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Bee Culture

THE MAGAZINE OF AMERICAN BEEKEEPING

NOVEMBER 2008 VOLUME 136 NUMBER 11

The last Fall flower still lingers in hidden places, warmed by the Winter sun. (photo by Buddy Marterre)

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FEATURES

DEPARTMENTS & COLUMNS

OBB Question

I have been following the articles of John Hoffman concerning his OBB conception of his hives. In the last article he addressed the dead air space created by the configuration of the OBB and no holes in the sides of the hives. My question is; He never mentioned the inner cover with it's hand hold in the center Does this opening need to be eliminated? Or is it of no concern to the overall working of the OBB system?

B. Shryer
Hermitage, MO

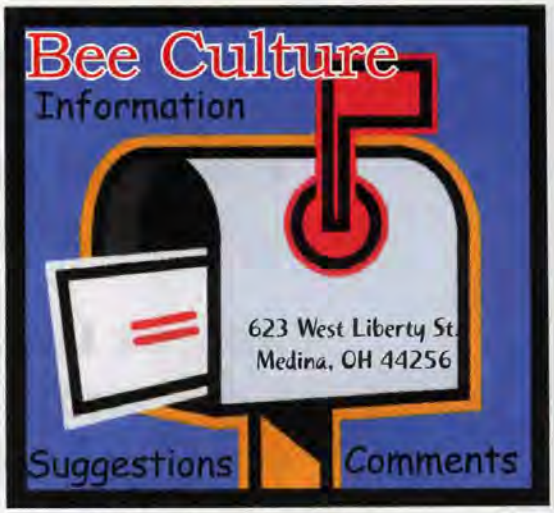
ANSWER from John Hoffman:

The inner cover's rectangle hole with the oval shaped ends is used with a bee escape to remove bees from the surplus honey supers. If you are not using the hole for that purpose or any other, than it must be sealed to assure the integrity of the "Dead Air Space" that we use with either the OBB or COBB system.

The hole can easily be sealed by covering with a flat piece of plywood or paneling. The thickness of the small piece of paneling must be thin enough to be sure it does not prevent the hive cover from seating properly on the inner cover Do not secure the piece of paneling to the inner cover – the bees will glue it in place with propolis.

However, covering the hole is not an option for me. I use that opening for other purposes. I use it as a port in the Spring to feed the bees sugar/honey solution containing Fumagilin-B to prevent Nosema. I use it in the Fall and Winter to feed the bees both the medicated sugar solution and pollen substitute simultaneously without intrusion into the brood chamber It is necessary to place an empty medium depth super on top of the inner cover and under the hive cover to provide space for the feeding devices. Thus, we end up with a new "Feeding Chamber" on top of either the brood chamber or the surplus honey supers depending on the season. The feeding chamber consists of (top to bottom) the hive cover, the empty medium depth super and the inner cover

The only opening in the feeding chamber is through the subject opening in the center of the inner cover to the dead airspace below. The opening remains open and is covered with an 8" X 8" screened frame to prevent bees from entering the feeding chamber When in use, the feeding chamber is an integral part of the dead air space. When not in use, the removal of the medium super and replacing the screened frame with the piece of paneling, returns us to the original configuration that assures the integrity of the Dead Air Space.



Microwave Honey

When my honey becomes partially crystallized I usually take the cap off and put it in the microwave for less than a minute. It works far more quickly than the hot water treatment but was curious whether other beekeepers do the same and are there any downsides to doing this.

Peter Krulewitch, Clove Valley, NY epetek1@gmail.com

Tulip Poplar Flow

I am responding to the letter from William Bartlett of Leonardtown, MD in the Sept. 08 *Bee Culture*. He is not alone in noticing the loss of a major honey resource. The problem seems to extend over the entire mid-Atlantic region, and has been getting worse for the last 15-20 years. When I moved to central MD in 1973, the tulip poplar flow could be counted on for 15-30 lbs gain per hive, during the last half of May Over the next few years, the flow decreased until today there is practically none.

In spite of the fact the blossoms still drip sweet nectar; the bees are simply ignoring it and staying home, or perhaps (in a good year) visiting black locust which blooms about the same time. I have consulted with a number of local and regional bee professionals over the last several years, and while some have noticed the routine tulip poplar crop failure, none has any kind of answer or even a reasonable theory

The problem may or may not extend to other areas; northern Ohio seems to still have a TP crop according to the editor of this Journal. Perhaps EAS could be persuaded to make a grant available to MAAREC or other bee research organization to study the extent of the problem and come up with some recommendations.

William VanAller
White Hall, MD

UV Sterilization

I have been researching UV Sterilization Wands available for household sterilization of countertops, bathrooms, bedding, etc. They claim they kill any DNA based virus or biological infection including mites. Has research been done on using these wands to sterilize bee frames, boxes, tools or other equipment before reusing them on the next years hives. I would be interested in any information available.

Bruce

My First Year

My first year as a beekeeper I read a few books, and understand that in time everyone has bad luck. One man I read about in 15 years had bees split and bear trouble. He even lost some to bad weather Well I had all this in my first year

I knew I'd get stung eventually. I wondered when and how many times. Well, then that bear hit my bees. I saw my hive on the ground, so like a fool I ran right over to see how bad it was. Well my bees weren't happy to see me. With no beesuit on I got stung 14 times before I got out of there. So I put a straw hat on my head with a curtain over that, a friend came over to help, so he did the same thing. After we got ready we went back to save my bees. I got stung three more times and so did my friend. So for the next 14 years I should be O.K. right?

So after all of that I still want more beehives and so does my friend. So if you think having bees is a bed or roses, think again!

But I love it and my beesuit finally came in.

Maria Hudgins
Parma Heights, OH

INNER COVER

In early October Dr Jeff Pettis and I were the scheduled speakers at a pair of back to back meetings in New England. The first meeting was most of a Saturday at the Worcester County Beekeeper's Association in Worcester Massachusetts (that's pronounced Wooster, for those of us that live west of Massachusetts).

We arrived early and had supper with the officers of the group on Friday night, met again for breakfast the next morning and spent most of Saturday in a Knights Of Columbus hall speaking, chatting, eating and generally having a good time with the 100 or so beekeepers that attended.

Later that afternoon we left that meeting and headed over to Rhode Island to attend their State Beekeeper Association's annual Harvest Banquet and Fall meeting (if you haven't already, try some Johnny Cakes with maple syrup, they are delicious). They met, appropriately, in the basement of a Grange Hall. This was a banquet by any standard and the 75 or so beekeepers ate well and talked long.

After supper they had their very short business meeting and then listened to Dr Pettis talk on a variety of topics, and me discuss the history of EAS (it was founded in Rhode Island), next year's meeting in New York, and their role as the EAS Host in 2011. After that we met with the planners of EAS 2011 for a bit, discussing some of the finer points of the meeting and their relationship with the EAS board. As former Chair I offered one perspective, as future hosts the RI people had their perspective, and as an oft-tapped speaker, sometimes attendee, and past winner of both the EAS Student Award, and the prestigious EAS Hambleton Award, Dr Pettis had yet another perspective. It was a productive first meeting for everyone. When finished, we drove the 20 or so miles back to the hotel in Providence and since Dr Pettis had provided all the transportation the least I could do was buy him a nightcap before we called it the end of a long day

Where all this is going is that for more that a full day I got to ride shotgun with the Research Leader of the USDA Honey Bee Research Lab in Beltsville. Jeff is certainly an upper level administrator in the second largest bureaucracy in the Federal Government – the USDA – but he is arguably one of the best known and most well-informed bee researchers in the U.S., and perhaps the world. He's a pretty good researcher in his own right (he did his post-doc with Dr Mark Winston in Canada), and has been charged with steering a lot of the recent work on CCD and *Nosema ceranae*, among other projects.

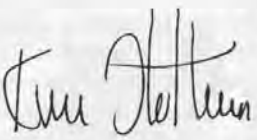
Between running his lab and driving Editors to meetings he doesn't get to do nearly as much field and bench work as he'd like, but it must be enough because his current boss, the SecAg not long ago considered CCD pretty much under control because USDA had "this great bee guy, tinkering around in the lab" and things looked pretty good.

Much of what Jeff discussed in the three talks he gave you've already read (or will read this month) in this and other magazines, in CATCH THE BUZZ, or in my column on www.thedailygreen.com. Some was new...the most interesting find that came out was that 30% of the samples Tony Jadczak, Bee Inspector in Maine, took in the Spring of 1985 (nearly 24 years ago) for tracheal mite sampling were recently found to have *Nosema ceranae* – 30% in 1985! In my opinion that deserves a whole different mindset about colony losses over the last 25 years, don't you think?

Perhaps coupled with that was another tidbit that hasn't quite jelled yet, and hasn't been published. Some recent work seems to have shown a relationship between *Nosema C.* levels in individual bees and the introduction of additional stresses, in particular low levels of some pesticides. This is still fermenting but it is intriguing relative to why bees sometimes die and we don't know why

He also talked about the Asian Longhorned beetle, maple trees in Worcester county, systemic pesticides, tree removal, and APHIS. There is a public comment period on the environmental impact of all of this on the APHIS page if you're interested, and a lot more info in a recent column I wrote about all this on thedailygreen.

If you've met Jeff you know he's an easy going, friendly 'regular guy' Over the miles we talked about family, travels, current and near future USDA Administration changes, why he can't accept honorariums, research projects he wishes he could do, and some he wishes he wasn't doing, and the frustrating holdup of USDA funds to get more CCD research kick started. This has been troubling for everyone – the money has been voted in by congress, but a continuing resolution to hold budget discussion until March 2009 is holding up appropriations it seems. The funds sit in limbo until Congress acts, and elections, bailouts and partisanship politics will keep it there for the time being. Such is a Research Leader's day



Thanks For The Ride, Jeff

NOVEMBER – PRICE REPORT & 2008 CROP PRODUCTION

Harvest 2008 Edition

We measured the 2008 honey crop this month by polling our 100+ reporters in all regions. We've done the same three years running now. Last year we figured the U.S. honey crop at 133.7 million pounds based on our figured average of 55.9 pounds per colony and 2.393 million colonies. USDA figured it to be 148.5 million pounds, with an average of 60.8 pounds per colony with 2.442 million colonies. We missed it by 14.8 million pounds (10%). We were short on average pounds, and figured our total with the previous years colony count.

This year, our overall average production per colony came to 60.7 pounds per colony, and using a colony count of last year's plus 5.0% since it seems colony conditions are a tad better this year (that's 2.564 million colonies), the total U.S. honey crop should be right about 155.6 million pounds…above last year's production by about 5%. We'll see how close we are. We've been pretty close in the past.

Explaining The Numbers

R = Crop Rating

% = Reporters harvesting Spring, Summer or Fall crop in that region

R	%
3.6	71

3.6 = Crop rating

71 = % of Reporters who harvested for that particular crop

R = Crop rating: 1 = Very good; 2 = Pretty good; 3 = Average; 4 = Not too bad; 5 = Very bad; A = Average

Regions	1		2		3		4		5		6		7		8		9		10		11		12		All Regions	
Crop Harvest	R	%	R	%	R	%	R	%	R	%	R	%	R	%	R	%	R	%	R	%	R	%	R	%	Avg	%
Spring	3.3	60	2.8	57	2.8	100	2.3	100	4.0	100	2.7	100	3.2	75	2.3	100	2.5	50	3.5	50	2.7	69	3.6	71	3.0	77.7
Summer	4.0	60	4.0	57	4.3	80	3.2	93	3.5	100	2.9	100	3.5	66	2.3	100	3.0	25	3.0	100	2.6	77	3.0	71	3.3	77.4
Fall	4.8	20	4.3	57	3.5	40	4.3	54	4.0	100	3.6	83	4.0	78	2.0	33	5.0	25	3.3	75	2.7	79	3.2	72	3.7	59.7
Avg. lbs./col	40.3		56.2		30.3		48.5		80.0		67.3		56.4		108		41.3		73.5		53.7		73.6		**60.7**	
Overall Crop Rating	4.3		3.6		3.3		3.0		3.5		3.0		3.2		2.0		3.5		3.0		2.9		2.9		**3.2**	

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	1.50	1.62	1.50	1.47	1.30	1.42	1.48	1.30	1.47	1.48	1.46	1.53	1.30-1.62	1.46	1.43	1.14
55 Gal. Drum, Ambr	1.33	1.35	1.35	1.38	1.20	1.33	1.42	1.33	1.33	1.33	1.26	1.33	1.20-1.42	1.33	1.30	0.99
60# Light (retail)	120.00	130.33	113.00	115.38	123.87	125.00	115.86	122.50	123.87	123.87	133.00	128.33	113.00-133.00	122.92	123.73	109.91
60# Amber (retail)	120.00	121.67	106.50	112.29	116.50	107.20	104.50	107.50	127.00	116.50	129.25	129.00	104.50-129.25	116.49	114.90	107.42
WHOLESALE PRICES SOLD TO STORES OR DISTRIBUTORS IN CASE LOTS																
1/2# 24/case	52.08	56.65	43.20	46.10	65.93	45.75	45.79	65.93	65.93	42.00	57.00	97.00	42.00-97.00	56.95	57.88	52.89
1# 24/case	71.04	80.06	72.00	67.60	120.00	73.20	66.94	72.40	60.00	94.00	85.50	96.20	60.00-120.00	79.91	79.23	70.24
2# 12/case	69.72	74.32	64.80	55.40	120.00	58.53	63.28	78.00	54.00	69.24	71.00	83.40	54.00-120.00	71.81	66.14	61.81
12.oz. Plas. 24/cs	64.32	69.98	52.20	65.80	73.87	61.50	56.60	58.47	54.00	55.54	79.50	68.25	52.20-79.50	63.34	64.13	53.88
5# 6/case	80.82	83.49	75.00	63.75	79.00	74.00	72.25	80.40	60.00	64.41	73.00	85.75	60.00-85.75	74.32	78.84	66.15
Quarts 12/case	104.99	120.15	112.20	92.78	104.99	83.70	87.00	89.00	102.12	120.00	96.75	114.00	83.70-120.15	102.31	95.80	91.80
Pints 12/case	65.89	63.48	66.00	62.27	65.89	50.57	65.00	55.27	66.00	56.25	61.50	66.00	50.57-66.00	62.01	56.65	57.77
RETAIL SHELF PRICES																
1/2#	2.88	3.64	2.36	2.90	2.19	2.83	2.84	2.35	2.88	3.33	2.85	4.80	2.19-4.80	2.99	2.98	2.66
12 oz. Plastic	3.63	4.65	3.21	3.67	4.00	3.70	3.23	3.35	3.59	3.34	4.06	4.41	3.21-4.65	3.74	3.50	3.38
1# Glass/Plastic	4.58	5.17	4.48	4.55	5.00	4.57	4.03	4.52	4.32	4.76	4.80	5.95	4.03-5.95	4.73	4.46	4.28
2# Glass/Plastic	8.25	7.65	7.40	6.80	6.29	7.04	6.86	8.00	6.36	7.20	7.91	9.77	6.29-9.77	7.46	7.51	7.02
Pint	6.76	8.08	6.50	6.17	5.80	5.43	5.95	6.15	6.10	5.99	6.00	8.45	5.43-8.45	6.45	7.14	6.12
Quart	11.55	12.32	11.00	10.00	7.89	9.52	10.47	10.31	10.83	11.76	10.48	14.65	7.89-14.65	10.90	11.18	10.95
5# Glass/Plastic	17.00	15.90	16.45	14.92	22.00	15.50	15.36	17.33	18.00	15.03	15.64	20.80	14.92-22.00	16.99	15.59	16.00
1# Cream	5.12	5.04	5.12	5.19	5.12	4.00	4.89	4.60	3.99	5.25	6.11	6.75	3.99-6.75	5.10	5.29	5.43
1# Cut Comb	5.38	5.57	6.50	5.43	7.78	4.83	7 12	5.00	7.78	6.50	11.65	8.50	4.83-11.65	6.84	6.73	6.09
Ross Round	6.70	4.13	6.50	5.15	6.70	4.00	6.83	3.75	6.70	6.70	7.60	8.50	3.75-8.50	6.11	6.08	5.56
Wholesale Wax (Lt)	2.50	3.69	2.50	2.66	3.07	3.65	2.92	3.25	2.75	3.00	2.55	2.63	2.50-3.69	2.93	3.33	2.37
Wholesale Wax (Dk)	2.75	3.30	2.43	2.48	2.76	2.88	2.74	2.25	3.00	2.76	2.50	2.00	2.00-3.30	2.65	2.37	2.19
Pollination Fee/Col.	80.00	75.75	62.50	43.33	93.62	47.25	50.50	60.00	93.62	93.62	50.00	135.00	43.33-135.00	73.77	87.38	63.57

Malcom T Sanford

The Promise of RNAi In Honey Bee Health And Research

"Gene silencing is one of the hottest topics in science these days."

This author takes some pride in bringing to the readers of this magazine various "scoops" of scientific information they might not have heard before. I have done this recently in describing both epigenetics[1] and *Nosema ceranae*.[2] Now get ready to be indoctrinated in another technology that is coming on strong called RNAi.

Gene silencing is one of the hottest topics in science these days. It is generally used to describe the "switching off" of a gene by a mechanism other than genetic modification and is related to epigentics, the regulation of genes through environmental factors.[3] A gene that would be expressed (turned on) under normal circumstances is in essence switched off in gene silencing.

Recall that the instructions for all life processes in plants and animals are found in the double-helix molecule, deoxyribonucleic acid (DNA). The DNA is a template from which ribonucleic acid (RNA), often called messenger RNA, is formed. An enzyme, RNA polymerase delivers (transcribes) the DNA's information onto RNA, stimulating genes to turn on or "express" themselves, usually by producing certain proteins, the chemical building blocks of life. If the message is not delivered, the gene is not turned on. In summary, the life process that is supposed to occur never begins, because the proper message is not received. The DNA genetic information has been "silenced."

RNA interference (RNAi) is a major cause of gene silencing in organisms. The term was coined by two scientists, who were awarded Nobel Prize in Physiology or Medicine in 2006. The work of Craig C. Mello and Andrew Fire capped a long history in genetic analysis in plants and other organisms investigating genetic expression and suppression. Their study of RNAi in nematodes (round worms) revealed a mechanism responsible for gene-silencing. The exact way RNAi works is complex, but begins when double-stranded RNA is created, then introduced into a cell, which recognizes it as somewhat of a foreign substance, and this activates RNAi.[4]

The ability to silence genes brings to the table huge possibilities in all realms of genetic investigation. RNA interference is a vital part of the immune response to viruses and other foreign genetic material, especially in plants. In a previous column,[5] I discussed the role of viruses in honey bees health. One of the statements I wrote at the time was "Besides being inconspicuous to beekeepers, other reasons exist for the relatively little work on honey bee viruses by scientists over the years. They are not easy to detect, and even if there was any evidence viruses were doing harm to honey bee colonies, there were few if any treatment options." The former topic of detection is becoming revolutionized via new technologies like those I mentioned in that column, including the RT-PCR assay and the Integrated Virus Detection System (IVDS).

We can now look at the latter topic, what to do about viral infections after they are detected, with a fresh eye thanks to efforts of scientists looking at possibilities using RNAi. Viruses produce their own messenger RNA, which hijacks the host's cell mechanics to replicate the virus instead of the original organism or host. If this can be interfered with via RNAi, the viral RNA no longer can do its job. Because the genome of viruses is shorter and less complicated than other organisms, it becomes relatively easier to get their DNA sequenced. A pioneer firm in this area is a brand new startup company that beekeepers no doubt will be hearing more about called Beeologics. It has the motto, "Working together to address the bee crisis."

According to its web site,[6] "Beeologics is an international firm focused on restoring bee health and protecting the future of insect pollination. With offices and laboratories in the United States and Israel, Beeologics brings together some of the world's most recognized virologists and microbiologists and is the only company to make a scientific breakthrough on the road to preventing bees from succumbing to viruses."

"Incorporated in 2007, Beeologics founded upon many years of research conducted by some of the world's leading scientists. It is due to this unique integration of diversified talent that Beeologics has quickly commanded worldwide attention and is recognized by the USDA, Department of Agriculture, and leading entomologists.

"While its primary focus remains on overcoming the CCD crisis, Beeologics' mission is to become the guardian of bee health worldwide. Through innovation, continuous research, and focus on applicable solutions, Beeologics is developing a line of products specifically addressing the bee's well being."

The first product Beeologics is attempting to bring to the market is Remebee®. The advantages of this include the following:

- Potent protection from Israel Acute Paralysis Virus (IAPV)
- Potentially applicable to all bee viruses
- Inherent robustness precludes possibility of virus breaking resistance
- Extreme specificity and no toxicity
- No residues in honeybees or honey

It would seem that the folks at Beeologics are hanging Remebee's® hat on its protection from Israeli acute paralysis virus (IAPV), which was given wide publicity at the World Apicultural Congress in Melbourne, Australia (Apimondia 2007) as being strongly correlated with CCD. This provoked a controversy that I have

"The ability to silence genes brings to the table huge possibilities in all realms of genetic investigation."

discussed in a previous column on bee viruses. Remebee® which is stated as the first line of defense product is the stated foundation for the development of a comprehensive RNAi based anti viral agent for a series of known bee viruses.

Beeologics has begun the regulatory approval process for Remebee® through the Federal IR4 agency to register it as a biopesticide, by the Environmental Protection Agency (EPA).[7] A recent ruling determined that it needs to be registered as bee medicine with the Department of Veterinary Medicine in the Food and Drug Administration (FDA)[8] This process is accompanied by the National Research Support Project No. 7 (NRSP-7)[9] which was established by the USDA and FDA to address the shortage of minor species animal drugs by funding and overseeing the efficacy, animal and human safety, and the environmental assessment required for drug approval. Currently there are only five active agents registered as therapeutic drugs for use on honey bees at the FDA, none of which are based on RNAi technology.

Although the timeline for registering a new medicine for a minor species is generally considered shorter than major food animals or human therapeutic drugs, it still must go through a rigorous process. Furthermore, the RNAi technology is so new that many questions still remain about registering materials developed using double-stranded RNA including the registering agency. Nevertheless, the firm is going forward with what it is calling a "clinical trial" and is signing up beekeepers as cooperators, the goal being to include over 100,000 hives. This would no doubt be one of the largest bee research projects of its kind ever to take place in the United States. Depending on how this shakes out, the folks at Beeologics may be asking beekeepers and scientists to help in this regard by enlisting their aid in informing the regulators that a genuine honey bee emergency exists in the form of colony collapse disorder (CCD), which is in fact correlated with Israeli acute paralysis virus (IAPV).

In the meantime, Beeologics is going ahead with another product called RemebeePlus®, a novel and unique feed formulation. This feeding supplement would be based on natural ingredients and does not appear to require much regulatory scrutiny.

The RNAi technology is new and expensive to research. So far Beeologics has held trials for Remebee® in both Florida and Pennsylvania and published papers from these studies are expected soon. At the same time, the firm has publicized its work in Europe and developed close relationships with researchers there as well. The final cost of a product of this nature is of concern. There is little doubt that the firm is investing a good deal of venture capital in this enterprise and so will have to balance its potential revenue against these expenses. No firm price has yet been established for any of its products.

Beyond the work by Beeologics, the technology will continue to be one examined by others in the field. Dr Eric Mussen at the University of California, Davis has written an analysis of the potential of the technique in his most recent newsletter, From the UC Apiaries.[10] He concludes: "If we can find a way to stimulate the anti-viral response in bees, we should ask the molecular biologists to find out what genes are involved so that we can survey our stocks and see which ones respond best to stimulation. We should favor those stocks in future selection programs."

