I'm putting a couple of beehives in the backyard; do I need to do anything special?"

The clerk asked "Hobby?"

"Yes," I replied.

"You're fine thanks for calling."

Three months later a cease and desist letter arrived. I was to immediately remove the hives or face a penalty of imprisonment and or a fine. Motivation.

Ironically enough, the owner that made the complaint concerning the bees lives in the home that is our only abutting property, didn't feel the need to keep his unsightly yard clear from free standing water. This, the year that mosquitoes were carrying the West Nile virus, was subsequently bitten and suffered the affects for almost a year. He was never cited and or probably never knew that his unconsciousness concerning the neighborhood was affecting everyone.

For years I had listened to my mother clamor on about the bees; their absence, their decline, formidable mites and people's selfish approach to nature. I wasn't habituating mountain lions, bees, albeit waning were in the backyard already. They were in the old maple trees that lined the streets; most assuredly they were in the crawl spaces of the big Denver squares that line my block.

No, I would not be removing the hives.

Allow, Support And Encourage

It's been a little over two years since the Denver City Council saw its way clear to pass an ordinance allowing for beekeeping. The proceedings crept slowly through the November evening. The council was addressed by 16 adults and one spryly child all of whom spoke with clarity and affirmation concerning their beliefs as to why Denver should: allow, support, and encourage the keeping of honey bees.

Finally, after four hours of ruminating the powers that be capitulated, voting 10-2 in favor of the proposed beekeeping ordinance.

I left the council chambers with an enormous feeling of responsibility.

You see they had demanded nothing from us; no permits, registration, inspections, or notifications to abutting property owners. Nope they made a huge statement "We trust you," whoever you may be.

I spent my childhood toe-chucking hive equipment around. The boxes, big, and bulky lured me from my despair of childhood labor by wafting the fragrant smell of honey that had being gently heated by Colorado Summer's sun.

We never made trips to the hardware store for bee equipment; however we did pick up supplies for gardening, birds, even bats but never any bee stuff. When equipment did arrive, from zip codes with very low lead in numbers, there was always an odd mystery that leaned into the unwrapping. Something seemed to be missing from the practice of this garden necessity.

The days following the council meeting left me with an enormous sense of urgency. Metaphorically, there was a big locomotive barreling down the track, filled with folks that had never before thought about hosting a box of bugs in their backyards. A ground swell had begun. The people were excited, enthusiastic, willing, but low on familiarity with all things buggy. I immediately grabbed a website, found a meeting location, did a little advertising and waited.

What seemed to be missing from the garden necessity was slowly starting to reveal itself.

Tuesday, 2009; DenverBee had its first meeting . . . thanks to David, Craig, Laura, Molly and Roman. Robert and his rules were not in attendance. We gathered in the basement of a Masonic lodge, we settled into the deep arm chairs of novice and began to discuss bees, breeds, suppliers, equipment, and the up side of stopping for red lights and gave away a red table wine thru a twisted raffle.

Different Crosses

Comparatively speaking, urban beekeepers have different crosses to bear than other beekeepers. One of the two issues for beekeepers is their neighbors and their neighbors and their neighbors around the idea of what they perceive a yard to be and be for. Historically urban yards had been postage stamps of pristine geometric figures. These symmetrical plots where divided by quaint walk ways with flowering borders of petunias, a smattering of geraniums and the occasional lilac bush. Deep in the back of the yard nestled against the alley and ash pit (trash removal of long ago) you would find a small robust vegetable garden.

The train was coming down the track but the vibration that it was bringing forth was crumbling the steadfast ideologies of everything that had been accepted as normal, desirable and natural in yards.

Twenty years ago my father died and soon after my mother (supposedly as a part of her grieving process) replaced the entire lawn with old roses and ground cover. In the Spring there's a constant procession of folks driving by calling out to my mom "I love your garden," she throws up a hand in acknowledgment and smiles.

In the Spring her garden is a site to behold with all the roses coming out with their first hardy and robust blooms! It's soothing, invigorating and the cadence is natural.

How To

The second issue is the availability of viable and pertinent information on bees and methodologies as well as equipment which was not readily available or inexpensive.

I pondered "trusted us." I realized that it was imperative for DenverBee to provide a place to attain viable information from pundits who came from the educational community at large. Tenacious educators/researchers with proven track records that had spent endless hours used boundless energy and felt an emotional connection to the honey bee.

The pre-existing community didn't have the man power or the knowledge base to offer the answers or direction to the challenge that lay before them.

Beekeeping, bogged down by more hyperbole than fact and cursed with disconnectedness and pious attitudes, was on the verge of coming into its own.

Why To

Often times the catalyst is confused for the reaction; in this case the who was confused with the what? It's remarkable the immaturity that exists when you you're attempting to succeed at the same thing. We did bring in pundits, and each one of them commented without prompting just how competitive beekeeping groups are. They're willing to stick their hand into 50,000 stinging venomous insects but have a very difficult time showing courtesy and respect to one another, it was met with remarks like "how much skin did you have to show to get him?" or the incessant need to know which group someone belongs to.

There is the argument, ad nausea, about the different shaped boxes, bees don't know architecture, they know their architecture but as you'll recall they plant themselves in bar-b-ques, soffits and long forgotten prams (baby strollers) stored in well insulated sheds.

It's true, aspects of beekeeping need to be challenged and discussed, who really needs smokers or that ridiculous yellow brush, use a feather or ornamental grass blades, but not at the cost of losing ground within the community.

The first year I had gathered 58 swarms on my own, by the end of the season I didn't have the will to live.

I passed them out to our beekeepers, and kept a few. I still have a few of those swarms. I found a methodology for gathering swarms; put them into a bucket during the day and return at dark to find them nestled quietly in the bucket, not one left behind.

I was on my way out the door, knowing just how this would play out.

I would arrive at nightfall, gather up the bucket and install them in their new home in the early morning.

I grabbed my keys, was in full stride going for the gate when I saw the lightening flash, then the clap "I'm very concerned about the birds, the cats seems be scaring them off. I sigh deeply and realize that meeting someone half way is the best trip you'll ever take. BC

What's New For You –

Books From Northern Bee Books, all
available from www.GroovyCart.co.uk/beebooks or any bookstore near you.

The Beekeeper's HandBook: or Twenty-Two Years' Experience in Queen Rearing, by Henry Alley. 6.75" x 9.5". 185 pages. Black and white. Soft cover. $26 (depending on exchange rate, or U.S. bookstore).

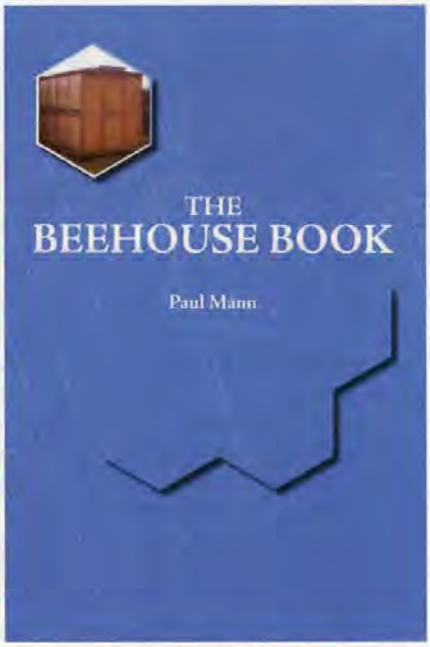
This is a reprint of Alley's 1883 queen rearing manual. It includes two chapters by other authors. One, by House on how to manage an apiary for maximum honey production and then how to market that crop, and another chapter by Locke on different kinds of bees – the Cyprian, the Holy Land, *Apis dorsata*, and the Hungarian bee. You will probably not find more accurate descriptions of these bees anywhere because they were not diluted with modern-day integration and gene mixing when first observed.

Alley's contributions however are profound and the reason is the detail he goes into to describe his technique and how to use it. The down side of this book is the organization – Alley's chapters are all over the place – every bit of information is good, but it is seemingly unorganized and jumbled. Each chapter is only a collection of thoughts – for instance the sub-heads for Chapter 9 (chapters have no Head, just the number) – Tested queens the standard of excellence; Selected queens; Warranted queens; Dollar queens; Robbing nuclei; how prevented; Fertile workers.

All of this is fantastic information with good insight and advice – it just seems a tad unorganized.

Don't let that stop you from reading this book however. If you use it more like an encyclopedia you'll be less frustrated – simply look for the topic you want to review and find it in one of the chapters. You will find yourself, however, simply reading each section of each chapter – it is engrossing and difficult to put down. And you'll be a better beekeeper when you're done. And when you're done, you'll see the reasoning Alley had when he wrote this – it kind of makes sense after awhile.

Kim Flottum



The Beehouse Book, by Paul Mann. ISBN 978 1 904846 67 3. 8" x 11.5" 52 pages. Black and white, soft cover. $19.00, with the same cautions on exchange rate.

This is a builder's book. If you want to consider all manner of buildings to keep bees in, those bee houses of old that is, this is the book for you. Buildings you can move on skids, buildings you can take apart, big bee houses, small bee houses and how to build them all. Diagrams, blueprints, photos...it's all here. Skylights, doorways, shelves, hive openings...if you build it, they will live there, no doubt. Try one this year...if it doesn't work out, you'll still have a place to store your bee gear in.

Kim Flottum

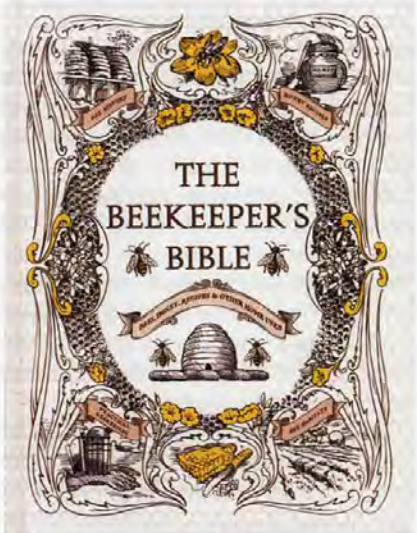
The Beekeeper's Bible. Bees, Honey, Recipes and Other Home Uses. ISBN 978 1 58479 918 4. 416 pages. Paperback (but I got a hardcover). 7.5" x 10" Color throughout. $35.

This book was originally released in the UK. That version had no author, which led me to believe it was a committee effort. I try to stay away from those titles. This version offers two authors, Richard A. Jones a UK expert on insects, and Sharon Sweeney-Lynch, a freelance writer for the Guardian newspaper. It still has a strong UK flavor, and reads like it was written by a committee. But I gave it a second chance and, after going through it again, with bias strongly in tow, could see the minor changes made to accommodate a U.S. market.

There's nothing new here. That's not necessarily bad, but I was disappointed. And they make several errors in identifying the photos (of which there are nearly 500, and all are stunning), which leads one to wonder about the rest of the information – for instance, they labeled an Api-Life Var pad as a formic acid pad. These weren't common, but often enough for concern. But, mostly they got stuff right. Overall, they covered a lot of topics, but with very little detail, or at least not enough to be useful as a practical beekeeping book. The book could be easily described as a mile wide but an inch deep, with the exception of swarming behavior, control and biology. They excelled in that particular topic. Interesting.

A quarter of the book is dedicated to honey recipes and uses for wax, propolis, bee venom and honey in creams, lotions and the like, and about a quarter is dedicated to the history of beekeeping, and there's space given to other bee species and races.

This book is pretty, no doubt. But it's not very useful.



The Honeybee Man, by Lela Nargi and Kyrsten Brooker. Published by Random House, Inc. ISBN 978 0 375 84980 0. 9.5" x 10.5". Color throughout, art by Krysten Brooker. Ages 4 - 8, 34 pages. $19.99.

This children's book is about a beekeeper in Brooklyn, New York, who keeps three hives on the roof of his three story apartment building. It has to do with bees in the city, the plants they visit and the places they go. And it has to do with Fred, the beekeeper. Fred enjoys his bees, and the story is about how the bees visit Brooklyn flowers and make Brooklyn honey. Fred takes care of the bees all summer, then harvests the honey and shares with friends and neighbors. The art is colorful and the bees shown are non-threatening. The biology is spot on, and the illustrations, all wonderfully done, are almost perfect...only a beekeeper knows they show the frames upside down. It would be a great book to read to a 4 - 8 year old to introduce them to honey bees and beekeeping in the city. We need more city kids to know more about bees and beekeeping. This is a good start.

Kim Flottum

Millerbees Manufacturing has several new versions of their small hive beetle traps. **www.beetlejail.com**

The new entrance trap is actually quite clever as it uses beetle biology to defeat beetle entrance into a colony. This unit attaches to the front of your colony, with supplied screws, but there are several ways to mount the trap. The landing board has two opening...the large one is just large enough for bees to enter, and they use this. But if you look closely you'll note a tiny slot beneath the larger opening. Actually, it doesn't even look like an opening but rather a small space below the larger slot. Beetles landing on the entrance ramp looking for a way in will run right into that slot...or, if guards are present, will be chased right into that slot. Beetles, thinking this is the perfect way to escape the guards, scoot right in, and the bees can't follow because it's too small. Once the beetles go in though, they immediately fall into a capture container filled with oil. End of beetle before they even get started. Available in 10 and eight frame equipment size.

A modification of their frame trap is available now too. Instead of an empty space below the oil-filled container in their frame trap, they have now added a space where the bees can build drone comb, so you are capturing two pests with one trap.

Clear inner cover. Long available in other countries, here's a clear plastic inner cover for eight or 10 frame equipment. Cover has Cypress wood frame, ventilation hole and screen to cover hole. The screen prevents hive beetles, wax moths, etc. from entering the hive. small hive beetles do not like the plastic and light, so they are driven down into other traps and or out of the hive. Cover allows top inspection of hive without disturbing the bees. Bees can be observed in any weather.

Bucko Gloves offers two new products for beekeepers. To meet requests, Bucko has available XXS and XXLG sized gloves with cuff ventilation. These are added to the S, M and L sizes already available. The new small size is ideal for children and those with smaller hands. The XXL size is for really, really big hands. They also now have gloves in S, M, L and XL without the venting. Plus, they now have just the heave duty canvas sleeve without glove available. Visit **www.buckogloves.com** for more information.

Certified Naturally Grown's (CNG's) apiary certification program promotes beekeepers with natural management practices who don't use synthetic chemicals in their hives. Beekeepers apply for certification online once they've identified their "local network" of at least two other natural beekeepers (whether certified or not). CNG is a peer-review certification program, so a local network is essential to the certification process. Once their application is approved and they've met the program requirements, Certified Naturally Grown beekeepers are entitled to purchase marketing materials with the colorful CNG logo and informative promotional cards. Participating apiaries are profiled on the organization's website. Annual on-site inspections are a program requirement, and are carried out by other nearby natural beekeepers. Certification requires an annual contribution of some amount. CNG recommends $50 - $200, but it's up to each member to determine the exact amount, whether more or less. CNG's apiary standards can be a useful guide for any natural beekeeper, and are posted on the website under Apiary Certification. Find participating beekeepers near you at **www.naturallygrown.org**.

From Mann Lake Ltd.

HopGuard™

The new highly effective, natural *Varroa* control system. This natural, food grade product is a proven miticide derived from hop compounds. HopGuard provides the beekeeper with a natural safe and easy to use alternative to traditional harsh chemical control agents. This treatment promotes bee health and survivability naturally. It is safe for bees, the beekeeper and the environment and is very easy to use. Strips are applied two per 10 frames and is most effective when used during the pre-pollination period (before sealed brood), mid-Summer, and at the onset of Winter brood development.

For information and pricing on both of these new items visit www.mannlakeltd.com

ULTRA BEE

HIGH PROTEIN POLLEN SUBSTITUTE

The Gold Standard in Bee Feed. Ultra Bee delivers 20% crude protein in patty form and 65% with the dry feed.

Why use Ultra Bee? Because: Good nutrition = Healthier, stronger, longer living bees and Healthy Hives = More Honey!

Ultra Bee® contains the highest content of crude protein available on the market!

Ultra Bee is non-soy based, contains no animal by-products, produces healthier, stronger bees, is full of beneficial vitamins, lipids and minerals and increases brood production!

Bee Villa is a high density polystyrene bee box, with no assembly required. It has a thickness of 2½ inches with an R-value of approximately 10. It is excellent for both hot and cold climates.

- Stackable for multiple box transfers
- More honey production
- No need to wrap hives for cold climate prep
- Greatly reduces propolization
- Overlapping design of boxes prevents water seepage
- Decay and photolysis resistant
- Lasts up to 30 years – no need to replace hive bodies often

Bee Villa, LLC 800-363-7657 **www.beevilla.com**

Bee Villa has two new kits, the Adapter Kit and the NUC Divider Kit:

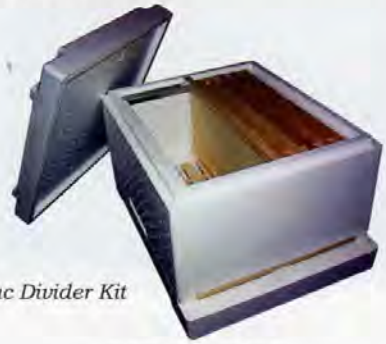
ADAPTER KIT includes: Lid, two Hive Bodies, Base, Adapter, two pairs "L" Brackets, Entrance Reducer, Wooden Grid, Winter Plug, Vent Screen (frames not included).

Bee Villa's Adapter Kit comes with a stainless steel adapter for compatibility of standard wood boxes and supers.

Adapter Kit

NUC Divider Kit includes: Lid, 1 Hive Body, Base, 1 pair "L" Brackets, NUC Divider Board, Winter Plug, NUC Plug, Vent Screen (frames not included)

Bee Villa's NUC Divider Kit is a single Bee Villa hive body split using a NUC Divider Board to make two five-frame NUCS.



Nuc Divider Kit

The Pull and Pop foundation support rods are designed to eliminate support pins and foundatin wiring. There is no need for grommets, wire, pins or crimping. The rods are color-coded the same as the queen color.

To install insert the support rod thru the end bars of the frame and lock in place with the rod nut. We also have plastic support pins which are color-coded the same as the queen colors. We can supply any amount needed.

For additional information and prices, contact **Peck's Bee Supplies** at **tpeckbees@comcast.net**. Or phone 717.545.6982, fax 717.545.1935.

Keeping Bees Healthy with Formic Acid DVD. 95 minutes. $10 plus postage. Bill Ruzicka, 2910 Glenmore Rd. N. Kelowna, BC, V1V 2B6 Canada. **www.MiteGone.com**. 250.762.8156.

This is an instructional video for using formic acid with the MiteGone pads. But it's a lot more. Bill now has a kit for small scale beekeepers to use, so they don't have to purchase a huge amount of formic acid or pads . . . good for groups to purchase together. But basically, MiteGone is meant for bigger operations. He shows how to make it work safely and efficiently, and it works on *Varroa* and tracheal mites, and puts a damper on chalk and makes life miserable for small hive beetles and wax moth. And, it doesn't contaminate wax. Used correctly it's safe for drones, queens and brood. On a commercial scale it's pretty good stuff.

But even if you never plan on using Bill's product, try the DVD, because Bill is an engineer, a pretty good biologist, and a heck of a beekeeper. You'll learn a lot from just watching how he gets things done in his operation. He raises queen, sells nucs, makes honey, moves bees for pollination, wraps bees for a hard Winter and does it all with about 5% loss each year. You'll see a bit of British Columbia, some of Europe, a few other beekeeping tricks . . . and learn a lot. Even if you never use formic acid.

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Science Of Bee Culture

Vol. 3 No.1

INSIDE

Preservation And Processing Methods For Molecular Genetic Detection And Quantification Of *Nosema ceranae*

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Summary

The prevalence of *Nosema ceranae* in managed honey bee colonies has increased dramatically in the past 10 - 20 years worldwide. A variety of genetic testing methods for species identification and prevalence are now available. However sample size and preservation method of samples prior to testing have not been thoroughly explored. Here, we test sample sizes ranging from 10 to 100 bees per colony and the suitability of ethanol, isopropanol, ice, and freezing as preservation methods prior to genetic testing. Larger sample sizes coupled with freezing/cold storage without the addition of chemical preservatives improve the reliability and suitability of samples for genetic testing and are recommending for diagnostic testing purposes.

Keywords: *Nosema ceranae*, real-time PCR, genetic testing

Introduction

Prevalence of the microsporidian *Nosema ceranae* has increased in managed honey bee colonies globally since it expanded its host range from *Apis cerana* to include *A. mellifera* in the 1990's or perhaps earlier (Chen et al. 2008). Based on evidence from diagnostic sampling, it appears that *N. ceranae* has displaced *N. apis* as the dominant microsporidian parasite of honey bees in the United States (Chen et al. 2009). While both species of *Nosema* have deleterious effects on honey bee colonies, their seasonality and pathologies differ markedly. Symptoms of nosemosis caused by *N. apis* are more easily observed in honey bee colonies which show large numbers of dead bees and diarrhea spotting at hive entrances evidencing digestive disorders of adults, mostly during winter and early spring. Symptoms of *N. ceranae* infestations are less detectable and consist primarily of poor colony growth and dwindling. *Nosema ceranae* can reach high infestation intensities

in both winter and summer. Both species cause decreases in honey production, foraging activity, and pollination productivity. For both species, spores are spread through infected feces which can contaminate combs, stored food, and even corbicular pollen (Rinderer and Sylvester 1978, Malone et al. 1995, Malone and Stefanovic 1999, Higes et al. 2007, Martin-Hernandez et al. 2007, Higes et al. 2008a, Higes et al. 2008b). Individual bees do not exhibit any external signs of infection. Even examination of the mid-gut without a microscope is inconclusive. This makes diagnostic sampling in a laboratory important for beekeepers to enable them to properly time control treatments. Diagnostic testing methods use either microscopy or molecular genetic detection and molecular quantification.

Microscopic analysis of the midgut contents is the traditional method for the detection and quantification of Nosema spores. Simple identification of *Nosema* sp. spores is probably of little value. Almost every honey bee colony seems to have some level of *Nosema ceranae* infection. Fortunately, honey bee colonies seem to tolerate a low level infection rather well. Beekeepers have learned that only when the number of spores rises to about 10 million do the colonies need treatment to prevent damage. Hence, meaningful microscopic analysis involves the use of a haemocytometer to quantify the intensity of infestations.

The availability of molecular diagnostics has increased very recently which introduces a need for preservation methods that will provide consistent and accurate results. Microscopy techniques are more forgiving of various preservation methods since the spores are difficult to inadvertently degrade with preservation methods. However, molecular tests require that moderately high quality DNA be extracted from *Nosema* spores and vegetative material. Preservation fluids like formalin or isopropanol may inhibit quality DNA extraction and amplification.

