May 2009

Bee Culture

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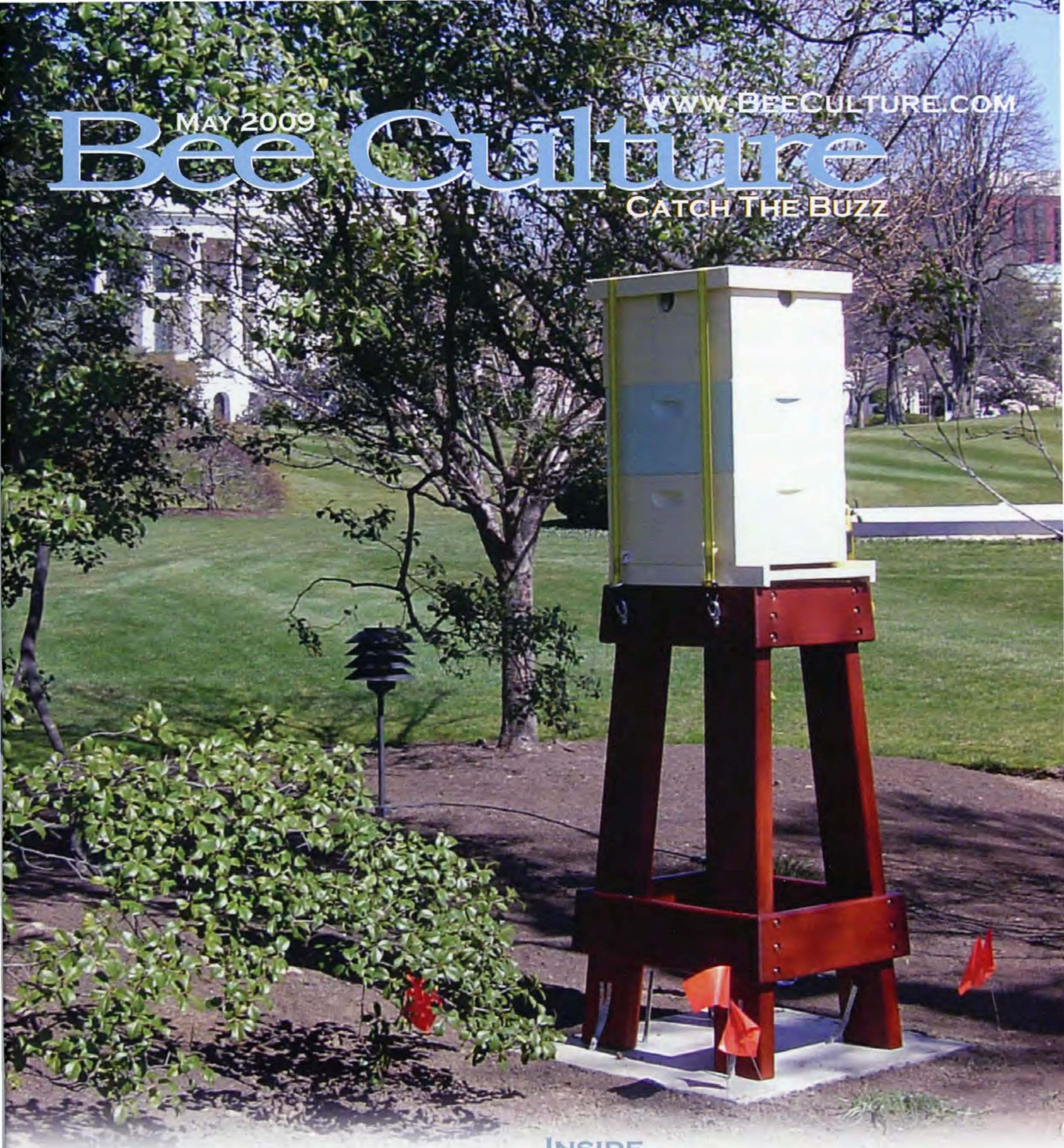

Inside . . .

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The White House Bees. This view, looking from the south fence toward the White House. From this view protective straps and ventilation ports are easily visible. The new organic garden is just out of sight to the left of the hive.
(photo by Charlie Brandt)

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Subscription Information

U.S., one year, $25; two years, $48. Newsstand price: $4.99. All other countries, (U.S. Currency only), $15.00 per year additional for postage. Send remittance by money order, bank draft, express money order, or check or credit card. Bee Culture (ISSN 1071-3190), May 2009, Volume 137, Issue 5, is published monthly by The A.I. Root Co., 623 W. Liberty Street, Medina, OH 44256. Periodicals Postage Paid at Medina, OH and additional mailing offices.

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Advertising

For information on advertising contact Dawn Feagan at 800.289.7668, Ext. 3220; Dawn@BeeCulture.com

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

Bee Culture

THE MAGAZINE OF AMERICAN BEEKEEPING

MAY 2009 VOLUME 137 NUMBER 5

FEATURES

DEPARTMENTS & COLUMNS

EAS 2009 at Holiday Valley – See the Short Course and Conference Programs and All the Rest of the EAS 2009 info at www.BeeCulture.com

Longevity Test

Do you want to find out long your bees are living?

This system works on Spring and Summer foragers. What you have to do is change the regular entrance. Probably the best way is to turn your hive ¼ one way or the other All foragers will come back to where the old entrance was to then crawl around the corner to the new one. All new bees will come to the new entrance.

Mark down when you make this switch, and when you see no more bees crawling around the corner this will be the approximate life of your foragers.

Jim Cowan
Aberdeen, WA

Beeswax Journey

Within the last year I have been bitten by the "beekeeping bug." One of my first actions was to subscribe to your publication. I rely on it heavily as currently I am unable to pursue the hands on part of my new hobby I have a question and a comment, the question being from my father – "Who sets the price of honey?"

The comment is more of a sharing of some information you may find interesting. This story aired on PBS here in Washington, about a 16th century Spanish galleon that wrecked on the Oregon coast. The ship was laden with Chinese porcelain and beeswax among its cargo, the beeswax coming from the Phillipines enroute to Acapulco. The ship wrecked off of Nehalem Bay at Neahkanie Point where the town of Manzanita is now built. As the Winter storms churn the ocean the beeswax, in pristine condition, comes ashore and some of it is on display at the Columbia River Maritime Museum. The program was put together by Oregon Field Guide. Perhaps you would be interested in the durability of the beeswax in such a tumultuous journey

Terry Mortensen
Aberdeen, WA

SHB – Fitz Refugia

The Small Hive Beetle arrived in my apiary six years ago. In my 56 years of keeping bees I consider this introduced pest one of the worst invaders of the hive. It's stealth nature and ability in short order to overwhelm a weakened hive requires constant vigilance.

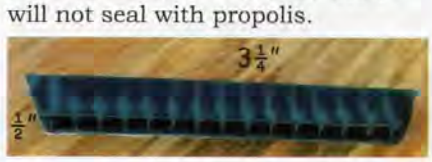
After observing their lifecycle I adapted the newest and evolving products and devices in an effort to control them. Several years ago I was a cooperator with the Pennsylvania Department of Agriculture utilizing an attractant trap for adults.

I concluded three years ago that the adults are continually seeking a Refugia from the bees in a strong colony I initiated many ideas based on this theory mainly in conjunction with Coumaphos or sticky traps in various Refugia type traps. None of which had very positive results. My conclusion was a Refugia type trap that is non-lethal and can be used year round without concerns for residue in wax or the honey crop. In testing various devices trying to emulate the peripheral cells the beetle hides in, I came across a sheet of plastic corrugated that had large cells and cut it into 3 x 1¾" pieces. I put them in two hives, one where I had essentially eliminated all beetles mechanically in November 2008 and one that went into Winter with a large number of beetles. These traps were put on the top of frames near the center of the cluster approximately February 15. On February 27 weather permitted inspection.

In the large number of beetle hive, the trap had close to 25 SHB which I lifted out and tapped on flagstone killing all. The other hive had none.

Conclusion: This trap has the potential to reduce to background levels the over wintering beetle population. The Key is beetles need the heat of the cluster on its periphery Thus they are concentrated in a small area and receptive to the Refugia.

I intend to use this trap all season to evaluate its potential for adult control during warm weather, by placing multiple traps over the brood nest. The theory being beetle pheromones will attract others. I am also testing small diameter drinking straw traps in an effort to evaluate what size hole the bee's will not seal with propolis.



I will share my observations in the Fall of 2009.

Joseph Fitzpatrick
Blue Bell, PA

Weighing Your Hives

To avoid any hit and miss all colonies should be weighed. The first thought is this will entail a lot of heavy lifting. Not so! I designed a scale that can be easily made and assembled and with hives placed on 2" x 4"s the hook to the spring scale can be used under each side of the hive. Weighing both sides and adding the total will provide a weight within a couple of pounds should you weigh them on a platform scale. In central IA we made sure that each colony weighed 115 to 120 pounds. That's the colony with a double brood chamber bottom and inner cover If located in Northern IA or in MN the weight should be increased. South of IA a lesser weight might do. A test of years will dictate how heavy they need to be.

We used this method from the mid 1940s to 1996 and during those years we didn't buy a pound of honey for the bees or for our own consumption. The honey bee is suffering from malnutrition. This is why the bees are more susceptible to all natural honey bee diseases just as a person is with a case of malnutrition.

Glen Stanley
Ames, IA ➢

No End

Is there no end to the torture perpetrated by humans upon the other creatures of this earth?

Is there no end to the waste of resources – time, money brains, education, office space, energy – that researchers create while they continually invent studies to justify their paychecks and academic standing?

As confirmed once more by the article "Booze and Bees" and the disturbing, cruel photograph that accompanied it, apparently not.

Becky Burdick
Evans City, PA

Still Missing Richard

I wish Dr Taylor was still with us. His articles were most useful and his beekeeping genuine beauty

Daniel T Collins
Alton, MO

Varroa Challenge

Apimondia 2009 (September 15-20) will be in Montpellier France which is about 150 miles from Toulouse. If you're passing through our area before or after the meeting please come by our queen breeding station and see how we select bees for *Varroa* resistance. We stopped treatments against *Varroa* mites in our hives over 10 years ago. At the same time you can participate in our annual "World *Varroa* Challenge" We will pay 1 cent for every *Varroa*, dead or alive, (from our hives) that you find during your visit.

You can camp and cook your meals at the station free of charge. If you don't have a tent we have plenty of hay to sleep on. For those of you not interested in counting *Varroa* there are lots of nice places to visit in our area or you can just sit, take it easy and chat with us. You can stay as long as you like.

Contact John Kefuss email: jkefussbees@wanadoo.fr

INNER COVER

Not far from the new organic garden, the fountain and the tennis court, just south of the south lawn, and visible from the street, on a four foot tall hive stand that's bolted to a cement slab, sits a brand new blue and white beehive. It's the first managed hive to grace the environs of the White House landscape, and it's there at the invitation of the current residents. But it's Charlie that's in charge. He works at the White House. And in his spare time he's a beekeeper

Though it's probably the coolest place in the world to have a beeyard, it's still just a beehive, and Charlie, he's a beekeeper pretty much like all the rest of us. Let me tell you a bit about Charlie, this hive, and the rest of his bees.

Charlie started keeping bees back in 2007 because he was eating so much honey he thought that if he had his own bees he could afford all the honey he was eating. Besides, the store-bought variety wasn't all that good. So he took a beginner's class and got a couple nucs for the backyard.