The new hire also at the University of California, Davis (Haagen-Dazs Post Doctoral Fellow Michelle Flenniken) also expects to focus on RNAi. According to a press release, "Skilled in multidisciplinary research – molecular biology, microbiology, chemistry and cell biology, she will study the biology of honey bee viruses, specifically the role of RNA interference in the honey bee antiviral immune responses. She has been quoted that this technology can be used as an antiviral strategy in honey bees, and will investigate the role of the RNAi machinery in virus infection and attempt to limit virus production in the bees by priming their RNAi machinery with viral specific double-stranded RNA."[11]

It is a given that in order to silence a gene, researchers must have the organism's genome to work with. The Remebee® RNAi solution requires intimate knowledge of both the specific viral and honey bee genome. This may not be at first obvious for it is possible to get appropriate genetic information from the virus and not knowing the hosts.

The a question about the applicability in the case of Remebee® was answered in an e-mail from the firm, "In order to design double stranded RNA sequences that are specific only to the virus, we BLASTED (sequence comparison using robust software tools) the bee genome to make sure that none of the proposed Remebee® sequences bears more than 20 b.p. sequences homologous (identical) to the honey bee genome. This is not only important to avoid inadvertently silencing a possibly important bee gene, but also because it helps regulating authorities declare the treatment safe. By the way, we did the same vs. the human genome to ensure the FDA that if accidentally swallowed by the beekeeper it cannot inadvertently silence human sequences (Although this is extremely unlikely even if there were homologous sequences)."

It is extremely fortunate that the Honey Bee Genome Project (HBGP) that I discussed in earlier columns[12] has been completed or applicable safety concerns could not have been addressed. Thanks must go Dr Gene Robinson and colleagues who developed the white paper that was the basis for the DNA sequencing. In those articles, I listed the reasons for and potential expected results for supporting the HBGP, including the following:

"Mental health. Some forms of mental illness, such as autism, involve problems with social integration. Bees show a high degree of social integration, and their activities are highly dependent upon their ability to read social cues; identification of several well-defined sets of social cues make for unusually tractable experimental social systems.

"Biosensors. A HBGP also may

enhance use of honey bees as environmental sentinels.

"Instincts. The societies of honey bees and other social insects occupy Wilson's second "pinnacle of social evolution," with complexity that rivals our own. Among the provocative similarities are: extensive communication systems (including the only non-primate symbolic language); highly organized defense and warfare; complex architecture (including the insect equivalent of skyscrapers – four meter high termite nests in Africa); and expressions of personal sacrifice unheard of in most of the rest of the animal kingdom.

"Cognition. Bees collect food from flowers, a highly ephemeral food source, and have evolved sophisticated cognitive abilities to maximize foraging success. They are excellent at associative learning, based on the need to associate a color, shape, scent, or location with a food reward. Honey bees also can learn abstract concepts such as "similar" and "dissimilar," and are able to negotiate complex mazes by using visual stimuli as direct or abstract "signposts" or by recognizing path irregularities.

"Gerontology. Queens and their workers have identical genotypes but queens live two orders of magnitude longer Identification of all differentially expressed genes responsible for these striking differences in lifespan, facilitated by a HBGP, undoubtedly has important implications for human longevity and aging."

Nowhere in the above panoply is the mention of RNAi. However, like so many new technologies, this specific application may not have been on the radar screen of those proposing the HBGP project. Thus, like the development of Teflon® and other developments due to the U.S. space program, those looking at RNAi and its use in honey bee research have a new tool thanks to the honey bee genome project to help them sort out the various challenges affecting beekeepers. Most researchers I've talked to say this technology has lots of promise in helping beekeepers address some of the most challenging problems facing their industry. Let's hope they are right. BC

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References: All URLs accessed September 19, 2008.

1. Sanford, M.T 2008, *More Than Just the Honey Bee Genome: Does Epigenetics Play a Role?* Bee Culture, Vol. 136: 17-19 (May) see www.squidoo.com/Bee_Culture
2. Sanford, M.T 2007 *A New Nosema*, Bee Culture Vol. 135 (2): 18-21 (February). See: www.squidoo.com/Bee_Culture
3. http://en.wikipedia.org/wiki/Gene_silencing
4. http://en.wikipedia.org/wiki/RNAi
5. Sanford, M.T. 2008, *Viruses and Honey Bees*, Bee Culture, Vol. 136, No. 8, pp. 19-20 (August) see http://www.squidoo.com/Bee_Culture
6. http://beeologics.com
7. http://www.epa.gov/pesticides/biopesticides/
8. www.fda.gov/cvm/minortoc.htm
9. http://www.nrsp-7.org/welcome.htm
10. Mussen, E. 2008. *From the UC Apiaries*, http://entomology.ucdavis.edu/faculty/mussen/JulAug2008.pdf
11. http://entomology.ucdavis.edu/news/michelleflenniken.html
12. Sanford, M.T 2006. *Update on the Honey Bee Genome Project*, Bee Culture, Vol. 134 (12): 21-24 (December), and Sanford, M.T. 2003. *Cracking the Honey Bee's Genetic Code*, Bee Culture (April 2003), Vol. 131 (4): 19-21, see http://www.squidoo.com/Bee_Culture

RESEARCH REVIEWED

The Latest In Honey Bee Research

Steve Sheppard

"The trend toward recovery in this population raises the possibility of obtaining Varroa resistant germplasm from feral honey bee populations."

The host-shift of a parasitic honey bee mite from an Asian species to the western honey bee, *Apis mellifera*, was a human-mediated biological event much lamented by many beekeepers Interestingly, some *A. mellifera* populations, notably Africanized honey bees in South America, had a measure of resistance to *Varroa destructor* that made chemical control efforts unnecessary In the decades following the host-shift, there have been reports of additional mite-resistant populations of honey bees in temperate areas. In a paper just published by Jose Villa and colleagues, we find another example of the resilience of honey bees and their ability to survive and adapt in response to selection (Villa et al., 2008).

Villa and colleagues made use of 17 years of data compiled from swarm collection traps maintained in Louisiana from 1991 to 2006 to monitor the spread of Africanized honey bees. The swarm capture rate was calculated by dividing the number of swarms captured each year by the number of bait hives available in that year (bait hive numbers ranged from 157 to 254). They also assessed swarms collected in bait hives for survival during nine of the years by maintaining them in culture and checking periodically to see if they were alive. The captured swarms received no management other than the addition of comb foundation in boxes when needed. Based on their design, the researchers were able to report on swarming rates and survival both before and after the arrival of *V destructor* in their region. The authors noted that the mites arrived in late 1992. Thus, swarms collected prior to 1992 were probably from a mixture of feral and managed colony sources, while after 1992, swarms likely originated from managed colonies that were protected by miticides. During the last four years of the survival study (1997-20000), the researchers attempted to avoid swarms from managed colonies by collecting their swarms in two parishes with "little or no beekeeping" In analyzing their data, the researchers clustered the time periods when swarms were collected into different groups related to the presumed *Varroa* selection pressure. These groups were: 1) "No-*Varroa*" (1990-1992), 2) "Early-*Varroa*" 1993-1996), 3) "No + Early Varroa" (groups 1 + 2) and 4) "Late-*Varroa*" (1997-2000).

Villa and colleagues found that the swarm capture rate was affected by both year and geographic location. The swarm capture rate prior to the arrival of *V destructor* was 0.85 to 0.95 swarms per bait hive year That is, most bait hives would catch a swarm each year During the next six years (1993-1998) there was a decrease in swarm capture rates to 0.36-0.60 swarms per bait hive year From 1999-2006 swarm capture rates recovered to levels similar to those pre-*Varroa* (0.75-1.04 swarms per bait hive year). Swarm survival (longevity) also varied significantly through time. During the "no-*Varroa*" period prior to 1993, the average swarm survived for 14 months. During the "Early-*Varroa*" period that followed, swarm survival declined to about 10 months. The swarms collected in the Late-*Varroa* period had an average survival time of 27 months. The authors reported that mite levels found in captured swarms and in colonies maintained for the survival study were in line with the assumptions of the three time periods ("no-*Varroa*", "Early-*Varroa*" and "Late-*Varroa*"). Thus, the first mites were detected in 1993. By the middle of the "Early-*Varroa*" period, 69% of the captured swarms had mites. During the "Late-*Varroa*" period, swarms were more or less "uniformly high" in testing positive for the presence of *V destructor* (67-87% of captured swarms).

The authors concluded that "Swarm captures and colony longevity of feral honey bees in southern Louisiana decreased for ≈ 5yr after first exposure to *V destructor*, but then rebounded to prevarroa levels" While a decline of honey bee populations following the arrival of *V destructor* has been well-documented in many instances, the authors found the apparent rapid recovery in both swarming rate and swarm longevity to be unexpected. They noted a growing literature reporting other examples of the recovery of swarming rate and survival in temperate honey bee populations exposed to *V destructor* Some of these stocks have been survivors from a starting population that was intentionally isolated with mites without chemical treatment, while others have been the result of scenarios that did not involve much manipulation (such as the one reported by Villa and colleagues). One theme common to all of these cases is that they represent the outcome of selection. Either "artificial selection", as in the case of beekeepers that bred from "survivor stocks", or "natural selection", where the honey bee

population responds through time to the selection pressure brought on by the disease or parasite. Note that breeding "progress" toward resistance seems to be most rapid when made in the absence of miticide treatments, that can effectively "prop up" susceptible honey bee genotypes and (consequently) slow down the population level response to the selective pressure. This may partially explain the development of mite resistance on isolated islands in Europe, whereby virgin queens produced by survivor colonies were unlikely to interbreed with drones derived from miticide-treated colonies.

Villa and colleagues note that both increased resistance (tolerance) of honey bees to mites and decreased virulence in mite populations have been hypothesized to be responsible for the recovery of some honey bee populations. However, based on the likelihood that mites could transfer among the hives in their longevity experiment (colonies were placed close to each other) the authors suggest that reduced virulence of the mites is an unlikely explanation for the recovery of the bees in their study. Similarly, they noted that the introgression of resistant bees into the feral population from other nearby sources (beekeepers, USDA-resistant stocks) could not be "ruled out", although "natural selection" remained the "likely" explanation. Perhaps one of the most interesting conclusions reached by the researchers was that the trend toward "recovery" in this population "raises the possibility of obtaining *Varroa* resistant germplasm from feral honey bee populations." As additional populations of *Apis mellifera* that are tolerant of *V destructor* are characterized by scientists or selected by beekeepers, it raises the very real possibility that we may be glimpsing a pathway (breeding) that the beekeeping community could use to reach miticide independence. Now there is a positive thought, in contrast to the oft-traveled pesticide treadmill that leads to resistant mites and diminishingly effective chemical control. BC

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J. D. Villa, D. M. Bustamante, J. P. Dunkley ad L.A. Escobar 2008. *Changes in honey bee (Hymenoptera:Apidae) colony swarming and survival pre- and postarrival of* Varroa destructor *(mesostigmata: Varroidae) in Louisiana.* Ann. Entomolo. Am. 101. 867-871.

Advances In The Dance Language

New Research, Even This Year Shows That Honey Bees Are Even More Complex Than We Thought

Norman Carreck

As we saw in the first part of this article, Adrian Wenner clearly demonstrated that honey bees can effectively find food sources using odor and other cues[28], so why did complex communication dances evolve in the first place? Gavin Sherman and Kirk Visscher[23] found that when using unscented feeders, as Karl von Frisch had, they could consistently demonstrate that bees with disorientated dances recruited less effectively than colonies with orientated dances, but when recruiting to natural food sources, sometimes the correct orientation of dances made a difference and at other times it did not. They concluded that the advantage may depend on the type of forage being visited. This idea was taken further by Anna Dornhaus and Lars Chittka[6], who demonstrated a considerable advantage available through dance communication in a tropical forest, but little advantage in temperate farmland. They speculated that in the forest conditions under which dance communication presumably evolved, good forage sources might include a single large flowering tree growing amongst many unprofitable trees, when precise recruitment to that location would be a considerable evolutionary advantage. In contrast, in a temperate landscape, where forage tends to exist as sparsely dispersed patches, dance communication may be of little value. An exception may be fields of flowering agricultural crops, and honey bees have been clearly demonstrated to make use of dance communication to recruit to heather moorland at a considerable distance from the hive[1].

The honey bee dances continue to be the subject of much study, and a very recent paper[11] has shown what had been suspected for some time, namely that the waggle and round dances are not mutually exclusive, but merely represent different ends of a continuum, and that both contain distance and direction information.

Although the title of this article concerns honey bees, it is worth mentioning that honey bee dance communication seems much less controversial when it is placed in the context of communication in other bee species. Bumble bees (*Bombus* spp.) are considered less evolutionary advanced than honey bees, and it was long thought that they were incapable of recruiting nest mates. Whilst there is no evidence that they can communicate the distance and direction of food sources, it is now known that they can indicate that food is available. Dornhaus and Chittka[4] observed that returning bumble bee foragers make frenzied and irregular dances, and found that nest mates then investigate the freshly deposited food, before flying off. They at first believed that the dancing bees were distributing the scent of the forage, but then later demonstrated that the dancers were distributing a "recruitment pheromone"[5], some of the chemical components of which have now been identified[15]

As long ago as 1967, Harald Esch concluded that the stingless bees of South America, which are distantly related to our own honey bees, also used complex means of recruitment[8]. James Nieh and colleagues at the University of California, San Diego have taken this work much further, demonstrating that bees of *Melipona panamica* combine sound, motion and scent for effective communication of both distance and height[21], whilst *Trigona hyalinata* uses a pulsed mass recruitment system using an odor trail[20].

Having established that honey bees can make use of vector flight information encoded in dances as well as odor cues to navigate, we now need to consider some of the other navigation aids available to them. One of the least well understood is a sensitivity to magnetic fields. It has long been thought that bees, as well as birds, are sensitive to the pattern of the earth's magnetic field[14,12,13,25] It has been found that bees do indeed contain magnetic material, and the process whereby magnetic fields might affect these iron granules has been recently explored[17] What use bees make of this attribute in practice still, however, remains unclear It has been suggested[29] that this sensitivity to magnetic fields may be involved in circadian rhythms being set according to daily variations in the earth's magnetic field. There is also a clear interaction between magnetic fields and other navigational aids. For example bees forced to dance on a horizontal comb eventually adjust their dances to orientate with the earth's magnetic field, and it is thought that magnetic cues may be an additional aid when the use of the "sun compass" is lost on overcast days. Similarly, swarms housed in cylindrical hives and deprived of all cues apart from the earth's magnetic field have been found to build comb in the same orientation as that of their parent hive. Frier *et al*[9] demonstrated that bees could discriminate between two 360° panoramic patterns set within plastic dustbins containing feeders, which differed only in their compass orientation.

This sensitivity of bees to magnetic fields has recently been in the news. In April 2007, the world's newspapers were full of headlines such as: "Are mobile phones wiping out our bees?" Articles then went on to indicate that a researcher from Landau University, Germany, Dr Jochen Kuhn had suggested that experiments that he had carried out could provide "a hint" towards the causes of Colony Collapse Disorder Examination of his experiments suggested something different. Kuhn and his colleagues were actually working on the possible effects of electromagnetic radiation from sources such as mobile phones on humans, and suggested that, given their known sensitivity to electromagnetic radiation, honey bees could perhaps be studied as a model organism.

Their experiment[16] used eight small beehives. Below the floor of four of these were placed the base stations of cordless portable phones (not cellular mobile phones, as reported in the press). Among other measurements, they carried some bees to a distance from the hive in a dark box, marked them and then released them. They found that few bees correctly returned to the hives with the base stations compared to the others. The study was however poorly designed, not capable of statistical analysis, and with a very small sample size, and has still not been published in a peer-reviewed scientific journal. The story was,

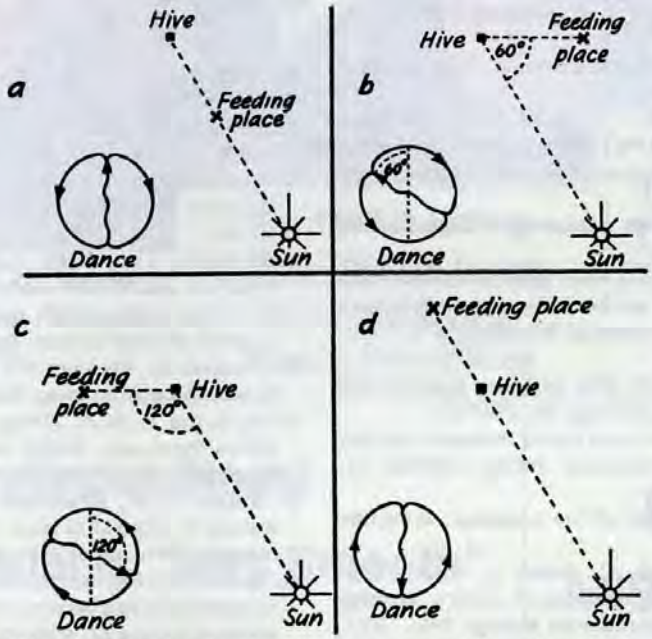
however, enthusiastically adopted by a pressure group opposing mobile phones, and amid the ensuing publicity, Dr Kuhn distanced himself from claims that he had solved the problem of CCD. A year on, it is fair to say that mobile phones feature fairly well down the list of possible causes of CCD in the view of most scientists.

Although bees do possess sophisticated techniques such as path integration and sensitivity to magnetic fields, and their use of these can conclusively be demonstrated experimentally in deliberately featureless landscapes, in the real world, bees experience landscapes with many distinctive visual features or landmarks which aid navigation. von Frisch performed numerous experiments[10] demonstrating that on a long flight, bees may make use of conspicuous landmarks as intermediate guides on route to the final goal, often deviating from the straight line that would take them directly from the hive to their destination. Tom Collett and colleagues[3] have explored this in more detail, and found that this use of intermediate landmarks is complex. They concluded that each landmark in a sequence is associated with a memory that encodes the distance and direction that will take the bee to the next intermediate landmark in the sequence and so on.

Lars Chittka and Karl Gieger[2] studied a sequence of landmarks using a series of identical colored tents in a featureless landscape. They trained bees to a feeder placed between the third and fourth tents in a row. They then altered the number of tents between the hive and feeder, although the absolute distance between hive and feeder remained unaltered. They found that if the number of tents was increased, bees tended to stop short of the feeder, whilst if the number of tents was reduced, they tended to fly past. This suggested that in these circumstances, the bees were not using the actual distance as a measure, but were using the sequence of tents as intermediate landmarks, breaking up the journey into a series of sections. Chittka and Geiger controversially suggested that this demonstrated a primitive counting ability ("protocounting") in honey bees, but it is perhaps better thought of as a sequential memory for landmarks.

There can be no doubt, however, that the array of navigational aids available to the honey bee enable it to perform very complex tasks. For example, harmonic radar was used to examine the behavior of bees which had been trained to a feeder in a featureless landscape[22], when that feeder is removed. This experiment therefore simulated the often occurring natural situation where a nectar source ceases to yield nectar The bee must then search for a new source of food. The radar recorded that the bees flew straight to the former location of the feeder, and then performed a complex searching behavior involving looping flights centered on the feeder location. Statistical analysis reveals that these flights have the characteristics of so called "Lévy-flights" which are said to have "scale-free" characteristics. In essence, such flights represent the most efficient search pattern, and for example have parallels with the types of flights utilized by air sea rescue teams when searching for a missing boat around a known last position.

This complex behavior brings us to the very controversial question as to whether bees can make use of "mental maps" to enable them to perform novel routes back to their hives when displaced. This controversy really started in 1986 when James Gould[13] published results of experiments which seemed to show that bees trained to one feeder could find their way back to their hive when artificially displaced to another feeder with which they were not familiar Gould suggested that this proved that they possessed a mental map of their surroundings, presumably obtained during orientation flights. This led to much experimental work, some of which failed to repeat Gould's results[26,27,7,18,19], but a general consensus seems to have emerged that whilst bees do indeed acquire a complex awareness of their surroundings, this resembles less an Ordnance Survey map than a database of separately acquired vector flight routes which can then be combined and interpolated to provide novel routes.



Giving the sun's bearing in a dance on a vertical comb surface. The little diagrams on the left of each drawing show the dance as it appears on the vertical comb.
(Taken from *The Dancing Bees* by von Frisch)

No doubt many new discoveries remain to be made, and just to demonstrate that the field of bee navigation is still fast moving, since I began writing this article, a paper has been published which throws more light on the dance language. Many years ago von Frisch[10] made the observation that different races of honey bee seem to dance with distinctive "regional dialects", mainly in terms of the duration of the "waggle" phase of the dances. It was later observed that the dances of the western honey bee *Apis mellifera* differ from those of the eastern honey bee *Apis cerana*. In a recent experiment, Shaowu Zhang and colleagues[24] first demonstrated using video recordings that *A. mellifera* and *A. cerana* did indeed have significantly different dance dialects, even when foraging on the same food source in the same location. They then, however, succeeded in producing a mixed colony of the two species, and found that when reared in the same colony, the two species could successfully read each other's dances, *A. cerana* being able to decode dances by *A. mellifera* workers and to successfully locate the food source indicated. This raises very interesting questions. Firstly, it means that the origins of

dance communication must be far older than previously thought, older that the 700,000 years or so when the various races of *A. mellifera* are thought to have diverged, but back perhaps six to eight million years when *A. mellifera* and *A. cerana* are thought to have diverged from a common ancestor The authors carry on to speculate that the ability of the two species to learn each other dances may improve with time, suggesting that social learning through experience may take place, demonstrating once again the complexity of honey bee behavior BC

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References:

1 Beekman, M., Ratnieks, F W.L. (2000) *Long-range foraging by the honey bee* Apis mellifera *L.* Functional Ecology 14, 490-496.

2 Chittka, L., Geiger, K. (1995) *Can honey bees count landmarks?* Animal Behavior 49, 159-164.

3 Collett, M., Harland, D., Collett, T.S. (2002) *The use of landmarks and panoramic context in the performance of local vectors by navigating honey bees.* Journal of Experimental Biology 205, 807-814.

4 Dornhaus, A., Chittka, L. (1999) *Evolutionary origins of bee dances.* Nature 401, 38.

5 Dornhaus, A., Chittka, L. (2001) *Food alert in bumble bees (*Bombus terrestris*): possible mechanisms and evolutionary implications.* Behavioral and Ecological Sociobiology 50, 570-576.

6 Dornhaus, A., Chittka, L. (2004) *Why do honey bees dance?* Behavioral and Ecological Sociobiology 55, 395-401.

7 Dyer, F.C. (1991) *Bees acquire route based memories but not cognitive maps in a familiar landscape.* Animal behavior 41, 239-246.

8 Esch, H.E. (1967) *The evolution of bee language.* Scientific American April, 96-104.

9 Frier H.J., Edwards, E., Smith, C., Neale, S., Collett, T.S. (1996) *Magnetic compass cues and visual pattern learning in honey bees.* Journal of Experimental Biology 199, 1353-1361.

10 von Frisch, K. (1967) *The dance language and orientation of bees.* Harvard University Press. 592 pp.

11 Gardner, K.E., Seeley, T.D., Calderone, N.W (2008) *Do honey bees have two discrete dances to advertise food sources?* Animal Behavior doi:10.1016/j.anbehav.2007.09.032

12 Gould, J.L. (1980) *The case for magnetic sensitivity in birds and bees (such as it is).* American Science 68, 256-268.

13 Gould, J.L. (1986) *The locale map of honey bees: do insects have cognitive maps?* Science 232, 861-863.

14 Gould, J.L., Kirschvink, J.L., Deffeyes, K.S. (1978) *Bee have magnetic remanence.* Science 201, 1026-1028.

15 Granero, A.M., Sanz, J.M.G., Gonzalez, F.J., Vidal, J.L.M., Dornhaus, A., Ghani, J., Serrano, A.R., Chittka, L. (2005) *Chemical compounds of the foraging recruitment pheromone in bumble bees.* Naturwissenschaften 92, 371-374.