Another requirement of diagnostic sampling (whether it is for microscopy or molecular testing) is analysis of samples having an adequate number of bees. Variation in the intensity of *Nosema* infestations among individual bees within a colony is high. For colony-level diagnostic evaluations, individual bees are pooled together and then examined. Hence, the number of bees used in the pooled sample may affect diagnostic test accuracy. Highly infested bees may be less common but the sample size must be large enough to include them in the proportion that they exist in the colony.

Here, we test four methods of sample preservation to determine which method yields the most accurate and consistent results from molecular analysis. We also examine the levels of individual variation within colonies and test the repeatability and accuracy of pooled samples of different sizes.

Materials and Methods

Sampling

Eight colonies were tested for the presence of *Nosema* spp. with microscopy. The colony with the highest infestation level was chosen and sampled. This colony had an infestation level of 4.3 million spores/bee. Approximately 2000 adult worker bees were collected and placed on ice. Groups of 300 Individual bees were counted and were assigned to one of four different treatment groups. The treatment groups, with different methods of sample preservation were: FRZR – storage at -20°C, POST – placed in a Styrofoam cooler with packs of blue ice for 2 days and then stored at -20°C (simulating samples sent to a diagnostic laboratory for evaluation), ETOH – storage in 70 % EtOH and ISOP – storage in 70% isopropanol. All samples were maintained in their respective treatments for 1 week prior to DNA extraction.

DNA Extraction

All bees in each treatment group were thawed, degastered, and processed for DNA extraction either as individuals or as pooled samples. Individual DNA extraction followed the protocol described in Bourgeois et al. (2010). Briefly, this entailed grinding separated gasters in 1 mL dH_2O per bee (i.e., making 1 mL of homogenate), concentration of 200 µL of the homogenate into a pellet, incubation of the pellet in H_2O_2, digestion in lysis buffer and proteinase K solution, precipitation of proteins with 7.5 M NH_4OAc, and precipitation of genomic DNA with isopropanol. For the first 100 bees processed for each treatment, all extractions were processed individually (i.e., one 200 µL aliquot for DNA extraction) as per Bourgeois et al. (2010). The remaining homogenate of each bee was then divided into 4 additional 200 µL aliquots. These aliquots were used to generate pooled samples containing homogenates from 10, 30, 50, and 100 bees. Two hundred additional bees were homogenized in groups of 10. Sub-aliquots (200 µL per bee) of these samples were combined to generate additional pooled samples of 50 and 100 bees each. All pooled samples were centrifuged at 800 x g for six minutes. The supernatant was then removed and the pellet was resuspended in 5 mL dH_2O. These samples were then processed in the same manner as the individual samples for DNA extraction.

Molecular Genetic Analysis

Real-time PCR not only measures presence/absence of a target DNA sequence, but also quantifies the number of copies of that fragment. In the case of the *N. ceranae* assay, both vegetative and spore DNA are represented in the sample. Results are presented as "nosema/bee", including both spores and vegetative material. Detection and quantification were performed on a StepOne™ Real-time PCR System (Applied Biosystems, Carlsbad, CA). Protocols for FAST PCR and reagent specifications followed those described by Bourgeois et al. (2010). Modifications to the protocol were made by elimination of primers and probe reagents for *N. apis* and addition of distilled water to adjust the reaction volume to 12.5 µL. All other reagents and specifications remained the same. All samples were run in triplicate and were directly quantified by comparison to a standard curve of known levels of *N. ceranae* DNA copy number. Standards were generated from serial dilutions of a cloned PCR product of the target sequence from *N. ceranae* (Bourgeois et al. 2010).

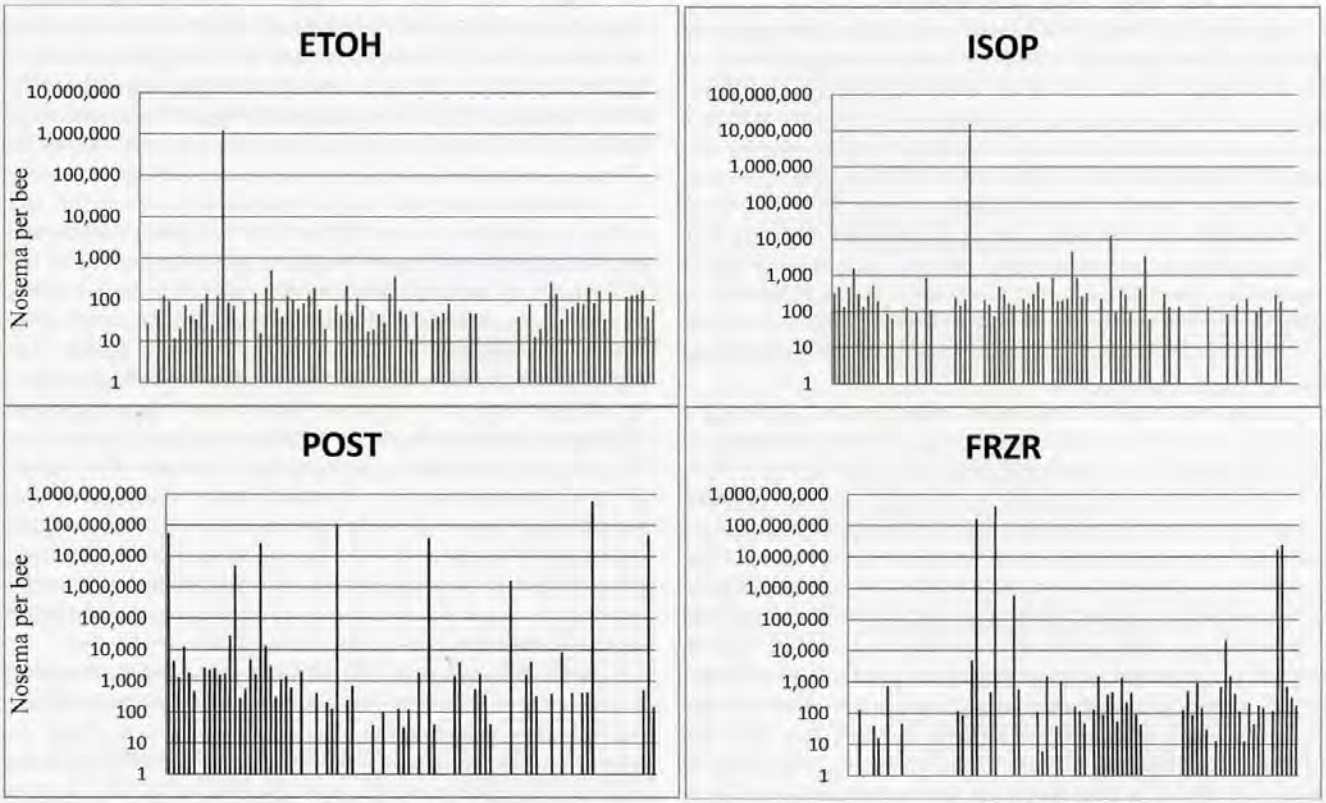
Data Analysis

A Mixed Model (SAS v 9.1.3) ANOVA was used to compare results for honey bees preserved in the 4 treatments. Pooled data were also subjected to Mixed Model ANOVA, using treatment and pooling as fixed effects and Bonferonni correction for multiple comparisons. Data passed Levene's test of homogeneity of variances ($P > 0.05$). Correlations (Pearson) were determined in SAS v 9.1.3 with Proc CORR.

Results and Discussion

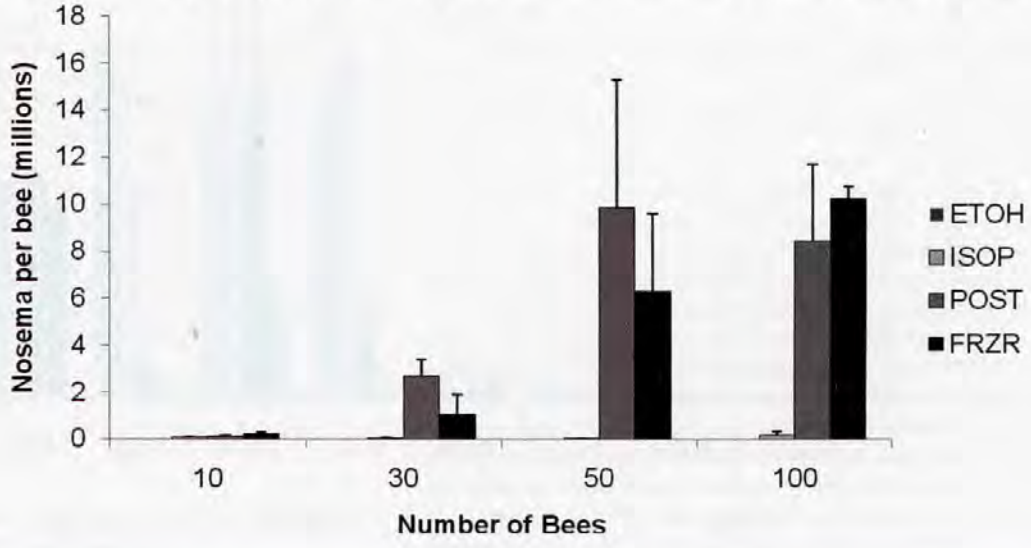
Variation among individuals was evident for *N. ceranae* levels across all treatments (Figure 1). Of the individual bees tested for each treatment, only 1% in each of ETOH and ISOP treatments had *Nosema* levels greater than one million nosema/bee whereas POST and FRZR treatments yielded 8% and 5% of bees, respectively,

***Figure 1** - Levels of* Nosema ceranae *in individual bees preserved by four methods. Data were generated from molecular genetic analyses. Data are presented on a logarithmic scale to make lower concentrations visible. ISOP - isopropanol, ETOH, 70% ethanol, POST - postal shipping, FRZR - freezer.*



with greater than one million nosema/bee. While isopropanol and ethanol are commonly used as preservatives, they may affect the recovery of high quality DNA from both sporulated and vegetative *Nosema*. Both types of preservatives at 70% concentrations may have deleterious effects on DNA quality and subsequently on amplification of DNA from samples that are used for quantification purposes. This is due to the high stringency and specificity that is inherent to real-time PCR technology. Any DNA degradation or inhibition of amplification will have a negative effect on the results. Ethanol and isopropanol at 70% concentrations were selected because these are the concentrations commonly available and hence used by beekeepers. For research specimens, 95 - 100% ethanol is preferred for sample preservation to minimize DNA damage. However, this is cost prohibitive for beekeepers. Both POST and FRZR samples had higher levels of *N. ceranae* than either of the alcohol treatments (ETOH: $P = 0.0016$ and $P = 0.0142$, respectively or ISOP: $P = 0.0019$ and $P = 0.0166$, respectively; Figure 2) treatments. Immediate placement of samples on ice and

***Figure 2** - Variation among bees from four preservation treatments. Data were generated from molecular genetic analyses. ISOP - isopropanol, ETOH, 70% ethanol, POST - postal shipping, FRZR - freezer.*



then storing at cold temperatures may have prevented degradation. No inhibitors were present in these samples, as no preservatives were used other than freezing temperatures.

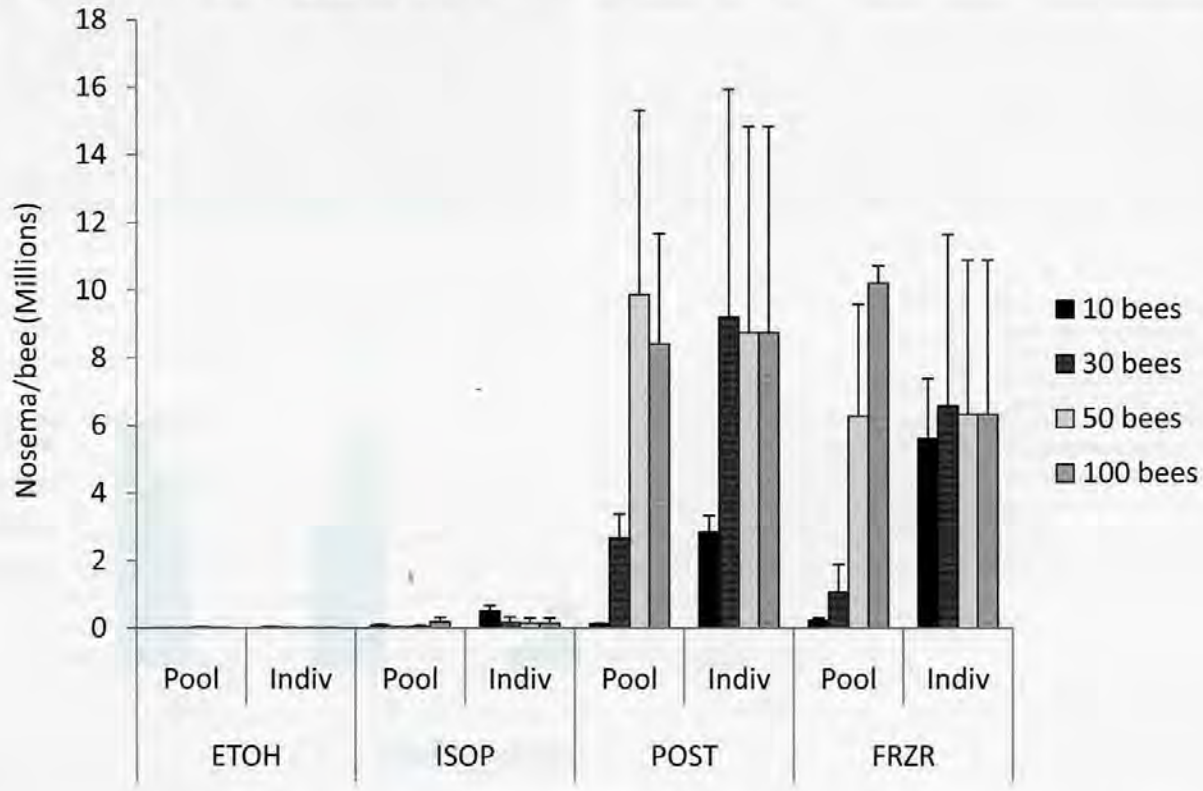
Among POST and FRZR treated samples, the variation among individual bees was high. Levels of *N. ceranae* ranged from 0 to 59.6 million nosema/bee, with the majority of bees having levels below 10,000 nosema/bee. Individual-level variation within a colony may be related to the age of sampled bees and other factors. Older, foraging bees have higher levels of *N. apis* and *N. ceranae* than younger bees (Martin-Hernandez et al. 2007). However younger bees may still be exposed to contaminated materials such as fecal matter and retrieved pollen. Spores of *N. apis* are primarily transmitted through fecal matter and soiled comb (Higes et al. 2008b). Specific data on spore transmission of *N. ceranae* are not yet available (Fries 2010), but fecal matter and self-contaminated pollen are two likely sources .

With high levels of individual variation within a colony, the question arises of how to adequately sample a colony for diagnostic purposes. Processing large numbers of individual bees is not time or cost effective. Pooled samples are typically used for diagnostic samples, however the number of bees in these pooled samples is different between laboratories. The first step in our evaluation of the sample size question was to test the reliability of pooled samples, i.e., how well do pooled samples represent the individuals from which they are taken. Levels of *N. ceranae* in bees used for both individual and pooled samples were highly correlated ($R^2 = 0.7881$, $p < 0.0001$). The second step was to test the consistency among different sample sizes and how different sets and sizes of pooled samples represented the colony. Among treatments, bees pooled in groups of 10 ($1.13 \times 10^5 \pm 6.01 \times 10^4$ nosema/bee) had lower levels of *N. ceranae* than groups of 50 and 100 bees ($3.77 \times 10^6 \pm 1.83 \times 10^6$ nosema/bee ; $P = 0.0461$ and $4.80 \times 10^6 \pm 1.60 \times 10^6$ nosema/bee; $P = 0.0055$, respectively after Bonferroni correction for multiple comparisons). Bees pooled in groups of 30 ($9.47 \times 10^5 \pm 4.01 \times 10^5$ nosema/bee) also had lower levels than those grouped as 100 ($P = 0.0308$; Figure 3). All other comparisons were non-significant ($P > 0.05$). Ideally, the more bees sampled the better representation of infection levels within a particular colony. However, there were no differences between those bees grouped in lots of 50 or 100.

We used a colony that had an infection level of less than five million Nosema/bee. As the sample size increased, the standard error associated with multiple estimates decreased until, with 100 bee samples, the standard error was about 1/3 of the mean estimate. Probably, larger samples still would have a smaller standard error. However, for the purpose of determining whether apiaries should be treated for *N. ceranae* the accuracy obtained from 100-bee samples is sufficient while samples that are lower than 50 bees might lead to incorrect treatment decisions. With colonies that have levels of *N. ceranae* that meet the higher treatment thresholds of 10 million or 20 million nosema/bee, the standard error would be smaller since a larger proportion of the bees would be highly infested and the effects of individual bees on the pooled sample would be less. For colonies with fewer than five million nosema/bee the standard error may be larger but these colonies have infestations well below treatment thresholds.

Beekeepers and many bee scientists are accustomed making treatment decisions and recommendations based on nosema spores per bee rather than numbers of nosema DNA copies. Using the correlation between molecular and microscopic measures of nosema numbers in a previous study, a conversion factor (0.028) has been

***Figure 3** - Variation in levels of* N. ceranae *among pooled and individual honey bee samples, generated from molecular genetic analyses. ISOP - isopropanol, ETOH, 70% ethanol, POST - postal shipping, FRZR - freezer.*



developed to convert molecular measures to spores/ bee. However, the conversion from number of nosema/bee to spores/bee should be used cautiously, as the stage of infection in individual bees is unknown and the ratio of vegetative material to mature spores will vary with the stage of infection. A more conservative conversion factor that has been determined for samples consisting only of older/foraging bees (data not shown) is 0.195. We recommend using this conversion factor when samples are processed with molecular genetic analyses.

Conclusions and Recommendations

Placing bees on ice in the field and later moving them to a freezer is a cost-effective means of sample collection and provides high quality samples for molecular genetic testing.

Samples which are placed on ice in the apiary, then shipped cold with "blue ice" and frozen within two days, also will produce acceptable molecular genetic results.

Sample size has an effect on results. Larger samples provided more consistant estimates of colony infestation levels. For small colonies, we recommend sampling a minimum of 50 bees. For larger colonies we recommend 100 bees. One hundred bees will easily allow the determination of whether a colony meets economic thresholds for treatment that are established at 5 or more million spores per bee.

Use of these recommendations should ensure that sample size and sample quality are adequate for accurate determination of *N. ceranae* levels in managed honey bee colonies.

Acknowledgements:

We thank D. Dodge and D. Winfrey for assistance with sample collection. Mention of a trade name, proprietary product, or specific equipment does not constitute a guarantee or warranty by the USA Department of Agriculture and does not imply approval to the exclusion of other products that may be suitable.

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The Effects Of Hive Color And Feeding On The Size Of Winter Clusters Of Russian Honey Bee Colonies

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Summary

This study determined the effects of hive color (black or white) and its interaction with feeding on colony growth of Russian colonies through the winter. One hundred and forty two colonies with pure-mated Russian queens were established. One half of them were in hives painted white and one half of them were in hives painted black. One half of each group was given only one gallon of sugar syrup to help assure survival. One other half of each group was continuously fed a small trickle of sugar syrup and pollen substitute from mid-November to mid-February. Colonies that were fed throughout the winter were 2.8 frames of bees larger than colonies that were minimally fed (Fed: 8.6 frames of bees, Minimally fed: 5.8 frames of bees). There was no difference in the size of colonies that were housed in black hives (7.3 frames of bees) and colonies that were in white hives (7.1 frames of bees).

Key Words: *Apis mellifera*, supplemental feeding, eight-frame hive, protein substitute, almond pollination

Introduction

Russian honey bees have been bred to have strong resistance to the parasitic mites *Varroa destructor* and *Acarapis woodi,* good honey production and strong overwintering abilities (de Guzman *et al.* 2001, 2002, Rinderer *et al.* 2001a, 2001b, 2001c). These breeding goals, begun in 1998, are still maintained as the Russian honey bee stock continues to undergo selective breeding by the Russian Honeybee Breeders Association (Brachman 2009). Russian honey bee stock can be used successfully, with only minimal treatment for parasitic mites, for honey production throughout the country.

However, the income base for many beekeepers in the United States has changed since 1998. Renting honey bee colonies for pollination has provided an increasingly larger share of the income of many commercial beekeepers with a large portion of this increase coming from the pollination of almonds. Colonies rented for pollination must meet size standards established in rental contracts with growers. Hence, many beekeepers who intend to rent colonies for almond pollination use colony management in an attempt to produce large colonies for mid-February (Traynor 1993).

Russian honey bee colonies build large populations in the spring after reliable natural pollen becomes available (Tubbs *et al.* 2003). Until then, the colonies are generally small and exhibit traits that favor winter survival such as using food frugally and producing a restricted late winter brood nest. That is, the colonies do not tend to grow in late winter and produce large colonies early. Italian colonies tend to produce large colonies early and often require substantial feeding to avoid starvation in early spring. It may be that restricted brood rearing in late winter contributes to overall resistance to *V. destructor* by favoring a winter die-off of mites infesting colonies. However, restricted winter colony growth is a disadvantage in attempts to produce large colonies by mid-February for almond pollination (Danka *et al.* 2006).

Typically, even among keepers of Italian honey bees, most beekeepers rely on special management procedures to build large colonies by mid-February. Italian honey bee stocks usually respond favorably to these techniques and large proportions of them remain or become large enough to be rented for almond pollination. Mostly these management techniques involve feeding individual colonies both a liquid sugar feed and a protein substitute, usually in patty form. Protein feeding is known to stimulate brood rearing (Danka and Beaman 2009, Degrandi-Hoffman *et al.* 2008, Mattila and Otis 2007, Nabors 2000, Peng *et al.* 1984, Standifer *et al.* 1973). The best timing, frequency and duration of feeding to prepare colonies for almond pollination rental are less well studied. In a study conducted by Degrandi-Hoffman *et al.* (2008), intermittent feeding of protein and carbohydrate syrup resulted in colonies that dwindled slightly while unfed controls dwindled by half. Rinderer *et al.* (2010) found that Russian colonies in eight-frame hives that were fed protein and carbohydrate syrup from October 2007 to February 2008 only dwindled slightly (0.3 frames of bees) by February. Unfed colonies lost about 2.3 frames of bees during the same period. In a second experiment, colonies in eight-frame hives fed from November 2008 to February 2009 grew about 3.2 frames of bees. Colonies in 10-frame hives that were fed grew less (2.5 frames of bees). Un-fed colonies in eight-frame hives grew only about one frame of bees and un-fed colonies in 10-frame hives remained about the same size.