He started with two Italians. One went on a scale hive because he's hooked up with Wayne Esaias and the HoneyBeeNet program for tracking honey flows on scale hives (see **http://honeybeenet.gsfc.nasa.gov/About/ScaleHives.htm**). The scale hive swarmed, but he still harvested about 80 pounds of honey that Summer and another 20 pounds later He requeened the swarmed colony with a Survivor queen he got from Adam Finkelstein, a local queen producer, but they superceded that queen so he let them raise another

One of Charlie's goals is to introduce a wide range of genetics into his area so the greatest diversity of local bees is possible. So the next April he brought in two packages of Russian Hybrids which did great all Summer, but like bees everywhere one did a lot better than the other and drew out six supers of comb the other not quite so much. In May he added two more locally produced nucs to the apiary with a Caucasian/Russian Hybrid/Open Mated background.

Over the Summer the hives that thrived were split for increase. Another Finkelstein queen was used, but this time a push-in cage was used for introducing her and she was accepted and has been successful.

This Spring Charlie has five colonies at home, and two just down the road from home, and now one at the White House. As of early April they mostly tend to be either strong and heading to swarm size or small and needing attention. One though was moderate sized that had a supercedure queen, and that was chosen to move to the White House. With supercedure queens considering that there are beekeepers about a half and about three miles away Charlie says you get what you get.

Plans for requeening some of his hives this Summer include more from Finkelstien's local survivor stock and perhaps some of the USDA's Russian queens. He doesn't want to expand much more, though because time to take care of them gets to be a problem.

The colony at the White House will be managed much like an observation hive, Charlie said. It can be added to if it needs, or bees, brood and honey can be removed if it gets too big. Considering it is on a four foot tall stand (to protect the family dog from dog/bee interactions) a hive that's managed to remain, well, manageable seems like a good idea.

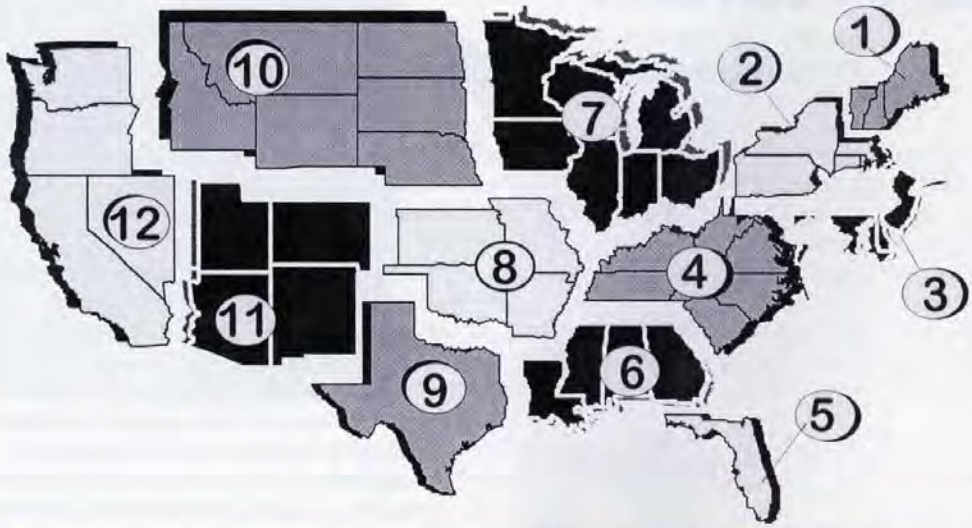
Charlie's bees are going to have to be smart, and tough. There's no pampering them with mite treatments or such. The first year he used a menthol treatment and he didn't like it any more than the bees did. Enough of that, he said. So after reading Ross Conrad's book on Natural Beekeeping and other sources of IPM information he took a turn for better bees and is using sticky boards to monitor mite populations (he got threshold info from Bart Smith at the Beltsville Lab just down the road), and is using drone comb removal for varroa population management. After a couple of years it seems to be working he said, so he's sticking to minimal treatments and choosing from the survivors.

Charlie's bees were inspected by local authorities during all the hubbub of moving. And, just so you know, keeping bees in the D.C. limits is prohibited, unless the bees are on Federal property and the manager of that property gives the O.K. It seems Charlie's bees cleared both of those obstacles.

Continued on Page 59

Charlie And The White House Bees

MAY – REGIONAL HONEY PRICE REPORT



Winter Losses

In April the Apiary Inspectors and the USDA sent out a survey to beekeepers regarding Winter losses. They followed up with phone calls.

In April we sent out a survey to our Honey Reporters on Winter losses too. Our Honey Market Reporters were asked how many colonies they lost, and their best guess as to what they died of. Of course every colony that dies in an operation overwinter doesn't die from the same problem. We also separated our Reporters by the size of their operations – hobby with fewer than 100, sideline with 100 – 1000 or so, and commercial with more than 1000. There are some interesting numbers here. For instance, Nosema played a big role in commercial outfits this year, but less so in hobby operations. Starvation, either due to not enough food, or too cold too long was a big player in colony losses across the board. It seems that wintering skills need some additional attention, and we have been spoiled with several past easy Winters. Back to basics is the new buzz word.

Beekeeping Summary						% Reporting Some Losses to:								
Size of Operation	% Reporters	# Colonies Lost: >10	10-100	100-500	500+	Pesticides	Nosema	Disappeared	Starved	*Varroa*	Disease	Pests	?????	Queens
Commercial	9%	–	–	66%	35%	–	67	33	100	67	–	–	67	–
Sideline	36%	21%	63%	16%	–	–	26	43	73	39	4	17	26	9
Hobby	55%	75%	25%	–	–	9	11	26	74	29	6	–	20	11

Thanks, Joe

Joe Warren, from Waco, Texas has hung up his hive tool and retired as one of our Honey Reporters, after more years than we can count. Good luck Joe, and Thanks for all the years of helping out.

REPORTING REGIONS

	1	2	3	4	5	6	7	8	9	10	11	12	SUMMARY Range	Avg.	History Last Month	Last Year
EXTRACTED HONEY PRICES SOLD BULK TO PACKERS OR PROCESSORS																
55 Gal. Drum, Light	1.61	1.62	1.61	1.57	1.45	1.50	1.62	1.61	1.61	1.38	1.30	1.45	1.30-1.62	1.53	1.49	1.23
55 Gal. Drum, Ambr	1.42	1.35	1.42	1.35	1.35	1.20	1.54	1.42	1.42	1.42	1.20	1.45	1.20-1.54	1.38	1.38	1.10
60# Light (retail)	120.00	131.33	130.00	121.50	120.00	125.00	123.00	105.00	125.00	130.11	120.00	157.50	105.00-157.50	125.70	124.25	116.41
60# Amber (retail)	120.00	126.67	130.00	120.00	120.00	125.00	88.50	125.00	110.78	110.78	115.00	145.67	88.50-145.67	119.78	121.85	114.88
WHOLESALE PRICES SOLD TO STORES OR DISTRIBUTORS IN CASE LOTS																
1/2# 24/case	52.08	61.98	43.20	45.25	65.81	54.00	51.73	65.81	65.81	52.00	45.35	95.00	43.20-95.00	58.17	54.39	50.40
1# 24/case	65.52	78.28	72.00	53.34	72.00	76.80	71.92	76.44	60.00	94.44	83.40	99.70	53.34-99.70	75.32	73.31	69.77
2# 12/case	69.72	74.72	64.80	58.20	66.00	65.70	63.63	81.00	54.00	69.24	56.70	83.00	54.00-83.00	67.23	64.59	61.75
12.oz. Plas. 24/cs	64.32	71.98	52.20	53.15	57.60	63.00	62.67	58.22	54.00	53.04	68.93	68.67	52.20-71.98	60.65	58.63	57.05
5# 6/case	85.41	83.99	75.00	67 17	79.74	79.74	71.18	96.00	66.00	64.41	60.00	92.00	60.00-96.00	76.72	73.97	71.15
Quarts 12/case	86.12	110.88	112.20	94.15	78.00	86.04	88.96	91.52	102.12	82.26	94.60	115.75	78.00-115.75	95.22	96.13	92.30
Pints 12/case	58.35	56.45	66.00	58.04	58.00	44.50	45.50	59.28	66.00	56.10	51.30	60.00	44.50-66.00	56.63	59.42	54.86
RETAIL SHELF PRICES																
1/2#	3.50	3.41	2.38	2.74	4.03	2.50	3.00	4.03	1.99	2.74	3.30	5.37	1.99-5.37	3.25	2.88	2.84
12 oz. Plastic	4.13	3.96	3.08	3.35	3.99	3.50	3.63	3.70	3.65	3.30	4.10	4.41	3.08-4.41	3.73	3.57	3.46
1# Glass/Plastic	4.88	4.49	4.48	4.52	4.75	4.42	4.43	4.33	4.12	4.60	4.75	5.75	4.12-5.75	4.63	4.46	4.33
2# Glass/Plastic	8.38	7.66	7.02	6.74	7.50	7.20	7.36	8.25	7.00	7 19	7.37	9.85	6.74-9.85	7.63	7.69	7.03
Pint	8.27	6.42	6.50	6.54	5.63	5.70	9.23	6.00	6.50	7.47	7.00	8.91	5.63-9.23	7.01	6.75	6.20
Quart	16.13	9.48	9.95	10.46	9.50	9.24	12.76	9.93	9.50	14.08	10.30	15.33	9.24-16.13	11.39	10.58	10.64
5# Glass/Plastic	17.00	15.89	16.45	13.38	16.33	16.33	16.81	19.00	18.00	13.76	14.99	19.35	13.38-19.35	16.44	16.93	16.13
1# Cream	5.25	5.55	5.63	5.56	5.63	5.63	5.48	5.63	3.29	6.35	4.50	6.91	3.29-6.91	5.45	5.49	5.03
1# Cut Comb	5.50	5.71	6.50	5.00	6.92	4.50	8.02	6.92	6.92	8.00	9.75	8.50	4.50-9.75	6.85	7.07	6.03
Ross Round	6.97	5.15	6.50	4.83	6.97	8.00	8.00	6.75	6.97	6.97	7.00	8.50	4.83-8.50	6.88	6.49	5.41
Wholesale Wax (Lt)	3.67	3.92	3.25	3.09	2.15	3.50	4.00	4.50	4.50	4.18	2.82	4.20	2.15-4.50	3.65	3.77	2.65
Wholesale Wax (Dk)	2.00	3.48	3.00	1.98	1.90	3.00	3.83	4.00	4.09	4.09	1.85	2.75	1.85-4.09	3.00	3.08	2.32
Pollination Fee/Col.	80.00	81.67	62.50	41.00	150.00	45.00	50.00	60.00	91.09	91.09	50.00	121.67	41.00-150.00	77.00	79.59	84.39

RESEARCH REVIEWED

The Latest In Honey Bee Research

Steve Sheppard

"Energetic cleaners, mite control and a male-female dilemma."

As regular readers of *Bee Culture* are aware, one of the main reasons that the honey bee mite *Varroa destructor* remains a problem for beekeepers has to do with the capacity of the parasite to develop resistance to chemical control measures. Some honey bee populations, including Africanized honey bees in South, Central and parts of North America, express a measure of resistance or tolerance to the mites, obviating the need for chemical treatment. With these factors in mind, one can reasonably argue that the most sustainable long-term solution available to deal with these mites will come from selection for genetic resistance within productive and industry-acceptable honey bee stocks. Likely, there are multiple genetic pathways down which honey bees can move toward *V destructor* resistance. One of the pathways currently under investigation by researchers involves a resistance mechanism known as *Varroa*-sensitive hygiene (VSH). In colonies that express VSH, honey bees open capped brood and remove mite-infested pupae, thereby interrupting the reproductive cycle of the mites. Recently, Dr Jeff Harris, a researcher from the USDA Honey Bee Breeding and Physiology Laboratory in Baton Rouge, LA reported that not all brood is created equal when it comes to the expression of VSH behavior by adult workers, a finding with substantial implications (Harris, 2008).