16 Harst, W., Kuhn, J., Stever, H. (2007) *Can electromagnetic exposure cause a change in behavior? Studying non-thermal influences on honey bees an approach within the framework of educational informatics.* Unpublished report, Landau University, Germany.

17 Hsu, C-Y Ko, F-Y Fann, K., Lue, J-T (2007) *Magnoreception system in honey bees.* PLoS One 2(4) e395.

18 Kirchner, W.H., Braun, U. (1994) *Dancing honey bees indicate the location of food sources using path integration rather than cognitive maps.* Animal Behavior 48, 1437-1441.

19 Menzel, R., Geiger K., Joerges, J., Müller, U., Chittka, L. (1998) *Bees travel novel homeward routes by integrating separately acquired vector memories.* Animal Behavior 55, 139-152.

20 Nieh, J.C., Contrera, F.A.L., Nogueira-Neto, P. (2003) *Pulsed mass recruitment by a stingless bee,* Trigona hyalinata. Proceedings of the Royal Society, London B270, 2191-2196.

21 Nieh, J.C., Roubik, D.W (1998) *Potential mechanisms for the communication of height and distance by a stingless bee,* Melipona panamica. Behavioral and Ecological Sociobiology 43, 387

22 Reynolds, A.M., Smith, A.D., Reynolds, D.R., Carreck, N.L., Osborne, J.L. (2007) *Honey bees perform optimal scale-free searching flights when attempting to locate a food source.* Journal of Experimental Biology 210, 3763-3770.

23 Sherman, G., Visscher, P.K. (2002) *Honey bee colonies achieve fitness through dancing.* Nature 419, 920-922.

24 Su, S., Cai, F., Si, A., Zhang, S., Tautz, J., Chen, S. (2008) *East learns from west: Asiatic honey bees can understand dance language of European honey bees.* PLoS One 3(6) e2365.

25 Walker, M.M., Bitterman, M.E. (1989) *Honey bees can be trained to respond to very small changes in geomagnetic field intensity.* Journal of Experimental Biology 145, 489-494.

26 Wehner, R., Bleuler, S., Nievergelt, C., Shah, D. (1990) *Bees navigate by using vectors and routes rather than maps.* Naturwissenschaften 77 479-482.

27 Wehner, R., Menzel, R. (1990) *Do insects have cognitive maps?* Annual Review of Neuroscience 13, 403-414.

28 Wenner A.M. (1971) *The bee language controversy: an experience in science.* Educational Programs Improvement Corporation. 109 pp.

29 Winston, M.L. (1987) *The biology of the honey bee.* Harvard University Press. 281 pp.

NOSEMA CERANAE
Not Your Father's Nosema

Randy Oliver

Most beekeepers are aware that a new form of nosema has established itself in North America (and throughout the world). Amazingly, Nosema ceranae *was able to spread worldwide without anyone even noticing until recently – it has been in the U.S. since at least 1995, but wasn't reported until 2007! Since that time, we have learned a bit about this new disease, but still have more questions than answers.*

Nosemas are microscopic fungi that typically parasitize insects. For example *Nosema locustae* parasitizes grasshoppers, and is used as a biocontrol against grasshopper infestations. Various bee species also have their own nosemas – each generally adapted for a specific host. The European honey bee, which most of us keep, has long carried *Nosema apis*. Until recently, if beekeepers referred to "nosema," that was the species that they meant. *N. apis* is normally a relatively benign parasite of honey bees. Its infection level generally spikes in Fall and early Spring, with the effects being most intense in areas with long, cold Winters in which bees are confined in the hive without the ability to enjoy cleansing flights.

Most healthy colonies can handle a *Nosema apis* infection as long as they get good nutrition. However, *N. apis* can be a serious problem when poor weather prevents bees from foraging for pollen (or if colonies are foraging on non nutritious pollen), and cold weather stresses the older bees. It can also be a problem in queens and packages – the chilling and confinement of the bees in queen cages and packages can lead to sudden spread of infection, and to premature supersedure of queens.

In order to prevent nosema problems, Northern beekeepers, and Southern queen producers, regularly feed the antifungal medication fumagillin (Fumagilin-B®, which replaced the older Fumadil-B) in gallons of heavy syrup in the Fall and/or Spring. This prophylactic practice, along with various husbandry practices (such as keeping colonies in sunny Winter locations) have long been successful for controlling problems with *N. apis*.

Enter *Nosema ceranae* – originally a parasite of the Eastern honey bee, *Apis cerana*. Just as the *Varroa* mite jumped from *Apis cerana* to the European honey bee, *N. ceranae* did the same trick. The problem is, that when a parasite jumps from one host to another (often "sister" species, as in this case), the new host does not have defenses against the new parasite (as you've likely noticed in the case of *Varroa*). So a minor parasite of the original host can become a highly virulent parasite of the new host until nature (or selective breeding) establishes a sustainable host-parasite relationship (or, in some devastating cases, the new host goes extinct).

The big differences between the sister species of nosema are that *N. apis* infection "disappears" during Summer (and generally Winter), and that it is restricted to infecting the cells lining the gut of older bees. *N. ceranae*, on the other hand, maintains infection all year long, and can move right into the bees' body tissues.

So just how virulent is *N. ceranae* in the European honey bee? Initial reports from Dr Mariano Higes' lab in Spain were that *N. ceranae* was invariably devastating to colonies – a virtual "kiss of death" if left untreated. He demonstrated that the massive colony losses in Spain coincided with the appearance of *N. ceranae* in about 2001. He also reported that bees inoculated with *N. ceranae* would die within days. These findings were reported just as the U.S. began suffering from Colony Collapse Disorder (CCD), and the symptoms of the disorder were nearly identical to the symptoms of *N. ceranae* collapse as reported by the Higes team. Furthermore, when Dr Diana Cox-Foster's team reported on CCD, they found *N. ceranae* in 100% of the CCD colonies that they tested!

Although the initial evidence looked damning, closer inspection raised questions as to whether *N. ceranae* was indeed the cause of the problem. Many colonies that collapsed showed no sign of *N. ceranae*, and many with *N. ceranae* appeared to be thriving. The following year Dr Antonio Pajuelo (also in Spain) released a study that found that when natural forage was adequate, that neither fumagillin treatment for, nor the addition of protein or vitamin supplements, had any significant effect upon survival or production of colonies infected with *N. ceranae*!

I've discussed these discrepancies with Dr Higes. He feels that colonies can handle moderate infections ***as long as the queen is able to sustain egglaying to offset the continued premature death of infected foragers***. Collapse may not occur for months, or maybe more than a year after the colony becomes infected. A new young queen, or supersedure queen, may give the colony a "second wind," but if the queen begins to fail, the colony will succumb. His recent studies have found that during this period of inapparent infection, colonies may exhibit a 50-70% loss of honey production.

In my own trials, I have also seen colonies that appear to thrive and produce honey (and swarms) while infected with *N. ceranae*. In speaking with some (but not all) large commercial beekeepers, they are not particularly concerned with moderate infection levels.

So what's up? Is *N. ceranae* devastating or benign? It appears that it can be either, depending upon extenuating circumstances. The first factor that comes to mind is the influence of nutrition. Several studies have linked the virulence of *N. apis* to poor nutrition (although

a recent study by Drs. Matilla and Otis was somewhat contrary), and research by Dr Frank Eischen, as well as Pajuelo's study, suggest that the same applies for *N. ceranae*. However, Dr Higes feels strongly that there is no nutritional connection with *N. ceranae* collapse.

A second possible factor is the presence of viruses. Several of the bee viruses are closely associated with nosema infections – the viruses apparently gain entry past the bees' immune defenses through the nosema-infected gut. This may be yet another case where one parasite (such as *Varroa* or tracheal mites) do not kill the host directly, but either stress the host, disable its immune response, or allow transmission of a virus, so the virus(es) actually deliver the *coup de grace*. However, Dr Higes was not able to associate any of the "regular" bee viruses with collapse of colonies in Spain.

Or, a third possibility is that the strains of *N. ceranae* and bees here in the U.S. interact differently (remember, *N. ceranae* has been confirmed to have been in the U.S. for at least 10 years).

What should you be doing about *N. ceranae*? Well that's the $64,000 question this year Unfortunately, the scientific research community got caught flatfooted by *N. ceranae*, and don't yet have all the answers.

I've been following the progress of research on this subject worldwide, and have performed a bit of research of my own (for far more information on this subject, please refer to the nosema articles on my website). Since we have little specific information on biotechnical methods of control for *N. ceranae* (such as colony management, comb disinfection, etc.), the beekeeper is left with four main things that he/she can do:

1. Make sure that your colonies receive good nutrition.
2. Breed from nosema-resistant bees.
3. Monitor nosema levels by periodic sampling.
4. Treat if necessary with medication.

Let's cover these items one at a time (for convenience, we'll get Nutrition and Breeding out of the way first, so that I can concentrate on Sampling and Treatment).

Nutrition

I've covered this subject in a previous article in this magazine – "nutrition" largely equates to colony protein levels, and protein levels equate with general colony health and disease resistance. Optimum nutritional input consists of a nectar flow, plus ample pollen from a variety of flowers. Some plants, such as sunflowers, dandelion, corn, and blueberries produce nutritionally-incomplete pollen, and colonies will go downhill if these plants are their sole source of pollen.

Other times that colonies suffer from low protein levels are any time that a colony full of hungry brood suffers from loss of daily pollen income. This can happen when the forage plants stop blooming, the crop is cut, or poor weather restricts foraging. It can also occur during Winter or drought, during intense honeyflows, or immediately after a flow.

In these cases, feeding supplemental protein to your colonies may be of great benefit. A number of products are on the market, or you can mix your own brewers yeast based supplement.

Breeding

Long-term, we must realize that the honey bee *Apis mellifera* has not yet had much time to develop natural resistance to its new parasite *Nosema ceranae*. However, Danish breeders have demonstrated that natural resistance to *N. apis* can be selected for relatively quickly There is no reason to expect that we can't do the same for *N. ceranae*.

Sampling

There's no sense worrying about *N. ceranae* if your bees are not infected. Unfortunately, there is no way to tell if they are infected without inspection of their gut contents under a microscope. This is frequently done by a lab, but I highly encourage beekeepers to learn to do it themselves. In order to make it easy for you, I have complete instructions on my website. You can use any microscope that can view at 400x magnification, but you generally get what you pay for It is much easier to view spores with a good scope. If you're going to look at a lot

The Suck-a-Bee – a portable vacuum modified to collect bees directly into alcohol. Plans for this timesaving device are at www.scientificbeekeeping.com.

A quick volumetric method of "counting" the number of drained bees in a sample. There are roughly three bees per milliliter. So this sample of 100ml of bees would contain about 300 bees, and need 300 ml of water to dilute them for a standardized spore count. In general, use 3x the volume of water as settled bees.

Grinding a sample of bees in a kitchen blender to release the nosema spores from their guts. One drop of the resulting homogenized slurry is then tested to determine the "average spore count" in millions of spores per bee.

Conversion Table	
Million spores per bee	Approximate number of spores in one field of view
1	5
2	10
3	15
4	20
5	25
10	40
25	100
50	200

of samples, I recommend a quality binocular scope (two eyepieces).

Check my website for features to look for in a scope. I've checked a number of brands, and am impressed by the Omano OM36 scope (http://www.microscope.com/beekeeper-special-omano-om36l-package-p-339.html). They have an ad in this magazine for this scope. If you want to do field sampling on the back of your truck bed in outyards, then get the portable model OM36L for an extra 50 bucks.

The key points in sampling are to take a *consistent* sample of *enough bees*, and to quantify the spore count per bee by using a *standard dilution*. The consistent sample should always be taken of bees at the entrance to the colony near midday These points are important since you want to sample the oldest bees (the foragers), which are most infected, and because infected bees tend not to fly in the morning. Samples of bees taken from inside the hive will have much lower spore counts (by a factor of 10 to 20), and cannot be compared to entrance samples or used for treatment threshold counts.

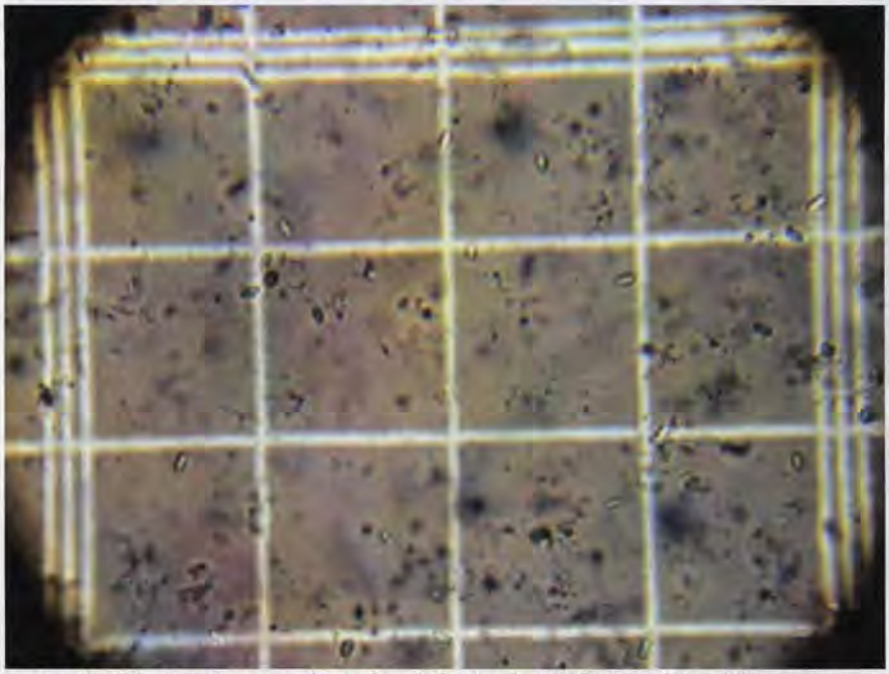
You should sample at least 25 bees per colony – 50 or more is much more accurate. The reason for this is that generally only a low percentage of bees in a colony will actually be infected – with smaller samples, a single infected bee (or the absence thereof) can greatly skew your spore count, which is ***the average number of spores per bee***. This average is an artificial number; in reality, most bees will have zero spores, and a portion will be highly infected.

I find that the quickest and easiest method of taking and processing nosema samples is to use a modified portable vacuum to suck up a dozen or so bees from the entrances of at least half the colonies in each yard (don't include any "crawlers" off the ground – they will skew the count). Alternatively, you can brush some off the landing boards into a cup of rubbing alcohol (so they don't fly back out). The point is to get a large, representative sample from each colony, or in the case of commercial beekeepers, each yard. All samples of bees should be immersed in rubbing alcohol, sealed in a jar (glass or plastic), and labeled.

Once home, you need to count the number of bees in the sample, so that you can make the proper dilution of 1ml per bee. Luckily, I've found a shortcut for counting large samples of bees that is accurate enough for treatment decisions. Simply drain the alcohol off the bees, and settle their damp bodies down into a measuring cup by tamping the bottom of the cup onto your palm. It just so happens that damp dead bees pack down to about three bees per milliliter, and since you want to add 1ml per bee, you can simply dilute them with three times the volume of water that there is volume of bees. For example, if you have a quarter cup of bees, then add three-quarters of a cup of water, for a half cup, add 1½ cups of water

The more astute of you will also have realized that the alcohol drained from those bees will contain all the *Varroa* mites (if you shake up the jar). So you've got a chance to do a "twofer" – take a nosema sample, and an accurate mite infestation level yard sample at the same time!

The bees need to be ground up to release the spores in their guts. The quickest (and most consistent) way that I've found is to use a kitchen blender (I've tried the 12v blender that we use to make Margaritas on the tailgate, but it doesn't work as well), and chop them up at the



A standard hemacytometer view of an infection level of about five million spores per bee. Each square demarks 1/400th of a square millimeter.

slowest setting (you don't want to totally liquefy them, as that makes too much debris for viewing). Dump the measured amount of bees into a half-pint or pint jar that will fit to the blender blade assembly Then add three times as much water as there was bees. Screw on the blade assembly, and hit the "chop" button for two five-second bursts, making sure that every bee is reduced to tiny pieces.

Take the jar off the blender, shake it well, and remove and rinse the blade assembly If there is much foam in the jar, tip the jar to an angle, and scrape the foam off with a spoon until you see the top of the grayish liquid below. This is the liquid that you view under a scope – all those bees are ground and mixed to yield the one tiny drop of average homogenate that you actually look at!

At this point, there are two ways to quantify the infection level – with an expensive hemacytometer glass counting chamber, or on a cheap microscope slide. For management decisions, the slide count is much quicker and easier – you just count the number of spores that you see in one field of view. Thanks to a grant from the California Beekeepers Association, I was able to produce a chart that converts the number of spores in one field of view to approximate millions of spores per bee (realize that even the hemacytometer count is still only an approximation, so don't get hung up on accuracy, since it is illusory).

Since nosema spores sink quickly, stir the slurry immediately before you take the sample for viewing. Dip the end of a swizzle stick, plastic utensil handle, or the like into the liquid, and place a drop onto a glass slide. Scrape any chunks of bee parts out of the drop, as they will hold up the cover slip too high. Then place a cover slip (I like plastic) over the drop, and tap it down lightly once with your fingertip.

Place the slide under the microscope, but wait at least a full minute for the spores to settle and the liquid to stop moving. Set the scope to 400x (10x top ocular lens, 40x turret objective lens). Look from the side at the space between the lens and the cover slip, and lower the lens until there is just a tiny gap. Then look through the scope, and use the fine focus to bring the slurry into view – you will see pieces of debris and ground bee guts, pollen grains, feathery setae ("hairs"), tracheal tubes, etc. If the view is full of bubbles, prepare a new slide.

View of a plain microscope slide prep, low nosema infection. Due to camera focus limitations, this is only part of the field of view that you would see if you were to look into the eyepiece. You can see about six spores, a partial pollen grain, and a feathery bee "hair" (seta).

Now focus slowly down to the lowest layer of debris – that's where the nosema spores will sink to. They will be elongated ovals, all roughly the same size. They will always have a dark rim, and generally "glow" white in the center as you move the fine focus up and down. With practice, they will jump out at you!

Once you learn to recognize them, you can quickly approximate what your infestation level is by counting how many spores are in the entire round field of view (check a few fields). Don't get hung up on precise numbers – all nosema counts are only approximations of the actual infection level, no matter what method you use. Here's all you need to know: for every million spores per bee, you'll see about four or five spores in a field of view.

The big question is, What level of infestation should I worry about, or begin treatment? With *Nosema apis* it was a million (1×10^6) spores. We really don't know what it should be for *N. ceranae*. Some authorities suggest the same threshold. I've spoken to some large commercial

The "drench" method of applying fumagillin – used by some beekeepers when feeding gallons of heavy syrup is impractical. It appears that about 120mg of active ingredient per dose may be necessary by this method of application to control Nosema ceranae, *but more research is needed.*

beekeepers, and have tracked nosema counts in my test yard since last Fall. It appears to me that colonies can often handle infections levels of 1-5 million spores without much problem.

I've followed some 30 infected, but untreated, colonies this season, and watched them build up, often throw infected (five million spores per bee) swarms, then make good honey crops. As of today's check in mid September, the only colonies that died went down due to queenlessness or brood diseases. The remainder have spore counts mostly in the one to six million range. I'm not sure how these colonies will fare this Winter, so I'm going to chicken out and treat most of them, saving five untreated to see what happens.

So I'm not about to make any recommendations. Luckily, in general, the yard samples that I've checked for myself or others often have nearly zero spores. In this case, no treatment is indicated. Indeed, there is unpublished data that fumagillin may have a negative effect on colonies, and is not indicated if spore counts are in the low million range. Dr. Frank Eischen presented data last year that indicated that colonies wintering in California built up better with pollen supplement alone, rather than supplement plus fumagillin, provided that spore counts were low.

Treatment

O.K., so let's say that you have found out which of your colonies (or yards) are actually infected, and that you're uncomfortable with the spore count. You ask, What treatment(s) will actually work, and how best to apply them? At this time, the only well-documented successful treatment for *N. ceranae* is fumagillin, sold as Fumagilin-B®. If it is given to infected colonies at normal label rates in gallons of heavy syrup, it is ***generally*** effective against *ceranae*. But not as consistently as it was against *N. apis*. Also, be aware that since *N. ceranae* thrives during summer, it can fairly quickly rebound after treatment.

Europeans are more concerned about contamination of the honey with medications, so may feed smaller amounts of syrup weekly, for four weeks. The point is that you must have the medication present through at least one full brood cycle to break the transmission of the infection. Dr Higes successfully controlled *N. ceranae* by feeding only 500ml (about two cups) of light medicated syrup a week for four weeks (at a concentration equivalent to one large bottle of Fumagilin-B in 40 gal of syrup).

There are times that feeding gallons of syrup are impractical, such as when colonies are plugged with honey, or during Spring or Summer when you don't want to contaminate the honey crop with gallons of medicated syrup. In these cases, many beekeepers are using the "drench" method. In a recent trial, I tested fumagillin as a drench at the colony dosage of 30mg of active ingredient (1 large bottle of Fumagilin-B in 20 gallons of 1:1 syrup, applied at the rate of one cup per week for four consecutive weeks). This treatment reduced the buildup of the infection, ***but did not stop it consistently.*** Apparently, drenching bees does not get the medication to them as effectively as by feeding it in larger quantities of syrup, so the beekeeper must compensate by somewhat increasing the dosage.

A number of commercial beekeepers are having success at drenching with eight to 12 oz of medicated syrup, prepared by adding a large bottle of Fumagilin-B to only five to seven gallons of syrup, and applying two treatments, 10-14 days apart. Note that this method gives about 25% more active ingredient to the colony than by feeding the standard medicated two gallons.

I also tested some other treatments. One that showed promise is Nosevit® (alaskaheavenlyhoney@hotmail.com), which is widely used in central Europe, but my trial was too small to determine if it was significantly effective. Other treatments, such as thymol, HoneyBHealthy, or bleach have yet to demonstrate efficacy in a controlled trial. There is currently ongoing research worldwide to test other promising nosema treatments.

Bottom Line

There are still a great number of unanswered questions about *Nosema ceranae*. We are not sure exactly what the treatment threshold should be, but it is likely in the one to five million spores per bee range. At this level, the vast majority of the bees in the colony may be uninfected – and most of the infection will be in the oldest field bees.

Once *N. ceranae* is in your operation (if you detect nosema spores during the Summer, you can likely assume that it is *ceranae*), it would be prudent to keep a close eye on it. In order to determine your level of infection (if any), samples should be taken at the entrance at midday, in order to sample the most infected bees. Samples should be taken throughout Spring and Summer, as well as Fall.

As far as treatment, Fumagilin-B is still the proven choice, best administered as per label instructions for the time being. Fumagillin should not be fed unless actual sampling demonstrates that there is indeed an infection, since it may set the colonies back a bit.

When feeding gallons of syrup is impractical, Fumagilin-B can be fed in less syrup or by the drench method, but the concentration of fumagillin needs to be adjusted. As always, consult with your State Apiculturalist for officially recommended treatments. Far more details of every aspect of this article can be found at my website (www.scientificbeekeeping.com), as well as citations for any research mentioned, and current updates. BC

Randy Oliver is a commercial beekeeper and pollinator in California. His web page is www.scientificbeekeeping.com.