One of our research goals is to identify management procedures which will improve the ability of Russian honey bees to meet the needs of pollination and especially almond pollination. The study reported here was undertaken to determine the effects of hive color (black or white) and its interaction with feeding on colony growth of Russian colonies through the winter.

Materials and Methods

The study was begun November 17, 2009 and final data were collected from the 18th to 25th of February 2010. One hundred and forty two colonies with pure-mated Russian queens were established. They were placed in five apiaries on four-way hive pallets. Colonies were in two eight-frame hive bodies with 16 Langstroth "deep" (9 5/8 in) frames of comb and one medium eight-frame hive body with four frames of honey and four empty frames.

When established, the colonies were evaluated for the presence of the queen and colony size. The numbers of bees on each side of each frame were estimated as tenths of the frame side covered with bees. Since commercial inspections of colony size for almond pollination consider 3/4 of a frame covered by bees to be one commercial frame of bees (Traynor, 1993), we calculated frames of bees by multiplying our estimate of full frames of bees by 1.25 to estimate commercial frames of bees. Colonies were equalized at the beginning of the experiment and averaged 8.9 ± 0.3 frames of bees.

Each group of colonies on a pallet was assigned one of four treatment groups: a) hives were painted black and fed through the experimental period, b) hives were painted white and fed through the experimental period, c) colonies were painted black and fed only minimally, and d) hives were painted white and fed minimally. Colonies that were fed received sucrose syrup fed from pails placed over holes in hive lids and patties of Megabee® pollen substitute. The pails had two small holes so that the bees only received a small but regular intake of syrup. The one-pound patties were placed between hive bodies over the cluster. Each week from November 17, 2009 to February 22, 2010 the colonies were inspected and feed was replenished as needed. Most colonies had adequate honey to survive the winter (8.1 ± 0.3 frames of honey) at the beginning of the experiment. However, after four weeks into the experiment all of the colonies assigned to the "minimally fed" control group (MFC) were provided 1 gallon of sugar syrup (1:1, sugar:water, w:w) to help provide adequate winter stores.

Final colony evaluations were made from February 18 to 25, 2010. Once again colonies were inspected frame by frame and colony size was estimated using the same procedures as mentioned previously. Data were standardized to correct for apiary differences. The data analyzed were in the form of "commercial frames of bees" (Traynor, 1993). Colony size could be affected by hive color and feeding, so the data were analyzed by a randomized block, two-factor analysis of variance. Data from 114 colonies were analyzed. One colony in a white hive that was fed had 21.6 frames of bees and was not included in the analysis since it was considered to be an extreme outlier. It disrupted the normality and variance of the data although its presence in an analysis of data lacking normality did not change main factor conclusions. Perhaps this colony had so many bees because of drifting. We do not know which colonies lost bees from drifting but, lacking evidence to the contrary, we assume that all treatments were equally affected. Twenty seven colonies (19%) were lost owing to queen losses, storm related mishaps (falling trees and hive covers blown off) and unknown causes. Losses were equally distributed across treatment groups (Black Fed = 7, White Fed = 4, Black MFC = 7, White MFC = 9. Shapiro-Wilk goodness-of-fit tests, along with an evaluation of the skewness and kurtosis measures, were used to evaluate the normality of the frequency distributions for colonies that were fed and colonies that were not fed. A linear regression was used to determine the relationship between initial colony size and final colony size (SAS 9.2, SAS Institute 2008).

At the evaluations at the beginning and the end of the experiment, samples of about 300 bees were taken from the brood nest of each colony. These bees were processed with a soap-washing technique (Rinderer *et al.* 2004) to remove *V. destructor* mites. Counts of both bees and mites in each sample were made and percentages of infestation were determined. Rates of infestation for each colony from the beginning and end of the experiment were used to determine mite population growth rates (MPG). MPG was standardized across apiary to control for any apiary differences and a correlation analysis was used to determine if larger colonies at the end of the experiment also had larger MPG (SAS 9.2, SAS Institute 2008).

Weather data were provided by the Louisiana Agriclimatic Information System (**http://www.lsuagcenter.com/weather**).

Results

Analysis of variance showed that there was a highly significant difference in size between colonies that were fed through the winter (Mean ± SD = 8.6 ± 0.5 frames of bees) and colonies that were fed sugar syrup only once (5.8 ± 0.5) ($P< 0.0001$) (Figure 1). The analysis also showed that there was no significant difference in the size of colonies that were housed in black hives (7.3 ± 0.5 frames of bees) and colonies that were in white hives (7.1 ± 0.6 frames of bees) ($P = 0.97$).

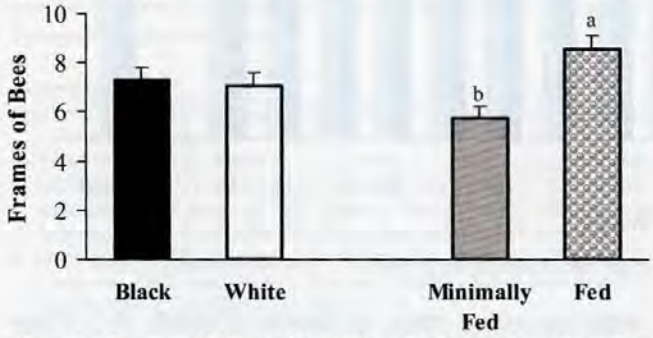

***Figure 1** – Commercial frames of honey bees in February for colonies that were overwintered in black or white hives and were either fed sugar syrup and Megabee® pollen substitute patties from November 2009 to February 2010 or fed one gallon of sugar syrup in November (minimally fed).*

An inspection of the distribution of colony sizes for colonies that were continuously fed and colonies fed only once suggests additional differences between the groups. The colonies that were fed were normally distributed for size (W = 0.99, P= 0.9008) (Figure 2). The colonies that were in the MFC group had a smaller probability of being normally distributed (W = 0.97, $P = 0.2175$) and appear to have a tendency to be bi-modal. Fewer mid-range colonies existed which could be included with larger colonies to make a group that met an average minimum grade.

There was no relationship ($P = 0.24$, $r^2 = 0.012$) between the initial colony size and the final colony size. While some colonies grew in size and others became smaller, the initial size did not predict the final size.

There was no relationship ($P = 0.11$, $r^2 = 0.023$) between the MPG and final colony size. There were also no differences in MPG in relation to color (Black: -0.02 ± 0.15, White: -0.07 ± 0.10, F = 0.09, $P = 0.76$) or treatment (Fed: 0.03 ± 0.14, MFC: -0.12 ± 0.11, F = 0.73, $P = 0.39$).

Discussion

Colonies that were fed had 2.8 more frames of bees than those that were miminally fed. This difference is consistent with the results of feeding in two prior years (2008 and 2009) (Rinderer *et al.* 2010). Colonies that were fed from November to February have been consistently larger through three years of experiments. In two experiments (this report and the experiment of 2008-2009), colonies that were fed continuously from November to February grew while colonies that were not fed or minimually fed became smaller.

This experiment used eight-frame hives since the experiments of 2007-2008 and 2008-2009 indicated that colonies in eight-frame hives grew a bit larger than hives in 10-frame hives from November to February. However, in all of these experiments, feeding had a much larger effect.

There are two important differences between this experiment and those reported by Rinderer *et al.* (2010). In this experiment, the surviving colonies that were fed began with 8.5 frames of bees and only grew by about 0.1 frames of bees while in 2008-2009 colonies that were fed continually from November to February grew by more than two frames of bees. It may be that the weather during the winter of 2009-2010 may have been unusually unfavorable (Figure 3). Average temperatures (and minimum and maximum temperatures) were significantly lower than average. Overall, the average daily temperature through the course of the experiment was 2.7°C (4.9° F) below the long term average. Also, in this experiment, there was

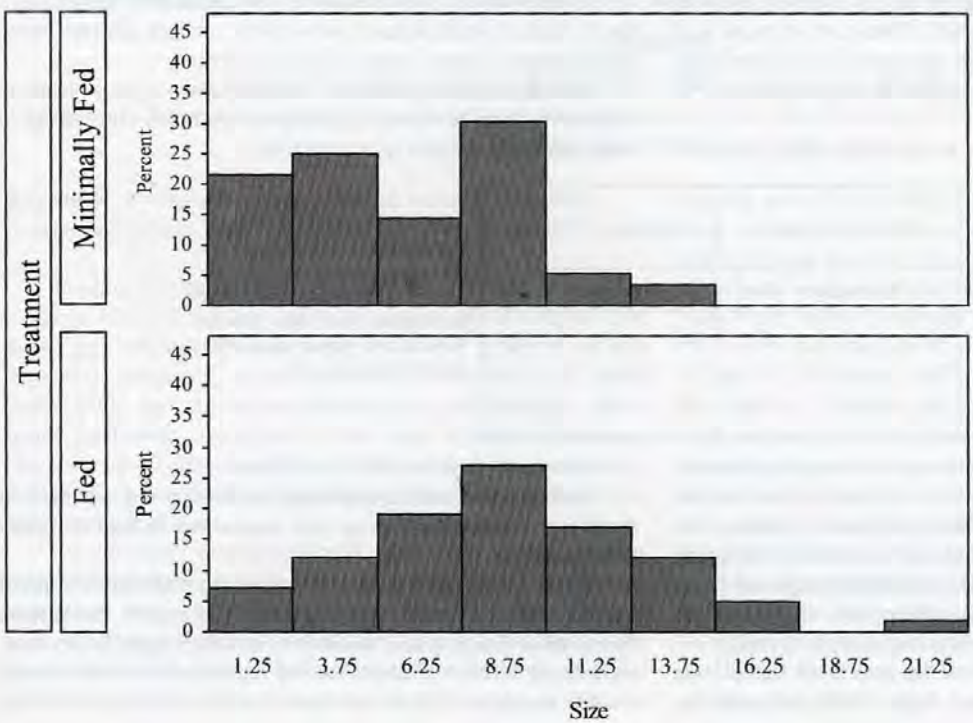

***Figure 2** – Size distributions in February of colonies that were fed sugar syrup and patties of Megabee® pollen substitute patties from November 2009 to February 2010 or minimally*

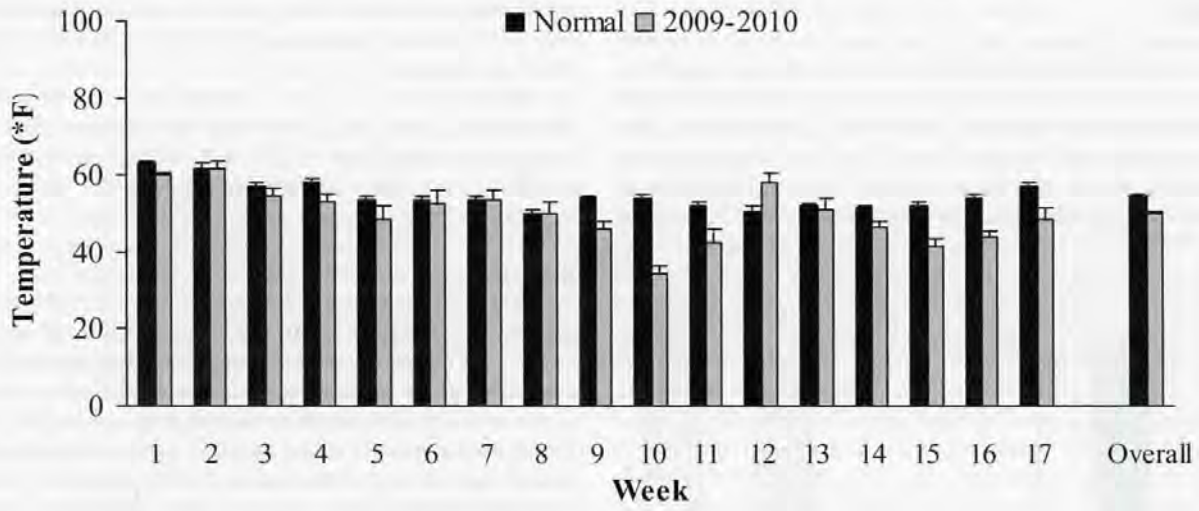

Figure 3 *– Normal average temperatures for the last 10 years and average temperatures from November 1, 2009 to February 27, 2010.*

no relationship between the initial size of surviving colonies and colony growth as there was in 2008-2009 when smaller colonies grew more. It may be that the relationship only occurs when weather is more favorable and colonies can grow substantially.

Not only did feeding produce colonies with a larger average population size, the distribution of sizes was somewhat different and together with differences in average size resulted in a positive change in the overall commercial value of the fed colonies as pollination units (Table). All surviving fed colonies averaged 8.6 frames of bees so the entire group could be used for a contract calling for an average of eight frames. In contrast, the smallest 22 colonies (39%) of the 56 that were minimally fed would need to be culled for the remainder to have an eight frame average. Also, a far greater proportion of the fed colonies were substantially larger than eight frames and were suitable for contracts requiring an eight frame minimum and contracts providing additional payment for larger sized colonies (Table). For example, 40 (69%) of the 58 colonies that were fed had eight or more frames of bees and averaged 10.5 frames while only 24 (43%) of the 56 colonies that were minimally fed had eight or more frames of bees and averaged a smaller 9.2 frames.

Painting hives was ineffective in producing larger colonies. Painting hives black was used as an alternative to wrapping colonies because it was necessary to open hives to feed protein patties. Evidently, the periodic warming of hives with solar radiation was inconsequential. It may be that insulating colonies by wrapping them would have favorable effects. However, wrapping hives would make it difficult to feed the colonies protein. Also, wrapping hives would not be a practical option for most migratory beekeeping.

The treatments had no effect on the growth of *Varroa* mite populations. The feeding produced larger colonies partly by supporting earlier brood production. However, the original numbers of *Varroa* mites were sufficiently low that the increased brood production was not accompanied by a similar increase in the numbers of *Varroa* mites.

Other techniques might be found that will enhance the development of Russian honey bee colonies through autumn and winter. However, it is clear that feeding Russian honey bee colonies syrup with a slow rate of intake and simultaneously feeding patties of pollen substitute will result in Russian colonies in February that are more than minimally acceptable for almond pollination. This is clear at least for beekeepers who overwinter their bees in the southern United States prior to moving them to California in February. This is less clear for beekeepers who overwinter in locations outside the southern states.

Conclusions and Recommendations

Russian honey bee colonies can be managed in the southern United States through autumn and winter to produce colonies which average eight frames or more of bees in February.

Colonies that are fed both sucrose syrup and protein supplement continually from November to February are much more likely to either maintain, or grow to, a large size.

Treatment	Lost Colonies	All Surviving Colonies		Colonies > 6 frames			Colonies > 8 frames		
	N	N	Size	N	Percentage	Size	N	Percentage	Size
Fed	11	58	8.6	43	74	10.2	34	59	11.1
Minimally Fed	16	56	5.8	25	45	9.0	15	27	10.1

Table *– The number and average size of colonies that were fed and minimally fed, and the percentage and average size of both groups that were greater than six and greater than eight frames of bees in size.*

Hive color does not affect colony size.

Earlier brood rearing stimulated by feeding did not result in significant increases in *Varroa* mite populations in Russian honey bee colonies.

Every successful change in beekeeping procedures requires learning and refinements by individual beekeepers. Beekeepers interested in changing their methods to include Russian honey bees, eight-frame hives or different feeding regimes should first attempt to make changes in half the colonies in one or a few apiaries. Doing

their own controlled experiment will provide both an opportunity to evaluate the usefulness of changes in individual beekeeping enterprises and help develop the experience needed to perfect and adapt the changes to specific environments.

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Presence Of Russian Honey Bee Genotypes In Swarms In Louisiana Notes

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Keywords: *Varroa* mites, microsatellites, honey bee swarms, Russian honey bees

In addition to the problems they have brought to the beekeeping industry, *Varroa* mites have, at least temporarily, devastated feral honey bee colonies. Russian honey bees were collected by this laboratory, evaluated, selected and bred for resistance to varroa mites, while still maintaining resistance to tracheal mites, good honey production, manageability and other desirable beekeeping characteristics (Tubbs *et al.* 2003). We were interested in determining if Russian bees are contributing mite-resistant genotypes to the feral honey bee population.

Two hundred pheromone-lured paper pulp swarm traps as reported by Schmidt and Thoenes (1987) were placed in locations near Baton Rouge, Louisiana, in March 2004. We placed traps in trees at varying distances around three apiaries containing ARS Russian and Italian honey bee colonies. The sampling area was 5.7 km x 1.7 km in a low-lying, somewhat forested area that was recently part of the flood plain of the Mississippi River. Sampling sites were chosen based on access and the presence of trees in which to hang the traps. These sites were generally along the edge of forested areas or along fence lines. Each week, for 28 weeks, traps were sampled, emptied, and then replaced. Samples (Mean = 617 ± 31 bees per swarm) were stored at -20°C until processing. A total of 147 swarms were sampled, 80 of which were used for this analysis. Clustering of captured swarms was observed in the traps around the ARS apiaries, but a more uniform distribution of analyzed swarms was desired to evaluate effect of distance on probability a swarm was Russian. Therefore, 80 swarms that were evenly distributed within the sampling area were selected for further analysis. Mite infestation levels were determined by washing, using detergent solution following Rinderer *et al.* (2004). Honey bee genotypes were generated from microsatellite and single nucleotide polymorphism (SNP) markers following Bourgeois *et al.* (2010). Four bees per swarm were analyzed individually for genetic stock identification, i.e., probability that they are Russian

(Ru) or Non-Russian (NRu). The mean of the four individual bee probabilities was calculated to estimate the overall probability of group membership for each swarm. Data for the correlation of genotype and mite infestation were analyzed with ANOVA using SAS proc corr (SAS 2008).

Of the 80 swarms analyzed, 10 were Russian (Ru $P > 0.60$), 15 hybrid ($0.60 >$ Ru $P > 0.40$) and 55 non-Russian (Ru $P < 0.40$). Thus, Russian genotypes were detected in 25 of 80 swarms. Possible sources of the Russian genotypes sampled are the Russian colonies in the ARS apiaries, feral Russian colonies from previous swarms, and Russian drones mating with feral virgin queens. While these colonies are intensively managed to reduce swarming and to maintain the Russian queens in the colonies for ongoing research, Russian colonies have been maintained in these apiaries for several years. Villa (2004) suggested an average swarm movement distance of 3 km for Louisiana, in the absence of swarm traps. Here, distance from the apiaries was positively correlated ($R = 0.224$, $P = 0.045$) with probability a swarm was Russian. However, the presence of traps alters the distance preferences of swarms (Villa 1993) so it is impossible to determine the origin of the swarms.

All swarms had either no comb or only early stages of brood which was unsuitable for *Varroa* mite invasion. Hence, all mites were phoretic on adult bees and mite infestation levels were low for most swarms, regardless of genotype (overall mean = 3.63 ± 0.45%; Russian = 2.20 ± 0.45%; hybrid = 2.57 ± 0.60%; non-Russian = 4.18 ± 0.62%) and showed no correlation with probability of Russian assignment ($r = -0.077$, $P = 0.5$; Figure 1). Only five swarms had mite infestation levels greater than 10%, all of which were non-Russian. Varroa mites have been present in this area for many years. It is possible that some of these non-Russian swarms may have come from ARS and other managed colonies that had been managed with treatments to control mites. The non-Russian swarms could also have originated from surviving feral colonies that had been naturally selected for varroa mite resistance, as was hypothesized by Villa *et al.* (2008). The incidence of Russian genotypes found here indicates that Russian honey bees are contributing to regenerating the feral population of honey bees. Harris and Rinderer (2004) reported that SMR-Russian hybrids had lower growth of mite populations than Russian bees, suggesting mite resistance may be an additive trait. Similarly, Russian swarms entering the feral population could be contributing an additive increase in mite resistance and increasing the genetic heterogeneity of the feral honey bee population. The contribution of Russian genotypes and a concomitant increase in mite resistance in feral populations is expected in areas surrounding Russian apiaries throughout the U.S. A regenerated feral population will be of benefit to growers depending on feral bees to pollinate their plants as well as contributing mite-resistant drones to mate with virgin queens from managed colonies.

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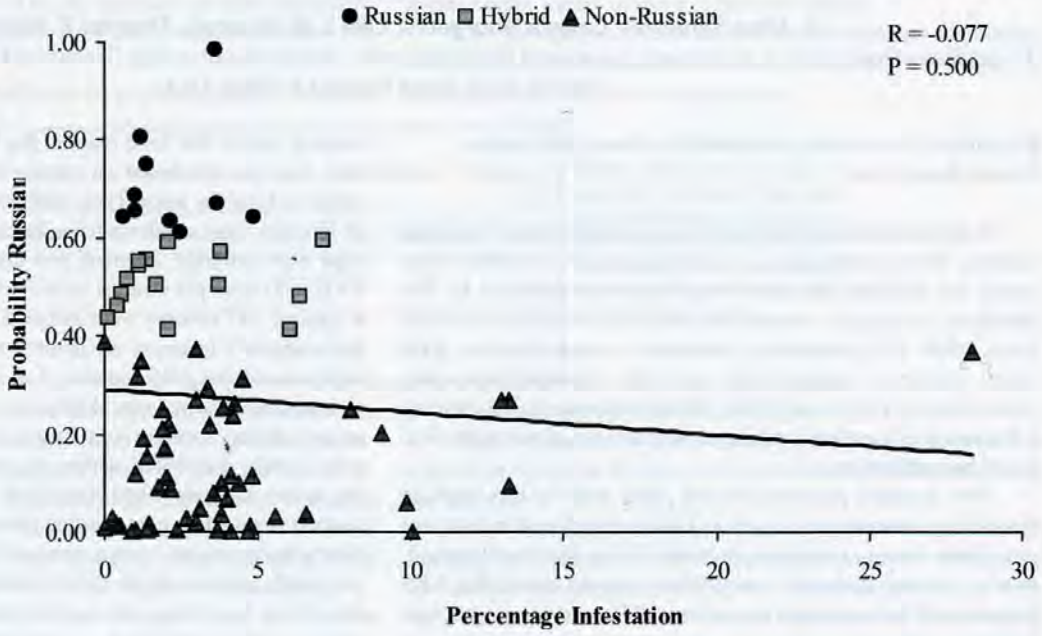

Figure 1 - Correlation between the probability a swarm is Russian and its mite infestation percentage.