In the Introduction, the author points out that hygienic removal of infested brood is a complicated process involving more than a single bee. Given that direct observations are difficult, researchers often look for secondary evidence of VSH behavior, such as the presence of a high number of uncapped worker bee pupae or a lower number of infested capped worker brood in naturally infested combs, after exposure to hygienic worker bees. The author notes that while VSH is reasonably well-studied as related to worker brood, very little is known about the expression of this behavior toward drone brood. Given that *Varroa destructor* is known to prefer to infest drone brood over worker brood, the author set up an experimental protocol to "compare the hygienic responses of VSH bees to *Varroa*-infested drone and worker brood."

The experimental design included both a laboratory component (incubator test) to examine the removal rates of drone and worker brood by VSH bees and a field experiment to examine changes in infestation rate through time within VSH colonies. The bee stocks included queens from two strains of honey bees; one stock selected for the high expression of VSH behavior (maintained through instrumental insemination (i.i.)) and a control stock of unselected commercial Italian honey bees (with queens also produced by i.i.). In the incubator test, Harris took a comb of uncapped worker brood from each of five colonies and an uncapped drone brood comb from each of five other colonies. The 10 combs were then placed in a single mite source colony until all the brood cells were capped. A second trial was conducted and repeated as above (20 combs total). The infestation rate was estimated by counting the infestations present in 200 cells (worker combs, 100 cells per side) or 10% of all available capped brood (drone combs, 15-40 cells). The individual combs with capped brood were then sawn in half and each half was attached to a half-comb of honey and pollen to make a complete comb. In this way, each starting comb provided two subsequent experimental combs that were photographed to provide a means to count the number of brood cells. One comb from each pair was then placed in a cage with VSH bees and the other was placed in a cage with control bees. All cages were placed in an incubator at 34.5°C. After 24 hours, the bees were brushed off and the comb sides photographed again to provide a post-test cell count. Counts of open cells and the infestation rate of the opened cells were also noted.

In the field experiment, Harris used 14 colonies selected for high levels of VSH behavior Combs from 25 other colonies were used as sources of naturally infested worker and drone pupae. Prior to experimental use, each comb was examined (as in the incubator study) to determine the initial *V destructor* infestation rate. Experimental worker combs were then placed in the high VSH colonies for one week and then removed and recounted to determine the post-test mite infestation rate. Within 14 days, a comb of drone brood was inserted in the colony and the test was repeated, including the post-test estimation of infestation rate.

The incubator test results showed that there was no difference in the removal of drone compared to worker brood in the 24-hour test period by either the VSH or the control bees. However, there was a significant different between the VSH and control bees themselves in the proportion of brood that was uncapped and removed in 24 hours, with VSH and control bees uncapping and removing 4-5% and 1-2% respectively Overall, the percentage of pupae that was removed from combs and the percentage of uncapped pupae that were mite-infested were "positively correlated to the initial infestation rate" (that is – the more mites that were present in the comb, the greater the removal rate of pupae and the higher the rate of mite infestation in cells that were uncapped).

The field test again showed that the final infestation rate was positively correlated to the initial infestation rate. However, there were apparent differences in the response of the VSH bees to the two types of brood. That is, the final mite infestation rates for capped worker brood were generally lower than the initial infestation rates while, in the case of drone brood, both the final and initial infestation rates were similar In both drone and worker brood, approximately 1-2% of the capped brood was uncapped by the VSH bees during the course of the weeklong experiment.

Based on the evidence related to initial and final infestation levels in the field experiment, the author indicated there was a "preferential removal of mite-infested worker pupae and either no removal or random removal of mite-infested drone pupae." Thus, despite the fact that similar proportions of cells of the two brood types were uncapped by VSH bees, the effect appears to be that a decidedly higher proportion of cells that were uncapped in the worker brood were infested by *Varroa destructor*, compared to cells that were uncapped in the drone brood. There are several important of this finding that Harris mentions. First, the fact that VSH bees do not appear to express any special hygienic behavior toward infested drone brood, opens the possibility that overall resistance to *V destructor* could be "compromised" if high levels of drone brood and mites coincided. However, he cites recent field research that showed that VSH conferred mite resistance in a commercial apiary without drone brood management, so if VSH leads to low mite levels in the Spring, it could still confer mite suppression adequate to reduce overall mite loads, compared to non-VSH colonies. Harris points out that a positive outcome of these findings, relative to mite control, is that drone brood could potentially serve as a refuge for susceptible mites, even in the presence of intensive VSH behavior by bees. The presence of a residual population of mites in the drone brood could reduce the rate at which mites develop resistance to VSH in bees. The author also notes that, due to the higher occurrence of multiple mite foundresses (and therefore genetic exchange between unrelated individuals) in drone cells, the potential for dilution of mite resistance genes is also higher in drone brood.

Interesting... if we imagine a scenario in the honey bee world where worker brood is protected from *Varroa* mites through the behavior of worker adults, to such an extent that only drone brood is available and used for mite reproduction, we recollect the situation between the mite and its original host *Apis cerana*. The prospect to find a genetic solution within *A. mellifera* that offers such symmetry to the natural situation between the mite and its "correct" host has quite a conceptual appeal, with overtones of sustainability Now that would be nice... BC

Dr. Steve Sheppard, Thurber Chair, Dept. of Entomology, WA State University, Pullman, WA 99164-6382, shepp@mail.wsu.edu; www.apis.wsu.edu.

Harris, J. W 2008. *Effect of brood type on* Varroa*-sensitive hygiene by worker honey bees* (Hymenoptera: Apidae). Ann. Entomol. Soc. Amer 101:1137-1144.

A CLOSER LOOK

LAYING WORKERS

Clarence Collison
Audrey Sheridan

Pheromone cues are the most likely regulators of worker egg policing.

Reproductive workers are seldom seen in colonies with a laying queen. The queen's pheromones and the pheromones from her brood inhibit ovarian development in workers. If a colony becomes queenless, either due to workers failing to raise a new queen or because the old one dies unexpectedly, the ovaries of a few workers become functional and they begin to lay eggs. Workers do not mate; therefore they only produce haploid (one set of chromosomes) male offspring. As a result, the worker population, and subsequently the brood-rearing activities, of laying worker colonies usually decline rapidly However, laying workers may produce more than 6000 viable drones before the colony dies out (Page and Metcalf 1984). Most of these viable males come from eggs that are laid within a few days of the onset of worker oviposition (Page and Erickson 1988).

Many factors are known to affect the rate of ovary development in individuals from queenless colonies including worker age (Delaplane and Harbo 1987), worker population size (reviewed by Harris and Harbo 1991), nutrition (Jay 1968), and the degree of ovary development of other worker bees (Velthuis et al. 1965, Jay and Nelson 1973). Racial differences in rate of ovary development have also been described for workers. Ruttner and Hesse (1981) ranked various honey bee races with regard to rapidity of ovary development, from fastest to slowest: *Apis mellifera capensis* > *A. m. intermissa* > *A. m. scutellata* > *A. m. ligustica* > *A. m. carnica* > *A. m. mellifera*. Generally, African races require five to 12 days of queenlessness before workers begin to lay eggs, and European races require 14-35 days.

Workers with developed ovaries are often attacked by other workers (Visscher and Dukas 1995). Nevertheless, about four percent of the workers can lay about seven percent of the total of male eggs (Jay 1968, Visscher 1996). Pirk et al. (2004) compared the viability of worker-laid male eggs to queen-laid male eggs by counting the number of larvae hatched within a 96-hour time window after introducing the eggs protected with mesh into queenright test colonies. They found around four times as many larvae had developed from queen-laid eggs than from worker-laid eggs, indicating a considerably reduced viability of worker-laid eggs. Also, in simultaneous studies with unprotected eggs, all worker-laid eggs were removed, whereas only 40-50% of queen-laid unfertilized eggs were removed from the combs after 24 hours. From these observations it was hypothesized that policing workers can tell the difference between viable and low-viable eggs, and remove the low-viable ones, which are normally worker-laid. Later, this hypothesis was challenged by Beekman and Oldroyd (2005), who found that policing workers distinguish queen-laid eggs from worker-laid eggs using factors other than egg viability

"Honey bee queens are more extensively fed with a protein-rich diet than are laying workers, and an augmented protein intake has been shown to significantly enhance embryo development in honey bees."

The difference in egg viabilities is probably based on parent nutrition. Honey bee queens are more extensively fed with a protein-rich diet than are laying workers, and an augmented protein intake has been shown to significantly enhance embryo development in honey bees (as reviewed by Pirk et al. 2004). The difference in diet could also result in differences in the eggs abilities to resist dehydration and, hence, viability Ovarian development in queens is greatly superior to that in laying workers and may also foster high egg viability Furthermore, in contrast to queens, workers often show imperfect oviposition, which perhaps damages the eggs.

Pheromone cues are the most likely regulators of worker egg policing. Queen mandibular gland pheromone and queen Dufour's gland pheromone have been shown to inhibit the development of worker ovaries, even though recent research has shown that the production of these two pheromones is not regulated by the same mechanism that controls the development of worker ovaries (Willis et al. 1990, Malka et al. 2009). The Dufour's gland, located at the base of the sting chamber, is present in both queens and workers, and is believed to produce a marking pheromone that protects the eggs from policing. The secretion from Dufour's gland is not the same in workers and queens (Katzav-Gozansky et al. 2001), but its composition appears to be controlled by the amount of juvenile hormone in the hemolymph (blood). The physiological state and the behavior of laying workers partly resemble those of queens. Laying workers have low juvenile hormone titers (Robinson et al. 1992), relatively high vitellogenin levels in the hemolymph (Engels 1974), and high levels of dopamine and its metabolites (Sasaki and Nagao 2001), similar to queens. Recent genome-wide analysis of gene expression patterns in the brain showed that the gene expression patterns of laying workers are also more queen-like, and may represent a core group of genes associated with reproductive physiology (Grozinger et al. 2007).

Pheromones also mediate cooperation between individuals in a hive to the advantage of productivity. In a queenright colony, the queen monopolizes reproduction, while the sterile workers cooperate harmoniously in nest maintenance. However, under queenless conditions, cooperation collapses and reproduction competition among workers ensues. Malka et al. (2008) demonstrated that both aggression and pheromone signaling are essential components of reproductive competition and that pheromone signaling actually triggers the onset of aggression. Groups of queenless bees were maintained until first aggression was observed. In groups where aggression occurred early, the attacked bee had consistently more queen-like pheromone in both the mandibular and in the Dufour's glands, although both contestants had undeveloped ovaries. In groups with late aggression, the attacked bee had consistently larger oocytes and more queen-like pheromone in the Dufour's but not the mandibular gland. The researchers suggest that at the early stages of competition, the mandibular gland secretion is utilized to establish dominance and that the Dufour's gland provides a fertility signal. They also believe that the higher amount of Dufour's gland pheromone is what triggers aggression.