Further Reading

Higes, M., et al (2008) *How natural infection by Nosema ceranae causes honey bee colony collapse* http://www.apitrack.com/pdf/Espania_Enviromental_Microbiology_09_2008.pdf

Matilla, HR and G Otis (2006) *The effects of pollen availability during larval development on the behaviour and physiology of spring-reared honey bee workers.* Apidologie 37:533–546.

Pajuelo, AG, C Torres and FJ Orantes Bermejo (2008) *Colony losses: a double blind trial on the influence of supplementary protein nutrition and preventative treatment with fumagillin against Nosema ceranae.* Journal of Apicultural Research 47(1): 84-86.

'Bout a 100 – Sideline Beekeeping

FACING THE CHALLENGES OF SIDELINE BEEKEEPING

Larry Connor

A Short List of Big Challenges; Learning from G.M. Doolittle

What challenges face larger hobby and sideline beekeeper these days? It's not hard to develop a list, and here are the key issues I see – my list – based on visits I have had with beekeepers around the country You might want to jot down your own challenges and see how much we agree or disagree.

1. Queens: Failure to Introduce, Failure to stay in the hive, and Failure to live more than a few months. And problems with abrupt termination of egg laying right in the middle of the flow, with no effort to supercede! How can I use virgin queens shipped to me from a distance?

2. Bee forage: What and where is it being produced? Is there enough to support my colonies? Or should I plan to feed colonies. And if so, when should I feed my bees? Should I be feeding in the summer when everything is in bloom? And if so, what with – pollen, sugar syrup or both? And is that high-fructose corn syrup really bad for my bees?

3. Honey: It seems I either have too much or not enough. What do you do about both situations? Should I develop a backup source for honey to meet my market needs?

4. Winter losses: How to eliminate them, or at least get them to an acceptable level, such as under ten percent, rather than the whopping 90% loss I had this past Winter/ Spring.

5. Fear of contamination of the hive and bee products with chemicals used in apiary work and from the environment. Do the so-called naturally occurring miticide treatments leave residues too? And do they interact with other pesticides in the environment, from herbicides to orchard fungicides to impact on foraging, stored pollen and nectar reserves and bee behavior?

6. Laws, rules and regulations restricting free trade of honey

7 Neighbors: The Good, The Bad and The Ignorant.

8. Time: How can I manage it better? Is there a way I can work a 40-hour week (that is often over 50 hours) and still run 25 or 250 colonies? What do I give up to do it?

9. Beekeeping is getting so expensive. And the fuel prices are killing me!

10. Allergies to bee venom in the family – what do I do when my kid is allergic to bee venom?

We will take the time to discuss each of these issues, and others, as they develop. I think it is very important that we spend as much time as necessary to discuss each point. This month we will look at the first issue, of queens and their challenges, through the eyes of an observer who first reported on his beekeeping activities in this publication in 1870, G.M. Doolittle.

Queens & Their Many Challenges

I have re-read Doolittle's *Scientific Queen Rearing* cover-to-cover in preparation for a reprint I have been threatening for nearly 20 years. G. M. Doolittle was a commercial beekeeper producing comb honey in Borodino, New York, outside of Syracuse, and this book was first published in 1889. While called the Father of Modern Queen Rearing, he freely admitted he was not the first beekeeper to develop ideas for the production of queens, nor the last. Yet the ideas and practices he developed over a century ago still form the essential base of the commercial queen rearing industry worldwide, and I teach the essentials of his process when I offer courses on queen rearing, and others do too. Doolittle's method of raising queens is often called the *grafting method*, yet Doolittle did not use that term to describe the transference of larvae from worker cells to those of delicate queen cups he hand dipped and affixed to grafting bars. In his book he used the word grafting only to describe the process used to fasten different genetic material to fruit tree rootstock.

My self-imposed and somewhat critical re-reading of this book re-

Normally emerged queen cell showing flap from the cocoon. Use of newly emerged virgin queens to requeen colonies was routine in Doolittle's era.

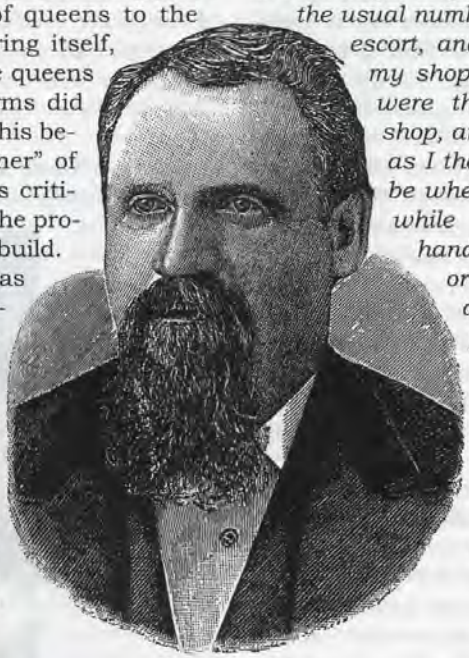
Doolittle argued that the sudden termination of a vigorous queen's egg laying was the cause of injury or imbalance that caused her to perform poorly when reintroduced into a colony.

minded me how amazingly unstructured – even disorganized – Doolittle was, and at the same time an absolutely brilliant observer of bee behavior and queen development. Some of the points he makes are spread out through a minefield of instructions for cage making and dimensions. Doolittle admitted to his own disorganization when he wrote:

It [the book] is not a manual, giving in terse, sharp periods, and the greatest amount of accurate information in the briefest space. My style, I fear, is often like my bee-yard, which in looks is irregular, while it attempts something useful. I never could be pinned down to systematic work. I always did like to work at the bees near a gooseberry-bush, full of ripe, luscious fruit, or under a harvest apple-tree, where an occasional rest could be enjoyed, eating the apples which lay so temptingly about. Do we not all need an occasional relaxation from the severer duties of life? [Preface].

One might argue that Doolittle was not really scientific about his work, but very systematic in his observations and trials. He took time to study an issue, and had the writings and correspondence of many other beekeepers to compare experiences and develop new observations. He tried things, sometimes for a number of years, before he rejected, modified or accepted them. His observational skills of the activities of bees are noteworthy – a skill I promote in all beekeepers. More beekeepers need to spend time looking at bee activity inside the hive, in mating nuclei, and at observation hives. This goes directly to the time issue – few of us have time (or invest it) to spend an afternoon in the mating yard watching the queens and drones flying in and out, and watching for returning queens with the last drone's endophallus – the mating sign – protruding from the tip of her abdomen! There are too many things most beekeepers miss about bees and beekeeping that Doolitttle noticed and examined.

For that reason we might think that Doolittle's world was much less complicated than our own, but he details the challenges he faced, of his evaluation of the different races of bees and how they performed. This is something we are again doing after a century of near-exclusive use of Italian bloodlines. Just a few years after the Civil War ended he reported a large loss of queens in the spring in prime conditions, without explanation or supercedure, these queens stopped laying! Now we would link an event like this to the presence of pesticides in the hive (I have certainly suggested this in my classes). After analysis, he linked this disappearance or failure of queens to the act of queen rearing itself, recording that the queens produced in swarms did not demonstrate this behavior This "Father" of queen rearing was critical of the process he promoted and helped build. He was a success as a queen producer, 120 or more years ago, before automobiles, airplanes, high fuel costs, planetary warming and other challenges. Doolittle's idea of a good day in the apiary was to rest with an apple from a nearby tree and doze in the shade after working his colonies.



G.M. Doolittle

I certainly identify with Doolittle's style of colony management and his way of thinking. Rather than being absolutely linear in my thinking I often have several mental pots simmering that eventually lead to a workable scheme at the right time and place. The idea of sitting under an apple tree and munching on a ripe apple on a bright fall day does not seem so bad to me either

Doolittle had answers about queen problems that are amazingly similar to what I teach. I suspect that this may be due to my integration of Doolittle's ideas over the years, from my initial reading the book back in the 1970s while working with Bud Cale in Hamilton Illinois for Dadants, or from working with those who have been exposed, directly or indirectly, to his concepts. So at the risk of admitting that I forgot where I first read about some of these ideas, and of again repeating myself, here are some of Doolittle's choice observations that I have somehow merged into my teaching! All these ideas are of immediate benefit to hobby and sideline beekeepers everywhere.

Doolittle examined the role of caging and handling queens and the interruption of egg-laying, and how these may or may not cause queen introduction and performance issues after they have been shipped:

I caught some of my most prolific queens and caged them, the same as I would for shipment, giving them the usual number of bees for an escort, and placed them in my shop. A part of these were thrown about the shop, and handled about as I thought they would be when shipped away, while others were handled very carefully or let alone entirely; all being kept from the hive from one to two weeks. Upon returning them as the heads of colonies again, some of them proved of little value, and, strange to say, a part of those that were of the least value, were among those treated the most carefully. I was now satisfied that

the cause very largely lay where I mistrusted that it did – in the sudden stopping of a queen from prolific egg-laying; for whenever a queen expects to leave a hive with a swarm, she almost, or altogether, stops egg-laying preparatory to leaving, but doing the same gradually [Chapter XXI].

In the prior Chapter he had suggested a method to circumvent one hazard of abrupt shipping:

If the bees are put up twelve hours before they are mailed, and left with the face side of the cage downward, but raised a little off the table, the queen will rid herself of eggs, and thus better endure the sudden jars which she will be liable to get [Chapter XX].

As far as the issue of shipping cage and introduction cage design, Doolittle was adamant that one cage could not perform these two duties. The next paragraph shows his reliance on the use of a wire cage, now called a push-in cage, as a means of introducing a queen.

No shipping-cage which meets the requirements as I have set forth, can be a successful introducing-cage; for to meet with the greatest success in introducing, the cage should cover at least one-sixth of one side of a comb, so that hatching brood and some honey can be enclosed. In the hatching of this brood, to form an escort of bees for the queen, and in her laying eggs in the cells enclosed by the cage, carries an assurance of safety, not found in any other item regarding cage-introduction of queens. When these young bees, which hatch out with the queen, become so attached to her that they accept her as their mother, it is not long before the bees outside of the cage fall into line. They now begin to feed her such food as is given for egg-production which means safety to any queen [Chapter XX].

DRONES! Compared with other writers from his era, Doolittle best recognized the importance of drones and the need to select colonies for drone production. He did not, as is often the case today, rely on all colonies in an apiary or area to produce drones. Instead he selected only certain colonies, showing desirable traits, for that task:

I find that the next best thing that I can do, is to set apart two or three of my very best queens for drone-rearing, causing them, as far as may be, to rear all of the drones in the apiary. I do this by giving these colonies a large amount of drone-comb, and keeping up their strength, if need be, by giving them worker-brood from other colonies. [Chapter XV].

Since all colonies instinctively produce drones, Doolittle *suppressed* their need for drones by introducing developing drone comb from the colonies he selected for drone production. His process is in complete agreement with what we know about drone production and colony social physiology:

The other colonies are largely kept from rearing drones, by allowing only worker-combs in their hives, and by giving them a comb of drone-brood occasionally from one of the colonies rearing drones, just when they want drones the most; for if this is not done, they will have drones anyway, even if they have to tear down worker-comb to build such as is needed to rear them in. As soon as the major part of the drones from this comb have hatched, it is taken away, before the inferior drone-brood (if any is placed in the comb) has time to mature. In this way I get all the drones reared from my best queens [Chapter XV].

Not only was Doolittle a northern beekeeper producing queens for sale from late May on, he had a strong market for his queens in the Fall. To insure mating into October in the central-New York area, he used a manipulation where a few colonies would house drones, similar to the Drone Holding Colony system I wrote about in *Bee Sex Essentials*. I suspect that Doolittle was the source of the DHC idea taught to me by Dr Bud Cale Jr while producing Starline and Midnite stocks:

To keep drones late in the fall, I make a strong colony queenless, at the close of the honey-harvest, and in this colony I put all of the drone-brood that I can find in my drone-rearing colonies at this time. As much of this brood is in the egg and larval form, when given to the queenless colony, I have them hatching after all the other drones are killed off, for queenless colonies which are strong, are very choice of drone-brood. In this way I generally have a hive full of nice drones, as late as I desire to rear queens, keeping them frequently into October [Chapter IV].

VIRGINS! Doolittle routinely used virgin queens to requeen colonies and mating nucs. He believed that most beekeepers knew

. . . That just-hatched virgin queens, which are so young as to be white, weak and fuzzy, can be introduced to any colony that will accept a sealed queen-cell, is a fact generally known to all [Chapter XVII].

Doolittle wrote that . .

. it is very desirable to have some plan whereby we can introduce a virgin queen from 5 to 8 days old to a nucleus as soon as a laying queen is taken away from it; as well as to introduce one into any other colony where we wish to place a virgin queen coming to us from a distance, which we have ordered to improve our stock, by a direct cross between her and one of our drones. [The discovery of the queen's multiple mating had not yet been made when Doolittle wrote this]. *From the fact that not one colony in 500 will take such a virgin queen, when giving her at the time of taking away the laying one...*

On no one thing in bee-keeping have I spent so much thought, as on how to successfully introduce virgin queens, from 4 to 10 days old; and I am happy to say that I am master of the situation; not that I have dug it out all alone, for I have not. I have picked up little things here and there for several years, and by saving every little item that proved to be in advance of what I already had, and applying them, together with what I could study out myself, eventually gave me success...

I believe that the day is not far distant, when the traffic in virgin queens will assume greater proportions than at the present. A virgin queen is not fit to start on a journey until she is at least 24 hours old; and as from 2 to 4 days must be required in her transit...

Doolittle described three methods using older virgin queens, going into considerable detail. I have included the first and perhaps the easiest to

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a closer look

TYLOSIN

Clarence Collison

Tylosin is virtually non-toxic to adult honey bees and less toxic than oxytetracycline to honey bee larvae.

American foulbrood (AFB) – caused by the gram-positive, spore-forming bacterium *Paenibacillus larvae* (formerly *Bacillus larvae*) – is the most serious infectious disease of honey bees. Diseased individuals in the larval and pupal stages turn brown, then black as they decompose; the resultant mass is a hard scale of material adhering to the inside wall of the cell. AFB is one of the few bee diseases capable of decimating a colony, and the longevity of the spores complicates prevention and control of the disease. Since the 1950's, the only preventative medication for AFB approved for use in the United States is the antibiotic oxytetracycline hydrochloride (OTC), sold under the brand name "Terramycin." Terramycin breaks down rapidly in solution, and is therefore unlikely to contaminate honey (Kochansky et al. 1999).

In recent years, many beekeepers in the United States have experienced the ineffectiveness of using oxytetracycline hydrochloride to control AFB infections. Miyagi et al. (2000) verified the existence of an OTC-resistant strain of *P. larvae* from AFB-infected brood. The brood comb was collected in 1998 from a Minnesota bee colony having a history of failed responses to Terramycin treatments. Resistance to OTC was not unexpected, as any time there is only one treatment for a disease or other pest, there is an increased chance of developing resistance. The appearance of resistant bacteria prompted researchers to search for other antibiotics that were effective against *P. larvae* having different pharmacological mechanisms from that of the tetracyclines.

The USDA had been screening alternate antibiotics for many years in preparation for the inevitable development of resistant *P. larvae*. Tylosin was first reported as a candidate medication for AFB in 1970 (Hitchcock et al. 1970, Moffett et al. 1970). Moffett et al. (1970) found that diseased colonies sprinkled with tylosin in sucrose syrup recovered from all visible symptoms of AFB in 32 days. The infected colonies were treated twice a week from the 2nd of August to the 9th of September for a total of 12 treatments. There was no recurrence of the disease by June of the following year Gorging colonies with sugar syrup or dusting them with dry powdered sugar were the two methods used for introducing tylosin lactate treatments; most cases of AFB were controlled when these treatments were repeated once a week for at least three weeks (Hitchcock et al. 1970). Overall, gorging was more effective than dusting in controlling the disease. Even severely diseased colonies recovered when they were given a dose of 1g/colony once a week for at least three weeks. Only two of 25 colonies given this dose had a light or moderate recurrence of AFB in the Fall, probably because those colonies had been treated for less than three weeks. Hitchcock et al. (1970) completed additional test in which tylosin tartrate was applied at much smaller doses: 0.25 or 0.1 g of tylosin/colony per treatment. These treatments were repeated more frequently, about every three days, for about seven weeks and resulted in 100% control of AFB.

"Tylosin was found to be effective in controlling oxytetracycline-resistant AFB in honey bee colonies, while not affecting adult and larval honey bee mortality."

Tylosin is virtually non-toxic to adult honey bees (Alippi et al. 1999) and less toxic than oxytetracycline to honey bee larvae (Peng et al. 1992, 1996). Studies conducted on immature worker bees maintained in the laboratory revealed that honey bee larvae could tolerate quite a range of doses (0.005-0.04 percent) of antibiotic in their diet (Peng et al. 1996). In laboratory studies, intermediate doses of tylosin protected very young larvae from becoming infected with *P. larvae* at an unusually high inoculum concentration of 1.5×10^8 spores/ml of diet. Incremental antibiotic treatments had no measurable effect on larval or pupal developmental rates until the dosage reached a lethal concentration (> 0.05 percent). Bees in field colonies readily consumed tylosin in powdered sugar, up to a

"In syrup prepared from commercial grade sucrose, both antibiotics were less stable, with OTC having a half life of 6.3 days and tylosin about 75 days."

dosage of 800 mg/7 g sugar (Peng et al. 1996). No negative colony effects were noted at any of the dosages tested (20, 100, 200, 400, and 800 mg). The effectiveness of a range of doses of tylosin was compared to the standard dose of Terramycin (200 mg) in AFB control. Both the 200 mg dose of Terramycin and a 100 mg dose of tylosin protected colonies for up to three weeks, and a 200 mg dose of tylosin gave an additional week's worth of protection. Doses of 100 mg or more of tylosin were adequate to eliminate signs of AFB in visibly diseased colonies. The results of the field experiments suggests that feeding tylosin at 200 mg per colony protects the colony from overt signs of AFB infection for four weeks. A second feeding will continue to protect the colony for another four weeks, or even a longer period of time, depending on colony and other seasonal factors. In addition, tylosin appears to have a 33 percent longer effective control period than Terramycin.

Tylosin was found to be effective in controlling oxytetracycline-resistant AFB in honey bee colonies, while not affecting adult and larval honey bee mortality (Elzen et al. 2002a, Kochansky et al. 2001). Elzen et al. (2002a) found that an optimal rate of 200 mg tylosin applied in 20g confectioners' sugar at weekly intervals for three weeks resulted in the complete remission of detectable symptoms 45 days after the initial treatment. No detectable disease symptoms were observed seven months after treatment at this rate. Various higher doses of tylosin (600mg and 1000mg per 20g confectioners' sugar) applied over three brood cycles resulted in no significant increase in adult and larval bee mortality compared to untreated controls. A second method of treatment was also tested, consisting of tylosin mixed with granulated sugar and vegetable shortening, applied one time as a patty, at an equivalent total dose of the repeat dusting method (Elzen et al. 2002b). The use of the grease patty in diseased colonies effectively eliminated symptoms of the disease; however, small hive beetle (*Aethina tumida* Murray) populations significantly increased compared with the dusting method and untreated controls. Because of the damaging nature of hive beetles, along with risks of developing disease resistance and residues associated with using patties and the lack of support for this method by regulatory agencies, the dusting method is greatly favored as a means of tylosin application.

Alippi et al. (2005) evaluated the susceptibility of 67 strains of *P. larvae* from diverse geographical regions to tylosin by determining their minimal inhibitory concentrations (MIC, the lowest concentration of antibiotic preventing bacterial growth on test plates).

MIC values ranged from 0.0078 to 0.5 µg/ml. These very low values imply that no resistance to tylosin was found in any isolate of the foulbrood pathogen.

Additional testing determined the appropriate rate of tylosin application (Pettis and Feldlaufer 2005). Two dosages of tylosin, 100 and 200 mg, were evaluated. The antibiotic was administered in 20g of confectioners' sugar three times at seven day intervals. The 200mg gave consistent control after 45 days, but the lower dose did not result in complete control. One of the 10 colonies given 100mg tylosin still had detectable disease after 45 days. Thus, it was concluded that 200mg applied three times over three weeks was the appropriate dose.

The stability of tylosin was compared with that of oxytetracycline in sucrose syrup (Kockansky et al. 1999). At 34°C(93°F) in the dark, OTC in syrup made from highly purified sucrose had a half life of 7.6 days (half life is the measure of time it takes for 50 percent of a substance to degrade). Tylosin was considerably more stable, with a half life of 186 days; the half life of the tylosin complex (tylosin plus degradation products) was 287 days. In syrup prepared from commercial grade sucrose, both antibiotics were less stable, with OTC having a half life of 6.3 days and tylosin about 75 days. The differences in stability for the antibiotics in purified versus commercial sucrose syrup are presumably due to the traces of metal ion impurities, such as iron or copper, which are known to catalyse oxidation of biological materials.

A tylosin and honey mixture was studied to determine the stability of tylosin residues over time. Residues were isolated from diluted honey and analyzed using high performance liquid chromatography Tylosin over-time is converted to a second antibiotic desmycosin, which has a half life of approximately four months at 34°C.

Desmycosin seems to be quite stable in honey, and the sum of the two antibiotics decreased only slightly over nine months (Kochansky 2004). Therefore the use of tylosin treatments requires caution to prevent residues from persisting in honey.

The development of American foulbrood resistance to OTC provides evidence for how the overuse of antibiotics can shorten their lifespan. This must be considered when using tylosin. Terramycin was used for many years as a prophylactic measure to ward off AFB symptoms, rather than being used only as a curative treatment (Elzen et al. 2002a).

The use of Tylan (tylosin tartrate) was approved for treating AFB diseased colonies in the United States by the Food and Drug Administration in October 2005. *It may not be used as a prophylactic treatment.* The directions for application are as follows: mix 200mg Tylan in 20g powdered sugar and apply to the top bars of the brood chamber immediately, repeat once weekly for three weeks. BC

References

Alippi, A.M., G.N. Albo, F.J. Reynaldi and M.R. De Giusti 2005. *In vitro and in vivo susceptibility of the honeybee bacterial pathogen* Paenibacillus larvae *subsp.* larvae *to the antibiotic tylosin.* Veterinary Microbiology 109: 47-55.

Alippi, A.M., G.N. Albo, D. Leniz, I. Rivera, M.L. Zanelli and A. E. Roca 1999. *Comparative study of tylosin, erythromycin and oxytetracycline to control American foulbrood of honey bees.* J. Apic. Res. 38: 149-158.

Elzen, P.J., D. Westervelt, D. Causey, J. Ellis, H.R. Hepburn and P. Neumann 2002b. *Method of application of tylosin, an antibiotic for American foulbrood control, with effects on small hive beetle (Coleoptera: Nitidulidae) populations.* J. Econ. Entomol. 1119-1122.

"Tylosin over-time is converted to a second antibiotic desmycosin, which has a half life of approximately four months at 34°C."

Elzen, P., D. Westervelt, D. Causey, R. Rivera, J. Baxter and M. Feldlaufer 2002a. *Control of oxytetracycline-resistant American foulbrood with tylosin and its toxicity to honey bees* (Apis mellifera). J. Apic. Res. 41. 97-100.

Hitchock, J.D., J.O. Moffett, J.J. Lackett and J.R. Elliott 1970. *Tylosin for control of American foulbrood disease in honey bees.* J. Econ. Entomol. 63: 204-207

Kochansky, J. 2004. *Degradation of tylosin residues in honey.* J. Apic. Res. 43: 65-68.

Kochansky, J., D. Knox and H. Shimanuki 1999. *Comparitive stability of oxytetracycline and tylosin in sugar syrup.* Apidologie 30: 321-326.