Varroa - still a problem in the 21st century?
29th January 2011.
University of Worcester, UK.
Abstracts

Varroa Biology

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The mite *Varroa destructor* remains the number one pest of the honey bee *Apis mellifera,* with Australia being the only large area remaining mite-free. The ability of the Varroa mite to spread to even remote places such as Hawaii reflects the truly global nature of beekeeping. Understanding *Varroa* biology is the first and most fundamental step in providing long-term solutions to beekeepers. *Varroa* reproductive biology was studied in the 1980s and 1990s and formed the basis of subsequent mite population models. More recently, the focus has shifted away from Varroa biology onto the mite's interactions with various viral pathogens. During the past 30 years we have seen changes in *Varroa* populations, as the more virulent Korean haplotype has become dominant. Studies have shown the importance of honey bee drones, and revealed that it is their sensitivity to invasion by *Varroa* that is a cornerstone of *Varroa* resistance in the eastern hive bee *Apis cerana.* Genetic studies have confirmed an almost clonal breeding system in *Varroa*, since brother-sister matings are the norm. An arms race between *Varroa* and beekeepers has developed as beekeepers use pesticides to control the mite, and mites develop resistance to them, although the actual mechanisms remain poorly understood. Africanized honey bees are the only managed honey bees that have a natural *Varroa* tolerance, although several European honey bee *Varroa*-tolerant populations have now been found. Detailed *Varroa* biology studies continue to help us to understand resistance mechanisms, and show how birth-defects have been misinterpreted as damage. Recently the entire *Varroa* genome has been sequenced, heralding in a new era of *Varroa* biological research.

Varroa And Viruses

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Approximately eighteen distinct viruses have been identified in honey bees. Although able to cause severe or even fatal diseases at the individual or colony level, most bee viruses persist and spread harmlessly within and between bee populations, and many bee viruses are extremely common. Most honey bee viruses are indistinguishable by particle morphology. They differ greatly, however, in their genetic and protein composition, and these properties form the basis of most diagnostic tests. Most honey bee viruses were described during the 1960s and 1970s, before the arrival of *Varroa*, and there is little doubt that these viruses have co-existed with honey bees for a long time. Viruses are entirely dependent on their hosts for reproduction, which means they must exploit their hosts sufficiently for maximum reproduction, but not so much as to cause their own extinction. This balance is different for each virus and depends strongly on the viruses' transmission strategies. Viruses are by nature highly variable and can adapt very quickly to changing conditions, which may also affect their pathogenicity, *i.e.* their ability to cause disease. Major changes to transmission efficiency, or new transmission routes are frequently at the centre of such changes in pathogenicity. This is also the main effect that *Varroa* has had on the relationship between honey bees and their viruses. Here we will discuss what those changes have been, how they are thought to have arisen and how they have affected the virological panorama at the individual bee, colony and population level.

Chemical control of Varroa

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The application of foreign substances to honey bee colonies may seem to some to be unnecessary and incongruous with the perceived ethos of beekeeping. The relationship between the honey bee and its major parasite, *Varroa destructor*, is however unusual, in terms of husbandry, and is a particularly dangerous one. To ensure the well-being of Varroa infested honey bees, the beekeeper needs to understand the biology of the interaction and to be aware of the variety of tools available to assist his infested animals, including amongst other things, chemical control measures. Some of the substances and methods used are discussed. What are chemical control agents, and how, when and why might they be employed in keeping honey bees healthy?

Integrated Pest Management in *Varroa*

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The unnatural parasitic relationship of *Varroa destructor* on the Western honey bee *Apis mellifera* has become a benchmark in bee science and beekeeping on a par with Langstroth's invention of the moveable frame hive. In those regions affected by *Varroa*, beekeeping history within living memory can be divided into halves – a time pre-*Varroa* when honey bees were self-sustaining, and a time post-*Varroa* when honey bees die in the absence of ceaseless inputs by the beekeeper. In the latest episodes of bee decline it is understood that bee decline is a result of interacting factors, not the product of any one, including *Varroa*. Nevertheless, it is a premise of this workshop that *Varroa* is at the centre of the problem and perhaps receiving less attention than it is due. It is my observation that *Varroa*, more than anything else, has morphed beekeeping from an agricultural industry inherently chemical-averse to an industry exceptional in its chemo-centricity. The irony of this transformation is huge, given that today we accept as normal the use of synthetic acaricides inside hives of living honey bees. The introduction of pesticides into beekeeping has meant the introduction of problems once the worry of other sectors of agriculture, such as pest chemical resistance and non-target chemical effects. Today it is understood that in-hive chemicals are not the answer to sustainable honey bee health maintenance; rather, they may be part of the problem. Progress toward non-chemical solutions has been mixed: cultural control is impractical for all but the smallest beekeepers, and specialized genetic host resistance has proven difficult to identify, propagate, and deliver at the industry scale. I propose that the time is right to revisit the problem at its most basic levels. What are the evolutionarily-driven strategies employed by social bees to withstand pests and predators? Recent work in the context of superorganism theory hints at the adaptive benefits of multiple mating that increase intra-colony genetic heterogeneity and phenotypic robustness against many types of colony threat. Ongoing taxonomic work on the *Apis/Varroa* complex may reveal previously unknown modes of genetic host resistance. Epidemiological theory points to host density as a regulator of parasite virulence. These are just a few of many areas of fundamental biology ripe for study and application in the fight against *Varroa*.

Biological Control Of *Varroa*

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Varroa is a major problem for beekeepers because it is highly damaging to bees and has evolved resistance to chemical pesticides. Alternative measures are needed that can give effective, sustainable control of *Varroa* as part of an Integrated Pest Management (IPM) approach. What kind of interventions could be used in *Varroa* IPM? There are some striking parallels between the current problems faced by beekeepers and the pest management issues that have confronted commercial growers of greenhouse crops for over 40 years, namely a range of highly damaging invasive pest species that have developed resistance to chemical pesticides. Progressive greenhouse crop growers now use a very effective form of IPM based around biological control agents, natural enemies that reduce the population of harmful pests and diseases. These natural enemies include microorganisms that function as parasites or antagonists. The great success of greenhouse IPM can be used as a model for how IPM could be used in apiculture, and should give beekeepers hope that *Varroa* can be managed successfully if the right control treatments are made available. In this presentation, we will discuss biological control of *Varroa* using fungal pathogens. We will review what progress has been made by researchers in different countries, and attempt to understand why some investigations have been successful while others have been less so. We will then draw conclusions by looking at the highly successful IPM / biocontrol programs used in greenhouses and make recommendations for the future.

Breeding Honey Bees For *Varroa* Tolerance

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Other speakers today have outlined strategies for the control of *Varroa* using chemical, biocontrol or biotechnical methods, but these all involve financial cost, time commitments and various disadvantages such as mite resistance, the contamination of hive products or harm to the bees themselves. Beekeepers and bee scientists therefore agree that the optimum solution for the Varroa problem lies with the development of bee resistance to the mite, but how successful has the search for resistant bees actually been in practice? It is a "known fact" that in time all parasites become less virulent to their hosts, but how true is this of the honey bee / *Varroa* relationship? What are the resistance traits known to exist in honey bee populations, and how useful have these proved to be when employed in bee breeding programs? Various "*Varroa* tolerant" strains of honey bee are commercially available in various parts of the world, but how resistant are these in practice? I will conclude by looking at the program at the University of Sussex to use intracolony selection to enhance so-called "hygienic behavior" in the dark European honey bee *Apis mellifera mellifera.*

Varroa – The Way Forward

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Recently an international *Varroa* workshop took place in Switzerland, and a national *Varroa* meeting was held in Germany, to assess the current situation and to identify gaps in our knowledge about *Varroa* biology, with the aim of evaluating research approaches targeting a sustainable solution to the Varroa problem. All participants agreed that *Varroa destructor* still has the greatest impact on the health of *Apis mellifera* worldwide. Recent problems in *Varroa* control such as a lower damage threshold, the need for multiple treatments each year, treatment mistakes and reinvasion, indicate the need for new control methods. Since these will take time to develop, a research strategy based on short as well as long term goals is envisaged. With the known control methods we need to advise a simplified but efficient control concept for beekeepers that could be applied comprehensively and be scheduled in order to reduce reinvasion. New research approaches aiming for a sustainable biological solution are aimed at disrupting or inhibiting the reproduction of the mite and developing the use of natural antagonists such as entomopathogenic fungi.

Science of Bee Culture
Supplementing *Bee Culture* Magazine

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REFERENCES

References should follow the name and date system, in chronological order, when cited in the text. If there are more than two authors give the name of the first author, followed by *et al.* (i.e., Estoup *et al.* 1993, de Guzman *et al.* 1997, 1998).

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Paper: Estoup, A, M Solignac, M Harry, JM Cornuet 1993 Characterization of (GT)n and (CT)n microsatellites in two insect species: *Apis mellifera* and *Bombus terrestris*. Nucleic Acids Research 21:1427-1431.

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Personal communications: Placed in the text as (Flottum 2008) and in the references as Flottum, K 2008 Personal communication.

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Varroa Resistant Bees

Here's Proof

John **Kefuss**

From 1984 through 1991 we helped researchers test different chemicals against *Varroa destructor* on our bees in Toulouse France. During this period we became well aware of not only the advantages but also the problems associated with chemical control. Chances are good that either you have used or still are using some of the chemicals that we helped test (1).

Since 1993 we have been selecting bees for low receptivity and sensibility to *Varroa destructor* using the "Bond Test" (2). Over the years we have cooperated with colleagues testing bee races from Europe, Africa, North America, South America and Asia for their resistance to this mite (3,4,5).

In 1999 to speed up selection on my own bees I stopped all chemical treatments. This was not an easy decision for me to make. It took me about three years to decide. At that time I was told that I would loose everything, i.e., "No treatments . . . No bees." However I preferred to take that risk rather than continue to expose my bees, and more importantly myself to the chemicals used against *Varroa*.

Because I couldn't buy *Varroa* tolerant breeder queens I knew that I would have to select for them myself and in addition develop new testing methods. I calculated that if I had a 10% survival rate I could run a breeding program for *Varroa* resistance. As a queen breeder I realized that even if all my hives died, I could always buy package bees from Italy and quickly get back into queen production. After a few years I had lost "only" two thirds of my hives and to be honest I was "happy" with the results, which were much better than the 10% or less, that I had expected.

Since then we have simply multiplied every year by naturally mating virgin queens from the survivors that were the best honey producers with the least amount of *Varroa*, i.e., "cave man genetics." These queens furnish *Varroa* tolerant drones for future matings.

John Kefuss paying off a Varroa *hunter.* (photo by Carl Georg lie)

At the present time our *Varroa* mite populations are low and under our conditions it is not economic to treat. In other words our bees are mite tolerant. Hygienic behavior at 24 hours has improved, honey production is correct and winter losses at 15% are less than the 23% for those in the same area that treat (1,6). Today we are back to the beekeeping situation as it was before the arrival of *Varroa* mites.

There is one point however you should always remember. Due to different environmental conditions what works for us may not work for you and vice versa. So it is important to select for resistance under your own conditions while maintaining as much genetic variability as possible.

You can select for resistance without knowing which of the many different resistance factors you are selecting for. My associate Maria Bolt told me that "selecting for resistance is just like flying on a plane. You don't need to know how the motor functions. The main thing is that you get to your destination." From time to time you should count the amounts of adult, daughter and immature mites in the capped brood to see how your selection is progressing.

My impression is that most beekeepers really don't know how much it costs them to treat and haven't taken into consideration the negative effects that these chemicals are having on their hives. This is about as logical as someone who shoots himself in the foot with a shotgun and then complains that he has holes in his boot.

A fellow queen breeder told me that he had to cut his vacation short in order to treat for mites. I told him that if he did some selection he could save the money

Left to right – Carl Georg Lie (1 Varroa*) Sweden, Dr. John Kefuss (holding the bank), Mikael Engstad (1* Varroa*) Sweden, Kirk Johnes (6* Varroa*), U.S. and Alberto Castro Socos (1* Varroa*) Spain.* (photo by Clive de Bruyn)

Where have all the Varroa *gone. Challengers pick them one by one.* (photo by John Kefuss)

he spent on treatments and take his wife on a longer vacation. One beekeeper from Canada wrote me that it costs him between 10 to 15 dollars to treat each of his 15,000 hives (For that amount he could take his wife on a really nice vacation. I hope she reads this!).

Our main *Varroa* problem today is that we don't have enough mites. It is very important to maintain a constant selection pressure at all times on the hives. But it is not so easy to get live *Varroa.* I placed an advertisement in the French bee journals for two years in a row to buy live mites but only two people answered. One said that he could not furnish the mites because he had just treated. The second proposed that I come to his place and collect the mites myself. I was wishing to buy mites by the thousands to dump into test hives to make certain that every hive had an equal chance to be infected. Several years later I found out from the Veterinary Inspection Service in Toulouse that they had received a lot of calls from all over France asking what was going on at my breeding station.

In the first years after our *Varroa* population crash we bought frames of *Varroa* infested brood from other beekeepers to re-infest the hives. Now we get free *Varroa* from other beekeepers as we move our hives around for honey production. That reduces our *Varroa costs* and gives us a better and more diversified selection pressure

Wojtek Smaruj (Poland) looking for mites. (photo by John Kefuss)

under commercial beekeeping conditions.

The "Bond" or "live and let die test" gave us clear results in our selection against mites but due to fear most beekeepers (and scientists) refuse to use it. In that sense it is not a good test. For them it is like learning how to swim by jumping into boiling oil. That is why we developed the "Soft Bond Test" which permits selection while limiting the financial and especially the "emotional" impacts of the "Bond Test"1.

Bee breeders will not select for mite resistance unless they have an example that they can "touch" with their own eyes (or even more important with their own wallets). So we had to find an efficient way to let their "eyes touch" our results. According to Newton's first law "a body persists in a state of uniform motion or of rest unless acted upon by an external force." Our problem then was to find a force that could get the eyes of resting "bodies" (beekeepers and scientists) in motion. To do that we created the World *Varroa* Challenge using hard cash as a "soft" incentive.

METHODS AND MATERIALS

Notices were published in bee journals throughout the world inviting beekeepers and scientists to a "World Varroa Challenge" near Toulouse France. The 600+ hives were located in a 40 km wide X 150 km long North-South zone exposed to *Varroa* infestations from other beekeepers. Challengers randomly chose their hives and the time they wished to spend controlling for *Varroa* adults on the bees and in the brood. Each challenger was given a detailed explanation of the selection techniques we use justified by data, so that if they wished, they could try our methods when they returned home.

To incite maximum participation by beekeepers and scientists, one cent (in euros) was paid for every *Varroa* mite that was found dead or alive according to the maxim "Put your money where your mouth is." A provisional budget of 100 cents was reserved to cover the costs of paying for all mites found. Female mites weigh between 0.5 mg and 0.2 mg depending upon whether or not they are pregnant (7). This comes out to 20,000-50,000 euros for a kilo of *Varroa* mites (about 13,000-32,000 U.S. dollars per pound). In addition free meals and hay to sleep on were provided.

RESULTS

Fifty-five challengers came from France, Germany, China, England, Wales, Poland, USA, Scotland, Morocco, Switzerland, Sweden and Spain. The challengers required more than 100 hours of inspection to find 109 mites. The provisional budget was exceeded by 9%.

Winners were Clive de Bruyn (England) 20 mites, Seth Rick (U.S.) 17 mites, Jose Manuel Docampo Rivetro (Spain) 16 mites and Ralph Büchler (Germany) 12 mites.

The Challenge convinced some beekeepers and scientists that they could use the "Soft Bond Test" in their own breeding programs. One scientist went back to China and trained 400 beekeepers in the technique. Others publish information on the "Soft Bond Test" in their national bee journals. Their "eyes were touched."

DISCUSSION

Most challengers (even those who did not find any

Left to right – Mea McNeil, Jerry Draper (U.S.), Wojtek Smanuj, Michal Dendusial (1 Varroa*), Wojtek Oczkos and Krzystof Loc (2* Varroa*) from Poland. The Polish group inseminates over 10,000 queens per year.* (photo by John Kefuss)

Hard cash for Clive de Bruyn. (photo by John Kefuss)

mites) were happy with their results. It was suggested that given the amount of effort required to find a mite, a payment of one euro per mite would be more equitable but still not enough (that comes out to two to five million euros per kilo of *Varroa* mites). As a selection program advances, fewer mites will be found. So this is a point that organizers of future World Varroa Challenges might wish to consider. In addition potential customers would be able to rank queen breeders by how much they were willing to pay for mites during the Challenge.

When Apimondia holds its congress in a country, the beekeepers and especially the queen breeders in that country should organize a "World *Varroa* Challenge". The next Apimondia congress is in Argentina in 2011. Then in Ukraine in 2013. Are there any beekeepers in Argentina or Ukraine who are willing to organize a "World Varroa Challenge"? This would be a good chance to show the world what you can do.

CONCLUSION

At one time chemical treatments were the only option against mites. We now know from breeding projects in different parts of the world and from our own that it is possible to select bees against *Varroa destructor*. For this reason we believe that it is the moral responsibility of everyone who breeds bees to try to select for resistance to reduce the impact of chemicals in hives. We owe this effort to future generations of beekeepers.

We hope that YOUR "Eyes have been Touched." BC

John Kefuss is a queen producer operating in France and Chile.

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Getting Bees

There's more than one way to get bees, but it comes down to time, or money.

Ross **Conrad**

Honey Bees, especially good bees, are in high demand these days. With beekeepers across the country experiencing historical losses, the need for replacement bees has never been stronger. Orders often have to be placed months and sometimes years ahead of time in order to guarantee that the bees you want are available when you need them. This situation combined with a surge in the number of new beekeepers who are getting involved in the craft has created a huge demand for packages, nucs and queens. Prices go up every year and still honey bee suppliers are running out of stock and are unable to fill the demand. In many ways, it has never been a better time to be a breeder or nuc supplier, while getting your hands on a great hive of bees gets more and more challenging.

As we gear up for another season with the bees, many of us are looking to add colonies to our operations. Perhaps you want to replace your Winter losses, or maybe this is the year that you are planning on expanding the number of hives under your stewardship. Whatever your reason for wanting to obtain bees this year, you have numerous options available to you and they all have their advantages and disadvantages.

Easiest But Not Inexpensive

The easiest way to successfully get a hive of bees off to a good start is to purchase a complete hive that is already thriving. Many beekeepers are downsizing or giving up on the business and complete hives have become more commonly available in many areas. The purchase of a complete hive eliminates issues associated with package and queen introduction, getting brood comb drawn out from foundation, and having to protect a weak and unorganized colony from being robbed. The downside is that a complete hive is heavy to lift and is one of the most expensive of all the honey bee procurement options. There is also the risk of "inheriting" problems such as bee pathogens, antibiotic and pesticide contamination, *Varroa* mites, tracheal mites, and small hive beetles.

When purchasing established colonies be on the lookout for worn out equipment, old combs, disease and pest problems. How are *Varroa* mites and foul brood kept under control? How has the hive been managed during the past year or two? Answers to questions such as these can give you a hint as to how well the hive may fare in the coming year. Knowing that many migratory beekeepers lost about 30% of their hives within the first few weeks of delivering them into the almond orchards last year would personally make me wary of purchasing any hives that are coming out of almonds this Spring for example. Migratory hives can be tempting however, since they may be on the market for less than the typical going rate.

One way to avoid many of the pitfalls associated with purchasing established colonies is to inspect the hive(s) prior to completing the transaction. If you don't feel qualified, have your local bee inspector give them a once over. Taking the time to kick the tires before taking the plunge allows you to have a better idea of what you are getting yourself into and may save you a lot of headaches down the road. The old adage "let the buyer beware" should definitely be your guiding principle here.

Nucs

Compared to purchasing established colonies, nucleus colonies (nucs) offer many of the same benefits but are easier on your back and are available at a much lower price. As with full hives, nucs should not need feeding or queen introduction. Simply transfer the frames into full size equipment, add additional frames for growth and you're off and running. It is important to have your additional equipment all ready to go before you pick up you nuc so that the bees can be given additional space before they become overcrowded and decide to swarm. However, nucs also come with all of the potential drawbacks of an established hive, including pathogens, antibiotic and pesticide contamination, *Varroa* mites, tracheal mites, and small hive beetles. In fact, a nucleus colony may be more likely to have such issues (unless you are buying bees from a migratory beekeeper that are just coming off the

Buying a hive that's already up and running, whether 10 or eight frame, is the easiest, but most expensive way to get bees.

Getting a package is the traditional way to get bees.

road). This is because it seems to be the practice of many nuc providers to make up their nucleus colonies with older combs in order to reduce the buildup of pathogens and chemical residues in their breeding colonies.

Admittedly, this is an age-old practice that has proven itself economically successful. Turn what would otherwise be waste and an economic loss or expense (in this case dark, old contaminated combs) into a money maker: components of a nucleus colony. This seems especially true of breeders who promote their bees as "survivors" that are treatment-free. Part of the reason such breeders are able to keep their bees alive without having to use mite treatments of any kind often seems to be precisely because they are regularly splitting up their hives to make nucs and at the same time removing the combs that have become chemical and pathogen ridden with age and replacing them with new foundation. The trap that many beginner beekeepers fall into is to purchase these survivors with the idea that they will not need to apply mite treatments to their bees either. Unfortunately, if the purchasers of such nucleus colonies do not regularly split up their hives to make additional nucs and regularly remove the old darkened combs from the colony as the breeder does, they should not be surprised when their hives die within a year or two. As with established colonies, look for new equipment and frames of light colored comb when making your purchase. If your nuc comes with dark comb, be sure to rotate them out of the hive by the following Spring if not earlier.

A swarm is inexpensive, exciting, and usually makes a great hive. Requeening is generally a good idea.

Inexpensive But Not Easiest

The most common way to obtain bees is to purchase a package. Packaged bees are less expensive than nucs or complete hives and easier to ship. Getting a package of bees started however, is much more challenging than when starting with a nucleus colony. The package of bees must be transferred into your equipment; the queen and the bees are typically unrelated and must be "introduced" to each other before they will work together in unison; and then there is the need to provide feed to keep the nascent hive from starving while at the same time, stimulating them to build comb if drawn out frames of comb from a previous hive cannot be provided.

While package bees may still carry diseases and pests, they are likely to be less infested or contaminated than nucs or established hives that are filled with comb simply because there are fewer places for pathogens, mites, or small hive beetles to hide in a package of bees. As with nucleus colonies, for best results plan ahead and have all your equipment ready to go before you package arrives.

The Most Economical Options

A less expensive approach is to make your own nucleus colonies from bees you have successfully overwintered. Rather than spend money on obtaining bees, your money only needs to be spent on getting the equipment ready to accept the nuc. By timing your nuc making with the natural swarming season in your area you help to increase the chances of success and reduce the need to feed the nascent colony.