"In groups where aggression occurred early, the attacked bee had consistently more queen-like pheromone in both the mandibular and in the Dufour's glands, although both contestants had undeveloped ovaries."

The behavioral changes seen in laying workers can also be attributed to a change in physiology. Nakaoka et al. (2008) investigated whether the physiological state of laying workers is more similar to nurse bees or foragers by examining the hypopharyngeal gland and hemolymph vitellogenin titers. In a normal colony, nurse bees have well-developed hypopharyngeal glands that synthesize royal jelly proteins and high hemolymph vitellogenin titers, whereas foragers have shrunken hypopharyngeal glands and low hemolymph vitellogenin titers. In queenless colonies, however, laying workers tended to have more developed hypopharyngeal glands and to synthesize royal jelly proteins, whereas workers with shrunken hypopharyngeal glands tended to synthesize á-glucosidase (which is needed for processing nectar into honey) and to have undeveloped ovaries. Furthermore, the workers with developed ovaries had higher vitellogenin titers than nurse bees, whereas those with undeveloped ovaries had lower vitellogenin titers. These findings indicate that the physiological state of laying workers is similar to that of nurse bees, and opposite that of foragers.

Laying workers do not occur exclusively in queenless colonies. An extremely rare 'anarchistic' phenotype occurs in workers, characterized by the development of functional ovaries and the oviposition of large numbers of haploid (drone) eggs in the presence of a laying queen (Oldroyd and Osborne 1999). Researchers demonstrated that the anarchistic phenotype is highly heritable; the majority of colonies headed by queens inseminated solely with worker-laid drones exhibited the anarchistic phenotype. In normal colonies around 10% of workers show some signs of ovary development, such as minor swelling of the ovarioles (Jay 1968, 1970, Kropacova and Haslbachova 1969, Visscher 1996) and around 0.01% of workers actually lay eggs. However, although approximately 7% of male eggs are laid by these few workers, 99.88% of these eggs are removed by worker policing (systematic removal and destruction of eggs) (Visscher 1996).

Page and Robinson (1994) reported that there are subfamily differences in drone production in queenless honey bee colonies which are not always explained by subfamily differences in oviposition behavior They found that queenless colonies have reproductive division of labor with respect to egg laying, egg eating and larval care. This division of labor is correlated with physiological differences among workers, and results in subfamily differentiation among those activities.

In summary, there are three principal observations made of queenless colonies containing reproductive worker honey bees: 1) One or a few workers in queenless colonies of European bees produce queen mandibular pheromone (Plettner et al. 1993) and suppress the egg laying behavior of their sister nestmates (Sakagami 1958, Robinson et al. 1990). 2) Workers behave agonistically toward each other on the basis of egg-laying status and genetic relatedness (Sakagami 1954, Evers and Seeley 1986). 3) At least a few workers in all subfamilies of queenless colonies engage in egg-laying, however, egg-laying activity is not equal among subfamilies (Page and Erickson 1988, Robinson et al. 1990).

Colonies with laying workers are recognized easily: only drones are reared in worker-sized cells, there maybe anywhere from five to 15 eggs per cell, and eggs are usually on the side of the cell instead of at the base, where they are placed by a queen. Laying workers are a sign that colony decline is imminent, and the best way to deal with hives that have actively laying workers is to combine them with a queenright colony or let them expire. Laying worker colonies are difficult to requeen because laying workers are physiologically similar to queens and most of the bees are old.

References

Beekman, M. and B.P. Oldroyd 2005. *Honeybee workers use cues other than egg viability for policing.* Biol. Lett. 1: 129-132.

Delaplane, K.S. and J.R. Harbo 1987 *Drone production by young versus old worker honeybees in queenless colonies.* Apidologie 18: 115-120.

Engels, W 1974. *Occurrence and significance of vitellogenins in female castes of social Hymenoptera.* Am. Zool. 14: 1229-1237

Evers, C.A. and T.D. Seeley 1986. *Kin discrimination and aggression in honey bee colonies with laying workers.* Anim. Behav. 34: 924-944.

Grozinger, C.M., Y Fan, S.E. Hoover and M.L. Winston 2007 *Genome-wide analysis reveals differences in brain gene expression patterns associated with caste and reproductive state in honey bees* (Apis mellifera). Mol. Ecol. 16: 4837-4848.

Harris, J.W and J.R. Harbo 1991. *Producing eggs from a single worker honey bee* (Hymenoptera: Apidae). J. Econ. Entomol. 84: 818-824.

Jay, S.C. 1968. *Factors influencing ovary development of worker honeybees under natural conditions.* Can. J. Zool. 46: 345-347

Jay, S.C. 1970. *The effect of various combinations of immature queen and worker bees on the ovary development of worker honeybees in colonies with and without queens.* Can. J. Zool. 48: 169-173.

Jay, S.C. and E.V Nelson 1973. *The effects of laying worker honeybees* (Apis mellifera *L.) and their brood on the ovary development of other worker honeybees.* Can. J. Zool. 51: 629-632.

Katzav-Gozansky, T., V Soroker, F Ibarra, W Francke and A. Hetz. 2001. Dufour's gland secretion of the queen honeybee (*Apis mellifera*): an egg discriminator pheromone or a queen signal? Behav. Ecol. Sociobiol. 51: 76-86.

Kropacova, S. and H. Haslbachova 1969. *The development of ovaries in worker honeybees in a queenright colony.* J. Apic. Res. 8: 57-64.

Malka, O., T Katzav-Gozansky and A. Hefetz 2009. *Uncoupling fertility from fertility-associated pheromones in worker honeybees* (Apis mellifera). J. Insect Physiol. 55: 205-209.

Malka, O., S. Shnieor, T Katzav-Gozansky and A. Hefetz 2008. *Aggressive reproductive competition among hopelessly queenless honeybee workers triggered by pheromone signaling.* Naturwissenschaften 95: 553-559.

Nakaoka, T., H. Takeuchi and T Kubo 2008. *Laying workers in queenless honeybee* (Apis mellifera *L.) colonies have physiological states similar to that of nurse bees but opposite that of foragers.* J. Insect Physiol. 54: 806-812.

Oldroyd, B.P. and K.E. Osborne 1999. *The evolution of worker sterility in honeybees: the genetic basis of failure of worker policing.* Proc. R. Soc. Lond. B. 266: 1335-1339.

Page, R.E. and E.E. Erickson 1988. *Reproduction by worker honey bees* (Apis mellifera). Behav. Ecol. Sociobiol. 23: 117-126.

Page, R.E. and R.A. Metcalf 1984. *A population investment sex ratio for the honey bee* (Apis mellifera *L.*) Amer Nat. 124: 680-702.

Page, R.E., Jr. and G.E. Robinson 1994. *Reproductive competition in queenless honey bee colonies* (Apis mellifera L.). Behav. Ecol. Sociobiol. 35: 99-107

Pirk, C.W W., P. Neumann, R. Hepburn, R.F.A. Moritz and J. Tautz 2004. *Egg viability and worker policing in honey bees.* Proc. Natl. Acad. Sci. USA 101: 8649-8651.

Plettner, E., K.N. Slessor, M.L. Winston, G.E. Robinson and R.E. Page. 1993. Mandibular gland components and ovarian development as measures of caste differentiation in the honey bee (*Apis mellifera* L.) J. Insect Physiol. 39:235-240.

Robinson, G.E., R.E. Page and M.K. Fondrk 1990. *Intracolonial behavioral variation in worker oviposition, oophagy, and larval care in queenless honey bee colonies.* Behav. Ecol. Sociobiol. 26: 315-323.

Robinson, G.E., C. Strambi, A. Strambi and Z.Y Huang 1992. *Reproduction in worker honey bees is associated with low juvenile hormone titers and rates of biosynthesis.* Gen. Comp. Endocrinol. 87: 471-480.

Ruttner, F. and B. Hesse 1981. *Specific differences in the development of ovaries and egg laying of queenless workers of several races of the honeybee,* Apis mellifera *L.* Apidologie 12: 159-183.

Sakagami, S.F. 1954. *Occurrence of an aggressive behavior in queenless hives, with consideration on the social organization of honeybees.* Insectes Soc. 1: 221-343.

Sakagami, S.F. 1958. *The false queen: fourth adjustive response in dequeened honeybee colonies.* Behaviour 13: 280-295.

Sasaki, K. and T Nagao 2001. *Distribution and levels of dopamine and its metabolites in brains of reproductive workers in honeybees.* J. Insect Physiol. 47: 1205-1216.

Velthuis, H.H.W., F.J. Verheijen and A.J. Gottenbos 1965. *Laying worker honeybee: similarities to the queen.* Nature 207: 1314.

Visscher, P.K. 1996. *Reproductive conflict in honey bees: a stalemate of worker egg-laying and policing.* Behav. Ecol. Sociobiol. 39: 237-244.

Visscher, P.K. and R. Dukas 1995. *Honey bees recognize development of nestmates' ovaries.* Anim. Behav. 49: 542-544.

Willis, L.G., M.L. Winston and K.N. Slessor 1990. *Queen honeybee mandibular gland pheromone does not affect worker ovary development.* Can. Entomol. 122: 1093-1099.

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The Honey Bee Diet

Ross **Conrad**

The Honey Bee's Diet – What's on the menu for your bees this Spring?

The honey bee diet has become a hot issue since the emergence of CCD. Bees, like all living organisms, need high-quality nourishment to reach their maximum potential and avoid becoming susceptible to diseases and parasites. Honey made from the nectar of flowering plants containing small amounts of vitamins and minerals, and pollen collected from blossoms are foods that nature has designed to provide honey bees with optimal health.

Difficulties in obtaining a natural balanced diet

Unfortunately our industrialized agricultural system renown for its mono-cultured fields of a single crop often creates dietary stress for bees by limiting their diet to a single plant source. Bees need a varied diet that consists of pollen from a variety of plants in order to be healthy as no single pollen source contains the wide range of vitamins, minerals, proteins and fats necessary for proper bee nutrition and robust health. Thus, the first rule of feeding should be to keep hives in an area where a variety of blooming plants are available for as much of the season as possible. In practice this means trying to find areas to keep your hives where there are a variety of agricultural activities going on, or a natural abundance of plants blossoming throughout the season within a two-to-three mile radius of the apiary since it is the rare beekeeper who has time to keep bees **and** plant and grow a significant number of foraging crops for their hives.

There are many areas of the world however, where such a diversity of plants simply doesn't exist, or they only exist during certain times of the year To make matters worse, shifting climate patterns can mean that the normal accompaniment of flowering plants in a given area simply don't bloom as usual due to too much or too little rain. Changing weather cycles can also mean that plants bloom either much earlier, or much later in the year due to out of season temperatures. It is inevitable then that even in prime bee foraging areas, there will be times when available forage may not be totally adequate for every hive. Add to this equation the fact that despite our best efforts, there may be hives that simply don't build up their population well and are unable to take full advantage of available forage during the course of a given year

Thus, the second feeding rule I work by is to use excess food stores from strong healthy hives to feed weaker hives that are not able to store enough honey and/or pollen on their own to make it through periods of dearth, weakness or disease. Feeding frames of capped honey in the comb is the ideal way to provide food to weak hives in need since it saves the recipient colony from having to expend energy and resources storing, processing and capping the honey themselves. By the same token, honey from hives that become queenless, or die out from causes other than disease can be used as supplement feed for needy hives. In the case of queenless or drone laying hives, the bees can also be transferred to weak hives along with the honey in order to give the weak hive a population boost.