Kochansky, J., D.A. Knox, M. Feldlaufer and J.S. Pettis 2001. *Screening alternative antibiotics against oxytetracycline-susceptible and-resistant* Paenibacillus larvae. Apidologie 32: 215-222.

Miyagi, T., C.Y.S. Peng, R.Y Chuang, E.C. Mussen,, M.S. Spivak and R.H. Doi 2000. *Verification of oxytetracycline-resistant American foulbrood pathogen* Paenibacillus larvae *in the United States.* J. Invertebr. Pathol. 75: 95-96.

Moffett, J.O., J.D. Hitchcock, J.J. Lackett and J.R. Elliott 1970. *Evaluation of some new compounds in controlling American foul brood.* J. Apic. Res. 9: 39-44.

Peng, Y.S., E. Mussen, A. Fong, M.A. Montague and T Tyler 1992. *Effects of chlortetracycline on honey bee worker larvae reared in vitro.* J Invertebr Pathol. 60: 127-133.

Peng, Y.S., E. Mussen, A. Fong, P. Cheng, G. Wong and M.A. Montague 1996. *Laboratory and field studies on the effects of the antibiotic tylosin on honey bee* Apis mellifera *L. (Hymenoptera: Apidae). Development and prevention of American foulbrood disease.* J. Invertebr. Pathol. 67: 65-71.

Pettis, J.S. and M.F Feldlaufer 2005. *Efficacy of lincomycin and tylosin in controlling American foulbrood in honey bee colonies.* J. Apic. Res. 44: 106-108.

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understand. In this, he adds a virgin queen to a colony that already has queen cells in production, arguing that these colonies are willing to accept a virgin:

I found that whenever I came across a nucleus or colony having queen-cells sealed, all that I had to do to introduce a queen was to go to my queen-nursery and pick out a nice virgin queen, and drop her in some honey; when, after pouring some of the honey out of a tea-spoon on her back, and rolling her about in it until she was thoroughly daubed, the quilt was raised from over the frames, and after scooping her up together with some of the honey, I turned the whole down among the bees between the combs. The hive was then closed, and I would usually have a laying queen in three or four days. To prevent the queen from flying, when introducing her in this way, I held the mouth of the cage close down to the honey (which I generally take in a tea-cup), when, by a sudden jar, caused by striking the cage, she was thrown down into the honey, thus daubing her wings, after which there was no further danger

This plan I also use when receiving a virgin queen from abroad [Doolittle was a major importer of genetic stock from overseas, something we cannot do today because of the risk of adding even more diseases, parasites and viruses], *if I have a colony that has been queenless long enough to have cells sealed.*

We must dig deep to find some answers to our frequent questions as hobby and sideline beekeepers. The above examples from Doolittle's observations made years ago should remind us that we do not always know our beekeeping history, or if we do, we must carefully review the work of our predecessors in beekeeping. The average bee school is taught by instructors who are either relatively new to the craft and/or do not have a great depth of knowledge that comes from reading old works and developing a depth of knowledge on the subject. I get very nervous when I hear bee school instructors passing out misinformation about bees and beekeeping, or advice that is one-sided and an incomplete version of the subject. There is no easy answer for this except we need to reflect on the work of the past, read everything we can find, and discuss these matters with an open mind for new, or very old, ideas. It may be daunting to "newbees" that I have been a student of the honey bee for 40 years now, and I'm learning, or relearning, something every day about these insects, their care and manipulation. What we do not know may just turn around and hurt us!

So, on with the list in future articles! BC

Dr. Connor will be in Connecticut for the Southern New England Beekeepers Assembly in mid November; check out www.sneba.com for further information. Many readers have found the www.wicwas.com website very useful for purchasing books, including Connor's two books, Bee Sex Essentials *and* Increase Essentials *and* Doolittle's A Year in the Out-Apiary. *Watch for notice of the reprint of Doolittle's* Scientific Queen Rearing.

Quirky, HEAVY Honey

Extracting, Filtering and Pumping Honey

James E Tew

The "extracting" Season

Though I still clearly recognize the four weather seasons, in many other areas, the concept of "the season" has become blurred. Seemingly randomly, TV networks will suddenly announce the "season finale." The "season premier" will not be until "next season" which does not start for the next four months or so. During October, the Dairy Queen near my home closes for the "season" and reopens in mid-February. What season was that? Mail order companies announce the beginning of the Fall season in early June. I recently bought a small tractor and got a good deal. The dealership was closing out the season. They didn't know when the new season would begin.

In our own small way, those of us in beekeeping add to the confusion. I generally consider mid-Summer to be the spring honey extracting season and October/November to be the Fall honey processing time – but that's just me here in the mid-West. With some preparation, honey-in-the-comb can be extracted any time of the year and in any climate. But that's not what I want to discuss in this article. By this time, most of us have extracted the year's crop and it is now in buckets or drums. What now?

Honey from the extractor

Each of us took one of maybe a couple of routes as our liquid honey flowed from the extractor Beekeepers with just a few hives and a small honey crop frequently strain the honey as it flows from the extractor Some of you will pump everything into five-gallon buckets or drums and then skim the cappings from the honey when it is readied for bottling. In some cases, this might be as long as several years.

Buckets and drums of honey

Plastic five-gallon buckets are straightforward. Lids are the challenge, but they are only a small challenge. Various gadgets are available to help pry the lids off and a rubber mallet is generally enough to force the lids on.

Drum characteristics

As your beekeeping project grows, you will, sooner or later, begin to use drums. Drums are far more exciting than buckets. Drums are like the beehive equipment from different manufacturing companies. They are really close to the same size but not quite. Some are metric-measurement based. Some are constructed of heavy gauge steel and are remarkably heavy while others are so light you can toss them across the room. Some are made from plastic. While I have not kept close records on damaged drums, I have a few of them that are slightly out-of-round. I'll bet you they are the lighter gauge steel ones. A drum full of honey weighs about 660 pounds. Obviously, a drum can be bent if – heaven forbid – it falls on its side when handing or unloading. More than likely, they were bent as they were being cleaned and were pushed over to pour out the wash water It's not worth the effort to try to get a lid to ever seal on that kind of drum again. Use it for a burn barrel or recycle it. Don't use it for a trash barrel. Believe me, it's tempting, but it's too heavy when full.

Generally, empty drums are exchanged when full ones are purchased. Bluntly, these drums are ugly. They have been used time and again and are beaten up and marked up with an indication of their history "Product of Argentina," Spanish references to miel (honey), and meaningless numbers from previous weights and honey composition are common markings. As described above, all drums are slightly different sizes that require lids that are attached to the drum with various styles of rims or clamps. It's a great idea to always keep the drum, lid, and rim together Drum lid gaskets are available from suppliers and should be replaced with each filling cycle so honey won't leak when the drum is tilted during transportation on a drum truck.

Loading, unloading, and transporting full drums

Your first drum of honey is a lot like your first beehive. There is the potential for lots of memories. This thing is HEAVY You feel as though you have made the big-time. Maybe your honey market has grown. Maybe you got the best price for honey in the drum. It's not uncommon for such a standard honey container to come into your bee life. But you should know there is the true potential for serious bodily injury not to mention the potential for a giant amount of spilled honey when handling these containers. Fingers and feet can be seriously crushed. Back injuries are possibilities. Fight the urge to "save" a barrel of honey that is tipping[1] Instead, save yourself. You can always get more honey

For most standard one-half ton pickup trucks, one drum of honey is all the truck wants to haul. Be sure the tailgate cables can withstand the weight of the full drum rolling across it. Slide the drum against the cab. If the drum is on a drum truck, set the drum down in the middle of the bed and push it against the cab. If you miscalculate and drop the drum too close to the cab, there is a chance you can knock out the back window. None

[1] I hope you don't try to use a traditional hand truck to move a drum. You will really need a drum truck that is designed for the job.

of my university trucks have proper tie-downs for truly restricting such weight. On my large truck, we just moved seven drums several hundred miles. That's around 5000 pounds[2] All I knew to do was push the drums against the front of the truck body and worry on the trip. It was impractical to lash the drums together and the truck box had no way to adequately tie the drums down. (*Hummm. That reads funny. Maybe I should be taking my own safety advice more seriously.)*

Why am I putting you through all this doomsday discussion? Because I'll bet that, at first, you won't have access to a loading dock or hydraulic truck gates powerful enough to deal with this weight. So you are going to be tempted to consider rolling this behemoth up or down an improvised ramp. That has the potential for being a ride you won't soon forget. A better plan, but an inconvenient plan, is to improvise a honey pump on the truck and pump the drum contents into five-gallon containers. But then a surprise frequently occurs. Upon opening the drum to begin the pumping process, you discover that the contents have granulated. What then? All you can do, if you still want to transfer the drum contents to five-gallon buckets, is to liquefy the drum.

Liquefying buckets and drums

Hot rooms and ovens are impractical for most of us. Hot water baths are available for five-gallon containers but they are a bit expensive. Not much is left other than heat bands for liquefying buckets or drums of honey. Just a quick comment – granulated honey in fives or drums is not all bad. In fact, it's probably a good thing. If there is an accident, there is more of a chance that some, if not all, of the honey can be salvaged. Be that as it may, before bottling can proceed, granulated honey must be liquefied and heat bands are the common way to go.

Heat bands are absolutely not infallible. I have one for use on five-gallon buckets in my lab that looks brand new. Yet when in use, it runs wildly hot and will melt right through the plastic bucket wall. I can't find any way to adjust it and I can't bear to toss it. So it just lays around – awaiting some future unsuspecting person. The drum bands are more expensive but are more adjustable. But be assured that drum bands can also overheat and ruin the honey Give yourself plenty of time to perform the liquefying process – even overnight. But I prefer to start the process early in the morning so I can babysit the process. When honey is being liquefied, my lab has the delectable odor of some kind of exquisite food being prepared. Yet this good smell weighs on me as a constant reminder that I must monitor it to avoid overheating. Liquefying a five-gallon bucket is straight forward. Go slowly. Stir occasionally and remove the heat as soon as possible. Drums are much bigger Drum heater bands are bigger so the process is bigger, but the fundamentals are the same.

The drum bands (either 120 or 240 volts – you choose which when purchasing) can be positioned either on the bottom or the top rim of the drum. A clumsy three-way chain contraption suspends the band in the selected position. Allow hours and hours for the process to proceed. Hot honey feels like hot tar if you get it on you.

[2]I know many of you are chuckling at the indication that 5000# is a staggering load. It's not. I realize that. But without proper equipment and loading/unloading facilities, 5000# can be a spectacular weight with which to deal.

Bee Lab drums.

It will need to be this hot to adequately convert it back to a liquid state. While it seems to make sense to use a thermometer, I rarely use one. Increasing or decreasing the temperature can take an hour or more. If the honey really gives off an odor and the band feels extremely hot, we just unplug it. The hot honey will continue to liquefy from the residual heat. If it is not enough to complete the job, the band is repositioned and heat is again applied until the process is complete. If stirring is required, we use a wooden canoe paddle that was purchased new just for this purpose.

We can rush the process quite a bit by starting the liquefying process at the top of the drum and pumping liquid honey as it becomes available. Obviously, care must be taken not to force the pump tube into the granulated honey or both the pump and the filter will quickly clog.

Pumping liquid honey

Honey pump devices are necessary for any beekeeper who handles even a single drum. A true, commercial pump is prohibitively expensive for most of us. Smaller, "get-by" pumps work well enough to allow you to "get by" but not without quirks of their own. I retrofitted all of my pumps with reversing switches so honey can be either pumped into the filter or back into the drum. This is especially useful when cleaning.

If you plan to improvise your own, the pump should run as slowly as possible. Otherwise, air is incorporated into the honey or if the pump is running too fast, the pump will "skip" and simply not move the honey

Hot pumps

These things get hot. They are pumping hot honey and they are under a load that results in friction heat. I don't know of any small pump that has ball bearings so the wear surfaces require periodic oiling. In previous discussions, readers suggested using lubricants with a high-heat tolerance. This helped, but they still get very hot to the touch. Highly refined oil smokes and evaporates quickly Not much can be done. Buy the cheaper pump and live with the heat characteristic.

Clogged pumps

Several times per year, these pumps must be torn down to remove granulated honey Even if copious

amounts of cleaning water are run through it, the pump still seizes up as it waits for the next pumping cycle a few months later Using the pump frequently obviates this quirk, but who of us is using our honey pumps frequently?

Pump lines

I use a combination of white PVC piping and clear plastic tubing that is used in the dairy industry. The clear tubing allows me to see if and how well the honey is flowing. The flexible line also allows me to change positions between the pump and the drum. Moving the pump is usually easier than moving the drum. But know this about the flexible lines – the hot honey heats the tubing. If the filter should become thoroughly plugged, the flexible line will dramatically balloon – resulting in people running, screaming and shouting. If someone doesn't get to the pump in time, the line will rupture. First order of business is to turn that pump motor off and release the line pressure. Pressure release is a simple thing to do if the pump motor has a reversing switch.

Hot honey and filters

Hot honey really flows and filters nicely. Alternatively, pumping cool (cold) honey is slow if not impossible and will quickly clog any style of filter While we don't want to overheat the honey, be confident that enough heat was applied and that you waited and stirred the honey well enough to be certain that all the granulation is gone. Even fine granulation quickly clogs honey filters. The time you saved in rushing the liquefying job will be lost in time spent opening and cleaning the messy honey filter

Epilogue

No kidding. As soon as I finish this article, I must go to my lab to put a full drum on a pickup truck for a move. The pickup has no lift gate. This will be a normal challenge. No doubt, I should re-read this article before tackling this task. BC

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BEEKEEPING

In Southern Greece

When John Phipps moved to a small hill village in Greece he had no idea that he had made his home in a region which was rich in beekeeping tradition.

John Phipps

It is in the Maniot village of Neochori, about 300 metres above the seaside resort of Stoupa, that my wife and I made our home almost eight years ago to the day. As I write this it is 35°C (95°F) in the shade and Homer's 'wine dark sea' of the Mediterranean below is an enticing prospect. Behind me, the mountains of the Taygetos rise to over 6000 feet, and although we have had no rain for the last three months the olives, oaks, pines, firs, strawberry trees and heather are still a vibrant green, unlike the bleached and burnt ground flora.

All I possess of my long years of beekeeping in the UK is a Sherriff veil which has given me good service for nearly 20 years. All my bees, hives and other beekeeping equipment went under the hammer at two local association apiaries six months before my departure from Lincolnshire and I was in that strange position of having no bees at all.

It is not difficult to explain why we settled in the Mani – that is in the southern part of the middle finger of the Peloponnese – it is a region which offers a good climate, excellent scenery, both on the coast and in the mountains, and a huge diversity of flora and fauna and the prospects for beekeeping looked good even though I wanted to keep just a few hives. Also having left an increasingly industrial arable farming area, it was good to be among people who still mainly practiced traditional methods of farming both with their livestock and olive culture.

The original inhabitants of the Mani were fiercely independent and known for their strength of both character and limb, and indeed it was from this region that the uprising was spawned which eventually rid Greece of several centuries of Turkish rule. The families were also very clannish and quick to take offence and often fought amongst themselves – so much so that many village houses had fortified towers into which warring families could retreat for as long as a feud lasted. Whilst these characteristics are still apparent in their descendents to us 'xenis', foreigners, the utmost hospitality – philoxenia – is shown and we feel welcome wherever we go.

When we first arrived in our village we could not help but notice that many caves in the limestone rocks were partly walled up and had been used as homes in the past. However, we failed to notice that several walled structures just in front of the caves were in fact rows and rows of stone beehives. Whilst searching for a supply of bees I found that one particular family, Marabeas, had a prominent display of honey in the local supermarket and using the information on the labels I was able to make contact with them. Within a few weeks I was accompanying Ioannis and his son and daughter-in-law, Vangelis and Irini, whilst they were working with their bees. When spring came they presented me with two nucs with newly mated queens. I also learned the fascinating history of how their family started beekeeping three centuries ago, and came face to face with one of the best examples of an historic apiary in the whole of Greece.

The Legend

Almost every antiquity in Greece has some story behind it, these beehives being no exception. The story is about an ancestor of the Marabeas family, a family in my adopted village who have been keeping bees, uninterrupted, for nearly three centuries. The story goes that in the middle of the 1700s, one of their ancestors left the village to walk over the two mountain passes to Kalamata. Some say that the man, a baker, was fleeing from the village to seek work in the town having just killed a family member Others, however, claim that he killed a Turk who had insulted him – for Maniot family honor demanded this of him. Whichever story is true, he was a fugitive from the law and he did what many in his position had done and would do in the future: he crossed the Peloponnese and made his way north east to the distant promontory beyond Thessalonika and sought refuge with the monks on Mount Athos. During his time in one of the monasteries he became a monk and also learned the mysteries of beekeeping. Yearning, however, for his homeland, the monk decided to return to the Mani hoping

that things had quietened down a bit and that he could settle there and keep bees. Tradition says he returned with 'bees in his hat' which is quite likely, especially if his hat at that time was the copious stove-pipe hat worn by the clergy, for it could easily have housed a small colony of bees. His return journey from Mount Athos to the Mani varies according to the teller One part of the Marabeas clan claim that he returned on a pirate ship, whilst the others say that it was an ordinary boat and, much to his fellow passengers' dismay, bees kept escaping from his hat and stung them so badly that they would jump into the sea to escape the stings. The passengers were more than relieved when the monk finally reached his destination and was unceremoniously dumped on the shore complete with bees. However, the monk was happy; he had reached his birthplace and made his way up the small ravine, where he set up home in a roomy cave. There he raised a family, built his beehives, created a small orchard of lemons, oranges and figs, sowed wheat and barley on the surrounding land, built a windmill, and kept a flock of sheep which were folded each night in the bottom floor of the cave, the family sleeping above them in a specially built loft. Of great importance, too, he founded and built a small family church on the top of the gorge which he dedicated to Agios Panteleimonas. Over the years the number of hives increased, and eventually they were so numerous that is possible to say that the hives are indisputably an early example of beekeeping on a commercial scale.

Ioannis at the back of his old hives. Leaning against the hives is the swarm catcher.

The beehives

Altogether 257 hives still exist in the gorge, most of them in excellent condition despite the fact that they have remained untouched for over 40 years. The first beehives, four of them, were built into the front wall of the cave and they were soon followed by a small wall consisting of two tiers, each with four hives. As the bees increased, further hives were built – the largest set made up of 55 x 3 (165) and another with 28 x 3 hives (94).

The hives are quite simply made – two stone uprights, a stone floor, a stone blocking the front with a small opening at its base, and a stone top. The back also is a piece of stone that can be removed when required. Except on the outside walls, adjoining hives share the same internal wall, and the floor of one is the roof of another Each wall of hives is covered with a tiled roof that slopes to the front. All the stone pieces used in construction are flat, rectangular and between 6cm(2.36") and 8cm(3.2") thick, and made from the local rock 'pourri', or a slightly harder material for which the English equivalent is 'marbleite' The internal measurements of the hives are: 55.5cm(21.8") deep x 21.5cm(8.46") wide x 25cm(9.8") high.

Managing the bees

Beekeeping using these types of hive was very simple. The colonies swarmed in Summer and were collected with a stick at the end of which was a woven straw receptacle in the shape of a cone. The bees were carried to the hives and thrown into the back of any empty ones, the stones at the rear then being sealed in place with cow-dung. Initially, the back stone was pushed half way down the hive to restrict the space, and only as the colony increased in size was it given more room. Ioannis Marabeas who worked these hives in the 1950s and 1960s, having started his

After the 1960s, like many beekeepers in Greece, most of the Marabeas family began to use Langstroth deeps both for brood and for supers. No queen excluders were used. Extra entrances have been made in the supers.

beekeeping life at the age of 15, told me that he had the job of looking out for and catching the swarms which meant a lot of clambering up and down the steep slopes of the ravines. He says that the swarms were placed into the hives as soon as they had clustered, but many of them absconded shortly afterwards – a phenomenon all beekeepers are aware of today when swarms are hived too early after leaving their nests.

Honey was extracted at the end of the Summer Before the hives were opened, a piece of dried cow-dung was put on a piece of tile and set on fire until it smoldered. The beekeeper then blew smoke into the rear of the hive when the back stone was being pried open, and from each colony a single comb was harvested using a long knife, the average yield being about one kilo(two pounds). Interestingly, the combs tended to be built at right angles to the hive entrance. No protective clothing was ever worn when working with the bees.

The harvested combs were carried into the caves behind the hives (where the bee-keepers and some of their families still spent the Summer 50 years ago) and the men squeezed the honey, by hand, into large pots. The women carried the heavy (25kg = 55 pounds) pots of honey up the ravine and into the villages where the honey was usually sold, exchanged for oil or other commodities, or distributed amongst the clan. The women were used to this heavy work for it was their job to carry water from the village down to the caves each day

If a villager wanted a colony of bees for their own use, the Marabeas family would make up a stock for them. The bees would be housed in a vertical, wooden hive with almost the same volume as the stone ones, the inside of the hive being 24cm(9.45") square and the vertical walls high. Halfway down the hive, wooden cross-sticks were wedged in place at right angles to each other to help support the combs. The roof was deep and fitted over the top of the hive and was sometimes given the extra protection of dried grass. The hive entrance was a small inverted 'v' at the bottom of the front wall. Normally, these hives were whitewashed on the outside.

The forage

The plants available to the bees all those years ago are not dissimilar with those growing in the area today From November until July, there is a succession of wild flowers which peak in variety and number between the months of November to May. Carob tree, almond, spurge, common sage, thyme, clovers and trefoils (originally sown for cattle fodder), oregano and the myriads of other flowers, as well as imported eucalyptus, all helped to give a good blend of local honey

The Present

Today all the members of the Marabeas family who keep bees use Langstoth hives. The Cecroprian bees they use are quiet on the combs, reluctant to sting, show little tendency to follow and have compact broodnests in the Winter months. However, they build up rapidly in Spring and need plenty of space otherwise they will swarm, so no queen excluder is used to restrict the broodnest. The transition to modern hives mainly began in the 1960s, but some of the family persisted in using the old stone hives. It took many years for these 'diehards' to realize the advantages which the Langstroth hives offered, not only a 20 30 fold increase in yields, but also in matters of swarm and disease control, and the chance to move the hives up the mountains to follow the flow. Those who still persisted in the old time practices eventually lost all their bees and went out of beekeeping.

Sadly, Vangelis and Irini's beekeeping is now on hold. With three children to bring up and get through college, the revenue from beekeeping just isn't sufficient to live on and they are both now involved in constructing housing for the increasing number of foreigners who wish to reside in this area. However, once a beekeeper, always a beekeeper, and in the future I look forward to supplying them with bees so that they can go back to a job that has given them both pleasure and satisfaction.

Whether or not Panteleimonas brought his bees from Mount Athos or not all those years ago, he nevertheless managed to lay the foundations for a long-running and successful commercial and sustainable enterprise using materials only available locally for his hives. The Marabeas family have a rich tradition extending back for nearly three centuries – a history which they all share and of which they can be justifiably proud. BC

John Phipps moved to Greece several years ago from the UK. He is the Editor of The Beekeepers' Quarterly, *and a sideline beekeeper.*

TURTLEBEE FARM

AGROTOURISM THAT WORKS

Alan Harman

It takes innovation to be a profitable farmer in 21st century America – simply producing a product and sending it to market just doesn't cut it.

As a result, Michigan beekeepers Tim and Kathie Bennett are taking agritourism to new levels on their 31-acre Turtlebee Farm, in Byron, 75 miles northwest of Detroit.

And this includes a somewhat radical idea.

"You know, you see farms with pick-your-own apples or strawberries, and our joke is we could have 'pick their own' honey," Tim says. "It could be pretty detrimental and mean a lot of liability, but it is no laughing matter any more.

"We are going to do it.