Once the nuc is made up, additional labor on your part can also be eliminated by allowing the bees to raise their own queen. Doing so will run the risk that the queen the hive raises may not mate successfully, but if they are successful the benefit is that the population of *Varroa* mites in the colony will not grow as fast as they would have without interrupting the brood cycle during their queen raising efforts. Control over the genetic make-up of the hive is reduced since the queen raised by the nuc is free to mate with drones throughout the mating area that is reported to range about six miles. By letting the bees do most of the work, queen introduction issues are eliminated.

For a relatively small cash investment, splits taken from a hive and made up of frames of bees, brood, honey, and pollen can be given a queen which will both increase your influence on the genetic make-up of the colony and speed the population growth rate of the hive. Introduction issues will have to be dealt with, but if the split is made up with unhatched eggs there is a chance that the hive may be able to fall back on raising their own queen should the queen introduction fail.

If you don't already have access to bees and don't want to shell out a bunch of clams in order to obtain bees, swarm catching is the way to go. There are no worries about queen introductions here, all you have to do is get the swarm into your hive body which can be enough of a challenge in and of itself. Swarms are primed to build new comb fast and if captured early enough in the season may

be able to store enough honey on their own that Autumn and Winter feeding are not necessary.

With swarms however, you have little control over the quality of the bees. Some swarms are composed of wonderful bees and some swarms are lousy. While you will save cash, you must invest the time to go chasing them down, and hope that they don't fly off before you arrive.

One way to eliminate the chances of being led on a wild goose chase is to make use of baited hives to lure in a swarm. Drawn out beeswax combs make any empty box with a cover more noticeable and attractive to scouts seeking a new home for the colony. A few drops of lemongrass oil on a cotton ball can take the place of a drawn frame used as bait within your swarm trap if no comb is available. For those with an added sense of adventure, you may want to try your hand at some old-fashioned bee-lining and track down a feral hive in a bee tree. Just be sure to bring along someone with logging skills if you are not handy with a chainsaw and ax.

More Than Just Bees...

If the current economic climate has found you unemployed or underemployed, providing a honey bee removal service may be just the ticket to meet your needs in your effort to obtain bees. Basic carpentry skills and tools will come in handy should you find yourself removing bees from inside the walls of a building or attic space. If honey bee removal sounds like something you are interested in you would be wise to purchase the *Honey Bee Removal Book* written by Cindy Bee and Bill Owens and recently published by the A.I. Root Company. It will provide you with tips to help you avoid the many pitfalls that can ensnare the beekeeper who attempts to offer this type of service for the first time. Like the errant swarm or colony of bees taken from a tree, the quality of removed bees can vary. At least with bee removal, if you charge for your services there is the consolation of monetary gain when the bees you take home prove to be less than hoped for.

There are numerous options and paths to gaining a hive of bees. Which is best suited for you depends on a number of factors including how much time you have, how much money you want to spend, and how picky you are about the type of hive you end up with. Whatever your choice, for the best results plan ahead and be prepared. BC

Ross Conrad is the author of Natural Beekeeping. *You can rech him at* ***dancingbeegardens@hotmail.com***.

Top Ten New Years Resolutions for Agritourism Operators!

Here is my Top 10 List for you to Grow Your Business.....

#1. Update your website & commit to keep it current. This is your most important 24/7 marketing tool. Too many farms wait until the week they are going to open to make updates.

#2. Register your farm for a FACEBOOK page. If you already are using Facebook - congratulations! 75.3% of the farms that took my fall survey know this has become a powerful new strategy. (By the way, it's FREE!)

#3. List your farm at www.google.com/places.You can also use this page to post photo's and videos about your farm. This listing replaces the old Google Business Center page posting and is more comprehensive.

#4. Respond to any and all customer remarks immediately whether they are on your facebook page, yelp.com, tripadvisor.com or any other consumer online review site.

#5. Checkout www.groupon.com to see if this coupon company is in your area. This is one of the largest internet coupon distributors and farms have had success this past year in attracting new customers through their coupon offers. (Did you know that 148 Million US consumers redeemed at least one coupon this year?)

#6. Look into online advertising as another method to grow your business. Including www.adwords.google.com, www.advertising.yahoo.com, www.facebook.com Traditional media advertising is often not getting the same effective results as it once did.

#7. Consider adding one of these activities at your farm this year: birthday parties, gardening classes, cooking classes, harvest dinners or weddings. All of these activities are increasing in popularity by our farm guests.

#8. Develop an event tie-in with a local non profit organization. This is a great way to give back to your community and to get more of your local community involved at your business.

#9. Make a plan now of when to contact the media with a press release or a phone call about something new going on at the farm. An "unpaid" media placement is often forgotten but truly offers the best potential for attracting new customers.

#10. Remember your employees are the front line to your customer. Develop ways to keep them informed, involved and interested in your business.

Jane Eckert
www.JaneEckert.com

LET'S PUT TOGETHER A TOP BAR HIVE

Edwin **Simon**

With these step-by-step instructions it's easy and relatively inexpensive.

The Top Bar Hive (TBH) has become an easy and relatively cheap way for a gardener who wants bees to maintain a hive to get into beekeeping. It has many advantages as well as disadvantages. These have been widely discussed and written about in all the magazines during the past few years. We'll build a TBH with an optional viewing window that will allow you to observe the activity within the hive.

Long Term Requirements

There is no standard for a TBH. Consequently interchangeability is a hit and miss proposition. If you are assessing the use of TBHs for more than a single hive then you should keep the measurements consistent. The most critical is the length of the top bar itself. The second most important is the angles used. If these are consistent then you can swap comb between hives. You may have to use a knife to trim the comb, but that is minor problem compared to not having any drawn comb at all.

The TBH consists of three components: the main body, the top bars and the telescoping top. Each section will be described independently.

Section #1 – Main Body Construction

The angles needed for the TBH require a little different construction technique. First we'll cut the separators which we'll then use for the jig to keep the sides and ends in alignment. We'll next cut the sides. The ends will be cut next; and to finish the hive body, the bottom will be cut. Its cut last since its width depends on the accuracy of the previous cuts and it can be easily changed.

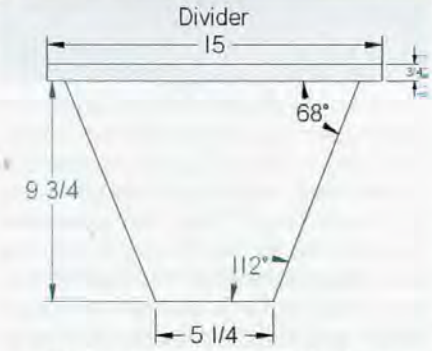
Parts (Thickness x Width x Length)

1. ¾" x 13" x 11 ¼" – Separators (2)
2. ¾" x 11 ¼" x 36" – Sides (2)
3. ¾" x 11 ¼" x 15" – Ends (2)
4. ¾" x 7" x 36" – Bottom (1)
5. ⅛" x 7" x 30" – Glass or plastic viewing window (1) (Optional)
6. ⅜" x 7 ½" x 32" – Viewing window cover (1) (Optional)
7. Hinges (2) (Optional)

A separator is used to restrict the bees to a certain section of the hive. Usually the section the bees start out in is small. Then as the bees become more numerous the separator is moved and additional top bars are added. It can also be used to split a hive if there is more than one set of entrances to the hive.

Step #1: Cut the separators.

By cutting the separators first you can ensure a snug fit when the hive is assembled. You may still have to trim the separators, but they will be close to fitting correctly.



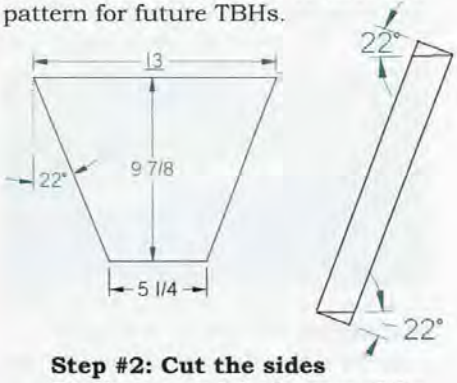
Note: Do not cut off the bottom of the separator. Because of the angles being cut and the possible difference in length made by a slight angle change, the height may vary. The bottom of the separator will be cut to the correct height after the hive has been assembled.

Note: The measurements defined are for a 22 degree angle. This is only a recommendation. You may find that a different angle will work better for you. Regardless, the assembly instructions are the same.

Use the following diagram to lay out a 1" x 12".

You will now be able to use these separators to hold the sides in position while you assemble the sides and ends.

Hint: For future consistency, **c**reate a third separator to use as a pattern for future TBHs.



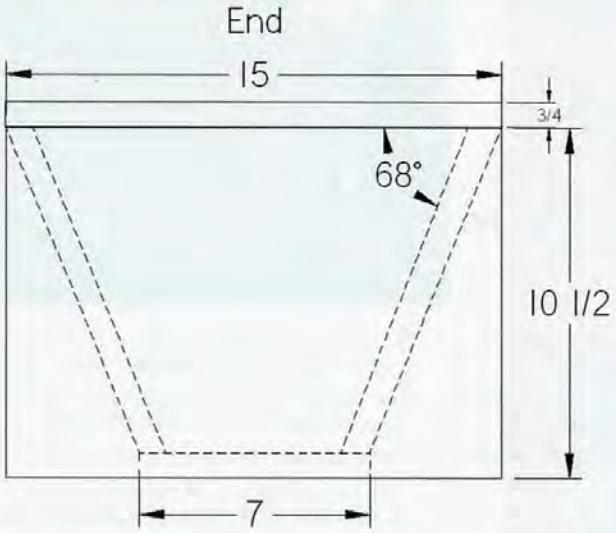
Step #2: Cut the sides

Rip the top and the bottom of the sides to a 22 degree bevel. This will allow the top and bottom of the sides to match the bottom of the TBH and the top bars to lay flat on the sides.

Step #3: Add a viewing port. (Optional)

The addition of a viewing window is optional. It provides a way to inspect the hive without removing the top bars. It's great to look inside the hive without suiting up. Remember, you cannot just remove the telescoping top and look down at the bees and comb on a TBH.

Top Bar Hive



Hint: If you are using plastic window, do not remove the protective covering of the plastic until you install the window and paint the hive.

1) Cut a piece of plastic or glass for the window
2) Layout glass on the **inside** of one of the sides – a minimum of two inches from the top so the telescoping top will not conflict with its use.
3) Mark the edges of the window with a pencil
4) Draw a second set of lines ½" inside the previously marked lines. The ½" lip is used to hold the window.
5) Cut on the inside lines with a circular and/or a saber saw.
6) Using a router, cut the ½" lip of the opening to the depth of the plastic or glass. Add a little to the depth for the caulking that will hold the window in place.
7) Test fit window and make adjustments as necessary.
8) Sand the edges of the opening. Do not install the window at this time.

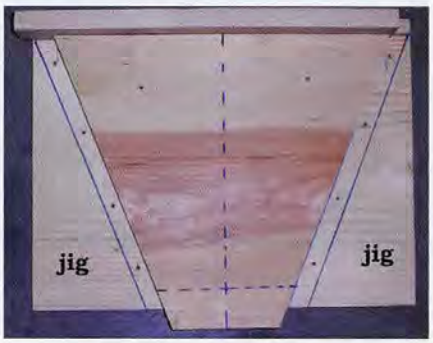
Step #4: Add entrance holes.

If you are going to use side entrances then drill the holes now. They can be added later but it is much easier to add the entrances before the hive is assembled. I recommend one set of holes at opposite ends on each of the sides. This allows you to split the hive with a separator board and have an entrance for each end.

Step #5: Cut the ends

Cut the two pieces of ends. ***WOW!*** This step was easy.

Step #6: Build a jig that will hold the sides in position while you assemble the unit.



Lay out the end pieces using the previously cut separators as a pattern. After centering the separator on the end, make sure you drop the top down the ¾" that will provide a lip that will be used to hold the top bars from falling off the end of the hive. Screw the separator in place. Mark positions for the screws that will hold the sides in place. Then drill starter holes for the screws. The screws will actually be driven from the other side of the end. Make a second end jig the same way.

Step #7: Assemble the sides and ends.

The jigs that you built in the previous step are now used to hold the sides while you glue and screw them in place. Position the end jigs and add a side between them. Glue and screw the ends to the sides. When complete remove the separators from the ends.

Warning: Remove the separators ASAP. Glue may have leaked between the separator and the ends. If left too long the separator will be blued to the end or sides and may be impossible to remove without making a mess.

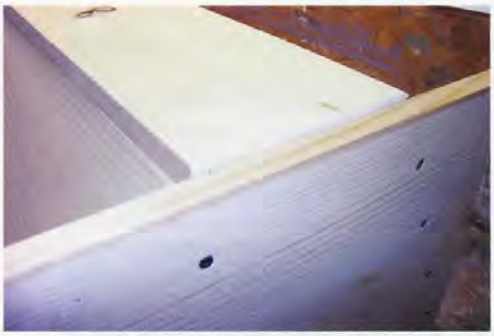
Step #8: Cut the bottom.

Note: The bottom is not glued to the sides or the ends. There is the possibility that you may want to clean or replace the bottom due to wear and tear. It is easier to do if the bottom is not glued in place.

Measure the width of the bottom from the outside edges of the sides. Rip a board to this dimension. Make sure the length of the bottom allows it to fit snuggly against end pieces.

Step #9: Install the bottom.

Since the sides are at a 22 degree angle to the bottom, drill starter holes using your eye to align the holes and screws. Screw the bottom to the sides.



Step #10: Extend the ends. (if needed)

On the TBH I made, the bottom of the TBH extended just below the ends.

To allow the hive to sit solidly I needed to extend the end pieces by adding a ¾" x ¾" extender to the bottom of the ends. This also keeps the bottom of the TBH from resting on any support.

Step #11: Install the window (Optional)

Note: We left the installation of the window until now, lessening the possibility of scratching or breaking it.

If you are using plastic, remove a ½" of the protective coating from the edges of the window. If not removed, the caulk will adhere to the protective plastic coating and not to the window.

Caulk the window in the recessed area that you routed for it. And allow it to dry.

Step #12: Paint the body

Hint: If you are using glass, then cover the glass area with masking tape before painting.

Two coats of exterior latex paint are recommended. It will extend the life of your TBH.

After the paint dries, remove the tape, or if you used plastic then the plastic protective covering from both sides of the window.

Step #13: Add a window cover

A window cover is needed to keep the hive dark and to provide some insulation.

Cut and paint a piece of plywood to cover the window. Use self closing cabinet hinges to keep the cover in place. Add a clasp or two at the top of the cover if the hinges will not keep it tight against the hive body.

Section #2– Top Bars

Parts (Thickness x Width x Length)

1. ⅛" x ¾" x 13" Starter strips (24)
2. ¾" x 1 ⅜" x 15" Top bars(26)
3. ¾" x ??" x 15" Spacer

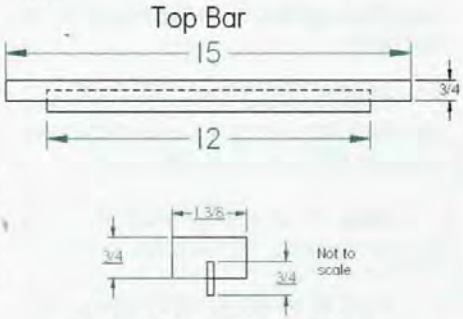
Step #1: Cut the starter strips.

The starter strips are used to give the bees a guide to build their comb. If they follow it or not depends on how well you've trained

your bees.

Hint: Because the starter strip is so thin, I used a pruning shears to cut and shape the ends. It was easier than using a saw.

Hint: Make some extra starter strips and bars. You never know when you are going to need an extra.



Step #2: Cut the top bars.

After cutting the top bar, cut a groove lengthwise in the center of the bar. This will be used to hold the starter strip. The groove should be just wide enough for you to slip a

starter strip in with very little wiggle room. You can also bevel the ends of the top bars with a sander. This will give you a guide for your hive tool when you want to separate the bars.

Step #3: Assemble top bars.

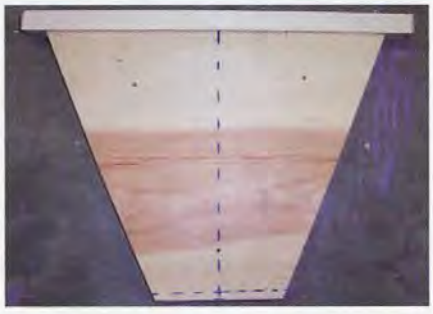
Glue the starter strips into the grooves in the top bars.

Step #4: Wax the starter strip

Add a layer of wax to the edge of the starter strip. This will give the bees an idea of where to place their comb. I used an old griddle that had a gutter around the edge. After melting the wax I dipped the strip in the wax. I wish I'd have thought of this before. It would have save me a lot of time.

Step #5: Finish the separators

Add a top bar to the two separators you used as a jig for aligning the sides and ends. Now is the time to cut the bottom off of the separators and adjust them to a snug fit.



Section #3– Telescoping Top

Parts (Thickness x Width x Length)

1. ¾" x 2" x 38" – Top Sides (2)
2. ¾" x 2" x 17" – Top Ends (2)
3. ⅜" x 18" x 38" – Top (1) (or multiple boards) (any thickness will work)
4. ??" x 19" x 40" – Top Aluminum Cover (1)

We've finally made it to the top of the hive. You need to have something to protect the bees from the weather. Over the years, tops become warped, weather beaten and outright cruddy, regardless of the best intentions of the beekeeper. It's extremely embarrassing when you are showing your hives to a group of students and you can't get the top off because it is warped. The point I'm trying to make is that making the top a little loose can save a lot of time and embarrassment in the future.

Construction

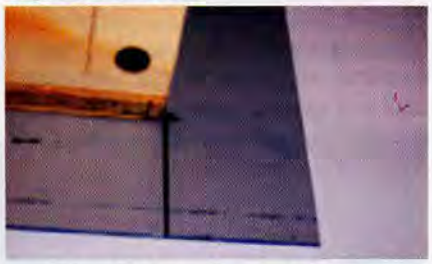
Hint: The wood used to cover the top (part #3) does not need to be very thick. The thicker it is the heavier the top will be and a TBH top is considerably larger than a Langstroth telescoping top.

Step 1: Cut parts 1, 2 and 3 from your stock lumber. Be extremely careful that the parts are cut square (90 degree corners).

Hint: An extra ¾" on each dimension may make your manipulation of the top easier.

Step 2: Glue and screw the sides and ends to the top (part 1). The top (part 1) sits on top of the sides and end pieces.

Note: Now would be a good time to paint the cover.

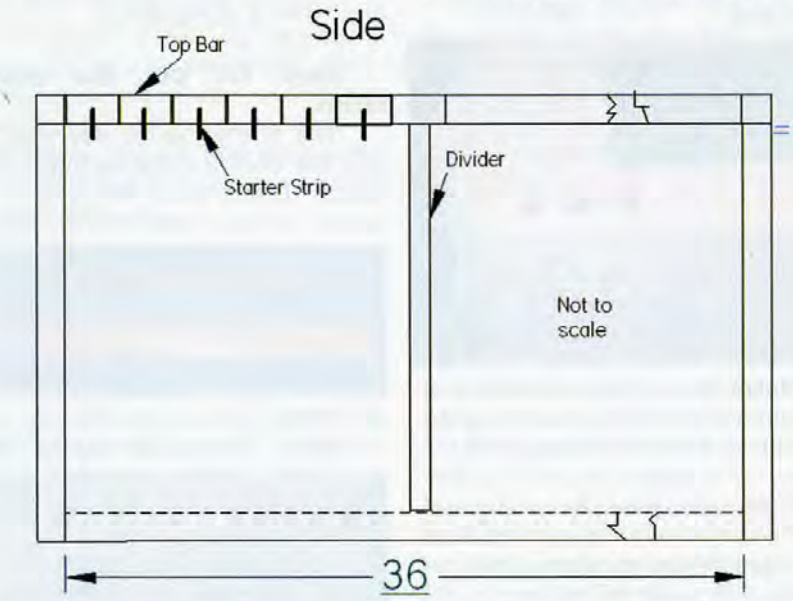


Step 3: Lay the metal top on a flat surface and center the wood top leaving an equal border surrounding the wood top. Mark this with a pencil. Extend the corner lines to the edge of the metal.

Step 4: Using the tin snips, cut one of the extended edge lines on each of the corners.

Note: If you make a shallow "V" cut on each side of the line, the line, the corner fold will be a little neater.

Note: Cutting the exposed corners at a 45 degree angle removes some of the sharpness and finger cutting potential of the completed top.



Step 5: Bend two adjacent edges of the metal over to form the lip of the cover.

Step 6: Bend the corner tab that was formed in step 4 around the corner and tuck it under the side.

Step 7: Screw or nail the two lips in place on the wooden cover.

Step 8: Bend the remaining edges over to finish the cover. Screw or nail them in place. If you use screws then use the center punch and drill holes in the cover.

Note: The more your cover weighs the harder it is to manipulate.

Note: The width needed for the lip is your decision. Some things to take into account are:

1. Local wind conditions
2. Where your hand holds are on your supers
3. Do you put insulation or fiber board under the cover in the winter
4. Do you use a rock or brick to hold the cover in place
5. When you wrap your hives do you have extra wrapping material to hold in place

Hint: A trip to a local printing business may provide you with some aluminum plates that they use on the printing presses. The plates come in various widths and thicknesses depending on the size required by the press. They are used only one time and are then recycled.

Usage

Wind, rain, sleet and hail should not keep the telescoping cover from doing its job. A telescoping cover can last a long time. Take care of it and it will protect your hive.

Conclusion

Our bee club has used a TBH as a training tool for the last two years. The window allows everyone to look into the hive without getting suited up. If you do have to pull out a top bar then a minimum number of bees are disrupted. BC

PROFIT & LOSS
As A Backyard Beekeeper

Cedric **Worman**

You should do the math for your own operation and get a feel for the money in, and out.

As a child was periodically fascinated by honey bees. I would spend several weeks reading everything I could find about them before being distracted by something else for a while. One day I woke up and realized, much to my surprise, that I was an adult. More than that, I was a propertied adult with my own house and there was nothing stopping me from keeping bees. So I thought, "O.K., then. Let's do this thing."