Natural diet substitutes

If one has to feed bees something other than honey in the comb, honey from a clean, disease-free source is the next best thing. Unfortunately, most of us don't have a lot of excess honey sitting around that we can use to feed our bees and purchasing honey is expensive and risky as it may carry American Foul Brood spores. In addition, most of the feeding apparatus available on the market do not work well when filled with crystallized honey, and some feeders may not be able to handle liquid honey due to its thick consistency especially in cool temperatures. Beekeepers that have extra honey they want to use as feed can mix it with water in order to bring the honey to a syrup-like consistency If you must use honey that you suspect may be contaminated with foul brood spores, the honey will require significant heating prior to feeding it to your bees. Classic research on foul brood's heat resistance conducted at Philadelphia's Regional Research Lab, indicates that such honey will have to be boiled (212F°) for about two hours in order to destroy the spores it may contain. Alternatively in order to conserve energy, a person could heat questionable honey up in the oven. The honey will need to reach a temperature of 285F° for two minutes, or 270F° for about nine minutes in order to become sterilized.

Unfortunately we are now getting into what I consider to be low grade food sources, as heating will destroy ➢

the natural enzymes that are found in raw honey and may cause some of the components found in processed honey to be altered, such as the proteins in pollen. Thus, all the time and energy involved in heating honey makes it a poor choice overall.

One of the most common feed stocks given to bees is white sugar typically converted into syrup or fondant candy Brown sugar should never be used since is contains significant amounts of material that can not be digested by bees. White sugar production involves collection of the juice from sugar cane or sugar beets, combining it with a neutralizing agent (often lime), and after various processes of removing sediment, filtering, and dehydration, sugar crystals are produced from the resulting liquid. During this process all the vitamins and minerals that naturally occur in the sugar are removed creating the "empty" calories so disdained by nutritionists. This pure carbohydrate formula can be fed to bees, but it lacks the natural enzymes and micro-nutrients (vitamins and minerals) that exist in nectar used to make naturally produced raw honey As a result, sugar syrup and other artificial foods may perform well as occasional temporary emergency feed, but regular feeding of such a diet can weaken the vitality and robust health of colonies over time when used regularly, similar to the effect an overconsumption of sugary treats can have on people.

One way to limit the detrimental affects of the deficiencies in sugar syrup is to follow the recommendations of Rudolph Steiner, the founder of Biodynamic agriculture, Waldorf education, and Anthroposophical medicine. Steiner recommended adding a generous pinch of salt and some filtered thyme and/or chamomile tea to the sugar syrup in order to reintroduce some of the missing nutrients to the sugar syrup. Please note that this works best when using natural sea salt that is typically gray or pink and has not been processed to remove the naturally occurring mineral content. While I am not aware of any studies that have been performed on such a formula, my experience indicates that fortifying the bee's syrup in this way to make a "Bee Tea" supports healthier bees in the long run. Along the same lines are reports of beekeepers leaving a salt lick (like those used for cattle or deer) in the bee yard so the bees can have access to some minerals all during the year

Not all sugars are created equal

Recently sugar made from sugar beets that have been genetically engineered (GE) to withstand herbicides have begun to hit the market. Unlike traditional plant breeding and hybridization, GE incorporates genes from completely different species (e.g. Viruses, bacteria, animals, etc.) into the plant's cells. Due to the fact that these types of changes would never occur naturally and there is a growing number of studies indicating potential harm to organisms (and people) who consume GE foods, organic standards ban these products from use. Only sugar made from sugar cane and labeled as "cane sugar" should be used by folks wanting to avoid GE sugar Certified organic beekeepers must go a step further and use only organic cane sugar

In order to save money on labor, many commercial beekeepers like to use high fructose corn syrup (HFCS) since it tends to be less expensive than sucrose and saves them the labor of having to turn sugar crystals into syrup before feeding. Unfortunately due to GE corn contamination of the global environment and most all corn and corn related plants, bee feed made from HFCS will result in honey that is likely to contain genetically engineered material. Even corn grown organically has been found to contain small quantities of genetically modified material. Beekeepers concerned about the well-being of their hive might also want to avoid HFCS because corn syrup contains two types of sugars that are mildly poisonous to honey bees; stachyose and raffinose. As a result, the life span of bees has been shown to be reduced when they are fed HFCS. Recent reports of mercury contamination in corn syrup does not help the situation. In addition, toxic compounds are formed if the syrup is exposed to high temperatures before being fed to hungry colonies. Such "bad batches" of HFCS that has sat too long in the baking sun in a tanker truck for example, will cause honey bees to die even sooner than those that receive untainted corn syrup. To help reduce its negative impacts, some beekeepers are diluting HFCS with a sucrose solution. Other beekeepers are buying sucrose solution (regular sugar mixed with water) by the tanker load and avoiding corn syrup's pitfalls, while saving money on the labor needed to make the syrup. No matter what type of sugar you use to feed bees in need, no feeding should ever occur when honey supers are on the hive.

Not all proteins are created equal

Bees consume pollen for its high protein and mineral content, and the colony requires an abundant supply when raising brood. As a wild-grown, nutrient-dense food source, pollen is difficult to replicate, though many have tried, typically by using soy powder as a substitute. Patties containing pollen protein substitutes are fed to hives early in spring to jump-start brood rearing in an effort to ensure a maximum worker population that will take full advantage of the first major honey flow of the season. However, an evaluation of the nutrient and protein differences between pollen and soy for example reveals that imitation pollen patties tend to be a poor replacement for the real thing and produce difficulties like those encountered from feeding honey/nectar substitutes. This is similar to a person who tries to make up for a poor diet by taking multivitamin supplements: it is better than a poor diet on its own, but not nearly as beneficial as a proper diet of natural whole foods. Soy protein is also reported to contain small amounts of the same types of sugars as HFCS that are mildly toxic to bees.

Whether one is regularly replacing honey with sugar syrup, or pollen with soy flour or some other protein substitute, the overall health and immunity of the colony may end up being compromised in the long run. This may occur even if no noticeable effects are immediately evident. Because of this, I believe that beekeepers that utilize artificial feed on a regular basis, or over prolonged periods of time, will tend to experience more problems among their hives than those that avoid such diets or use them only when starvation is imminent. Common sense dictates that, like all creatures, honey bees thrive on wholesome ➢

natural foods and they suffer when forced to consume the equivalent of junk food over extended periods. BC

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Selected Resources:

E. J. Calesnick & J. W White, Jr., *Thermal Resistance of Bacillus Larvae Spores In Honey,* Eastern Regional Research Laboratory, Philadelphia, Pennsylvania, 1951 http://jb.asm.org/cgi/reprint/64/1/9.pdf.

Rudolf Steiner, *Beekeeping: Nine Lectures on Bees,* published by Steinerbooks, Blauvelt, New York second printing 1988.

Louise A. Malone and Minh-Hà Pham-Delègue, *Effects of Transgene Products on Honey Bees (*Apis mellifera*) and Bumblebees (*Bombus sp.*), Apidologie* 32 (2001): 1-18,
http://www.hortresearch.co.nz/files/science/gmimpacts/m1403malone.pdf

Minh-Hà Pham-Delègue et al., *Long-term Effects of Soybean Protease Inhibitors on Digestive Enzymes, Survival and Learning Abilities of Honey Bees,* Entomologia Experimentalis et Applicata 95 (2000): 21-29.

Brian Halweil, *Outlawed GMO Corn Shows Up In Mexico,* World Watch, January 2002 http://www.accessmylibrary.com/coms2/summary_0286-24959175_ITM

Seeds of Deception: Exposing Industry and Government Lies About the Safety of the Genetically Engineered Foods You're Eating, by Jeffery M. Smith (September 2003)

Bob Harrison, *Weslaco Bee Lab and Current Research,* American Bee Journal 147 (4): 323-326

'Bout a 100 – Sideline Beekeeping
NEIGHBORS: THE GOOD, THE BAD AND THE IGNORANT

Larry Connor

Fighting Stereotypes

Many of us have some stereotypes about our neighbors and their attitudes about bees and beekeeping. These examples are probably ALL wrong, but here are a few of the ways beekeepers think their neighbors will react when bees are moved next door!

1 Your neighbor will fight you every step of the way if you put a colony or two in your backyard.
2. Your neighbor will run to the city/town/township manager and file a formal complaint about your bees.
3. Your neighbor will run to an attorney after their rock-throwing child is stung to take everything you own and then some.
4. Your neighbor does not know what he or she is talking about.

You may not realize it, but your neighbor has some stereotypes about bees and beekeepers. And about you:

1. Your bees will hunt them down and sting them, and they will have to call the ambulance to save their lives.
2. Whenever they plan an outdoor party, you intentionally bring in billions of bees to torment their guests.
3. You carefully train your bees to visit their birdbath and swimming pool.
4. You do not know what you are talking about.
5. You are an idiot for keeping bees and cannot possibly be talked to.

My goal here is to break down some of the stereotypes about bees and beekeepers as well as with bees and the general public. There is no secret that most people, including some in your own family, are afraid of bees. Some of this fear is probably based on genetically programmed instinct, since most folks have some natural vibrations against things that go *buzz* and sting. But a great deal of the fear has been learned from parents and from teachers. I remember a teacher going into a fear-driven panic attack when a bumble bee queen flew into the classroom. She did one thing right by turning off the lights and letting the queen fly toward the window. But she certainly emphasized the risk (however remote) of being stung, and failed miserably at turning the uninvited classroom visitor into a really skillful learning opportunity She could have instructed the class to sit quietly and discuss what the queen was doing, looking for a nesting site or food but not looking for delicate six-year-old children to carry off to her nest and feed to her babies! Then during recess or as part of science, she could have taken the class out to the edge of the playground and watched the bees working on the dandelions or goldenrod, depending on the time of year

I have worked with excellent teachers who turn the visiting bee into a class lesson – a positive learning situation. The result is pretty amazing. The children from these teacher's classrooms are often the ones who want to see inside a beehive, and some even start keeping bees with their family. As one who has worked with third and fourth graders a great deal collecting and studying insects and especially bees, I can tell you that the number that are afraid of the bees are so because someone worked hard to implant that fear into them at a much younger age.

If you are setting up your first colony this Spring, or you have been keeping bees all your long life, here is a simple review of some of the things beekeepers can do to work nice-nice with the neighbors.

A. Don't advertise your bees – Out of sight out of mind works for placing your bees on your property Back when I was on the faculty at (The) Ohio State a beekeeper explained that he was having battle with a neighbor and had aimed the entrances of his colonies so that the bees would have to fly over the neighbor's garden. For some reason the neighbor did not like that, and rightly so. Personal squabbles should not include bees. This brings up an interesting fact of bee behavior we need to keep in mind. Bees will fly out low to the ground and then rise in altitude and then fly 20 to 100 feet up in the sky, above

With the house, the fence and the tree providing protection from neighbor's gazes, the beekeeper was challenged by the large open lawn. Her solution was to put a burlap screen on poles to shade the bees and to screen them as well. (Photo provided, with thanks, by Rich Wieske, Royal Oak, Michigan.)

View of the hidden hive, with plenty of work room for the beekeeper and a few friends. The bees are encouraged to fly up and out with this setup.(Photo provided, with thanks, by Rich Wieske, Royal Oak, Michigan.)

the treetops. They do not routinely fly along the ground unless actively foraging. This provides us with a biological recommendation – get the bees to fly UP as soon as they leave the hive. Position the hive with the flight entrance facing a hedge, fence or even an artificial barrier, such as a big piece of burlap hung on a clothes line. Up, up and away girls, you don't need to fly over the rutabagas!