"We probably are doing it now with the students. But what we want to change is, if a family says, 'We want our own honey,' we want give them that option.

"We will dress up the family, we will go the hive, harvest the combs, bring them in, uncap and extract the honey, bottle it. We will have someone in the office printing a label for them. They can give the honey to their friends and relatives. It's their honey. They picked it. They harvested it."

Tim, 50, has come a long way after being a machinist for 25 years. He bought the farm 16 years ago, eventually quit the machinist's job and started beekeeping. He now has 400 colonies, but it was learn as you go.

Kathie says it all started with a home-schooling project for their family that now numbers nine children, ranging from Destiny aged six to Autumn aged 24.

"Tim was reading to the children from *The Hive and the Honey Bee*," she says of L.L. Langstroth's classic work. "The more he read, the more interesting it was. So we did it as a science project with the kids.

"We just continued. We started the beekeeping courses pretty much right at the beginning. We had such fun bringing people in and teaching them what we were learning – showing them how to get the honey "

Tim's radical thinking on farm development may have been influenced by a well-known source.

"I have enjoyed reading some of A.I. Root's earlier writings," he says. "He used the magazine (*Gleanings in Bee Culture*) as a soap box."

Tim says he started by hosting father and son groups, while his wife organized mother and daughter groups.

"It was just the coolest thing to show them the beehives," he says. "It grew from there."

Now Turtlebee Farm hosts some 300 to 400 students of all ages, some even from out of state, every year

They pay from $10 to $30 depending on age, or $75 for the family, to learn all aspects of the beekeeping operation and often complete their course by buying hives filled with bees.

"There is something of interest for everyone, and the classes are appropriate for all ages," Tim says.

Classes are conducted in a picturesque valley with students sitting on hay bales in an open-side tent, alongside a turtle-filled lake. On the other side of the lake, beehives are used for demonstrations and for the students to gain practical experience.

Tim says students come for three different reasons and about 80% are complete novices.

"Some of them come just because they want to see the nectar go from the flower to the little bear, the container," he says. "About a third come because they are afraid of bees and they want to get over their fears; they come closer to the bees."

The third group is made up of hobbyists who have a hive and have never gotten honey, or they have gotten honey but complain of being stung during the harvest.

"They are surprised to hear me say they don't have to get all stung up to take their honey off, or they are surprised to hear me say they don't have to put it all in the oven or microwave and melt it all down," Tim says. There's other ways they are ruining their honey "

Tim says his family style of operation – with his wife and nine children involved in the farm operation – attracts many students.

"Somehow the news has traveled," he says. "Parents bring their kids here and they are just elated to see their children liberated from the fear of bees. Maybe not completely, but certainly we have had a big part in tearing down those walls of fear "

"There are other beekeeping courses, but if people like the family style, they like the way we operate. We are not a high-tech school, and it's not just a guys-only type club."

Other people who attend the classes want to become beekeepers. They take the course and on graduation purchase beehives.

"We sell complete beehives," Tim says. "The Spring classes leave with an established beehive, a starter hive, right on the back of the SUV or minivan. Most of those who buy one hive end up coming back and getting more."

Tim says the secret to the classes is keeping them simple.

"Doing this for as many years as we have has really kept us at the novice level," he says. "Although we are master beekeepers and produce and retail our own honey, we are able

Students watch as Tim Bennett opens a hive.

to teach people at the level where they are at."

Marketing is a fulltime operation for the Bennetts. They spend Summer weekends at farmers' markets in their area and at county fairs as far away as Kalamazoo, 120 miles southwest of the farm.

"We do a lot of shows, such as the agricultural expo at Lansing," Tim, says. "We do arts fairs with beeswax candles, and we do home school events and other education exhibits."

Turtlebee Farm is also a destination for established beekeepers looking for supplies of package bees, nucs, queens and beekeeping equipment and supplies.

The farm is hidden in the byways of Michigan and navigation devices such as TomTom lead visitors to the wrong side of a closed country bridge.

"We don't advertise farm gate sales because we are so remote, but we do get a lot of repeat customers," Tim says.

He estimates he has some 4,000 customers on the farm's books and rewards them with a loyalty program.

"What we do is we have our shelf price," he says. "If somebody returns one of our label containers, we give them 10% off. If they come to the farm with one of our label containers, and we fill that container, they get 15% off.

One of Kathie Bennett's candle-making students.

"I would say probably close to half of our business is repeat. It is people waiting for their honey containers to be filled."

Tim is working to make the farm a customer destination in response to a state government program encouraging agritourism.

"Eventually, I want to be able to cut back on the traveling to fairs and markets and make the farm the destination," Tim says. "Instead of us going to farmers markets, people would come to the farm.

"If I had my way, it would happen next Spring," he adds with a laugh.

"We have some shows we have decided not to attend, and we're not doing indoor exhibits this fall because we need to give that time to the infrastructure here. We can't be distracted; we need to start cutting off some of that travel. We will still do some of the bigger shows but you can't do all that other stuff and be at the farm to produce."

The change in emphasis is because many of the farmers' markets are on Saturdays and the Bennetts know it will be a busy day at the farm.

"One of the reasons we think we can switch to a destination farm is because we have been doing all those events," Tim says. "Our dedicated customers will be happy to come to the farm."

Turtlebee Farm has the product to meet demand.

"I shoot for 50 to 100 pounds of honey a colony," Tim says. "Last Summer we averaged about 30 pounds in drought areas, but north of the farm we were getting 100 to 150 pounds a colony. We probably averaged 75 pounds, which at a commercial level is pretty good."

Other changes Tim envisages include running classes year round in a permanent facility he wants to build so he can handle the cold, snowy, Michigan Winters.

"In five to 10 years I see new extracting facilities, new permanent classroom facilities, indoor, as well as outdoors."

Another idea being considered is having customers pay to keep their hives at Turtlebee Farm, in effect paying rent for a piece of land for their own hive.

"That is a possibility," Tim says. "because we would be a destination farm. That's community-supported agriculture, which is kind of where we are heading.

"Where somebody is not only going to get their honey from us but also get their milk and other foodstuffs from us.

"We have our Jerseys and they would be buying into a cow share. We have our beef, we have our lamb, and we have our pork. Right now we retail all that to our customers.

The farm carries 73 head of beef, 50 head of sheep and about 30 pigs raised twice a year The meat is all custom-butchered two miles down the road at a USDA-certified abattoir

The farm operates to organic principles but is not registered as such.

"We can go organic certified whenever we want, but we looked at the economics in Michigan right now and we got cold feet," Tim says.

"People are going to get the same product. It costs money to go organic. We have organic standard products, but if we become certified we have to raise the prices.

"We really feel right now, looking across the board, we are going to lose more business than we gain. But I can see that changing if we become a destination farm."

The Bennetts over Winter their bees and last Winter lost about 25%.

"I have been keeping bees for 16 years and my losses have never changed," Tim says.

One thing that also won't change is his desire to be a family farmer

"I was a machinist for 25 years and with a company for 20 years that worked me seven days a week, 12 to 14 hours a day," he says. "I said enough. I was being taken from my family

"We can farm as a family We will continue doing what we are doing. We are showing profitability " BC

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Alan Harman is a frequent contributor to these pages.

HERBAL REMEDIES

Plants Good For Bees & People

Abbas Edun

Herbal medicines are those which are derived from the roots, stems, leaves, flowers and fruits of plants.

This first of several articles deals mainly with the history of herbal remedies. The articles which follow in the next few months will introduce you to plants not only having useful, medicinal value to people and other animals, but that are also beneficial to honey bees because they yield nectar, pollen or propolis.

Herbal medicines are those which are derived from the roots, stems, leaves, flowers and fruits of plants. They are used for the purpose of dealing with an imbalance in health, of preventing and treating illness and alleviating discomfort due to an assortment of disorders.

Evidence-based medicine (EBM) seeks to apply evidence gained by scientific methods to certain portions of medical practice. Its aim is to assess the quality of evidence relevant to the benefits and risks of treatment or the lack of it.

History

Man has been gathering indigenous plants not only for food, but also to cure illness and injury for thousands of years. Anthropologists speculate that our propensity to collect medicinal plants evolved from the behavior of wild animals. They developed a tendency to search for secondary metabolites, the bitter parts of plants, when they were not feeling well. With the passing of time, by trial and error, the foundation for herbal medicine would naturally have been laid by our early tribal ancestors. The ratio of risk to benefit favored the latter and other animals that were willing to experiment when they were ill. As the time-honored base of empirical knowledge became wider over the years, the specialized role of the herbalist developed. The process would likely have taken place in varying ways in a wide range of cultures.

There is evidence which suggests that the Neanderthals, living 60,000 years ago, used medicinal plants. A body that was excavated from the Shanidar Cave in Kurdistan was buried with the following eight species of plants: bachelor's button, cornflower, grape hyacinth, groundsel, hollyhock, woody horsetail, St. Barnaby's thistle and yarrow. They were identified in soil which was gathered for pollen analysis. Research revealed that they may have been chosen because of their considerable therapeutic effects. Their curative powers as astringents, diuretics and stimulants as well as anti-inflammatory properties have long been known.

The first generally accepted use of plants as healing agents was depicted in the cave paintings discovered at Lascaux in southwestern France. They have been radiocarbon-dated at between 13,000 and 25,000 B.C.

Medicinal herbs were found in the personal effects of Ötzi the Iceman, the well-preserved natural mummy of a 40-year old. His body was frozen in snow and ice from about 3300 B.C. It appears as if they were used to treat parasites in Otzi's intestines and that he used natural laxatives and antibiotics. He was found by two German tourists from Nuremberg, on September 19, 1991 in the Schnalstal glacier, near Hauslabjoch on the border between Austria and Italy He is Europe's oldest human mummy, and has offered an unprecedented view of its inhabitants in the Chalcolithic (Copper) Age.

Written records show that herbal medicines were used by the Sumerians over 5,000 years ago. Well-established uses for plants such as caraway, laurel and thyme were found by archeologists on clay tablets.

The Chinese have been using plants as medicine for centuries. Their first herbal, dating from about 2700 B.C., lists 365 plants and their uses, including ma-Huang, the shrub that introduced the drug ephedrine to modern medicine.

Medicinal plants were used by the ancient Greeks and Romans. Their practices, as preserved in the writings of Hippocrates and Galen, provided the basis for later western medicine. The former advocated the use of a few simple herbal drugs, as well as fresh air, rest, and proper diet. Galen, on the other hand, recommended large doses of drug mixtures, including ingredients from plant, animal, and mineral sources.

Pedanius Dioscorides, a Greek physician, compiled the first European treatise on the properties and uses of medicinal plants, entitled *de materia medica libri quinque* (concerning medical matter in five volumes). This famous compendium of the first century A.D., covered about 500 plants plus a number of therapeutically useful animal and mineral products. It remained an authoritative reference well into the 17th century Also important for herbalists and botanists of later centuries was the Greek Historia Plantarum that founded the science of botany It was written in the fourth century B.C. by Theophrastus.

Written records show that herbal medicines were used by the Sumerians over 5,000 years ago. Well-established uses for plants such as caraway, laurel and thyme were found by archeologists on clay tablets.

The uses of medicinal plants changed little during the Middle Ages. Many Greek and Roman writings on that and other subjects were diligently preserved by scribes.

They prepared holographs in monasteries which tended to become local centers of medical knowledge, their gardens providing herbs for the treatment of common disorders. At the same time, folk medicine in the home continued uninterrupted, supporting numerous itinerant and stationary herbalists. Among these were the "wise-women," who prescribed herbal remedies, sometimes with incantations and chanting. In the later Middle Ages those who were knowledgeable in herb lore became the targets of the witch hysteria. Hildegard von Bingen, was a famous 12th century Benedictine nun who wrote a medical text called *Causes and Cures*.

In the 11th century medical schools began to teach Galen's system. At that time, the Arabs were more advanced in science than the Europeans. As a trading nation, the former had access to plant material from China and India. Medical texts and translations of the classics of olden days arrived both from the east and west. Muslim botanists and physicians significantly expanded on the earlier knowledge of herbal medicine. Abu al-Abbas al-Nabati, a 13th century Andalusian botanist, introduced empirical techniques in the description, identification and testing of numerous native plants of Spain. He segregated reports supported by actual tests and observations from those which were not verified. This allowed the study of herbal medicine to evolve into the science of pharmacology *The Canon of Medicine*, Avicenna's distinguished work of 1025 is considered the first pharmacopoeia. It is a standard medical text in many Islamic and European universities.

Herbal medicine and the university system continued to flourish concurrently In the centuries following the Middle Ages, the continuing importance of herbs was made manifest by the hundreds of herbals published after the invention of printing by Gutenberg around 1439.

The golden age of herbals was between the 15th and 17th centuries. Many of them were, for the first time, available in languages other than Greek or Latin. The most notable one was *The English Physitian* by Nicholas Culpeper in 1654. Although he was ridiculed by his fellow physicians for intermixing traditional medicine with astrology, legends and magic, his book nevertheless enjoyed remarkable popularity. The Age of Exploration and the Columbian Exchange introduced new medicinal plants to the Europeans.

A slow deterioration in the preeminent position held by plants as sources of therapeutic remedies was seen in the second millennium. This started with the introduction of (a) the physician and (b) active chemical drugs, and was followed by the rapid development of physical sciences such as chemistry. It led, more and more, to the dominance of EBM or "scientific" medicine, as it has come to be known in the last hundred years, as the orthodox system of the 20th century.

The role of herbal remedies in modern society

The use of indigenous plants to cure illness is almost universal in non-industrialized countries. At the end of the 20th century a number of traditions were dominant in the use of herbal medicine: the practices of the Greek and Romans, the Siddha, Ayurvedic and Unani-Tibb medicine systems, Chinese herbology and Shamanic Herbalism.

Of the pharmaceuticals now available to doctors, many have a long history of use as herbal remedies; examples are aspirin, digitalis, opium and quinine. The World Health Organization (WHO) estimates that medicinal plants are now being used by 4/5 of the world's population, half of which lives on less than $2 U.S. per day; pharmaceuticals are prohibitively expensive. Herbal medicines can, however, be grown from seed or harvested at little or no cost.

The search for, and use of, dietary supplements and drugs derived from plants have been expedited in recent years. Botanists, chemists, microbiologists and pharmacologists are expanding their ideas of how we can be healed, and are looking everywhere for plants that can be used in the manufacture of pharmaceuticals for the treatment of various diseases. According to WHO, approximately a quarter of the modern drugs being used in the United States are derivatives of plants.

Of the plants that provide active ingredients for prescription drugs, 75% came to the attention of researchers because of their use in herbal medicine. About 120 active compounds have been currently isolated from plants and are widely used in EBM; 80% of them show a positive correlation between the traditional use of the plants from which they are derived and their modern therapeutic use.

At least 35,000 of all the plants in the world are estimated to have medicinal value.

More than two thirds of them come from developing countries. And, 7,000, or more, of the medical compounds to be found in a modern pharmacopoeia are derived from plants.

The biological background

As part of their normal metabolism, all plants produce chemical compounds which include primary metabolites, such as sugars and fats. Secondary metabolites are often restricted to a narrow set of species within a phylogenetic group. Primary metabolites are directly involved in the development, normal growth and reproduction of organisms. Secondary metabolites are organic compounds that are not directly involved in those processes, but usually have various important ecological func-

tions: pheromones are used to attract insects for pollination, while alkaloids serve as defense mechanisms against predation by herbivores, insects, and microorganisms. Plants regulate their biochemical paths in response to the local mix of predators. The chemical profile of a single plant may vary with the passing of time as it reacts to changing conditions. It is the secondary metabolites and pigments which can have therapeutic actions in humans and which can be refined to produce drugs.

Use of herbals or pharmaceuticals

Herbalism is a diverse field and few generalizations are of universal application, nevertheless a rough consensus can be inferred. Many herbalists concede that pharmaceuticals are more effective in emergencies where time is important, for example, where a patient has elevated blood pressure that posed a threat of imminent danger However, they claim that, on the whole, herbs may help the patient to resist disease and also provide nutritional and immunological support lacking in pharmaceuticals. Their goal is prevention as well as cure.

Herbalists are inclined to use extracts from parts of plants, such as the roots, stems, leaves, flowers or fruits, but the trend is not to isolate particular phytochemicals.

Herbs may help people resist disease and provide nutritional and immunological support lacking in pharmaceuticals.

They reject the notion of a single active ingredient. Pharmaceutical medicine, however, prefers individual ingredients because dosage can be more easily quantified. They assert that various phytochemicals present in many herbs will interact to augment the therapeutic effects of the herb and weaken toxicity Furthermore, they argue that a lone ingredient may contribute to multiple effects. Herbalists maintain that herbal synergism cannot be reproduced by using synthetic chemicals. They argue that trace constituents and phytochemicals acting on one another may alter the response to the drug in ways that cannot currently be duplicated by combining a few hypothetical active ingredients. Persons in the pharmaceutical industry who are engaged in research recognize the concept of synergism but state that clinical trials may be needed to investigate the efficacy of particular herbal preparations, provided the formulation of that herb does not change. BC

References and additional information for this series of articles will appear on our web page www.Beeculture.com after the article appears in this Journal. Look for it soon.

Abbas Edun has been keeping bees in Ontario, Canada since 1979.

Grin & Bear It . . .

There's more than one way to beat a bear

Ross Conrad

Few honey bee predators can elicit a level of fear and trepidation in a beekeeper as much as a bear Be it black, brown or of the grizzly variety, a bear can reduce a tall, well-organized, proud hive into a chaotic mess of splintered wood, mangled combs, and dead bees very quickly. In general, bears live in wooded areas and tend not to wander around too much in open fields, especially where there is a lot of human activity. Bear problems can be especially acute during Autumn when bears in northern climates are feeding heavily in preparation for Winter hibernation.

One of the earliest forms of protecting an apiary from bears was to use a physical enclosure of some kind, such as a stone wall. The inside of the wall would contain recessed areas, in which woven skep hives (also called "bee boles") could be placed. Today, permanent fences, such as those made of chain link fencing, may enclose an apiary in order to provide bear protection. A common alternative popular in our modern society and for those looking for a movable, or temporary solution, is the electric fence. Photo voltaic technology allows self-charging solar-electric fences to be set up in hard to reach remote locations. Some beekeepers recommend hanging a slice of bacon from one of the hot wires so that when a bear first approaches the fence, they will tend to reach out and touch the bacon with either their nose or their tongue. The idea being that by initially touching the electric fence with one of these two sensitive and wet parts of its anatomy, the resulting shock will be painful enough to prevent the bear from continuing to harbor any curiosity about what is beyond the fence.

A less pricey, low-tech approach involves creating a bed of sharp thorns that deters a hungry bear in much the same way that is recommended for use against skunks. Pieces of plywood containing nails or screws long enough to protrude between one-half and one inch and embedded on one side of the board at two- to three-inch intervals create a powerful, low-cost, low-maintenance deterrent when compared to an electric fence. The boards should be large and placed all around the hive so that a curious bear will not miss them when approaching from any direction. I have also heard of some beekeepers using carpet remnants in place of plywood. Although carpeting has the advantage of not warping like wood does, care must be taken to use thick enough carpeting to hold the nails or screws with enough rigidity that they will not be easily pushed over

New York beekeeper Chris Harp told me a story about a fellow beekeeper who had moved some hives into an apiary but was in a hurry, so he did not take the time to remove the moving straps that were around each hive. Before he had a chance to return and remove the straps, a bear visited his beeyard. In an attempt to gain access to the delectable delights stored within the hives, the bear pushed the colonies over However, because they were strapped, the supers did not separate and the hives did not break open when they hit the ground. As a result, the bear was not able to easily gain access to the combs so it left the hives alone. The beekeeper simply returned the hives to their stands and realizing their value as a bear deterrent left the straps on. Sometime later after one of the first light snow falls of the season had covered the ground, the beekeeper was visiting the yard and noticed bear tracks that went right through his apiary but none of the hives had been touched. Apparently the bear remembered his previous unsuccessful attempt to ransack the hives and had simply walked by them leaving them unmolested.

I recently had the chance to test the idea of using straps as a bear deterrent on some bees that were moved up into the Green Mountain National Forest wilderness areas Northeast of Middlebury, Vermont. A bear was known to be active in the area raiding peoples bird feeders. Sure enough, within two weeks something visited my apiary and knocked over boxes of bees, but because they were strapped, no damage was done! In order to avoid having my straps accidentally torn or cut by a bear's sharp teeth or claws, I used metal straps based on the kind that beekeepers in Australia often use. Australian beekeepers tend to move their hives around a

In wooded and mountainous regions, a solar electric fence tends to be the remedy of choice for keeping bears at bay.

This galvenized strap sold by Mann Lake beekeeping supply is easy to take on and off and rugged enough to withstand the elements when left on the hive year round.

The strapping holding these hives together was enough to prevent them from being destroyed by bears despite repeated bear visits to this beeyard.

lot following the various nectar flows and they will leave such straps on their hives year around, a testament to their durability and functionality Use of such strapping against bears can save you hundreds of dollars, and lots of time over using fences or bear boards.

Once a bear has gotten a taste of the honey and brood combs that sit in your hives, or for some other reason becomes very determined, it is practically impossible to keep them out no matter what type of bear protection you utilize. Strapping hives, like all the other options for bear protection, is not without its potential weaknesses and points of failure. Even when using metal straps which can hold up to a bear's sharp claws, a bear could conceivably catch the cam lock buckle with a claw by accident while mauling the colony and loosen the strap. A really determined bear is also strong enough to simply rip the sides of the hive bodies apart in order to gain access if he or she chose to. If the hive is outfitted with a screened bottom board that is open to the ground the bear could easily rip the wire mesh out and reach up inside of the hive.

The biggest weakness of bear boards is that they tend to warp. This makes it easier for a crafty bear to catch the edge of a board with its paw and turn it over, or shove it out of the way Pushing the bear boards up flush against the hive stand, or adjacent boards and staking them around the edges with wooden sticks or tent stakes can help prevent this. Just don't forget to move the boards when you want to work the bees!

Fences, being one of the most common and expensive forms of bear control, are notorious for failing. Determined bears will dig under them, climb over them, jump over them (from an overhanging tree limb), or even go through them. One Vermont beekeeper even told me of a video that caught a bear backing into an electric fence in order to push through the fence without exposing its sensitive head and face to the hot wires. Electric fences also tend to require periodic maintenance in order to keep the battery charged and prevent vegetation from grounding out the hot wires. Some beekeepers who rely on a chain link fence, and have a relatively small yard to enclose, will cover the top with fencing along with the sides and even bury the fence two to three feet deep in order to reduce the chances of a bear climbing over or digging under the fence.

To help prevent drawbacks of the above approaches from providing you with a single point of failure, you may want to combine two, or all three of the above. This way one approach acts as the back-up system for another should a bear figure out how to get around one of them.

One alternative to all these approaches is to shoot the bear This remedy is typically applied after the bear has already visited one or more times and reeked havoc and is not without its drawbacks. Shooting a bear that is attacking your hives may not be legal in all states. Be prepared to stay up all night waiting for the bear to show up, IF it decides to make an appearance. Unfortunately, killing an offending bear only works until the next bear comes along. Bears don't understand human inventions such as property rights and boundaries One could argue that sentencing a bear to death simply for wandering around exploring its world and munching on all the good things it finds to eat along the way, just as bears have always done for thousands of years is extreme and unjust.

An alternative enclosure that some beekeepers use is to house bees inside a structure of some type. "Bee Houses" have included old barns, trailers with structures built on top of them, and old buses and vans that have the seats removed in order to make room for the hives. If you can get an old junker cheap (or free if you are willing to tow it away for the owner), this has the potential to be one of the least expensive and most bear proof of all the options with one exception moving the bees out of bear territory Of course bear territories may change along with the changing climate conditions.