Before I started beekeeping, I asked a group of beekeepers how long it might take for a backyarder to break even. Of course I realized that the answers were going to vary based on region, location, management, and number of colonies, but it would have been nice to get some sort of idea of what I was in for before getting started. However, I never received any real answers. Scattered among the usual wisecracks ("There's a lot of money in beekeeping. The trouble is getting it back out!"), were surprisingly vehement proclamations that a hobby (by definition) could, should, and would never ever make any sort of money! If beekeepers could faint from astonishment, I believe they would have. Perhaps these responses stemmed from a history of long and heated discussions between beekeepers and their spouses about the economics of their activity. Having convinced their spouses (and themselves) that a hobby is properly a money-sink, the dangerous suggestion that this perhaps wasn't the case elicited an immediate visceral reaction.

I began my own journey with a pen and a notebook, recording the passing of every penny (Figure 1). I started out by reading every bee book I could get my hands on. Then, starting in August of 2005, I began amassing the various and sundry pieces of equipment necessary and preordered a package of bees that November. In spite of my being frugal even to the point of building my own boxes, the bottom line dropped steadily and deeply into the red, reaching over $350 before the bees were even purchased. When the bees came on the last day of March in 2006, all of that was forgotten in the first hiving (which, due to time constraints, occurred after dark, a bad idea for a new beekeeper but that event is best left to the imagination) and the mad excitement of rushing out multiple times a day to see what the bees were up to.

Against all odds, I managed to wait a week before tearing open the hive (ever so gingerly) to see their progress, and spent the next several months happily charting their expansion across the foundation in one hive body to the next. Eventually, I was forced to add a couple of shallow supers to contain the hive's youthful exuberance. The supers were foundationless as I had no access to an extractor. The bees and I made a proper mess of them, which made it rather difficult to get all the workers out before the super was brought inside for processing (this is not a small issue when non-beekeepers and pets are inside).

That September, I had my first honey harvest of 5.7 lbs of pure liquid gold! More of which flowed from the hive later that Fall ending with a total of 24.1 lbs for that season (Figure 2). (Living in northern Florida means that the bees work essentially year-round, with a large spring harvest and a smaller Fall crop.) As small a harvest as that is, there is nothing like a first harvest for a new beekeeper. Because I didn't have an extractor, the finest honeycomb was cut from the frames and used as-is. The rest was processed by crush and strain. What wasn't slotted for home use was eagerly snatched up by friends and family and there was a momentary upswing in the bottom line.

At this point, I should perhaps mention my method of accounting. My honey was priced at a base price of $5/lb (although I calculated once that it cost about $80/lb to produce). Honey used at home or traded was counted as a gain just as if it were sold. I never counted my time (or the time of my crush and strain assistants) as a loss. Why? I can hear the objections now: "Why, I'm a lawyer! My time is worth $500/hr if it's worth a penny!" (I, of course, am not a lawyer, but that's the often heard response to accounting in backyard beekeeping.) The problem with this line of reasoning is that lawyers get paid for practicing law, not keeping bees. Now if someone takes time off of work to do some beekeeping activity, then certainly they are losing money and that needs to be accounted for, but what is an hour of a lawyer's time worth on a day off? It's approximately $0/hr, or if he goes to the movies -$5/hr. If we truly want to keep track of the value of a backyard beekeeper's time, we can't look at what they do for a living, but what they'd be doing if they weren't beekeeping, which is either not making any money at all, or spending it. Once beekeeping eats into one's day job it is no longer a hobby but a sideline (or an addiction).

The next Spring I ordered another queen and split my lonely hive into two. Now I was really rolling along. I also switched to buying and using only medium boxes (the savings over building from scratch were infinitesimal) and using starter strips. They are a bit trickier than

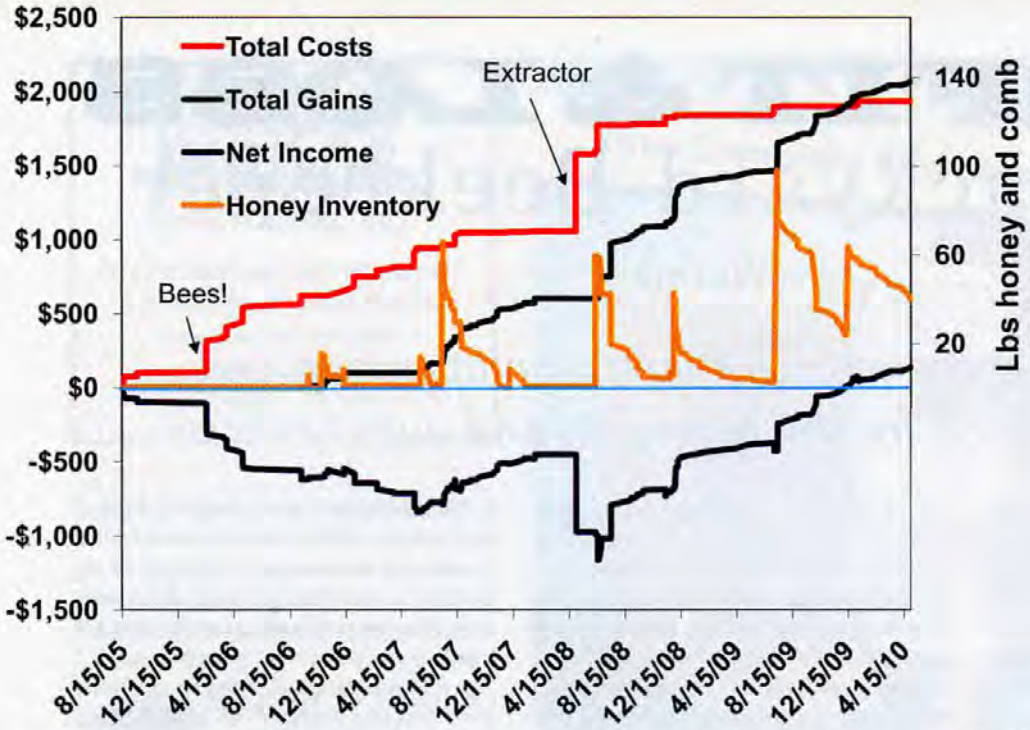


Figure 1 – *The costs, gains, net income, and honey inventory of a small (one to two hive) hobby apiary. The blue line indicates zero. Major turning points, the purchase of bees and an extractor, are indicated. Note that the demand for honey is generally highest just after harvest.*

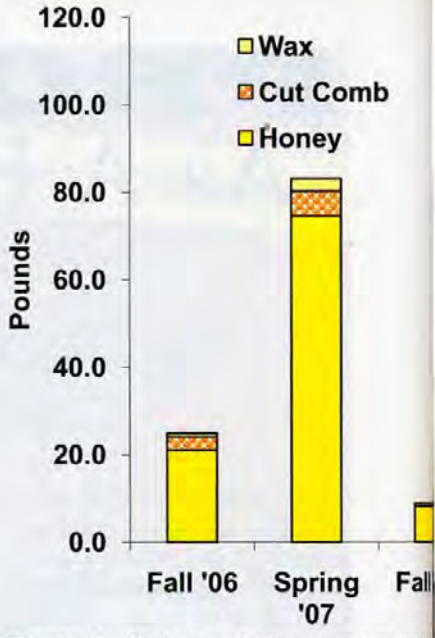


Figure 2 – *The amount of wax, cut comb, ary. Point A was when the extractor was wax harvest caused by extractor use. Poi tracted comb in the supers. Harvests afte extractor use. The apiary in the Falls of 20 the apiary consisted of two hives.*

foundation, but with a little finesse they work just fine for crush and strain, cut comb, and extractors, for the most part.

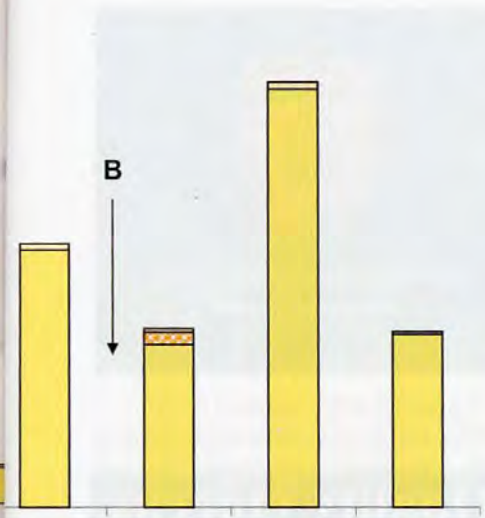
After splitting the colony, the Spring harvest from both was around 80 lbs. I was well on my way to becoming overwhelmed with honey and my bottom line stopped its steady descent into the abyss and began to slowly rise.

I certainly had my share of trouble. That year I placed the stronger hive at a friend's place and it died. The distance and inconvenience involved didn't kill the colony, but the infrequent inspections resulted in a problem being missed until it was too late. In spite of the loss of the hive or perhaps partially because if it, I got better at managing the space I gave to the bees to deal with their pests: *Varroa* mites, wax moths, and Small Hive Beetles. *Varroa* were a constant companion to my bees. I did drop counts though a screened bottom board that were sometimes extremely low but generally exactly at the economic treatment threshold for my area, so I avoided treatments. My hives, in northern Florida, always had Small Hive Beetles wandering around the inner cover (and the upper super if there was too much room). I tried various traps, but they never seemed to work very well and the number of beetles seemed more dependent on the weather and space than my trapping efforts. Wax moths, like the beetles, were kept in check by the bees unless there was something seriously wrong with the colony and it was unable to defend itself.

Somewhere at the end of my second year of beekeeping, I began to wonder about getting or making an extractor. As entertaining as it was to be covered to the elbows in sticky layers of amber honey, with every harvest it began to seem more of a shame to be destroying perfectly good comb and all the work and energy that went into it. I hesitantly dipped my toes in the possibility and then finally took the plunge and got a nine-frame radial hand-powered extractor for around $450, which in turn sunk my bee-nances to their lowest level ever. Fortunately, there was enough of a demand for honey that the extractor expense was made up by the end of the year, but did the extractor pay for itself?

It's really difficult to say with any degree of certainly due to the small number of years and hives (other people in other locations will certainly have different numbers) but, using what I have, it appears that the extractor increased the spring harvests by a measly 1.4 lbs/hive or an increase of 3% (Figure 2). The fall harvests, smaller and more dependent on empty comb rather than the building of new comb, however increased 11.6 lbs/hive, an increase of 114%. For the whole year, the extractor increased honey yield by 13.1 lbs/hive, a 24% increase. With my low overhead and penchant for reusing containers before buying new ones, it appears that a rough estimate of the number of hive-years it would take for the extractor to pay for itself is around seven. So using the extractor for seven years on one hive or one year on seven hives or two years on 3.5 hives (and so on) would spin enough extra honey to pay for the extractor.

Of course, using an extractor also reduces the amount of wax collected in each harvest. For every 100 lbs of honey harvested, the amount of wax harvested fell from four pounds to two pounds with the extractor. Factoring the loss of wax into the economics of extracting is somewhat problematic because wax is generally made into a value added product, such as candles or unguents, the value of which has more to do with the processing than with the raw materials. I did find a market for raw beeswax, largely revolving around woodworkers, traditional archers, and gentlemen with handlebar moustaches. In any case, the amount of wax harvested was minuscule (I often had to buy



ey harvested by season from a small hobby api-ed. Harvests after point A show the reduction in licates the beginning of the use of previously ex-3 show the increase in honey harvest caused by 2007 consisted of one hive. In the other seasons,

beeswax from other sources to meet the demand for candles) making the production of beeswax negligible in terms of economics.

Propolis is another hive product that should not be ignored by the backyard beekeeper. We have the time to scrape every frame and box as they go through the hives and I accumulated quite a bit. Propolis, like beeswax, tends to be incorporated into value added products like tinctures and varnishes and few people have any idea what it is or what it could possibly be used for. Propolis contains strong antibacterial, antiviral, and antifungal compounds in varying amounts and tinctures are popular in medicine cabinets in Eastern Europe. However, certain people (including me) can easily develop an allergy to propolis and develop an itchy red rash due to skin contact so it must be used with caution.

As can be seen in Figure 1, most honey sales occurred right after the harvest. This observation can be explained by combination of talking about the honey harvest, which increased awareness and reminded people that I had honey for sale, and people wanting to try the unique flavor of that particular season. Each season was given a unique and poetic (if sometimes cheesy) name and the different colors and flavors of the seasons (light yellow sometimes with green tones and light flavoring in Spring and dark red with robust flavor in the Fall) led to people having favorite honeys and snatching up the seasonals when they could. The Christmas season was another great time for sales as people wanted unique local gifts to send to their families in other parts of the country and even the world.

So I found out that even with nothing but word-of-mouth advertising, a backyard beekeeper can indeed break even and indeed make a profit. It took me about four years even with the purchase of an extractor. It would have happened faster if I had had more hives and more slowly if I had been reduced to selling my honey for less than artisanal prices, but profit is actually possible, enjoyable, and oh-so-sweet! BC

Cedric Worman lives and keeps bees in Gainesville, Florida and has been a fan of Bee Culture *for several years.*

MOVIN' BEES

Everybody that's moved bees has a story.

Jennifer **Berry**

There are only a few things I dislike about beekeeping and foremost among them are: shipping queens and moving bees. Regarding the former, my article a few months ago mentioned that I was about to try UPS and would let you know how they compared to the USPS. Well, the first batch went out, and several died in shipment. What a disappointment! But, it could be worse, for example if several million bees were tipped out onto the highway at 65 mph, which brings to mind one of many fears beekeepers have associated with the latter.

But if everything goes ok, what's the big deal, right? Boxes of bees are loaded onto a trailer, the back of a truck or bottom of a trunk, either before sunrise, after sunset, or during the day when temperatures are cool, hauled a few or thousands of miles from home, unloaded, set up and they're good to go. Yet, when things go wrong, it can get really bad, really quickly, even to the point of downright dangerous.

If you've moved bees, then you know what I'm talking about. It's kind of a secret society. We recognize each other, (our fellow movers) as we pass in the hall at meetings. It's that understanding head nod, which translates into "Yeap, been there, done that, and why did I do that?" And, if you've moved bees with any regularity then you more than likely have a story to tell; one that hopefully includes a good bit of laughing.

Even though moving bees is hard work, and can be extremely nerve-racking, I find myself doing it quite often for the lab and the business. For example, every year, starting at around 80 miles north of Athens, the opportunity to make a potentially massive amount of sourwood honey presents itself at the end of June. At least that's in theory. Reality, sometimes, is not so generous. The sourwood nectar flow can be very fickle and will fluctuate drastically from year to year. If you have ever moved colonies to the mountains only to find a single cell of sourwood honey after weeks of work, then you would understand. It can be a very frustrating ordeal. It can also be deadly as well. Folks figure the bees will have plenty to eat, only to come back a month later to 1000s of starved bees.

But the promise of world-class honey can drive one "to drive" up there and back with a load of bees. You can't resist. Each year I get caught up in the frenzy despite not having made an ounce in previous years. Location, location, location!!! Then my friend Bob Binnie came to the rescue and offered to give up one of his great spots just outside of Tiger, Georgia. Finally, I thought, I'll get a taste of the "sourwood experience."

The spot was perfect, off the beaten path, down several winding dirt roads, and finally up the side of a mountain with beautiful scenic views and hundreds of sourwood trees. But, getting a truck and a trailer up there, loaded down with hives, was not going to be easy. The move was not only not easy, but downright miserable. I guess complacency had set in over the years because I found myself unprepared and unprotected. Plus, I had hired Bob Luckey, who was a brand new beekeeper, squeaky clean, right out of the box, had only worked bees a few times, and had never been stung before; he had no clue what he was about to get into.

Strong, robust colonies were needed for the job and had already been selected in advance. However, they were scattered across four different locations, which meant a lot of driving. It was a hot, humid night as we pulled into the first yard. The first thing on the list was to close en-

Putting foam in the front door.

Putting straps on.

Straps over screened top.

Two-wheelers make life easier . . .

. . . especially up ramps.

trances, for which we used window screen to allow extra ventilation into the colony along with bottom screens. The screen used is a heavier gage window screen that holds its shape once bent and stuck into place. It is much easier than having to nail on entrance moving screens for each of the 30 colonies (and cheaper). But, remember, you get what you pay for.

Once the entrances were all closed, it was time to strap the colonies. I prefer using moving straps as opposed to hive staples. I've had issues in the past with hive staples coming loose over time, allowing hive bodies to slip apart, and releasing bees. But, you know the saying, "If you have 10 beekeepers in the room you're going to get 12 different opinions." Everyone has a method they prefer. For me strapping colonies is easy and not too expensive. The main issue here is to make sure the straps are cinched down tightly and the loose pieces are tied securely so that they're not flapping around or getting tangled up. As we began the task of strapping, it was starting to get dark; so I was off to the truck to grab my trusty Coleman lantern, but it wouldn't turn on. After several minutes of fooling around with it, I went back for the Maglite flashlight, yet it wouldn't work either. "Really? Really?" Both sources of light wouldn't work . . . "Really!!!!" Then I turned on the truck lights because at least I knew those worked!

Now, if you're a direct descendent of Superman, Wonder Woman, Batman, Cosmic Boy, Spiderman or Mighty Mouse, then lifting a colony onto the back of a truck or bed of a trailer would be a piece of cake for you. I imagine you could load 30 colonies in a flash, the blink of an eye, a split second, but, for us mortals, picking up 100-200 plus pounds is not such an easy task. And over time, things begin to wear out a bit and since we can't regenerate broken down or worn out body parts, protecting what we have, especially our backs, becomes important. Two person hive lifters work nice for lighter colonies, or adjusting colonies once loaded, but, for the larger double-deeped, triple-supered ones, a hand truck comes in "handy". Though here's a word of caution: if your bottom boards are screened, you need to make sure the tongue of the hand truck is long enough to clear them. Otherwise, you may puncture your screen.

In the glow of the truck's lights, we were able to load the hives one by one without incident. Once loaded, the

Three on, more to go.

colonies were strapped to the trailer. Insert motto here: "Better to be safe than sorry!" A sharp swerve to miss a critter that just ran across the road or a sudden stop to avoid the stupid driver that cut you off while texting, scrolling through their iPod, and yelling at their child (all at the same time) instead of paying attention to the road. Sudden changes in direction or speed can result in hives bouncing down the road, which is not a good thing!

As we drove to the next yard, I figured we had experienced our requisite glitch for the evening (lights not working). So, we should be good to go. Hmmmm, have you ever seen Apollo 13? Remember, right after take off, they had a minor problem with the #5 engine, and, once it was bypassed, and the alarms went silent, Jim Lovell says to the crew . . . "looks like we just had our glitch for this mission." Little did he know, because just a few hours later – well, you know the rest of the story. A minor hiccup, followed by a sense of calm, then, Boom, even more issues materialize to deal with. And, it all started as we entered the fourth and final yard.

This is one of those yards you love and hate. You love it because it has great nectar potential, and you hate it because driving through it is enough to dislodge the fillings in your teeth. Yard 4 had been logged some years past and what remained were large stumps, holes, divots, terraces, ruts, and a steep incline to where the bees were. By now it was late and the grass was wet with dew. The

Ford with its trailer refused to go up the hill. No way sista! So, Bob and I grabbed what we would need and walked up the hill to retrieve the colonies.

Once we got there, we encountered yet another problem. Apparently, I can't count properly. This last yard had seven colonies needing to be screened and strapped, but only four screens and straps remained. Leaving the three colonies behind was not an option as I had promised the owners that I would remove all colonies that night so they could clear more land the next day. So, we stuffed grass into entrances and began hauling 200 lbs colonies down the hill using a two-person hive lifter. There was lots of huffing and puffing, but we managed just fine until the last hive.

It was an extremely heavy one, and, as we were about to clear the last stump, we both stumbled into a hole and dropped the hive. Fortunately, it only came apart between the top two supers but bees still went everywhere. We quickly put the colony back together, then dashed back to the truck to put on our veils. Both of us choreographed the sting dance as we removed bees from all parts of our body.

Once the dancing stopped we maneuvered the unstrapped hives into the center of the trailer, duct-taped the supers and lids, braced colonies, then bounced out of the yard and finally headed north towards sourwood country. It was midnight by the time we hit pavement, which meant we would arrive on site at 2:00 a.m. Bob Binnie had agreed to meet us at the bottom of the mountain and show us the way, which was a good thing. We never would have found it by ourselves. What a great friend Bob is to get out of bed at 2:00 a.m. and help us out.

The roads getting in while a bit bumpy, were at least maneuverable except for the last 100 yards. There was a steep bank with more of that dew covered grass. Bob Binnie recommended that I "gun it" in order to get the truck and the trailer up the hill, around a big oak tree, and to make the 90° turn needed to keep us from falling off the other side of the mountain. I did just that. I know for a fact that the truck and trailer went airborne at one point or another. By the time we came to a stop, the original positions of the hives had shifted quite a bit, especially those colonies that weren't screened or strapped. When we started unloading, bees covered the bed of the trailer, as well as the sides and tops of the hives. One thing you should know is that bees rarely fly at night; instead they crawl! And, insects always want to crawl up. Hence, as we're standing there trying to move hives, bees were crawling up our legs, underneath our britches, and under our shirts. With no bee suits to wear, long sleeve shirts to put on or gloves to show off, our veils, blue jeans and short-sleeved t-shirts became our only protection against the onslaught. Normally bees are particular adept at finding exposed skin to sting, but after the rough treatment these girls had just experienced; they were on a mission! By the end of the night, we both were showing off our new "cankles."

All bee movers belong to a Secret Society, you know. There's a handshake and everything. Dues are paid in stings.

Because of this experience we now have a box that is brought along anytime colonies are moved. The box contains suits, leather gloves, (which we affectionately have termed "our big boy gloves,") a flashlight, extra screen and straps, duct tape, hive tools, a lighter, a first aid kit, box cutters, a 4 x 7 smoker, a small wad of pine straw, and a tin of Altoids (those "Curiously strong mints").

Another tidbit of information that I've learned since that night is to use foam pieces to block entrances and screened moving tops. The foam works great. It's cheap, and, if one piece is too long, you just pinch it off, or, if too short, just add another piece. You can get an old cushion from Goodwill and slice the foam into long, narrow pieces about the width of an entrance. Now, it is ready for stuffing. Screened moving tops are a must when moving colonies during the warm months. With screened tops and bottoms you don't have to worry about colonies overheating with entrances stuffed with foam. Just be ready to cover them if it begins to rain.

There is still time, even in the south, to get your colonies moved to that ideal location before the temperatures get too warm. The best part about this time of year, you don't have to move hives in the dark. Chilly mornings provide perfect opportunities because the bees are still clustered and not foraging. But please remember, be prepared, be careful and take your time. Never get in a hurry, especially when moving bees. It could end disastrously.

And as far as catching the "sourwood" fever this Summer; I'm prepared. I left the bees up in the mountains which both Bobs, the bees and myself are very happy about!