Just as important as the upward mobility of the foragers, a flight deflector puts the bees in a setting out of the view of the neighbor, perhaps behind the garage, in the back of your lawn/garden, or somehow positioned so the bees are not detected, either as a hive or as a returning forager crashing into the neighbor pulling weeds in the vegetable garden.

B. Do talk to the neighbors – In this post Colony Collapse Syndrome/Heightened Media Awareness (CCD/HMA) environment, it is likely that your neighbor knows a great deal about the problem with disappearing bees. Use that as the opener for an adult conversation. "Have you noticed how few honey bees we have in the neighborhood? I've been having problems with the pollination of my cucumbers, melons, raspberries, apples (fill in the correct answer), and have made arrangements to get a colony of very gentle bees to pollinate local gardens. Let me tell you where I plan to place them so they don't bother anybody "

Once you have bees, a few jars of honey to each neighbor will produce an amazing amount of positive public relations. Add a set of gift candles in the Fall, and a few items the bees pollinated from the garden, just to drive the point home. Invite your neighbor to a local beekeeper's meeting, and give them a beesuit to wear as they watch you work your bees. These are small items, but with a huge payoff. Turn your neighbor into your friend, ally, and unexpected PR person when you are not there to defend yourself. Mentor their children about bees. Show them all how to remove a stinger if they are stung.

C. Summer Water – This may be the most common reason people complain about bees and is not always the easiest to solve. Bees need water in the Spring when they liquefy crystallized honey for brood rearing, and for cooling the hive when the temperature rises. Bees are often seen at birdbaths, the dog's water dish, and at swimming pools. You are wise to use a watering system on your own property to divert water collection, but bees need certain mineral salts to function. Consider the flocks of butterflies gathering water at wet spots. They are actually gathering essential ground minerals they need to live. Bees are much the same, looking for essential elements for their developmental needs. That means there is something in the water at the birdbath, dog dish or swimming pool that is lacking in your clean water source. Experiment with natural mineral sources (at low levels) and determine what your bees like to visit.

As far as swimming pools, you may not want to put bees on property near a swimming pool, since it is a bee magnet. Try some floating sponges the pool owner can put into the pool while not swimming so the bees can crawl up and fly home.

Many beekeepers build watering devices with floating vegetation and a rocky/stony area where the bees are able to land, gather water, and fly home. This may use rainwater supplemented with a hose with a very slow leak.

D. Offer to move your bees during neighborhood parties – Why tempt fate? Move your colony to a temporary location when your neighbor's daughter gets married in the backyard. If there are honey bees around, you can quietly explain that you moved your colony, so there must be some wild bees in the old bee trees, and isn't that wonderful the bees are returning to the area. This will show the neighbor that you are being reasonable and caring for them.

E. Local Zoning – Recently the cities of Vancouver (BC), Ann Arbor (MI) and Cleveland (OH) have enacted regulations that allow beekeeping in their limits (as well as a few chickens). This obviously shows the impact of the "eat local" movement as well as the CCD publicity It is time that elected officials recognize the role of bees in pollination of urban gardens in areas where burned-out, bombed-out blocks are more productive in agricultural use rather than in unrealistic land speculation (especially in the current economy). The proliferation of urban gardening cooperatives and programs are adding bees and beekeeping to the skill set they are teaching. This is certainly long overdue and must be promoted in small communities as well as large.

F. Wasp and Bee Confusion – Even new beekeepers are confused by non-honey bee pollinators, and need a good course in bee ID. I suggest you start a collection of bees of different species. Show honey bees of different races to show the color variation. Alongside put some wasps, hornets, bumble bees (in different sizes), winged ants, and any special look-alikes in your area. For fun, put in a few beeflies and other insects that mimic honey bees in size, appearance and behavior Educate the neighborhood kids first, since they are likely to share this with parents and then the adults will want to see.

Some beekeepers use the argument that it couldn't be their bees that are causing the problems at the neighbors. Rather than taking a position, share what you can about identification and general information about stinging insects.

G. Learn what a defensive behavior is, and when it is time to replace the genetics of a hive. Here is a simple table of bee behaviors and the acceptable (desired) and unacceptable (time to move the bees or replace the queen):

BEHAVIOR	DESIRED	UNACCEPTABLE
Yard Patrolling	Bees do not meet you at the garden gate or hit your veil. You are able to smoke the entrance of the hive and mow or trim in front and the bees do not fly out to patrol.	Bees hit the car or truck wind screen as you drive near them, and dive into you as you mow the grass or work the garden.
Nest Defense	Bees do not fly out when you work the colony, but remain in the hive. You can inspect the colony without stinging.	Bees fly out of the hive in large numbers and start stinging behaviors; the level of stinging increases rapidly until you give up and close the colony
Temperament	Bees remain quiet on the honey and brood combs	Bees drop off the combs, fly into the air and make hive work unpleasant
Robbing	Bees do not rob other bees or from soda pop containers or at picnics (perhaps you have kept them well fed).	Bees produce coca-cola and Mountain Dew honey by visiting trash containers (and are not themselves because of all the corn syrup).
In general	Nobody notices your bees.	You get phone calls about your bees because they are terrorizing the neighborhood.

H. When there is a problem – I am not an attorney, but I know most issues with neighbors involve either a misunderstanding or a deliberate attempt to provoke. There are some personality types that will not respond to reason and logic – and I have seen that in both sides, beekeeper and beekeeper's neighbors! If you happen to have such a neighbor and have no plans to move, I suggest you develop a full set of notes (dates, times of hive introductions, working schedule, genetic make-up of your bees, number of stings you received while working the bees, any problems with the bees (queenlessness, robbing) and anything you think might help. Set up a video camera to show how peaceful the bees are when you work them. IF you know of some problems in the neighborhood (open soda-filled trash cans at a local park, fair grounds or amusement park), add notes, photos and videotape of your observations.

Years ago I had to appear in small-claims court for not paying a snow removal contract (of a condo association). The property manager and I had tons of documentation that the snow was never removed, and the judge shut me up as I spread out all the documentation in front of him when he ruled against the contractor for not doing the job. Having a full set of notes and a diary of sorts goes a long way in court. Remember, I am not an attorney, but I know what worked for me in this court case.

Finally, there are times it is better to locate the bees somewhere else. In the past year I have been amazed how many small farmers want you to put bees on their property, and will work with you to protect them. Bee clubs should have a dating-service like matching program for beekeepers and property owners, and offer an annual meeting to discuss the nature of a good relationship. BC

This Summer Dr. Connor is offering two classes at the family farm near Kalamazoo. They will be on New Beekeeper Essentials, a season-long class at the farm for small groups of beekeepers. The second program will be a three-day course in queen rearing and bee breeding. For information go to www.wicwas.com or email LJConnor@aol.com.

Supplement to *Bee Culture* Magazine, Volume 137, Number 2
May, 2009
Published by The A.I. Root Company
Medina, Ohio

Science Of Bee Culture

VOL. 1 NO. 2

INSIDE

A note on flight activity of 4-lb Australian package-bee colonies used for almond pollination

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Keywords: honey bees, *Apis mellifera*, foraging, *Prunus dulcis*

Increasing acreage of almonds (*Prunus dulcis*) in California has increased the demand for honey bee (*Apis mellifera*) colonies for pollination. Since 2005, domestic U.S. colonies have been supplemented with colonies started from package bees imported from Australia. The need for almond pollination in late winter in California fits well with the availability of bees in late summer in Australia. Little is documented, however, about how recently imported bees perform as pollinating units. We compared flight activity of Australian package bee colonies (APBCs) and overwintered colonies during almond bloom.

We measured overall flight activity and pollen collection of 28 APBCs and 28 overwintered colonies. Packages (Brown's Bees Australia Pty Ltd., Mendooran, NSW) were 4-lb. units imported and hived in mid January 2006. Overwintered colonies, which had been started as APBCs in spring 2005, were managed in southern California prior to being moved in early February together with the APBCs for pollination. All colonies were in 1½ story hives and fed two gallons of sucrose/fructose syrup and one pound of pollen patty. Bees were placed in 12-colony groups (one colony type per group) along a road between two 40-acre (0.162-ha) blocks of almonds near Delano, CA. In one block, 'Sonora' 'Nonpareil', and 'Mission' ranged from early bloom to initial petal fall during the observation period. The other block of 'Butte' and 'Padre' had little bloom. Colony populations were obtained by measuring the coverage of each comb (estimated to the nearest 10% of a deep Langstroth comb) by adult bees and by sealed brood.

Measurements of flight activity were made on 14, 17, 18, 20 and 24 February. Two observers used flight cones (Gary 1967) to count the number of bees exiting each colony for 30 sec once every hour from 0800 through 1600 h. Data were converted to bee flights per minute for analysis.

Pollen foraging was measured in a subset of 12 colonies of each type between 1100 and 1400 h each day. Hive entrances were screened closed for ca. 1 min and then 30-40 returning foragers were swept into clear plastic bags. The percentage of bees carrying pollen pellets was recorded, and the bees were released.

Analysis of variance (ANOVA) and regression analysis were used to evaluate how flight activity was influenced by colony type, adult bee population, brood population, temperature and period of the day. Black globe temperatures were recorded at 5-min intervals at the test location. Period of day was assigned as morning (before 1100 h), midday (1100 – 1359 h) or afternoon (1400 h and later). Details of temperature measurements and statistical analysis are available elsewhere (Danka and Beaman 2007). Differences in pollen collection between the colony types and days were evaluated by ANOVA. Differences in bee populations between the colony types were evaluated with *t*-tests. Variation is reported as SE.

Temperature was the strongest regulator of flight activity. Flight rate increased with rising temperature but the increase was less at higher temperatures. This quadratic response to temperature differed for APBCs and overwintered colonies. Overwintered colonies had a greater rate of increasing flight through much of the observed temperature range (Fig. 1). Flight from overwintered colonies was nearly double that from APBCs at temperatures of peak flight activity (ca. 75 °F; 24 °C).

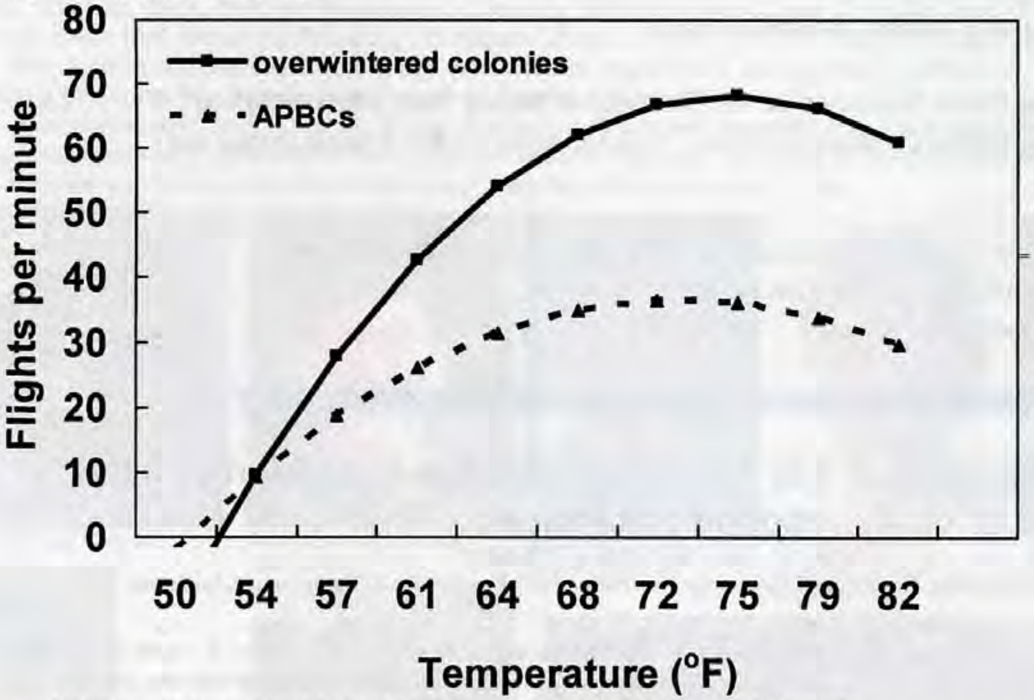

***Figure 1.** Flight activity from Australian package-bee and overwintered colonies in relation to temperature. These flight responses are modeled using regression parameter estimates together with the average adult bee populations of each colony type and average response from the three periods of day.*

Colonies with larger populations of adult bees had more flight activity, but population size had a more pronounced effect in the morning and midday than it did in the afternoon. An additional comb, completely covered with bees, yielded about nine more flights per minute before 1400 h but only 4.5 flights per minute after 1400 h. We recorded a similar trend in a previous test of overwintered colonies during almond pollination (Danka *et al.* 2006). The area of sealed brood did not significantly influence flight activity.