Moving bees is much easier than moving the bear which typically requires that the bear be trapped and/or tranquilized. This typically involves the local Fish and Game Department and is probably the most expensive option. Should your colonies be destroyed by bear despite your best efforts, some states will offer partial or full compensation to cover the loss. Check with your state bee inspector or Fish and Game Department for the situation in your region. Some states require that bees be registered in order to be covered by such a program. After all, dealing with bears is like dealing with bees: There are no guarantees! BC

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Bee Crafty

Nancy Tozier Sieling

BeeMovie and Colony Collapse Disorder have brought bees and beekeeping into the limelight. Enter a gift shop, and you will find gift items, note cards, mugs, and clothing sprinkled with fanciful honey bees. Take advantage of this surge in popularity to showcase the honey bee in your own work. To remind your friends, neighbors and customers that honey bees are important, dress up your honey jars for gift giving or as a value added sale item. Fill your hand made gift bag with products of the hive – a honey bear, honey sticks, baked goods made with honey, or your own beeswax candles. Personalized cards and gift tags are always a hit, and afford you another opportunity to remind everyone where to get their honey. Try these projects with your children or grandchildren. Make beekeeping a family activity, even when all is quiet in the bee yard.

Honey Jar Covers

Supplies needed:
¼ yard honey bee themed fabric
Jute
Beads
Pinking shears
6" or 7" Plate or bowl for circle pattern

Iron fabric. Place a bowl or plate on back side of fabric and trace around it with a pencil or pen. Use a 6" circle to make a cover for a standard 2-lb honey jar and a 7" circle for a standard 5-lb jar Cut out the fabric circle with pinking shears. A ¼ yard piece of fabric will yield seven jar covers.

For a 2-lb jar, cut a piece of jute 28" long. Tie a knot in one end 1" from the end. Untwist the end fibers and trim lightly to create a fringed end. Moisten the other end with water or spray starch and twist jute to form a point. Thread two beads onto the jute. Push the first one all the way down to the knot. Repeat knot and fringe process on the other end. Push the second bead up against the second knot.

Lay the fabric cover on top of the jar, center it, and smooth it down over the lid. Loosely tie the beaded jute in a loop slightly larger than the jar lid and slide it down over the fabric. Tighten it, and tie in a bow.

Use the pinking shears to cut a 7" circle for the 5-lb jar Cut three 30" long pieces of jute. Tie them together 1" from one end. Braid the jute from the knot all the way to the other end. Moisten and twist ends together and slide two beads onto the braid, pushing one all the way down to the knot. Knot the second side 1" from the end, and push the second bead up against the knot. Unbraid and unravel both tails, and trim if necessary. Complete project the same way you would a 6" jar cover, ending with a knot instead of a bow.

- Look for bee themed fabrics at discount and fabric stores in the calico, quilting, and novelty fabric departments.
- Choose beads designed for use with jute or macramé cord rather than jewelry. Jewelry beads have tiny center holes that are too small for the jute to pass through.

Gift Bag

Supplies needed:
Brown paper lunch sack
Colored paper scraps
Card stock or cardboard
Craft ribbon
Paper punch
Jute
Craft glue or rubber cement

Cut two pieces of cardboard or card stock 1"X 4-7/8" and one piece 3"X 4-7/8"

Fold down one inch of the top of the bag to the inside, then fold it down again. Sharply crease the folds. Unfold, and glue the two 1" pieces of card stock to the upper inside edge of the bag, one in the front and one in the back. Fold down the edge of the bag over the card stock to the inside, all the way around. Run a bead of glue around the new inside upper edge and fold down again, creasing firmly Set it aside to dry for a few minutes. Punch two holes 1" down and 1" in from the sides of the front of the bag. Cut two pieces of jute 15" long. Thread a piece of jute through the holes on bag front from outside to inside and knot. Be sure your knot is large enough that it does not slide through the hole; double if necessary Trim off excess. Repeat for bag back. Place the 3" wide piece of card stock on the bottom of the bag for strength and stability.

Use paper and ribbon to decorate your bag. Cut paper shapes and pieces of ribbon with a paper cutter or scissors and glue to the bag. Experiment with novelty scissors that cut edge patterns to make your own paper trims. To make little honey bees, Dab a circle of yellow craft paint on the bag with a stencil brush or q-tip wherever you want a bee. Once the paint has dried, use a fine tip marker to add stripes, head and stinger. Allow bag to dry thoroughly before use.

Potpourri candle

Supplies needed:
Glass candle holder, 3½" X 6"
Potpourri
3" beeswax candle

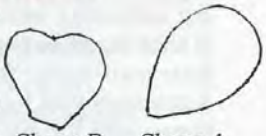
Place a portion of the potpourri in the bottom of the glass jar Set the beeswax candle firmly on top of it. About 1" of the candle should extend above the top of the glass. Add small pieces of potpourri to the jar between the candle and the glass until the lower third of the candle is covered.

Note and Gift Cards

Supplies needed.
Card stock
Colored paper
Ribbons and trims
Bee themed fabric scraps
Scissors and paper punches
Fine tip marker
Paper cutter (optional, but helpful)
Craft glue or rubber cement

To make standard sized note cards, cut a piece of card stock in half horizontally, creating two pieces that are 8½" X 5¼", or purchase blank note cards.

Gift cards can be any size you choose. Decorate with contrasting papers cut in strips or punched shapes. Use sections or individual items cut from honey bee fabric, as well as ribbons and trims. Add tiny details and personalized messages with a fine tipped, permanent marker To make tiny bees, cut shape A (body) from yellow card stock and shape B (wings) from translucent paper Layer body over wing segment and glue in place. Once the glue is dry, outline the body and wings with a fine tipped marker Add stripes, stinger, head and wing details.


Shape B *Shape A*

Add your personal touch to these projects. Choose colors that express your taste and style. Make jar covers that match your honey labels. The possibilities are endless. BC

Nancy Sieling creates bee crafts from her home in Bath, NY She is an occasional contributor to these pages.

-Scrap booking paper works well for this. Many fabric, craft, and general merchandise stores carry open stock paper in a wide variety of colors and designs.
-Scrap booking equipment such as specialized scissors and paper punches can also be used to help create your own unique designs.

How Many Eggs *Can* A Queen Lay?

Walt Wright

The queen is often given credit for preferences she doesn't have and judgments she doesn't make.

The word "can" is emphasized in the title of this submission. There are two kinds of "can." The rate of eggs per day is one kind, and the total eggs the queen is able to produce in her lifetime is the other We'll touch on both.

Those of you familiar with my normal output will know that I am not shy about challenging "conventional wisdom" that is not supported by my personal observations. This submittal is no exception. Brace yourself for a discussion of the subject that strays from what you learned early in your beekeeping training. If you are certain that what you "know" is accurate, just flip the page, and enjoy the rest of the magazine.

We'll start with what the experts tell us. Two "facts" that are challenged herein are that the maximum queen laying rates range from 1000 to 2000 eggs per day and that a single, deep hive body is all the room a queen needs to lay in. Those two facts will be treated in that order in this discussion. Rate first and volume second. Although rate and required volume are interrelated, we'll try to separate the two. Life time capacity is discussed later

The highest rate of eggs per day that I have seen in the literature is about 2000. Most literature rates are somewhat less. In a recent article by Larry Conner, the rate per day that he used was 1400. C.L. Farrar[1] used 1600. In my opinion, these numbers are well below the actual rate per day that a quality queen *can* produce. It is not the intent of this submittal to promote my colony management approach, but application of that system suggests that standard management does not use the queen to capacity My management system induces annual supersedure. In contrast, colonies managed by standard procedures often are headed by the same queen for three years. This disparity gives rise to the obvious question – Why? In the past, automatic supersedure was reported with no reasons given. I try to report what I see. If a reason is not obvious, I try not to guess.

Before we get into the numbers game, let me identify a few other unpopular opinions growing out of observations of my management system. These opinions are not found anywhere else, but significantly affect queen laying rates.

The queen is often given credit for preferences she doesn't have and judgments she doesn't make. Her daughters make the judgments on where and when eggs are needed. They, the workers, know which cells have been prepared for eggs. When the workers have need of the queen's services, they round her up (literally) wherever she is meandering and escort her to the area that is ready for eggs. Then the steering committee (court) fawns over her to induce laying. This opinion is supported by the fact that sometimes the queen can be found lumbering over empty brood comb with no interest in laying and no "court"

The workers also determine area and its location of the active rearing cells of the brood nest. The space allocated to active brood rearing is controlled with a built-in safety margin in the volume of the brood nest that can be protected. For example, the late Spring freeze seldom causes any loss to brood chilling. Their safety margin in cluster size versus brood volume normally protects the brood.

Keep in mind that the brood nest size stays in a state of change for the entire active season from start up in mid Winter to close out in late Fall. The changes are slow and may not be obvious to the casual beekeeper, but the changes reflect the colony objectives with the passing season. Briefly: early – build population to support reproduction by colony division; mid season – reduce population to limit erosion of accumulated stores; early Fall – build a population of young bees for wintering; late Fall – close out brood to conserve stores in early Winter

One last observation that I expect to be unanimously rejected is that the colony adjusts the population to be proportional to stores and hive total volume. Adjustment of population is accomplished by regulation of brood nest volume. This population control can be seen in the relative cluster size going into Winter in northerly locations versus my area. Where successful wintering requires three deeps for wintering the early Winter cluster is much larger than in my area where a story and a half is sufficient. Think about it for a minute. If the colony failed to maintain population in balance with stores what would happen? Overpopulation would be suicidal – too much consumption would lead to starvation. Too little population would

[1]Dr. C.L. Farrar was the Research Leader at the USDA Honey Bee Research Lab in Madison, Wisconsin in th 1970s.

"Call me a liar if it suits your purposes, but I am certain that I have seen brood volumes that would require a queen to lay at least 3000 eggs per day.

lead to slow build up, and the colony would fail to meet reproduction requirements in a timely manner. They need to maintain a supply of foragers to take advantage of any field sources that become available. Additionally, all the population need to be on the inside before the advent of severe cold weather

I suspect the skill for population control is a result of their natural habitat. All tree hollows are not the same volume. The bees are adapted to using the total volume and regulating population and stores in proportion. Enough of my personal opinions! Let's push on.

This season (08) two swarms were collected from hives checkerboarded in early March. These hives were sold to a beginning beekeeper in the winter, and I showed him how to open up the overhead honey for swarm prevention on March 1. He failed to meet the second requirement of swarm prevention by not maintaining space at the top for colonies to grow into. Expecting them to swarm, three trips were made to that location on prime swarm issue days to see what happened. Two oversized swarms were collected and relocated closer to home. It's what happened to the two swarms in the establishment process that is relevant to the subject of this submittal. Not ever having collected a swarm from a checkerboarded hive, I followed their establishment progress with interest.

Both these swarms were large – a product of the increased brood volume of my management approach. Housed on foundation, they covered more than four frames. A normal feral swarm covers two to three. Geared for establishment, with a good flow on, they were not fed. At the end of a month, both had nearly filled their deep with drawn comb. At that one-month inspection, both colonies showed queen failure with a spotty brood pattern. They also showed they were on top of the problem – both had started supersedure cells. While it is normal for a natural swarm to supersede the old queen later in the establishment process as a precautionary measure, this was a little early in the process. And both were identical in cause and effect. This caused the old man to wonder if perhaps the increased brood volume of my system pushed the queen to her lifetime limit of egg production. Two other observations came to mind. In other seasons, occasionally a colony started supersedure well before the others, and generally, slower or weaker colonies did not start supersedure as soon as the strongest. Collectively these observations suggest that the total lifetime egg production of the queen may be approached in one season when checkerboarded. Time to do the arithmetic.

First order of business – get an accurate count of cells per frame. I was surprised at the numbers of cells imprinted on an installed sheet of foundation. I use deeps for the basic wintering brood nest and shallows for the Spring brood nest expansion. The count yields slightly more than 3500 cells per side or 7000 cells per deep frame. A shallow frame is almost exactly half that. Wow!

Before we get too far into this, let me quote Dr Farrar's reference to queen laying rates. He was an astute investigator, and I'm inclined to trust his judgment.

"Good queens seldom lay more than 1,600 eggs per day" (Part I)

"A prolific queen will require the equivalent of from 12 to 18 standard combs, depending upon the amount of honey and pollen in the hive even though theoretically all of her brood could be contained in five to six combs." (Part II)

Elsewhere in his eight-part article he used 24 days as a brood cycle. This allows a few days for cell cleaning after emergence and preparation of the cell for eggs to start the next cycle. We'll use his number for a brood cycle. Note that with the stroke of a pen, he debunked the notion that a single deep hive body is sufficient room for a queen to lay at her max rates.

If we integrate quote I and II above, we could conclude that most of his brood nest is contained in two deeps. He refers to his management system as an "unrestricted" brood nest. He maintained a larger brood nest by periodic hive body reversal to offset the natural brood nest reduction of swarm preps.

I also refer to the brood nest of checkerboarded colonies as unrestricted, but it is quite different. When checkerboarded prior to the swarm prep period the colony does not start the brood nest reduction of swarm preps. They continue brood nest expansion through the swarm prep period. My target brood volume is 2½ deeps of brood, but I often see more than the equivalent (in shallows) of three deeps of brood. That is a huge difference in population to work the flow. As Dr. Farrar points out, the key to maximizing production is colony population.

Back to the numbers game: To avoid boring you with an overdose of calculations, let me try to summarize. The numbers provided by Dr. Farrar are supported by my three-dollar calculator and observations of the brood nest size in double deeps. With 7000 cells per frame (wall to wall) it would take 4.3 + days for the queen laying 1600 eggs per day to fill a frame. With 24 days to make the circuit, she could recycle brood in roughly 5½ frames at that rate. It is important to keep in mind that the brood nest expansion into overhead honey in the Spring is dome shaped. The upper deep brood volume seldom exceeds half the available cells of the brood frames. When periodically reversed the natural brood nest reduction is offset during the swarm prep period and that technique does increase population for the flow. It also reduces swarming by not letting the brood nest decrease to the point of starting swarm cells. The brood volume is maintained at about a deep and a half through the reversal period, but contracts sharply after the last reversal. Dr. Farrar reversed hive bodies into the main flow to insure population through the flow.

The checkerboarded colony not only has more brood volume during the buildup but they are also slow to reduce the brood volume into the main flow. They seem to enjoy operating with a position of strength and accumulate much more honey than they need.

But this is about queen laying rates. I'm not an investigating scientist and have not accumulated definitive data on brood volumes. As noted above brood volumes of the equivalent of three hive bodies are seen routinely. Using a nine frame brood chamber, normally, the five center frames are used for brood. Another factor to consider is that as the brood nest grows upward through shallow supers the expansion dome is often in the top shallow super Intermediate shallows are often wall to

wall shallow frames of brood in five frames. Five shallow frames of wall to wall brood is approximately 3500x5 or 17,500. It would take a queen laying at a rate of 1600 eggs per day almost 11 days to recycle brood in that single shallow. She could recycle brood in two such shallows in the circuit time, but what about the other shallows and the basic deep? My target brood volume of 2½ deeps translates to a deep and three shallows. Often the brood volume is more than that – up to two shallows more (a deep and five shallows.) Recycling that volume at 1600 eggs per day is not possible.

Call me a liar if it suits your purposes, but I am certain I have seen brood volumes that would require a queen to lay at least 3000 eggs per day. Inspection of those oversized brood nests indicated the queen was keeping up with the demand. Perhaps the capability of the queen to exceed normal requirements is just another safety margin as are built into all survival traits of our bees.

If I were going to investigate maximum queen laying rates, I would check the rates of the new supersedure queen. Depending on how early in the supersedure process the old queen is terminated, substantial empty brood cells accumulate. The colony superseding will hold essentially the whole brood nest open pending the maturing of the supersedure queen to egg laying capability The supersedure queen, playing catch up, can exceed the 3000 rate. She might start slowly, but in a few days she can move out, smartly. The enterprising post-grad student could pick up this gauntlet and slap me about the head and shoulders with it. If he proved my observations are valid, he could make a name for himself.

With the normal ups and downs of seasonal brood volumes, it is difficult to estimate the total eggs laid in one season, or the difference between standard management and nectar management.

At this point, I'll withhold judgment on whether or not early supersedure of the two swarms described above was caused by the queens running out of lifetime capacity. I have no way to evaluate the amount of sperm stored by the well-mated queen. Seems I've seen a million plus in the literature. A rough count of local brood volume for the season, when checkerboarded, doesn't reach those numbers, but I'm not dismissing it as a possibility

For nine months of the year the CBed colony brood volumes are similar to the reversed double deep. The extreme differences are primarily seen during the swarm prep through early main flow. That period spans the prime swarm issue season. Checker Boarding accelerates brood nest expansion and induces continued expansion until three weeks prior to "main flow." But even twice the brood volume at the peak doesn't seem like a big impact on the season-long total. That certainly would not explain the longevity of the queens with standard management.

Supersedure, when CBed, does occur in that peak demand period, or shortly thereafter It is possible that the colony decision makers perceive the strain on the queen in keeping up with demand and opt to supersede. We'll leave it to the experts to determine if they ever get around to caring about honey production again.

This submittal shouldn't be construed as an attack on the concepts of Dr Farrar He was on our side, and his investigations and recommendations were oriented to increasing honey production. In retrospect, I think he shaped my thinking on honey production. I highly recommend his eight-part discussion of the details for anyone interested in making more production per colony *American Bee Journal* republished his 1973 series starting with the January 1993 issue – Title: Productive Management of Honey – Bee Colonies. BC

Walt Wright is a student of honey bee biology, and a sideline beekeeper, living in Elkton, TN.

Vines For Bees

Connie Krochmal

Clematis virginiana

Vines are valuable plants for the bee garden. Depending on the species, these can be woody or herbaceous.

Most vines need a support, such as a trellis. Don't allow them to strangle trees and shrubs. Vines can be grown as ground covers.

Among the suitable vines for bees are the following.

American bittersweet (*Celastrus scandens*)

Also known as waxwork and shrubby bittersweet, this species is native to the East. Its range extends westward to New Mexico. Avoid growing the introduced types as they're invasive in a number of states.

American bittersweet is a vigorous, deciduous, twining vine that reaches 12 to 20 feet in height. As a ground cover, it can spread rapidly across the soil.

Bittersweet has shiny, oblong, alternate leaves, up to five inches long. This becomes bright yellow during the Fall.

The female plants produce huge, terminal clusters of dark yellow fruits with vivid, orange-red arils in the Fall.

Though there are some exceptions, the male and female flowers tend to be on separate plants. To get fruits, one plant of each kind is needed. If garden space is limited, put both in the same planting hole.

Typically, the green blooms are small and inconspicuous. The blossoms appear in terminal clusters. They start in June and continue for several weeks. While both kinds of blooms yield nectar for bees, only the male flowers will provide pollen.

Bittersweet is easy to grow, requiring little attention. Full sun is best.

American bittersweet is recommended for zones three through eight.

It prefers a reasonably moist soil. This adapts to a range of pH from acidic to slightly neutral.

Clematis (*Clematis spp.*)

Some clematis vines are woody, while others tend to be herbaceous. All vining types of clematis are good sources of nectar and pollen. Members of the buttercup family, there are over 100 species and varieties in cultivation. Though some are evergreen, others are deciduous.

The hardiness can vary from one kind of clematis to another The hardiest species are suited to zones two or three. These vines prefer an alkaline to neutral soil. They do best in partial shade.

Having no tendrils, the vines attach their leaf stalks to the support provided. The height of clematis can vary considerably. While the smaller vines are only six to eight feet tall, the most vigorous reach 30 feet in height. Clematis has opposite foliage that is often compound.

The blooms range in size from one to eight inches in diameter, depending on the type being grown and the growing conditions.

For bees, choose smaller flowered varieties. The blossoms can occur either singly or in clusters.

Clematis flowers, which are sometimes fragrant, consist of large, brightly colored sepals. They lack true petals. Usually, the blossoms open during the late Spring and Summer

Several clematis species are particularly suitable for bees. These include Armand clematis (*Clematis armandii*), which is hardy to zone seven. This grows to eight feet tall.

Anemone clematis (*Clematis montana*) is hardy to zone six. This reaches 15 to 20 feet in height.

Sweet autumn clematis (*Clematis paniculata*) is one of the hardiest – to zone four Its blooms open from late Summer throughout the Fall.

Clematis vines prefer an alkaline to neutral soil. Most of these vines will need a regular pruning every couple years. Typically, they do best in partial shade. These prefer a pH between 4.5 to 7.0.

Bees collect both nectar and pollen from clematis blossoms.

Chilean glory flower (*Eccremocarpus scaber*)

Related to the trumpet creeper, this climbing woody plant is hardy to zone seven. Elsewhere Chilean glory flower is grown as a climbing annual. This evergreen

Clematis

blooms the very first year if the seeds are started early indoors. Transplant during the Spring after all danger of frost has past.

This vine reaches six to twelve feet in height. Native to South America, it climbs by means of tendrils. The opposite leaves are doubly compound with the individual leaflets being about an inch long.

Chilean glory flower bears small, orangish-red blooms throughout the Summer months. Tubular with a slightly irregular shape, these are over an inch long. They open in terminal clusters. Later during the Fall, the inflated fruit pods mature.

This species needs full sun. Most any kind of soil is suitable so long as the spot is well drained.

Chilean glory flowers provide nectar for bees.

Climbing hydrangea (*Hydrangea anomala subsp. petiolaris*)

Though most hydrangeas are shrubs, this one is the exception. It is recommended for zones five through eight. The large, shiny, dark green leaves are notched. These are two to four inches long.

This clinging vine can have stems that reach 60 to 80 feet in length. Climbing hydrangea attaches by means of root-like structures called holdfasts that emerge along the length of the stem.

Climbing hydrangea blooms heavily for a long period during June and July. The individual white flowers are about 1¼ inch across. These open in large, flat clusters that can be up to eight inches wide. Both inconspicuous fertile and showy sterile blossoms are borne on the same clusters.

Though it is very slow growing initially, this increases once the plant is well established. It can be grown from seed. However, the resulting plants will take years to bloom.

Climbing hydrangea requires very little attention. Preferring full sun, it thrives in a moist, well drained soil. A pH between 3.5 and 7.0 is suitable.

There are several related vines that are similar to climbing hydrangea.

Japanese hydrangea vine (*Schizophragma hydrangeoides*) is Winter hardy to zone six. It also uses holdfasts to cling to its support. This species has flat stems. It blooms somewhat later than climbing hydrangea. The blooms open in drooping clusters. These have a single large sepal. Compared to climbing hydrangea, this vine has coarsely toothed, dull green foliage with wider teeth.

Chinese hydrangea vine (*Schizophragma integrifolium*) isn't quite as hardy – only to zone seven. The foliage is quite large – four to eight inches in length. The edges can be slightly toothed. The blossoms open in huge clusters up to a foot across.

All of these species are good sources of nectar for bees.

Morning glory (*Ipomoea purpurea*)

Both the wild and cultivated morning glories are excellent bee plants.

Originally introduced from the tropics, the common morning glory has naturalized in much of the U.S. A soft stemmed, twining vine, it is sensitive to frost. The plant grows to 15 feet in height. With hairy stems, this has heart-shaped foliage that is sometimes lobed.

Morning glory blossoms open throughout the Summer into early Fall. The funnel-shaped flowers come in a range of colors, including white, blue, red, bluish-purple, and deep purple. Some even have strips. Morning glories have white throats.

As a garden plant, this vine is easy to grow from seed. Plant after danger of frost is past. Soak the seeds overnight before sowing.