See Ya! BC

Jennifer Berry is the Research Coordinator at the University of GA Bee Lab. Contact her at ***Jennifer@Beeculture.com****.*

In The Burbs

"Suburbs" Don't All Look The Same

Ann **Harman**

In the United States if you say you live in the suburbs you have just indicated that you live in an area outside of a town or city. The concept of such an area is not new. The Romans had these areas a thousand years ago, although those had a slightly different way of life from today's suburban living. The *Oxford English Dictionary* listed the word in 1380.

Suburbia today is generally an area of single-family homes within reasonable commuting distance of an urban area. People go to the suburbs to live in less-congested places than found in cities. So suburbs have proliferated, especially in the years after World War II. Hundreds of books, movies and songs exist about suburbia. The name has even been given to vehicles. Although the Chevrolet Suburban is perhaps the most recognized today, the name has been on various station-wagon types since the 1930s.

If we were to visit some suburbs around the U.S. we will find quite an assortment of designs for these residential areas. Some have lot sizes only a bit larger than found in the adjoining town and the houses are cheek-by-jowl. Other suburban areas can have lot sizes of an acre and even up to five acres. A few may even have larger lot sizes, depending on the availability of land. Some suburbs are adjacent to farmland; some border on other suburban areas. In some parts of the country almost every suburban house has a swimming pool. In other areas there are very few. Suburbs with large lot sizes may have huge lawn areas; some will have large gardens, even with a few fruit trees; other lots may have many trees, ponds, shrubbery, sculpture, and large patios. In arid places sand and cactus may predominate, especially if water use is restricted.

Some suburbs consist of gated communities with restrictions on appearance: color of paint on house or trim, grass mowed to certain height and no clotheslines for drying clothes. Noise restrictions, such as mowers and leaf blowers may exist. Some suburbs will allow horses and chickens; others ban livestock. So one can say that no single description of suburbia will be possible.

What about beehives? Well, generally you may find that they are permitted in the suburbs. With the increasing interest in gardening and the "eat fresh, buy local" movement, many see their suburban property as a place to have a garden with perhaps a few fruit trees. The plight of honey bees has encouraged many to become small-scale beekeepers. The beehives and bees fit into the picture of a suburban home and garden.

Since suburbia is neither urban nor rural, a beekeeper can face situations particular to suburbia. However, a number of those situations include ones common to both urban and rural beekeeping. Many states have written a Best Management Practices (BMP) document that is distributed to beekeepers. These BMP documents give beekeepers a very good guide for being a Good Neighbor. Always keep in mind that beekeepers view bees as interesting, cute, fascinating, lots of fun, great family project, and working hard to pollinate, as well as contributing good, healthful honey for family and friends. Non-beekeepers view bees as bugs that fly and sting. All beekeepers should have a copy of their state's BMP. Read it and use the information.

One item that is common to all beekeepers everywhere and is most important for being a Good Neighbor is a source of **water**. Bees use water all the time, all year. In temperate climates water will freeze during the cold months. Besides, bees stay inside the hive. Bees are creatures of habit. Many times beekeepers will only start to supply a water source too late in the season to train the bees to their own close-by source. In warm climates, with bees flying almost all year around, water needs to be available on the bees' schedule that can mean every day of the year.

In a suburban area with many backyard swimming pools the bees can easily decide which pool is the most desirable. A beekeeper and family may well find it charming that their bees use the home swimming pool for their water source. But those non-beekeepers invited for a pool party may well feel that swimming

pool is dangerous. Another water source can be quite attractive – bird baths, very common in suburbia. The birds don't mind; but the non-beekeeper owner will. Suburbia is a land of dogs. Dog owners will frequently provide their dog with a bowl of water outside, perhaps by the back door or on the patio or deck. A dog owner will be most upset if the dog is stung. An avid gardener may have a pool in a suburban garden. Bees find these garden pools very useful.

So it would seem that suburban beekeepers could be surrounded by desirable sources of water for their bees. Some of these sources may not be immediately apparent, such as garden pools. Therefore it is essential that providing a water source be at the top of the list of management.

In second place on that list is swarm prevention and control. A swarm to a beekeeper is both disappointing and satisfying, depending on whose colony swarmed. To a non-beekeeper it is a threatening mass of bees, sometimes terrifying. If anyone in the suburb knows who keeps bees that swarm is obviously from **that** beekeeper. When you are called to rescue the people who discovered the swarm, make the situation an educational one. The gift of a jar of your honey to the swarm finder will insure good neighborly relations.

Let's pay a visit to some suburban beekeepers to see what they are doing. Here is a nice suburb with lot sizes about a couple of acres or a bit more. This area was carved out of a farm some years ago and is bordered by other newer suburbs and fairly close to still-rural areas. We see well-cared-for lawns, trees that were planted by the first homeowners, flower gardens and some new vegetable garden plots. Children of all ages are seen playing. Now what are our beekeepers going to face?

One of the first things we may notice is the number of carefully groomed green lawns. Does every homeowner spend the evenings and weekends tending such a lawn? Perhaps various lawn services are doing much of the lawn care. Some lawn services are moving toward a "greener" type of care but others are still applying insecticides. Lawn work is done during the day. A suburban beekeeper can only hope that honey bees are not being affected. Something else to think about: a lawn service does not want its workers coming into contact with bees. Therefore, just like the urban beekeeper, a suburban beekeeper needs to have the colonies isolated.

Perhaps we should consider other possible sources of pesticides a suburban bee may encounter. Vegetable gardens are becoming very popular again. Fortunately for the bee, tomatoes – the most popular homegrown crop – are not appealing to bees. But other vegetables are being grown that bees do like. Since the various dwarf apple trees fit a suburban lot, the suburban bee will certainly find those. Blackberries and raspberries are attractive too. Suburban gardens may also have many flowers and flowering shrubs. Not every neighbor is growing organically, without pesticides. Pesticide losses of bees are frequently thought of as being a problem in rural areas. In the suburbs pesticides may actually be a larger problem.

Wild animals – bears, skunks, raccoons, possum and deer – once considered part of rural life actually thrive in suburbia. It's a comfortable life there. Rubbish containers with tasty garbage are an easy midnight supper. Some dogs and cats are fed outdoors and may leave some of their meals uneaten. Some suburbanites, enchanted with the wildlife, actually purposefully feed the various critters. So the suburban beekeeper may need to consider protection for the hives, particularly for bear and skunk.

Outdoor activities, both for adults and children, are an essential part of suburban life. Adults may enjoy giving barbecue parties for neighbors and other friends. Children, along with their friends, will run and throw balls. The beeyard needs to be in an area that will not interfere with the activities taking place in the back yard. The beeyard can be behind a hedge just as the urban beekeeper does. If vandalism is a problem the hives can be protected with a study fence either with or without a hedge.

The beekeeper needs to keep in mind that foods, especially those containing honey, can be attractive to honey bees. Here again we have the dilemma of beekeeper with a casual attitude towards the bees and the visiting friends taking a dim view of bees inspecting the picnic foods set out on the table.

If a strong nectar flow is on, the beekeeper's bees may just ignore commotion and the picnic food. But in a dearth, with foragers having nothing much to do, the colonies should be well-supplied with sugar syrup to keep the bees busy "at home."

In your enthusiasm for bees and beekeeping keep in mind that inviting friends and neighbors, including children, to watch you open a hive or participate in hive inspection may not be wise. You have no idea whether someone is truly allergic to a sting.

Seeing or smelling smoke from a smoker could be cause for alarm if neighboring houses are close and nobody knows you are a beekeeper. Many communities have a ban on burning. You really don't want to be accused of breaking the law. So perhaps it is wise to do a bit of positive publicity about honey bees and beekeeping,

Remember that honey is more than just a delicious natural product. For a suburban beekeeper it is a peace offering, a bribe, an insurance policy. A gift of a jar of your honey, along with good bee management, will keep visitors and neighbors happy that you have bees. BC

Ann Harman keeps bees and writes about beekeeping from her home in Flint Hill, Virginia.

RESEARCH REVIEWED

The Latest In Honey Bee Research

Steve Sheppard

"Less than 5% of workers, even in highly hygienic colonies, are involved in the tasks of uncapping and removing diseased brood."

In previous Research Reviewed columns, we covered several papers that investigated the link between the "hygienic behavior" of honey bees and resistance to diseases or mites. Within this context, hygienic behavior involves the detection and removal by worker bees of dead, diseased or parasitized honey bee brood. With continuing reports of high levels of colony losses in the U.S. from a variety of known and unknown causes, there is a growing awareness that hygienic behavior represents a type of "social immunity" for honey bees to deal with pathogens and parasites at the colony level. Increased concern about the development of pathogen resistance and contamination of hive products, has led some beekeepers to eliminate the routine application of antibiotics for disease control. Deciphering the genetic underpinnings of hygienic behavior remains an area of continuing research, although the relative ease with which bee breeders can increase expression of this trait within a given honey bee stock already has led to widespread practical application. Selection for hygienic behavior is now common in commercial U.S. queen production operations, University and government honey bee stock selection programs and in bee breeding programs in a number of other countries.

There have been numerous studies detailing honey bee hygienic behavior in response to capped honey bee pupae that were experimentally killed by freezing (freeze-killing) or piercing through the capping with a pin (pin-killing). These studies have shown that colonies expressing high levels of hygienic behavior are measurably more resistant to infection with American foulbrood and chalkbrood and may defend themselves to a greater extent against *Varroa* mites. Quite recently, an international team lead by Dr. Maria Palacio of Argentina reported on the behavior of individual worker honey bees from hygienic (H) and non-hygienic (NH) colonies toward brood cells that were experimentally infected with chalkbrood. By recording the worker bees' activities throughout the inspection, uncapping and removal process, the authors were able to address the hypothesis that H and NH colonies would differ in the frequency (number of visits per bee) or duration (time spent) invested in specific tasks related to hygienic behavior (Palacio et al, 2010).

The researchers used honey bees from both a selected hygienic (H) line and a non-hygienic (NH) line of bees. The hygienic colonies derived from a population that had undergone selection for hygienic behavior for 10 years. Colonies were considered hygienic if they would remove 90% of the dead brood presented in a pin-killed brood assay within 24 hours. The non-hygienic colonies removed less than 50% of the brood in an identical assay. In the experimental set-up, brood comb from H and NH colonies were placed in separate single comb observation hives and 500 g of adult workers from the same H or NH colony was added along with a queen. A 5 x 10 cm block of comb was removed from the middle of the comb in each observation hive and replaced by a portion of brood comb containing individually identified chalkbrood-infected capped cells (Exp 1) or individually identified chalkbrood-infected capped cells and five to seven pin-killed pupae in capped cells (Exp 2). The chalkbrood-infected cells were prepared in field colonies by feeding 20 individual larvae (per 5 x 10 cm block) a honey and water solution containing chalkbrood spores. While most larvae infected in this manner were removed prior to capping, three to seven chalkbrood mummies in each block were capped over by the bees. The block was then removed and placed in the observation hives for subsequent observation and filming. For the comparison with pin-killed brood (Exp 2), five to seven healthy capped pupae in each block were also killed by inserting a pin through the capping.

To evaluate the behavior of H and NH bees toward the cells containing diseased or pin-killed brood, the researchers obtained adult workers that emerged from brood combs of each group (H and NH) in an incubator and then labeled 200 newly emerged honey bees each day using numbered plastic disks. Colors of the tags being applied were changed daily to allow subsequent age identification of each numbered bee. Experimental observation hives were each stocked with a total of 1200 marked bees and filmed observations began when the ages of the tagged bees ranged from three to 21 days. In experiment one, the researchers evaluated the behavior of individual bees in both H and NH stocked observation hives to individually infected cells containing chalkbrood mummies. The behaviors measured included activity (inspection, uncapping or removal) and time spent in the activity. They were also able to collect data on the age of bees performing tasks and the percentage of chalkbrood mummies removed. In experiment two, the same measures were made on both the group of cells containing chalkbrood mummies and pin-killed brood.

The results of the experiments

provided insight into the nature of hygienic behavior of individual bees toward individually infected cells at a very detailed level. In Experiment one, as might be expected, a greater proportion of the tagged bees in hygienic colonies were found to inspect, uncap and remove diseased brood (chalkbrood mummies) colonies than in the non-hygienic colonies. However, there was no significant difference in the mean number of visits per bee that inspected the chalkbrood mummy cells. That is, while significantly fewer tagged bees inspected individual diseased cells in the NH colony, they did not visit the cells more or less often than did tagged bees in the H colonies. However, the few NH bees that were involved in the remainder of the process subsequently made significantly more visits to uncap and remove chalkbrood mummies from infected cells than did the tagged bees in the H colonies. Likewise, although the average time spent by bees involved in the activity of inspecting infected cells was not different between H and NH bees, the NH bees involved in hygienic behavior spent significantly more time uncapping and removing diseased brood. Although individual NH bees involved in hygienic tasks spent more time visiting the diseased brood and visited more often, the H colonies were superior in removing the diseased brood, removing 98% of the diseased brood compared to 70% for the NH colonies. The median age of bees involved in these tasks in both groups was 15 days. Interestingly, the proportions of tagged H and NH bees that took part in the three phases of hygienic behavior were rather limited. Inspecting, uncapping and mummy removal tasks were performed by 17%, 4% and 3% of the tagged H bees and 5%, 1% and 1% of the NH bees, respectively.

In experiment two, comparing behavior toward chalkbrood infected and pin-killed pupae, bees in the H colonies began uncapping activity on cells containing pin-killed pupae or chalkbrood mummies significantly earlier than did the NH colonies. From start to finish, there were no significant differences in the time involved for H colonies to uncap either pin-killed or chalkbrood mummies from cells. However, the NH colonies took significantly longer to uncap pin-killed pupae compared to chalkbrood mummies. The proportion of pin-killed or chalkbrood mummies that was eventually uncapped by either the H and NH colonies was not significantly different within each group over the duration of the observation (nine hours). However, H colonies both uncapped significantly more brood (pin-killed and chalkbrood) and removed significantly more brood (pin-killed and chalkbrood) compared to NH colonies. Within both H and NH colonies, the bees removed a significantly greater percentage of brood infected with chalkbrood compared to pin-killed brood.

The researchers noted in their discussion that this was the first experimental study of individual bees performing hygienic behavior where all stages (inspecting, uncapping and removing) of the behavior were recorded in relation to infected brood cells. The laborious process of tagging individual workers in both H and NH colonies and then observing individual interactions with infected brood cells, provided new insight into hygienic behavior, especially in demonstrating that less than 5% of workers, even in highly hygienic colonies, are involved in the tasks of uncapping and removing diseased brood. In addition, the authors noted that significantly more bees in the hygienic colonies were involved in performing all three tasks (inspecting, uncapping, removing) than in the non-hygienic colonies. Researchers continue to uncover new details of the behavioral repertoire of honey bees and, as in this case, discover novel information about how honey bees respond to their hive environment and deal with pathogens. Meanwhile, beekeepers face very practical issues related to the economics and sustainability of existing beekeeping practices and continue to search for pathways to maintain a healthy pollinating force of honey bees for agriculture. Within the larger context of research findings and applications to beekeeping, the work of Palacio and colleagues adds to the growing evidence that selection for a high level of expression of hygienic behavior within honey bee stocks represents an attainable genetic approach that can contribute to improved honey bee colony health. BC

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Biennials For The Bee Garden

Connie **Krochmal**

Biennials Bloom The Second Year And Then Die

Forget-me-not (Myosotis Sylvatica)

A biennial is defined as a plant that normally blooms the second year and dies. Parsley is a member of this group. So are a number of flowers that are suitable for the bee garden. Usually a true biennial will have a rosette of foliage during the first year, and produce blossoms the following year.

For the most part, the seeds of biennials are usually planted during the Summer or Fall. Some species will self sow if they're given a chance. In order for this to happen, the seeds must be allowed to ripen before the old plants are pulled up.

Over the years plant breeders have developed some varieties of biennials that bloom the first year. There are a number of such early-flowering varieties. However, like any other biennial they will still die the following year after flowering for a second time. In some cases, gardeners have treated the early flowering varieties as annuals by replacing them every year. The following biennials are recommended for the bee garden.

Canterbury bells (*Campanula spp.*)

Also called bellflowers, this group includes annuals and perennials as well as biennials. With perhaps 300 species worldwide, several are these are treated as biennials. Their hardiness can vary somewhat from one kind to another. The alternate foliage is often toothed.

The blooms can be cup-shaped, bell-like, starry, or tubular. Providing nectar and pollen for honey bees, they're usually white, blue, pink, or violet. The biennial species include the following.

Canterbury bells (*Campanula medium*) can be grown as both a biennial and annual. Native to southern Europe, this stout, rough and hairy plant reaches four feet in height. The lance-like foliage is toothed. The annual varieties are typically shorter than the true biennial forms. The blooms come in a variety of flower colors, including lavender, blue, and white. Opening from May to August, the spectacular blossoms open on crowded spikes, and are two inches in length. Various varieties are available. These are generally grown from seeds.

Chimney bellflower (*Campanula pyramidalis*) was originally native to southern Europe. Hardy to zone three, this biennial can reach four to five feet in height. It has notched, heart-shaped foliage. Wider at the bottom than the top, the flower spike is shaped like a pyramid, which explains the Latin name for the species. The blooms can be white or blue. Opening on tall, graceful flower spikes, they appear during the late Summer for about 1½ months.

Coventry bells (*Campanula trachelium*) are a biennial that was originally native to Asia and Europe. The erect plants reach about three feet tall. This has rough, hairy, heart-shaped leaves, up to three inches in length. Blooming from June through August, it features lovely nodding, blue or purplish-blue flowers, up to an inch in length. These emerge from the leaf axils.

Forget-me-not (*Myosotis spp.*)

There are at least three biennial species of forget-me-nots. Hardiness can vary slightly, but most are hardy to zone two or so. While the low growing ones are around six inches tall, others reach two feet in height.

The woodland forget-me-not (*Myosotis sylvatica*) is seen most commonly in gardens. A member of the borage family, it is native to Europe. This erect, hairy plant has oblong to lance-shaped foliage. Blooming from May to July, this typically has blue flowers. However, they can be white in some varieties.

Well suited to shady gardens, the forget-me-nots prefer a moist soil. Forget-me-nots often self sow. Bees work the flowers for nectar and pollen.

A honey bee on a hollyhock.

Hollyhock (*Alcea rosea*)

A member of the mallow family, the common hollyhock is hardy to zone three. Originally a native of China, this can easily reach eight feet in height. The lobed leaves are rough and hairy. The basal foliage is quite large, and tends to form a rosette.

Hollyhock blooms come in a variety of colors, including white, pink, red, purple, black, and apricot as well as yellow. Some of the reds are so dark they're almost maroon. The blossoms open throughout the Summer into the Fall. Some varieties have double or semi-double flowers, which are unsuitable for bee gardens.

Very carefree, these plants require very little care. They will self sow. However, be careful that you don't end up with double or semi-double blooms in subsequent years, which can happen.

Some varieties of hollyhock will bloom the first year the seeds are planted. The catalog or seed packet should indicate if this is so. These bring nectar and pollen for bees.

Honesty (*Lunaria annua*)

Also called money plant, this was originally native to Europe. All of these offer nectar and pollen to bees. A member of the cabbage family, it reaches three feet in height with a spread of about a foot. It can be grown as both an annual and biennial.

The notched foliage can be opposite or alternate. Although the scented blooms are usually purple, they can be white in some varieties. These blossoms open in Spring and Summer. Honesty is grown widely as an everlasting for the flattened, papery seed pods, which resemble disks.

Honesty is hardy to zone four. Very easy to grow, these will self sow. They're adapted to most any soil. These can be planted in the Fall as well as in the Spring. There are several related species that are grown as bee plants, including *Lunaria coronaria.*

Mulleins (*Verbascum spp.*)

Mulleins are members of the figwort family. Several biennial species are suitable for bees. These include moth mullein (*Verbascum blattaria).* Hardy to zone three, this can reach four feet in height. Moth mullein was originally native to Asia and Europe, but has naturalized in North America. With notched edges, the alternate foliage is 2½ inches long. The blooms open in clusters on a terminal flower spike. They begin blooming in June, and continue into September. An inch wide, the blossoms contain five petals. These are white on the inside and pink on the outside. The buds are pink.

Verbascum thapsus.

Pansies.

Greek flannel (*Verbascum olympicum)* is reportedly hardy to zone five. In some areas, this will behave as a true biennial. This branching plant reaches six feet in height with a two foot spread. Up to two feet in length, the very white, woolly leaves form rosettes. The yellow, saucer-like blooms open on a dense, three-foot-tall flower spike from June through September. The flowers are over an inch wide.

Purple mullein (*Verbascum phoeniceum*) is hardy to zone four. This can behave like a biennial or short lived perennial. The plant is four feet in height with a 1½ foot spread. Up to six inches long, the foliage is evergreen. This species blooms from late Spring into the mid-Summer. Opening on tall stalks, these flowers can be purple, white, or violet. This species is native to Europe.

The mullein blossoms are a source of nectar and pollen. The plants prefer full sun, and a quick draining soil that is low in fertility. An alkaline pH is ideal. Mulleins are easy to grow from seeds. The plants can also be divided or grown from root cuttings.

Pansies (*Viola spp.*)

All of these species are a source of nectar. Several species and hybrids can be grown as biennials. Because some of these will bloom the first year, they can also be treated as annuals. All pansies and violets can be grown from seeds and cuttings.

The common pansy is *Viola x wittrockiana.* Some pansies are hardy to zone four or five, depending on the variety. They can sometimes reach a foot in height. Preferring cool weather, these bloom freely for a long period in the Spring and early Summer. Assuming hardy varieties are chosen, Fall planted pansies usually bloom through the Autumn until severe Winter weather arrives. The flowers, which can be solids or bicolors, can differ considerably in size and color from one variety to another. Flower colors include violet, bronze, green, reddish-brown, mauve, black, pink, yellow, and blue. They can be ruffled. Some have a colorful face in the center. For the longest flowering season, deadhead the plants to encourage new blooms.

The horned violet (*Viola cornuta*) is also known as tufted pansy. Considered a hybrid, it is hardy to zone six.

This can be grown as an annual or biennial. Generally, the scented blooms are somewhat smaller than those of the common pansy. Reaching about six to eight inches in height, this has a spread of about a foot. There are a number of horned violet varieties available.

Many pansies do best in shade, particularly in warm climates. However, some are suitable for full sun. They do especially well when planted in a moist, rich soil high in organic matter. However, pansies will generally thrive in most garden situations.

The Other Poppies (*Meconopsis spp*)

Related to the perennial Oriental poppies that are commonly cultivated, the other hardy poppies are grown mostly as biennials. There are several species in cultivation, including blue-flowered ones. Generally hardy to zone six or so, these prefer some shade. The biennial ones include the following.