Overwintered colonies were more populous than APBCs in both adult bees (4.7 ± 0.3 vs. 3.9 ± 0.2 combs fully covered with bees, respectively) and sealed brood (1.6 ± 0.1 vs. 1.1 ± 0.1 combs fully covered with brood, respectively). At these overall adult bee populations, average flight activity across the range of temperatures observed was 40 bees per minute from overwintered colonies and 34 bees per minute from APBCs.

The percentages of foragers returning with pollen did not differ between the colony types; overall, 59 ± 3% of foragers collected pollen. Pollen foraging differed between days but there was an inconsistent interaction between colony type and day, i.e., APBCs had a greater percentage of pollen collectors than overwintered colonies on 17 February, but the converse occurred on 18 February.

APBCs were less responsive to changes in temperature and fielded fewer foragers than overwintered colonies, especially at higher temperatures when most flight occurred. APBCs were smaller (i.e., they had 17% fewer adult bees and 34% less sealed brood), and so had less flight activity. The combination of different colony sizes and temperature–dependent flight responses led to significantly more foraging flights from overwintered colonies (with an overall average of 47.4 ± 1.35 flights per minute) than for APBCs (27.4 ± 0.8 flights per minute). Thus, newly hived 4-lb (1.8-kg) APBCs had only 58% of the flight activity of overwintered colonies. This finding is consistent with other recent measures of comparative foraging activity of APBCs (Eischen 2006). The lower foraging activity of APBCs should be considered when these units are used for almond pollination.

Acknowledgements

We thank Red Bennett for providing access to the colonies. This article reports the results of research only. Mention of a proprietary product does not constitute an endorsement or a recommendation by the USDA for its use. This work was completed in cooperation with the Louisiana Agricultural Experiment Station.

References

Danka, RG, L D. Beaman 2007 *Flight activity of USDA-ARS Russian honey bees (*Hymenoptera: Apidae*) during pollination of lowbush blueberries in Maine.* Journal of Economic Entomology 100:267-272.

Danka, RG, HA Sylvester, D Boykin 2006 *Environmental influences on flight activity of USDA-ARS Russian and Italian stocks of honey bees (*Hymenoptera: Apidae*) during almond pollination.* Journal of Economic Entomology 99:1565-1570.

Eischen F 2006 Personal communication.

Gary, NE 1967 *A method for evaluating honey bee flight activity at the hive entrance.* Journal of Economic Entomology 60:102-104.

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Overwintering of Russian honey bees in northeastern Iowa

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Summary

Colony survival, levels of tracheal mite infestation, worker population size and weight loss of colonies from Russian test lines were evaluated during three winters (2001, 2002 and 2003) in Cresco, Iowa. Overall, 90% of the colonies survived the period from November to April with all lines showing good survival. The percentage of bees infested with tracheal mites in most Russian colonies in August, November and April was below the economic threshold of 20%. Surviving Russian colonies had good populations at the end of each winter [cluster volumes at *ca.* 50ºF(10°C) averaging at least 750 cubic in (12 *liters*)]. Colony weight loss from November to April was on average less than 20 lbs. (9 kg). The use of a screened bottom board increased weight loss by 20% compared to a standard wooden bottom board while additional top insulation had no effect. Russian bees provide a viable alternative for beekeepers needing to overwinter colonies in northern states.

Keywords: *Apis mellifera, Acarapis woodi*, honey bees, survival, tracheal mites

Introduction

Tracheal mites have made overwintering of honey bee colonies more difficult in the United States and Canada. Until the middle of the 1980s, high colony survival (about 90%) was possible for colonies which were disease-free, had large populations of workers, had a productive queen, had adequate honey stores and were physically protected from rapid heat loss due to wind or extreme cold (Furgala and McCutcheon 1992). In those days, colony losses were generally caused by small populations of workers or by inadequate honey stores (e.g. Johansson and Johansson 1971). Since the arrival of tracheal mites, increased winter mortality has been associated with high levels of tracheal mite infestation in the autumn (Furgala *et al.* 1989, Otis and Scott-Dupree 1992, De Guzman *et al.* 2006).

Tracheal mite resistant stocks prevent mites from reaching harmful levels. Colonies resistant to tracheal mites have a much greater chance of successfully overwintering, especially if they have other characteristics such as frugal food consumption and good clustering ability. Honey bees imported from the territory of Primorsky in far-eastern Russia are highly resistant to tracheal mites (De Guzman *et al.* 2002) and have shown good overwintering attributes (De Guzman *et al.* 2006). Beekeepers in Primorsky report good survival of colonies through winter, especially when colonies are held in wintering barns. We report on the overwintering performance in northeastern Iowa during 2001, 2002 and 2003 of colonies from queen lines being tested in the USDA, ARS breeding program of Russian bees. The main aims of this program are to select for resistance to varroa mites and honey production. However, the program also selects between and within queen lines to maintain resistance to tracheal mites and overwintering ability. The objectives of these tests were:

1) To confirm that Russian bees can overwinter successfully without treatment for tracheal mites in climates where beekeepers tend to have large problems with tracheal mites.

2) To evaluate possible differences between Russian queen lines in their overwintering performance prior to their inclusion in the breeding program.

Materials and Methods

Test Queens – Queens in colonies placed into overwintering tests were produced in the spring of each of three years. Queens produced in 2001, 2002 and 2003 were from lines in blocks C, A, and B of the breeding program, respectively (Rinderer *et al.* 2000). Queens were mated each year with drones from groups A and B, B and C, and A and C, respectively. Additionally, queens from a standard Russian queen line ("White-Yellow/Blue" from block A) were used each year.

Colony Conditions – Colonies chosen for the wintering experiments met several criteria, as follows: (1) the presence of the original queen introduced in the spring had been verified in August or September, (2) they were treated in August with Apistan® to eliminate possible confounding effects of varied rates of varroa mite infestation, (3) they had worker bee populations which were adequate for successful overwintering in that area (bees occupying at least the equivalent of 6 standard Langstroth sized frames), (4) they were housed in two standard Langstroth boxes and had been fed high fructose corn syrup (three to five gallons, 11 to 19 *liters*) so that most of the top box was filled with feed and honey and the total hive weight was above 90 lbs.

Data Collection – Colonies were overwintered in the same one or two apiaries near Cresco, Howard County, Iowa. Samples of workers for dissection of tracheal mites were taken in August of two of the three years (2002 and 2003). Colony weight, cluster dimensions (length, width and depth) at 45 to 55°F(*ca* 7 to 13°C), and worker samples were taken in November of 2001, 2002 and 2003. Colonies were placed on a metal platform attached to a load cell (SP4-100, HBM Inc., Marlboro, MA) connected to electronic digital displays for monitoring of weights. Colonies were then fitted with three sheets of insulation board (R-10, Dow-Corning) over the inner cover, and covered with corrugated cardboard wraps (WT-150, Mann Lake Ltd., Hackensack, MN). The same cluster measurements and samples were taken in each colony in April after removing the winter wraps. Summary weather data from a station 20 mi SSE (KDEH, Decorah, Iowa) were used to assess the severity of the winter periods.

Winter 2001-2002 – In the fall of 2001, 49 colonies representing nine test lines, and the Russian standard line (W-Y/B) were set up in two apiaries. In this test, the possible value of screened bottom boards and additional top insulation [25 lbs. (11.3 kg) of dry oats in a screened box] also were evaluated. Beekeepers in the area had used this technique decades ago because of possible value for humidity control and insulation. Cluster dimensions of colonies were used to produce size classes to which random assignments were made of four treatments (combining either a standard bottom board or a screened bottom board with a standard cover or a screened rim with oats).

Winters 2002-2003 and 2003-2004 – In 2002 and 2003, fewer colonies with original queens were available after evaluations in the autumn. The emphasis of the tests changed to comparing possible differences between Russian queen lines. A few colonies with queens of Italian origin were also included these two years (two and three colonies, respectively). In 2002, 21 Russian colonies from six test lines and a standard line (W-Y/B) were established in one apiary with screened bottom boards. In 2003, four test lines, plus colonies from the standard line were replicated for a total of 16 colonies in one apiary. Due to smaller bee clusters in 2003, this experiment was conducted with standard bottom boards.

Statistical Analyses The weight loss and final cluster volume of colonies surviving the winter of 2001-2002 were compared between treatments by analysis of covariance of a randomized block design with a factorial treatment arrangement of bottom board (screen vs. solid) and top insulation (addition of a layer of dry oats vs. the standard 3 layers of R-10 insulation board). Initial colony cluster volume was added as a covariate, and apiary was considered a random effect. Weight losses and final cluster volume in April for the two other winters (2002-2003 and 2003-2004) were analyzed as a completely randomized design with queen line as a fixed effect and initial cluster dimensions as a covariate.

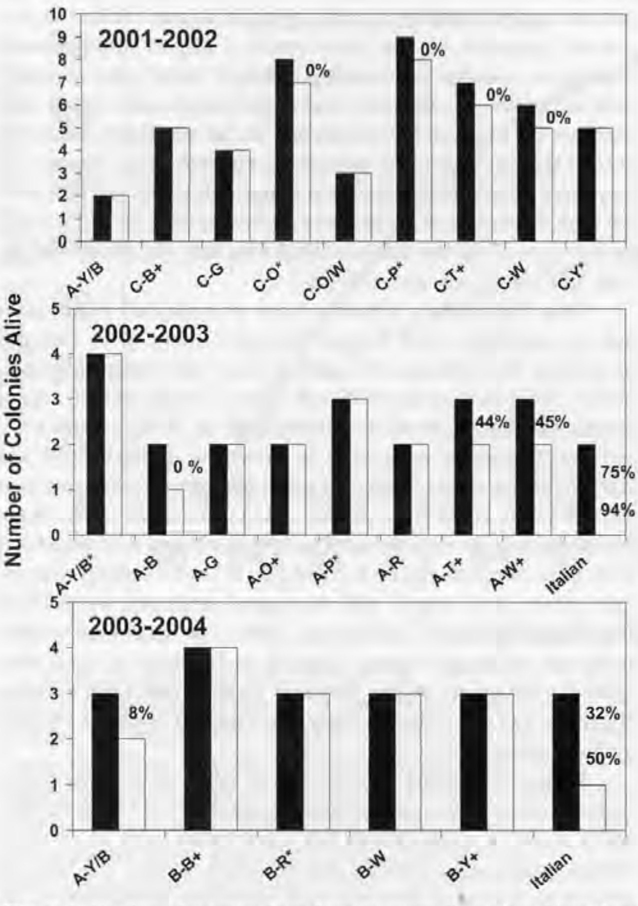

Figure 1. Number of colonies from Russian queen lines placed into three tests in November (solid bars) and alive in April (clear bars) of the following year. Eight out of 86 colonies of Russian origin died through the winter, while four out of five Italian origin hives died. Percentage of workers infested with tracheal mites in November is indicated in the position corresponding to death of a colony recorded in April. Russian queen lines are indicated by group and color code within group. Queen lines followed by an asterisk were maintained in the breeding program. Queen lines followed by a cross were removed from the breeding program.