Needing full sun, morning glories are carefree plants that require little attention. This vine prefers a rich, well drained soil. Usually grown as an annual, it can become a perennial in warm climates.

Though the blooms can be quite large, they're attractive to bees, which collect nectar and pollen from them.

The morning glory can yield a good surplus of honey, around 80 pounds per colony This honey is considered excellent quality. Water white, it has a delicate, pleasant flavor

Passion flower (*Passiflora spp.*)

Some of these vines can be evergreen. Hardiness can vary somewhat from one species of passion flower to another While some are Winter hardy to zone six or seven, others tend to be rather tender

Native to the New World, these vines climb by means of tendrils. The height can vary greatly, depending on the species. Some are 15 to 30 feet tall. Passion flower vines can have winged stems.

The attractive, alternate leaves are four to six inches long. With wavy margins, they can be entire or compound. These often have large lobes. There can be vivid purple markings as well.

The floriferous passion flowers are known for their large, intricately ornate blooms. Some of the passion flowers have scented blooms. These are often white, red, or yellow.

With five petals, the blossoms range from two inches to four inches in diameter These open in clusters containing two to three blooms. They appear all along the stems. Their notable features include long, decorative filaments and spectacular stamens that form a central column, which is often fringed.

Many of the passion flowers produce fleshy, edible fruits, which can be 10 inches in length.

These plants are propagated by seeds and cuttings. Several species can be found growing wild. Maypop passion-flower or wild passion flower (*Passiflora incarnata*) is native as far north as Virginia. Its range extends westward to Texas. This is hardy to zone six. With purplish markings, the whitish-pink blooms are two inches across. This species blooms from mid-summer through the Fall.

Morning Glory (Ipomoca sp.)

Yellow passion flower (*Passiflora lutea*) is native to the East with its range extending northward to Pennsylvania, and westward into Texas. This species is recommended for zones six through nine. It has yellowish-green blossoms.

Passion flowers need full sun. They'll grow in most any rich, well drained soil.

The flowers provide bees with nectar and pollen.

Wisteria (*Wisteria spp.*)

All of the cultivated and native wisterias are attractive to bees. For best results, buy grafted plants. Those grown from seeds can take many years to bloom.

Native species of wisteria can be found throughout much of the country, particularly the East and Midwest. There are about ten species with the Japanese and the Chinese being the most popular cultivated kinds.

Hardiness depends upon the species being grown. While Japanese wisteria (*Wisteria floribunda*) is the most hardy – to zone four, Nippon wisteria (*Wisteria japonica*) is only reliably hardy to zone seven. Most of the others are fine for zone five.

American wisteria (*Wisteria frutescens*) does well in zones seven through nine. This is native to the Southeast. Its range extends westward to Texas. It blooms throughout the Summer

Chinese wisteria (*Wisteria sinensis*) is suitable for zones six through nine.

Kentucky wisteria (*Wisteria macrostachya*) is native from Kentucky into Tennessee, Illinois, and Missouri all the way to Texas. It is among the hardiest wisteria, being suited to zones five through nine. Especially floriferous, this species blooms several weeks later than most other kinds.

Silky wisteria (*Wisteria venusta*) is recommended for zones six through nine. Related to Chinese wisteria, this has heavily scented white blooms.

Over a period of years, wisteria vines can become quite huge. Like other legumes, these plants have alternate, compound leaves with the number of leaflets varying from one species to another Some species twine from left to right, while others go right to left.

A member of the pea family, wisteria has large, attractive, showy, bean-like blooms. These drooping flower clusters can range considerably in length, depending partly upon the growing conditions. The blooms can be white, lilac, or pink. Sometimes, wisteria flowers will have a striking fragrance.

Because double-flowered varieties are unsuitable for bees, read the descriptions before buying plants.

Generally, wisteria will bloom in late Spring – mostly in late May or early June for about three weeks or so. Sometimes, there is a second flush of flowers several months later

Wisteria is suited to most soils from light sand to rich loam. It adapts to a range of pH from 4.5 to 7.0. This vine thrives in a moist, well drained spot in partial shade.

These vines need full sun. Other than pruning and training, they require no special care. Wisteria can be trained as a tree standard. This involves staking the plant and pruning the tops each year so that the stem eventually resembles a tree trunk. The easiest approach is to give the vine some means of support, such as a trellis or fence, and let it ramble.

Wisteria blossoms provide bees with nectar and pollen. They tend to yield more nectar when the weather is warm. BC

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

Cooking On The Wild Side

Ann Harman

It is the season for game. In 1825 Brillat-Savarin wrote: "The term game includes all animals which enjoy a state of natural liberty in the fields and woods, and are fit to be eaten." He then went on to list some examples of wild animals that are not eaten. Today those who hunt and fish have their favorite recipes but perhaps are willing to try a new one. For those who do not hunt and fish, game can be found in specialty supermarkets. Some, such as bison and deer are farm raised. Since these are running free on a farm they still fit the definition given above.

Game needs to be cooked with care. The meat is generally very lean and therefore subject to turning into something resembling shoe leather if overcooked or roasted when it should be braised. Then, too, the age of the game animal enters into its tenderness. Unless large game is farm-raised you really do not have much idea about its age. The older, the tougher That is why you can find so many recipes for marinades for game.

The purposes of marinades are several. They contribute moisture and flavor but, most importantly, they tenderize. Basically marinades contain various herbs and spices, sometimes oil, but almost always an acid such as vinegar or lemon juice. Meat can be soaked in a marinade for a few minutes to 12 hours. The easiest way to marinate a piece of meat is to place it and the marinade in a plastic bag, seal it, refrigerate, and turn the bag every few hours. The marinade can be used as the basis of a sauce to accompany the meat.

Here is a nice marinade for game. The recipe has been adapted from *The Joy of Cooking* by Rombauer and Becker Please use a good quality table wine, not the "cooking wine" frequently found in supermarkets. After all, game deserves good ingredients.

1 cup dry red wine
¼ cup lemon juice
½ cup olive oil
3 or 4 juniper berries or
2 or 3 sprigs rosemary
A sprig of parsley
A sprig of thyme
2 bay leaves
1 to 2 crushed garlic cloves
A pinch of nutmeg
1 tablespoon honey
1 teaspoon salt
A dash of hot pepper sauce

Combine all ingredients.

This next recipe is for buffalo. It is becoming a very popular meat. Technically it is called bison, but everyone seems to call it buffalo. Whatever you wish to call it, buffalo is a very nutritious meat, having minimal fat, excellent assortment of vitamins and low cholesterol. The cuts of buffalo are exactly the same as for beef so you can use any of your favorite beef recipes for buffalo. I strongly suggest the use of a meat thermometer for roasts because they can cook quicker than the same cut of beef. The flavor is wonderful. Once you have tried buffalo, beef will seem bland.

Here is a recipe for short ribs. Yes, you can use it with beef also, but try it first with buffalo. By the way garlic powder is not garlic salt. If you substitute garlic salt you will add too much salt to any recipe.

CHIPOTLE BUFFALO SHORT RIBS

2 pounds buffalo short ribs
½ bottle dark beer
4 tablespoons honey
2 tablespoons chipotle in adobo sauce, pureed
1 teaspoon salt
1 teaspoon pepper
1 teaspoon garlic powder
½ cup soy sauce
¼ cup Worcestershire sauce
water-soaked hickory chips for grill

Combine the honey, chipotle, salt, pepper, garlic powder, soy sauce and Worcestershire sauce. Mix well, then set aside. Wrap ribs loosely in foil, adding the ½ bottle of beer Tightly seal the foil. Place on grill away from the pile of coals (indirect heat). Cook for 1½ hours with the lid on at low heat. After the 1½ hours, add the water-soaked hickory chips on top of the coals. Open up the foil on the ribs. Smoke for 30 minutes with the lid closed. You may have to add more chips. After 30 minutes remove the ribs from the foil and sauce the ribs. Put them directly on the grill but away from the coals. Close the lid and smoke/brown for another 20 or 30 minutes, or until done.

Make It Easy – Make It Bison
National Bison Association

Rabbit can be cooked with any recipe for chicken but why not try a honey recipe especially for rabbit. I cut the rabbit up into pieces. This recipe is especially good if the rabbit is not young and tender The long, slow simmering will tenderize it.

HONEYED RABBIT

1 rabbit, cut into serving pieces
1 medium onion, sliced
1 clove garlic, finely chopped
3 tablespoons cooking oil
3½ cups tomato juice and pulp
½ teaspoon salt
¼ cup milk
¼ cup honey
1 cup flour
¼ teaspoon pepper
1 teaspoon salt
6 tablespoons cooking oil

Sauté the onion, garlic, parsley in the three tablespoons oil until onion is golden brown. Strain the tomato juice to obtain some pulp. Add pulp and ½ teaspoon salt to the pan. Simmer for 10 minutes. Mix in milk and honey Remove from heat. Dip rabbit in the mixture then roll in the flour seasoned with the salt and pepper Brown in the six tablespoons oil. Cover rabbit with sauce and tomato juice and simmer about 1½ hours. Serves three to four

Wild Game Cookbook
Ed. By L. W "Bill" Johnson

This same book has another nice recipe using honey Although it is for antelope, I have used it for venison and elk and always found it very good.

HONEY ANTELOPE BAKE
1 large steak, about 3 inches thick
1/2 cup flour
4 tablespoons butter or oil
3 cups sour cream
1/2 teaspoon salt
1/8 teaspoon freshly ground pepper
1/4 cup honey

Knead flour into steak. Brown it on both sides in the butter or oil. (Butter gives the best flavor.) Cover bottom of baking pan with 1½ cups sour cream. Add steak and season with salt and pepper Pour honey over top. Cover and bake in 250°F for 1½ hours or until tender Add more sour cream when necessary to retain moistness. Serves four

Since many game recipes are rather rich and hearty, use this salad to accompany your dishes. It is a refreshing addition to a game menu.

ORANGE SALAD FOR GAME
4 oranges
watercress
2 tablespoons brandy
2 tablespoons olive oil
1 teaspoon honey
¼ teaspoon salt
A few grains cayenne
Chopped tarragon

Peel and section the four oranges. Put a bed of watercress on four plates. Arrange orange sections on top. Combine the brandy, oil, honey, salt and cayenne. Pour over orange sections. Sprinkle the tarragon on top. Serves four

Adapted from *Joy of Cooking* by Rombauer and Becker

Now what to do with the bear meat from the bear that invaded your apiary? Use the marinade and serve accompanied by the Orange Salad, of course. BC

CALENDAR

♦INTERNATIONAL♦

The 2008 Ontario Beekeepers' Association, Canadian Honey Council and Canadian Association of Professional Apiculturalists will hold their meeting December 11-13 in Niagara Falls, Ontario.

For more information visit www.honeycouncil.ca or www.ontariobees.com.

♦CALIFORNIA♦

The California State Beekeepers Association will hold their 119th Annual Convention November 11-13 at Harrahs Lake Tahoe, Lake Tahoe, Nevada.

Speakers include Jerry Bromenshenk, Michelle Flenniken, Eric Mussen, Sue Cobey, Steve Sheppard and Eric Olson.

For information and registration contact Patti Johnson, castatebeekeepers@hotmail.com or 209.667.4590.

♦CONNECTICUT♦

Southern New England Beekeeping Assembly will be held November 22 in Hamden. This event will be cosponsored by The Back Yard Beekeepers Association and The CT Beekeepers Association and Wicwas Press.

Speakers include Rick Fell, Kirk Webster, Blake Shook and Larry Connor. Registration is $45 by October 31 or $65 after that. Lunch is available for $8 additional.

For information visit www.sneba.com.

♦FLORIDA♦

The Florida State Beekeepers Association will meet October 30 November 1 at the Florida Farm Bureau, 5700 SW 34th Street, Gainesville.

The theme is "Beekeeping In Florida 15 Years From Now." The Master Beekeeper Apprentice Course will be Thursday and Lessons in Beekeeping on Saturday.

For registration forms, fees and updates visit www.floridabeekeepers.org or contact Nancy Gentry, 386.684.3433, farmbees@gmail.com.

♦IDAHO♦

The Idaho Honey Industry Association will hold their 2008 conference December 4-6 at the Red Lion Downtowner Hotel in Boise. For reservations call 208.344.7691 and mention the beekeepers for the special rate.

Speakers include Jerry Hayes, Sue Cobey, Randy Oliver and more. Vendors will be available.

Bill Ahaus, 208.454.1825, bahaus@cableone.net.

♦INDIANA♦

The Indiana Beekeepers' Association will hold their Fall meeting November 7-8 at the Brown County State Park in Nashville.

Krispin Given from Purdue will be talking about how to raise the best queens.

For information contact Kenny Schneider, 812.951.3737 or visit http://indianabeekeeper.goshen.edu.

♦IOWA♦

Iowa Honey Producers will hold their 96th Annual meeting November 7-8 in Marshalltown at the Best Western Regency Inn, 641.752.6321. Speakers include Randy Oliver, MIchael Bush, Warren Nelson and more.

For information contact Melanie Bower, 515.287.9875, MELRB@msn.com.

♦MISSISSIPPI♦

Mississippi Beekeepers Association will hold their annual conference November 7-8 at Mississippi State University, Starkville. A block or room has been reserved at The Holiday Inn Express, 662.324.0076.

Speakers include MS House of Representative Ken Morgan, Marla Spivak, David Tarpy, Tom Rinderer, Clarence Collison, Richard Adee and more.

Contact Harry, 662.325.3390, harry@mdac.state.ms.us or D. Wesley, 601.736.3272, dwesley39483@msn.com.

♦NEBRASKA♦

Nebraska Beekeepers Association will hold their Chemical-Free Beekeeping Conference November 21-23 at Southeast Community College, 301 S. 68th Street Place, Lincoln. Cost is $95 and deadline is November 14.

Speakers include Dee Lusby, Corwin Bell, Dean Stiglitz and Michael Bush.

For more information contact Nancy Holman, 402.437.2712, nholman@southeast.edu.

♦NEW YORK♦

EAS 2009 will be held at Holiday Valley Resort in Ellicottville, August 3-7, 2009.

Mark your calendars now and watch for details.

♦UTAH♦

Utah Beekeepers Associaitoin will hold their annual convention December 4-5 in Salt Lake City. Marla Spivak is one of the keynote speakers.

For information contact Neil Shelley, neilshelley@gmail.com or visit www.utahbeekeepers.com.

♦VIRGINIA♦

The Virginia State Beekeepers Association will meet November 1 at Blue Ridge Community College in Weyers Cave. The theme is "Research Related to Beekeeping, nearby and from unexpected sources."

Speakers include Jose Fuentes, Wayne Esaias, Frank Linton, Wyatt Mangum, Rick Fell and others.

For details on meeting and lodging visit www.virginiabeekeepers.org or vabees@virginiabeekeepers.org.

♦WISCONSIN♦

Wisconsin Honey Producers Association will hold their Fall Convention November 7-9 at the Best Western Grand Seasons Hotel, Waupaca. For reservations 715.258.9212.

Contact Dan Piechowski, 920.566.4132.

ABF 2009 In Reno

The 2009 North American Beekeeping Conference is taking shape. The Conference is being hosted in Reno, Jan. 13-17, by the American Beekeeping Federation.

The program will cover a variety of topics, touching on everything of interest to the beekeeper, no matter what the size of his (or her) beekeeping operation.

The Conference opens on Tuesday evening, Jan. 13, with a "meet and greet" reception that is free to all Conference registrants. It will be an opportunity to renew old friendships and start new ones with beekeepers from across North America.

The convention program always includes top presenters in the industry Among those invited to speak are Jeff Pettis, Beltsville Bee Lab; Marla Spivak, Univ. of MN; Marion Ellis, Univ. of NE; Jim Tew, OH State Univ., Jay Evans, Beltsville Bee Lab; Keith Delaplane, Univ. of GA; Charles Wick, U.S. Army's Edgewood Chemical Biological Center; Eric Mussen, Univ. of CA, Davis; Frank Eischen, Weslaco Bee Lab; and Sue Cobey, Univ. of CA, Davis.

In addition to the main program talks, the Shared Interest Groups that meet on Wednesday afternoon will provide opportunities for persons interested in the various segments of the honey industry to meet and hear presentations directed to them. The interactive workshops that are a popular feature of the ABF conventions will give attendees an in-depth look at a variety of subjects on Saturday morning. The Serious Sideliner Symposium, a popular extra feature of recent ABF conventions will be back with two full days of topics of interest to the smaller beekeeper Coordinated by Dr Larry Connor of Wicwas Press, the SSS runs on Friday and Saturday.

The Conference will be held at John Ascuaga's Nugget Casino Resort Hotel, Jan. 13-17 To learn more about the hotel, access www.janugget.com, or call 800.648.1177; the ABF group rate at the hotel is $95 with a reservation deadline of Dec. 10. The rate is good for three days before and three days after the conference, allowing time to enjoy the wonders of the area. To receive a Reno-Lake Tahoe Adventure Visitor Planner, call 800.367 7366 or visit www.renolaketahoe.com.

Details are on www.ABFnet.org. For additional information, contact ABF, P.O. Box 1317, Jesup, GA 31598, 912.427.4233, fax 912.427.8447, info@ABFnet.org.

BOOKS

BOOKS FOR THE DIY BEEKEEPER – Fight inflation – make your own equipment. Complete plans. Bee Hive Construction, $12; The Eight Frame Hive, $12; Nuc Hive Construction, $8; Bee Hive Table, $8; Small Scale Queen Rearing, $5. Prices include shipping. More available at www.petersieling.com. Check, VISA/MC, Discover Garreson Publishing, 7201 Craig Rd., Bath, NY 14810, 607.566.8558.

VIDEOS

BEGINNING BEEKEEPING VIDEO 2 hrs! All survival essentials: building hive; installing, feeding, medicating, inspecting, managing bees; harvesting, diseases & parasites; behavior. $35. Dr. Iacobucci, 172-BC Washington, Pembroke, MA 02359 www.roctronics.com/bee.htm.

PERIODICALS

RURAL HERITAGE – bi-monthly magazine in support of farming and logging with horses, mules, and oxen. Subscription includes THE EVENER Workhorse, Mule & Oxen Directory; $29 for 6 issues; sample $8.00. Rural Heritage, 281-B Dean Ridge Lane, Gainesboro, TN 38562. 931.268.0655, www.ruralheritage.com

IBRA: INFORMATION AT YOUR FINGERTIPS. IBRA is *the* information service for beekeepers, extension workers and scientists. Members support this service and enjoy the benefits of belonging to IBRA, which includes *The Journal of Apicultural Research incorporating Bee World*. For more information contact: IBRA, 18 North Road, Cardiff CF10 3DT, UK. Telephone +44 29 2037 2409. Fax +44 29 2066 5522; mail@ibra.org.uk.

THE AMERICAN BEEKEEPING FEDERATION has many benefits to offer its members. Send for a membership packet of information today! Contact the American Beekeeping Federation, P.O. Box 1038, Jesup, GA 31598, ph. 912.427.4233, fax 912.427.8447 or email info@abfnet.org.

IRISH BEEKEEPING. Read An Beachaire (The Irish Beekeeper) Published monthly. Subscription $22.00/year, post free. Mr Graham Hall, "Weston", 38 Elton Pk., Sandycove, Co. Dublin, Eire, email: Graham Hall@dtti.team400.ie.

Bee interested. For beekeeping information read the AMER. BEE JOUR. New editorial emphasis on practical down-to-earth material, including question & answer section. For information or free copy, write to: AMERICAN BEE JOUR., Hamilton, IL 62341.

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After my arthroscopic surgery this Summer, the surgeon said. "Your knee looked a lot worse than I expected, but I did the best I could!"

This wasn't the report I was looking for, but I had to appreciate his candor Why buoy the patient with a false sense of optimism?

I was flat out of commission for awhile. Paul pulled my Flat Tops honey for me when he picked up his own in late August. I still needed to get 40 colonies off the Flat Tops and down to Silt Mesa for the Winter I wanted to do this sooner, rather than later, because you'd better not count on good weather at 9,000 feet around here after Labor Day. But with my bum knee, I couldn't hand-truck them up a ramp onto my flatbed. I'd have to hire somebody.

My tenant helped me one evening after work, but I underestimated the time this move would take, not least because I forgot how long it takes to staple beehives together We worked until it was as dark as a tomb but only managed to load 19 colonies. You'd think I'd have remembered to bring a flashlight.

So I still had 21 hives at two locations to pull, hopefully in one evening. This time I decided I needed somebody with some real *mojo* to help, because it's a wicked push up that ramp at the Lettuce Patch yard. The hives were plugged double-deeps with a pollen trap and one mostly empty honey super When I put out the word to Paul's crew that I had some $25-an-hour overtime available, 20-year-old Erving jumped at the opportunity

Erving is not a big kid, and I barely knew him, but Eric whispered that "Erving carries five medium supers at a time." *Five*? He sounded like my guy

I told Erving I'd pick him up at Paul's one day after work. We'd load the little darlings that evening and unload first thing in the morning. Erving lives down the road, so I told him he could sleep at my place. I'd feed him supper and breakfast and pack his lunch. And I'd get him at work at Paul's by 8 a.m.

"So the job comes with meals and a hotel room!" he said cheerfully

"Yeah," I said. Hey, whatever it took. I needed those bees moved.

I was in a tizzy when Nick and Erving rolled in 20 minutes late for our rendezvous. We were on a tight schedule, and I didn't want to finish this job in the dark!

Erving got out of the truck and said, "Just a minute. I gotta help Nick back up to the dock."

"Forget it. I've gotta go!" I snapped. I climbed into my truck and was about to pull away, when Erving jumped into the cab. He never said a word. He didn't have a toothbrush, a pair of socks, or even a jacket. He looked like a waif sitting there with absolutely nothing but a bee veil for an overnight kit. I sort of wanted to laugh, but I didn't.

We had nearly an hour's drive to the beeyards, and my radio doesn't work, so we got to talking, or at least I did. I found Erving's story of his youth in the big city captivating, although I had to practically pry it out of him. A native-born American, his parents came from Nicaragua to escape the Contra insurrection in the 1980s. He grew up in New York, Miami, and "Jersey " He talks like he's from New York. He's streetwise. If he auditioned for a part in "West Side Story," he'd probably get it.

He wound up in Colorado when his dad, who owns a small fleet of trucks, found work as a subcontractor for the natural gas rigs.

He said his family owns some land in Nicaragua. There'd been talk about raising cows on it. When I asked if he thought he might like to go down there, he said, "Yeah, but my Spanish is pretty rusty "

I'll bet it's still better than mine.

We knocked out the Lettuce Patch yard pretty fast. Erving pushed the hand truck and I pulled with a rope. He wore slippery shoes, which made for some interesting moments.

We tied down the last of the hives at the Dodo yard with 5 minutes of daylight to spare. Just down the road, Erving spied the biggest bull elk. He said, "What is that? A moose?" I told you he's from Jersey

Back at the house, Erving smelled the crock pot buffalo stew as soon as we walked in the door "I hope you're not a vegetarian," I said.

After supper, I said, "I don't have a TV, but you'd better get some sleep, anyway "

I didn't hear him stir all night. I never woke him until breakfast was in the pan. He was still not fully awake at 5:45 when I scraped three eggs onto his plate. I said, "That doesn't look like enough," so I gave him three more. He just smiled.

I packed him a quart of stew and some crackers and grapes and apples for lunch. Otherwise he'd be eating gas station hot dogs. I know how that goes.

The unloading on Silt Mesa went pretty smoothly Erving slid down the ramp like a skier in his slippery shoes, while I steadied the hand truck from the side.

At Paul's when I wrote him a check, he said, "Thanks, and thanks for making my lunch."

Thanks? Thank you, Amigo. I'd have never got it done on my own.

Ed Colby

Erving