Welsh poppy (*Meconopsis cambrica*) is native to Western Europe despite the common name. It has milky latex like the popular Oriental poppy. Hardy to zone six, this reaches 1½ feet in height. The six inch long, pinnate leaves are white on the underside. Opening from June through August, the pastel yellow or orange blossoms are three inches in diameter. Double flowering forms, which aren't recommended for bee gardens, are available. So, choose your variety carefully. Welsh poppy will easily self sow. There is a similar species (*Meconopsis regia*) from Nepal that has yellow blooms. It is also hardy to zone six.

There are several blue flowering poppies that behave pretty much as biennials or short-lived perennials. The Tibetan or Himalayan blue poppy (*Meconopsis betonicifolia*) is hardy to zone six. This reaches five feet in height with a spread of 1½ feet. The heart-shaped, hairy leaves look rusty. In early Summer, the astounding blue blossoms open from the leaf axils and terminally. They're purplish-blue or true blue. These poppies are a source of nectar and pollen.

Sweet William (*Dianthus barbatus*)

Grown both as an annual and biennial, this reaches about 1½ to two feet in height. This cottage garden flower is a long-time favorite. Originally native to China and Russia, it has now naturalized in much of Europe. The plants have lance-like foliage.

There are many varieties of sweet William available, some of which will bloom the first year. The flower color varies widely. Shades include white, pink, and red. For bee gardens, avoid the double flowering ones. The blooms open in flat-topped, dense clusters that appear terminally. Opening from June through August, these offer nectar to bees. The plants are hardy to zone three. Acidic conditions are unsuitable, so add lime if necessary.

Wall flower (*Cheiranthus spp.*)

These are members of the cabbage family. Due to disagreement concerning the preferred Latin name, some sources refer to these as *Erysimum* rather than *Cheiranthus*.

Though wallflowers can be grown as short-lived perennials, they're generally treated as biennials, especially when growing in heavy soils. They provide nectar and pollen for bees.

Several species are in cultivation. The wallflowers require full sun, and a very quick draining, reasonably rich soil. They prefer an alkaline to neutral pH. Calcareous conditions are considered ideal.

The blooms open on lush, full flower spikes. The fragrant blossoms have four petals that form a cross. These plants are grown from seed, and are available as bedding plants.

The one seen most frequently in gardens is the common wallflower (*Cheiranthus cheiri*). It is sometimes grown as an annual in some areas of the country. Hardy to zone three, this thrives in regions with cool Summers. Native to Europe, it can reach 2½ feet in height with a spread of nearly 1½ feet. In the right climate, this will self sow.

The very scented blossoms look velvety. For the species, they're usually yellow or orange. Some cultivated forms feature blooms in a range of colors, including mahogany, bronze, cream, pink, and various reds. BC

Connie Krochmal is an award winning garden writer and a beekeeper in Black Mountain, North Carolina.

GLEANINGS

MARCH, 2011 • ALL THE NEWS THAT FITS

FRIENDS OF THE INDUSTRY

Betty and Jack Thomas of Mann Lake Ltd., received the special 'Friends Of The Industry' Award from Jerry Brown, Executive Secretary of The American Honey Producers Association, at the 2011 North American Beekeeping Conference in Galveston, in January.

CANADA ADOPTS BIOSECURITY STANDARDS

The Canadian government and the Canadian Honey Council are working on a new voluntary national biosecurity standard intended to help bee keepers minimize the risk of pests and diseases in their colonies.

Agriculture Minister Gerry Ritz says the government supports the creation of standards that will contribute to the stability of such an important industry in the agricultural community."

"Bees are a major contributor to the health and vitality of agriculture," Ritz says.

Bumble bee, leafcutter and honey bee keepers will be contacted at random and asked what they do at the farm level to keep their colonies healthy as part of the planning to create the biosecurity standards.

Council chief executive Heather Clay said the biosecurity standard is important to help control the spread of bee pests and diseases.

The standard, expected to be released in 2012, will benefit all managed bees in Canada. It is being developed in partnership between Agriculture and Agri-Food Canada, the Canadian Food Inspection Agency, provincial departments of agriculture, the bee industry and academia.

Meantime, the council acknowledged that Clay has retired from the council.

"We are all very sorry to lose Heather and wish her the very best in retirement," the council says in a statement. "Heather has done a great job in building honey council to the position that it is in today and we thank Heather for her contributions over the years."

– Alan Harman

CANADIAN HONEY COUNCIL CHANGES LEADERS

The Calgary Bee Club was one of many sending Heather Clay into retirement with a gift and a Big Thank You. Here, Heather shows the gift of a stained glass window from the club.

Heather Clay, Chief Executive Officer of the Canadian Honey Council for 12 years retired at the end of 2010. She was presented with a ceremonial clock at the retirement party, and, in part the Council stated: The twelve years you served as Chief Executive Officer helped move the honey bee industry into a recognized and more prominent role in the Agricultural sector. Your vision for a new direction and structure of the Canadian Honey Council has truly helped shape the organization into a stronger and more dynamic organization ready to face all and any challenges going forward. Throughout your career, beekeepers always knew that someone who had their best interests at heart was representing them. Congratulations Heather.

Following in Heather's footsteps is Rod Scarlett, Executive Director. Rod has worked as the Ex. Director of Wild Rose Agricultural Producers, Alberta's general farm organization. Rod can be reached at chcecm@honeycouncil.ca.

AUSTRALIA ABANDONS SEARCH FOR ASIAN BEE

The Australian government is abandoning the fight against the Asian bee incursion in the north of the country in a decision that could make the U.S. temporary ban on Australian bee imports permanent.

The Asian Honeybee National Management Group (AHB NMG) decided it is no longer technically feasible to eradicate Asian honeybees (*Apis cerana*).

The AHB NMG is made up of the chief executive officers of the national and state and territory departments of agriculture and primary industries, representatives of the Australian Honey Bee Industry Council (AHBIC), Plant Health Australia and is chaired by the federal government.

Opposition agriculture and food security spokesman John Cobb accused the Labor government of gross negligence, saying the decision could potentially decimate the Australian bee industry and will have major public health implications.

Government ministers stayed out of sight, leaving the announcement to a news release from the federal Department of Agricultural Forestry and Fisheries.

The Asian honey bee is an invasive species which adversely impacts populations of European honeybees by competing for floral resources, robbing managed hives and transmitting disease. It is a natural host for *Varroa jacobsonii*.

The bees were first detected near Cairns in far north Queensland in May 2007. A nationally cost-shared program aimed at eradication was implemented, led by the Queensland government and overseen by the AHB NMG.

Some 342 swarms or nests have been found and destroyed. None of the bees in the nests destroyed carried any exotic mites of concern such as *Varroa, tropilaelaps* or tracheal.

The eradication campaign was funded by the Australian government, state and territory governments and the AHBIC at a cost of about A$3 million (US$3.03 million).

Other industries relying on bees and bee pollination services were approached at peak representative level to be involved in the management of the response but declined to contribute resources.

The AHB NMG's decision to give up the fight was based on a number of factors including: the tendency for the bees to swarm; the bee breeds rapidly and can travel long distances, particularly with assisted movement on vehicles and trains; and limitations of surveillance methods which made it difficult to locate all nests and destroy them.

The AHB NMG agreed to recommend continued funding for residual activities being carried out under the program until March 31. It was also agreed that a group of senior biosecurity officials should meet to determine whether any further national action is warranted.

Opposition spokesman John Cobb says the decision will have serious ramifications for Queensland and the rest of Australia, but Minister for Agriculture Joe Ludwig had hidden behind department bureaucrats when he should have had the courage to stand up and make the decision himself.

"Information coming from the Queensland government is that they are horrified by the decision and rightly so," Cobb says.

He says the Asian honeybee is a natural host for the *Varroa* mite and is a major threat to the Australian honey bee industry.

"Asian honey bees also have an aggressive robbing habit taking honey from managed hives possibly causing hives to starve and there is now clear evidence that the Asian honeybee displaces native bees from their natural habitats by competing for floral resources," Cobb says.

"One of the major concerns is the Asian honeybees very aggressive nature especially when protecting hives and they are much more inclined to sting people and when cornered will attack.

"This is especially a concern with the increased incidence of anaphylactic reaction in allergy prone people and will become a major health risk as the Asian honey bee spreads rapidly across the country.

"Apis cerana has shown an ability to colonize and establish nests in a wide variety of locations and situations, including in cars, boats, boxes and machinery."

Cobb says this allows rapid dispersal over potentially long distances through movement of infested vehicles or equipment.

"The pest itself however has particular ramifications for Australia's tourism industry," he says. "The Asian bee becomes a pest in urban areas through establishing nests in houses and its aggressive stinging behavior. It will also disturb native fauna such as native bees, small marsupials and birds that nest in similar places.

"There is a clear public good in the government continuing to fund the eradication program but despite concerns from the bee industry and the Queensland government, Minister Ludwig has just given up."

He says the government not only failed to protect Australian borders, but now also refuses to spend the money required to eradicate problems if they occur.

"The agriculture minister is proving as uninformed as the former minister when he should be doing his duty to protect Australia from exotic diseases and pest incursions," Cobb says. – *Alan Harman*

RECORD NUMBER OF COLONIES

A Banyan tree that houses 625 honey bee colonies in the Indian state of Karnataka is to enter the Guinness Book of World Records.

Dr. M.S. Reddy, professor in the Centre for Apiculture Studies at Bangalore University, says no other tree comes close to the Banyan in the number of colonies. The tree is located 22 miles from the state capital of Bangalore.

Reddy tells the Express newspaper the 625 bee colonies were counted in January 2008. Every year, the colony formation starts from December and lasts till February. There has been an increase in the number of colonies on the tree for the last 12 years.

The centre and environmental specialists have proposed the tree be recognized as a world heritage site so that it could be preserved and awareness raised about the significance of the bee colonies.

With such a huge number of colonies on the tree farmers in the surrounding area report a tremendous increase in productivity of their agricultural and horticultural crops.

Researchers at the apicultural center report there are as many as 2,200 bee colonies on about nine different trees within a two-mile radius of the Banyan tree.

– *Alan Harman*

WOOSTER, OHIO SPRING WORKSHOP

Ohio State University Extension and Tri-County Beekeepers Association of Northeastern Ohio will hold the 33rd Annual Beekeeping Workshop on Friday Evening & Saturday, March 4 & 5, 2011, at The Ohio State University, Ohio Agricultural Research and Development Center (OARDC). OARDC is located at 1680 Madison Avenue in Wooster, Ohio. This is the largest one-day beekeeping workshop in the United States.

This year's Workshop theme is: Honey Bees – Back from the Brink. In his keynote address, Dr. James E. Tew will speak about "The Natural Bee Nest: Their Own Design".

On Friday, March 4, 2011, at OARDC's Fisher Auditorium, the Spring Workshop will start with an evening program. Dr. Mark Headings, Associate Professor OSU/ATI, will talk about "Bee Biology for the Backyard Beekeeper". Mr. John George, Chairman of the Central Ohio Beekeepers Association (COBA) Beeyard Management Program will discuss "Assembling Bee Equipment." Also, OSU's Beekeeping Museum will be open for visits before the presentations and refreshments will be served after the presentations.

On Saturday, after the Keynote there will be breakout sessions on "Winter Kills: How to Start Over," "Beehive Chemistry," "City Beekeeping Photography," "Making Soap with Honey," "Practical Beekeeping for Women" and a Basic Beekeeping program for beginners--just to list a few. Other interests are the Baking Contest, Door Prizes, Vendor Displays, Bee Museum tours and the bee equipment Hands-on/Demo Room. Registration starts at 8:00 a.m. and the program is from 9:00 a.m. until 4:45 p.m.

TRUE SOURCE HONEY™ LAUNCHES CERTIFIED HONEY TRACEABILITY PROGRAM

The True Source Honey™ Initiative enthusiastically announces the launch of a Certified Honey Traceability Program beginning in January 2011. The program officially known as True Source Certified™ was unveiled at the 2011 North American Beekeeping Conference in Galveston. Details were revealed regarding the program, which is designed to certify the origin of honey being distributed and consumed within North America, resulting in better food safety and product purity assurances for quality-minded customers and consumers. Further details of the program have been posted at **www.TrueSourceHoney.com**.

This new voluntary program is open to all interested honey companies (packers, beekeepers, importers and exporters) who desire True Source Certification. It was developed by a multi-disciplined group of industry participants who want to maximize industry participation in solving the problem of illegally sourced honey. Intertek, an internationally recognized third party audit firm, will begin conducting audits for any interested candidates starting this month. The program will help create transparency within the industry, going beyond current certification expectations and federal regulations while adding an additional layer of traceability beginning at the hive. For those applying for certification, Intertek will conduct unannounced inspections, review documents and collect samples for country-of-origin verification.

There are a number of honey companies in North America that have resolved to purchase only legal, properly sourced honey from legitimate sources. These companies now have an opportunity to certify their purchasing practices through an independent third party auditor, enhancing customer and consumer confidence while clearly demonstrating the value which they have been providing.

Most imported and domestic honey is from high-quality, legal sources. However, some importers and honey packers have been illegally importing honey by misrepresenting the true country-of-origin, in order to circumvent dumping duties of $1.20 per pound that have been assessed against certain countries. This results in honey being sold to companies and consumers that is of questionable origin. In addition to creating food safety issues for consumers, this practice threatens the honey industry by undercutting fair market prices and damaging honey's reputation for quality and safety.

"Cheap illegal imports hurt legitimate U.S. packers and beekeepers," said David Mendes, president of the American Beekeeping Federation. "I applaud the efforts of the True Source Honey Initiative to create a 'bottom up' solution to illegal transshipment. I would encourage U.S. beekeepers to support this effort."

The new certification system is consistent with the latest food safety reforms, including the new FDA Food Safety Modernization Act of 2010. The new law is designed to change the mission of the Food and Drug Administration (FDA) so that the agency is focused on preventing food-borne illnesses and implementing new import requirements that provide for tighter controls. Since these new food safety-related traceability requirements are now statutory law, the True Source Certified system has been designed to accommodate these new mandates.

The True Source Honey Initiative is an effort by a number of honey companies and importers to call attention to the problem of illegally sourced honey; to encourage action to protect consumers and customers from these practices; and to highlight and support legal, transparent and ethical sourcing. The initiative seeks to help maintain the reputation of honey as a high-quality, highly valued food and further sustain the U.S. honey sector. For more information, visit **www.TrueSourceHoney.com** and follow us on Twitter at and Facebook.

NOD APIARY GETS THE NOD FOR FORMIC QUICK STRIPS

The US beekeeping industry will welcome a versatile new product to the varroa mite control tool box. Mite Away Quick Strips™ (MAQS™) was officially federally registered by EPA in the United States as of February 4, 2011, obtaining the Section 3 registration.

The product will be gradually available over the next few months as production ramps up and pesticide registrations are obtained in each state.

MAQS™ is a formic acid gel strip product. Two strips are placed on the top bars in the brood area of the hive. The treatment period is seven days and can be used during the honey flow at temperatures up to 93°F. No extra equipment is required. MAQS™ achieves up to 95% mite kill and penetrates the capping to destroy the male mite and immature female mites as well as the phoretic female mites on the adult bees.

For more information, visit the website at **www.miteaway.com.**

UK COOL

The British food industry agreed on voluntary country of original labeling system in the United Kingdom in a move Food and Farming Minister Jim Paice says will make British consumers the best informed in Europe.

"This industry code will give consumers confidence to know, for example, that if it says British on the label, it's British in the packet," Paice says.

The Department of Environment, Food and Rural Affairs says the agreement will formalize and strengthen the information provided by companies on the origin of their meat and dairy products.

"Championing the practices of the best performers and bringing others into line will reduce confusion and ensure improvements in both the quality and consistency of origin information for all consumers," it says in a statement.

Food organizations who have signed up to the code are British Retail Consortium; British Meat Processors Association; British Hospitality Association; Dairy UK; Food and Drink Federation; and Business Services Association.

Paice says many individual businesses already provide excellent origin information.

"These principles formalize and strengthen what they do," he says. "Championing the practices of the best performers and bringing others into line will reduce confusion and ensure improvements in both the quality and consistency of origin information for all consumers."

Food and Drink Federation communications director Julian Hunt (FDF) says the new voluntary principles build on current legislation to provide even clearer labeling for consumers.

"We agree consumers should not be misled with regard to the origin of a food product and our members are committed to providing clear, honest labeling," Hunt says.

Alan Harman

NO WHERE TO HIDE

Northern Ireland-based Randox Laboratories Ltd. is offering the world's only multi-analyte semi quantitative drug residue analyzer; the Evidence Investigator.

It says the system meets the requirements of industry authorities and research laboratories for rapid and sensitive screening methods for the detection of residues of sulphonamides, nitrofurans, amphenicols, quinolones and other antibiotic drugs in honey.

"The multiplex platform we have developed means we can simultaneously detect a wide range of antibiotic residues (tetracyclines, sulphonamides, quinolones, streptomycin, tylosin, nitrofurans and chloramphenicol) from a single honey sample," Randox says.

"The excellent generic nature of our antibodies also allows detection of 10 different tetracycline compounds and 14 quinolone compounds."

Randox says this multiplex testing format reduces cost, run time and labor requirements and guarantees faster turnaround time for results and a higher throughput – 675 tests in under two hours).

It says its comprehensive test menu allows for the consolidation of laboratory testing on to one platform, and with up to 65 new drug residue antibodies in development it can guarantee faster adaptability to the new regulations for this marketplace.

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Alan Harman

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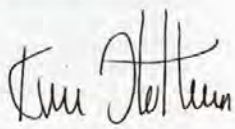
If numbers count, something to consider is the number of people in urban areas taking up keeping bees. The New York group boasts 1000 members. Denver, Cleveland, Minneapolis, soon-to-be Los Angles – think what those numbers could do if they put their mind to it. If a third of the New York group showed up at an Empire Honey Producers annual election (The official beekeeping organization for the state of New York) – well, they'd own the group. Same with Colorado, California (well, maybe not California), Ohio. Goodness, if these new groups get a hint at what they could do – well, let me tell you, the politics and flavor and focus of how keeping bees is viewed in state capitols would definitely take a turn – for the better do you suppose, or not?

It's been cold, snow and worse almost everywhere. Check your bees. They need you.



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This Is Cuba

Ed **Colby**

The driver of our bombed-out 1956 Pontiac taxi was going much too fast. He seemed to be having trouble staying in his lane. Where's a seat belt when you really need one?

My sidekick Marilyn and I sat in the front seat. She put her arm around me, smiled and said, "Life is good."

I looked down the eight-line highway. Traffic was light, with horse-drawn buggies outnumbering cars and trucks. Graceful royal palms dotted the verdant countryside. In the far distance, a sugar mill belched thick black smoke. Alongside the road, a doctor and a nurse hitchhiked in their hospital smocks.

"This is Cuba," I said.

When we turned onto the two-lane road to Vinales, we passed by a cluster of houses. Up ahead, I saw one bicycle on the left, one on the right, and some pedestrians. The driver blew his horn and accelerated.

When the bicyclist on the right wobbled across the road directly in front of us, our driver swerved, and then there was the horrible thud.

At first I thought the driver was going to keep on going, but then he abruptly brought us to a stop. As I reached for the passenger side door handle, he put his arm across my chest. "Be calm," he said

Be calm? For all I knew, that was a corpse lying on the road back there.

The driver got out and did a quick front bumper inspection. Then he walked back to the crash scene.

By this time, the bicyclist was on his feet holding his bike. Its front wheel and front forks were mangled. A bystander pointed at the bicyclist and said, "He's drunk!"

First the bicyclist and the taxi driver shook hands. The bicyclist said he was fine. Within two minutes we were on our way again. No money exchanged hands. No one filled out any paperwork or called a cop. This struck me as odd, because after all, this is a police state.

We were on our way to Vinales to find some Cuban bees, and at the private home where we rented a room, our gracious hostess informed us that the chicken farmer next door knew some beekeepers.

I knocked on his door. Mayito said sure, he'd set up an introduction with the beekeepers. He recommended for transportation an illegal taxi owned by his friend Antonio.

The car was a mint condition, jet black '47 Chevy with the original straight-six engine. It was Antonio's pride and joy, not to mention his sole means of livelihood.

And he was as careful driving as our earlier driver had been reckless.

It was 15 or 20 miles to the bees, and when we got there, the beekeepers were somewhere else. But an affable apprentice offered to show me around.

First we looked at stingless bees that lived in a two-and-a-half-foot-long, oblong wooden box above someone's doorway. They looked pretty much like ordinary honey bees. They stored their faintly bitter-tasting honey not in combs, but in spacious, waxy mosque-shaped reservoirs adjacent to a brood chamber made up of horizontal sheets of comb similar to the comb of our own *apis mellifera*. These bees are apparently not raised commercially.

It was pleasant to look at bees without the obstruction of a veil, and I asked about Africanized honey bees in Cuba. Julio said, "We don't have them."

"Yet," I replied.

We looked through some *Apis mellifera* hives set out neatly in a row in the shade, resting on two long pipes suspended off the ground. They were just getting on a honey flow.

This 900-plus hive migratory operation sells its honey to the government. They have a coastal season and a mountain season. They burn their AFB hives and practice drone brood removal for *Varroa*. Terramycin is illegal. Julio said they never use it.

He'd never heard of Nosema.

He was such a good natured kid, and he knew a lot. When our visit was over, I tried to give him some money. Unless they have relatives abroad, pretty much everyone in Cuba is desperately poor, even professionals like doctors and engineers. Culturally, they're middle class, most of them. They dress pretty well, They read and write. They have basic health care. But they haven't got two nickels to rub together.

So when Julio refused my offer of monetary compensation for a service I requested, I didn't know what to do. Ten or 20 bucks would have been a small fortune to him, but I didn't want to offend him. He said he was just happy to be of help. Maybe I got a little misty-eyed when he said that.

I'd brought bee gloves that I thought I might give away, but later I reflected that they were caked with American propolis and wax. I didn't want to introduce some American virus or bacteria to the island of Cuba. So I left them in my suitcase.

I did bring a brand new Mann Lake "Pollinator" jacket with zip-in veil. Not cheap, but a quality garment made in USA. I rush-ordered it especially for this trip. I wanted insurance for dealing with possibly Africanized Cuban bees.

Our last morning in Havana before we flew out, I noticed the jacket was gone. I don't know where I might have left it. It's lost. Somebody in Cuba will surely use it, but it almost certainly won't be a beekeeper.

If I'd have insisted, maybe Julio would have taken it. I never planned to give it away, but now I wish I'd made him take it. I really do.