Results and Discussion

Colony Survival and Tracheal Mite Infestation

The survival of Russian colonies ranged from 86 to 94% (Fig. 1) during three typical winters for the area. These survival rates were comparable to the 71 to 94% survival observed the previous two winters with Russian bees in the same apiaries (De Guzman *et al*. 2006). The survival of these Russian colonies matched the levels recorded in Minnesota for bees from different sources in the U.S. prior to the arrival of tracheal mites (Haydak 1958, Sugden and Furgala 1982, Duff and Furgala 1986, Sugden *et al.* 1988).

Most Russian colonies maintained negligible or very low levels of tracheal mites during the winter (Fig. 2). Colony mortality the first year was clearly associated with smaller colony sizes and not due to tracheal mites. The four Russian colonies that died had the smallest cluster volumes in November, and no detectable tracheal mites (Fig. 1). In contrast, the death of both Italian and Russian colonies during 2002 and 2003 were clearly associated with high tracheal mite loads in November: two of four Russian colonies that died those two winters and all four Italian colonies had more than 30 % of the bees infested prior to the wintering period (Fig. 1). Dead workers could be recovered from four of these six colonies at the end of the winter evaluation. From 90 to 100% of the recovered workers in each colony were infested with tracheal mites. Similar associations of high mite infestation with mortality had been found in Russian and Italian colonies in the same apiaries (DeGuzman *et al*. 2006).

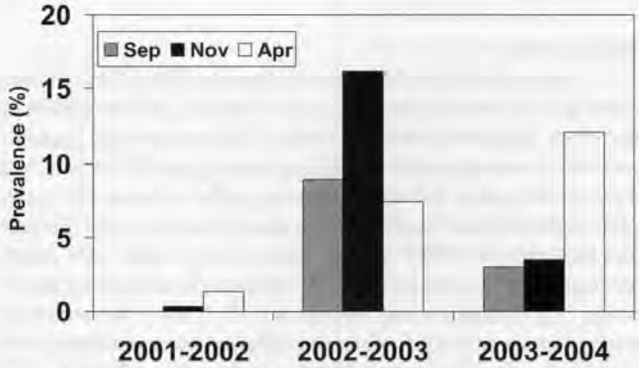

Figure 2. Average colony tracheal mite prevalence (percentage of bees infested in a colony) in Russian colonies during three overwintering seasons. No data was collected in August of 2001. Data in April include infestation of dead workers recovered from the eight colonies which died between November and April.

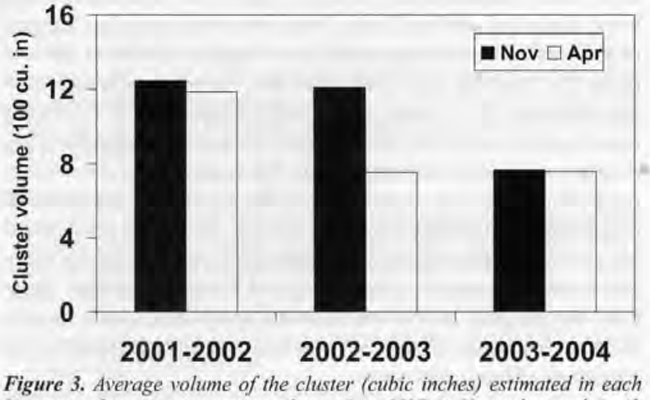

Figure 3. Average volume of the cluster (cubic inches) estimated in each Russian colony at temperatures from 45 to 55°F in November and April. Analysis of covariance for each year showed no differences between lines.

Colony Populations

Colonies which started the winter with low levels of tracheal mites and adequate populations, survived the most critical part of winter with good populations of bees (Fig. 3). Predictably, there were effects of the initial cluster volume in November on the final cluster volume in April (P=0.276, 0.007, 0.014 for 2002, 2003 and 2004 respectively). No significant differences between queen lines were found in the estimated final cluster volume in April (P= 0.66, 0.13, 0.46 for 2002, 2003 and 2004, respectively) when the initial volume in November was used as a covariate. Although Russian lines vary in other characteristics, they have similar good abilities to survive winter.

Colony Weight Loss

Weight loss per colony during the period from November to April averaged less than 20 lbs., 9 kg. (Fig. 4). De Guzman *et al.* (2006) found weight losses of Russian colonies in these same apiaries during the winter of 1999-2000 to be very low (about 9 lbs., 4 kg.), and found significantly higher weight losses in larger colonies of Italian origin (about 15 lbs. 7 kg.). Colony weight loss did not differ between Russian queen lines any of the three years (P=0.12, 0.97, 0.80 for weight loss through April 2002, 2003 and 2004, respectively), when initial colony volume was taken into account. Not surprisingly, a larger colony volume in November tended to increase weight loss (P=0.0013, 0.79, and 0.08 for 2002, 2003 and 2004, respectively). While we had no simultaneous comparisons with typical U.S. colonies of Italian origin, we have observed that Russian colonies tend to maintain lower populations during the winter. This attribute may prevent early starvation during the period of intense buildup in April and May, where honey stores and possible incoming resources are consumed at a very high rate (Furgala and McCutcheon, 1992).

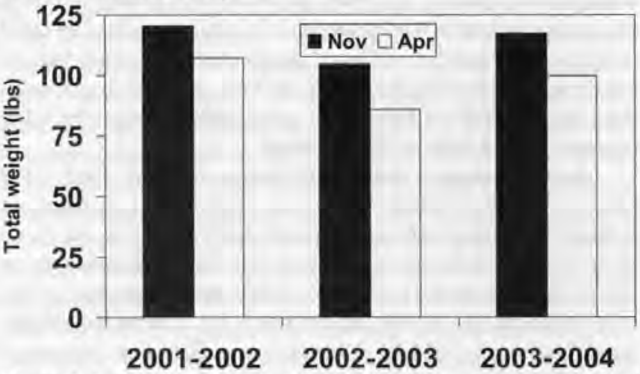

Figure 4. *Average weights of Russian colonies (lbs) in November and April during three overwintering periods. Analysis of covariance showed no significant differences between lines in the weight losses each year.*

Effect of Screened Bottom Boards and Additional Insulation

The test evaluating the benefits of extra top insulation [a layer of 25 lbs. (11.3 kg.) of dry oats above the hive] and of screened bottom boards did not show any clear colony survival advantage. The test did demonstrate that the screened bottom produced an increase in food consumption of about 20% (P=0.04, Fig. 5), but that the additional insulation from the layer of oats did not significantly decrease food consumption (P=0.37). There was no significant effect of the type of bottom board or of the extra insulation on the final cluster volume of bees in April (Fig. 5).

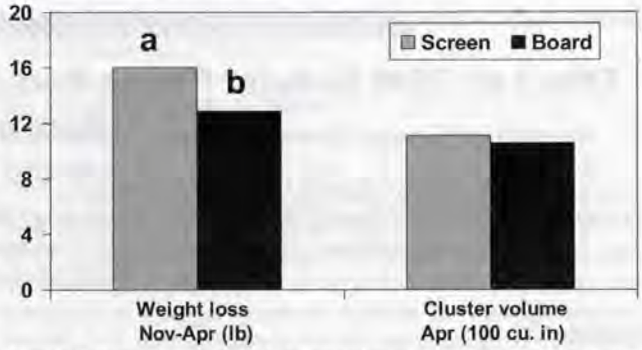

Figure 5. *Weight loss and final cluster volume in April of 49 colonies overwintered in 2001-2002. Colonies were assigned either a screened bottom board or a regular bottom board, combined with either standard insulation from three sheets of insulation board (R10) or a screened box holding 25 lbs of dry oats below the standard insulation boards. Analysis of covariance indicated no effect of the extra insulation, so the data are summarized for the effects of screened vs. solid bottom boards only. Different letters above the bar indicate significantly different means (P<0.05).*

Conclusions and Recommendations

Russian colonies can survive well through the winter and are a valuable genetic resource for North America. Russian colonies tend to maintain tracheal mite levels below critical levels even through harsh winters, and this gives them an advantage in surviving winter periods with good populations for the spring buildup period. Additionally, Russian colonies use honey stores frugally during the overwintering period, decreasing the need for feeding in the spring.

Acknowledgements

Trey Guillory, Victor Rainey, Tony Stelzer and Rachel Watts assisted with field work or dissections for tracheal mites. Robert Danka, Robert Cox and Ed Levi provided comments on the manuscript. Research was conducted in cooperation with the Louisiana Agricultural Experiment Station.

References

Furgala, B, S Duff, S Aboulfaraj, D Ragsdale and R Hyser 1989 *Some effects of the honey bee tracheal mite (*Acarapis woodi *Rennie) on non-migratory, wintering honey bee (*Apis mellifera *L.) colonies in east central Minnesota*. American Bee Journal 129:195-197.

Furgala, B, DM McCutcheon 1992 *Wintering productive colonies*. In The Hive and the Honey Bee, Graham, JH ed. Dadant & Sons, Hamilton, IL, 829-864.

De Guzman, LI, TE Rinderer, GT Delatte, JA Stelzer, G Beaman,V Kuznetsov 2002 *Resistance to* Acarapis woodi *by honey bees from Fareastern Russia*. Apidologie 33:411-415.

De Guzman, LI, TE Rinderer, M Bigalk, H Tubbs, SJ Bernard 2006 *Russian honey bee (Hymenoptera: Apidae) colonies:* Acarapis woodi *(Acari: Tarsonemidae) infestations and overwintering survival*. Journal of Economic Entomology 98:1796-1801.

Duff, SR, B Furgala 1986 *Pollen trapping honey bee colonies in Minnesota. Part I: Effect on amount of trapped, brood, reared, winter survival, queen longevity, and adult bee population*. American Bee Journal 126:686-689.

Haydak, MH 1958 *Wintering of bees in Minnesota*. Journal of Economic Entomology 51. 332-334.

Johansson, TSK, MP Johansson 1971 *Winter losses* 1970 American Bee Journal 111:10-12.

Otis, GW, C Scott-Dupree 1992 *Effects of Acarapis woodi on overwintered colonies of honey bees (*Hymenoptera: Apidae*) in New York*. Journal of Economic Entomology 85: 40-46.

Rinderer, TE, LI De Guzman, J Harris, V Kuznetsov, GT Delatte, JA Stelzer, L Beaman 2000 *The release of ARS Russian honey bees*. American Bee Journal 140:305-307.

Sugden, MA, B Furgala 1982 *Evaluation of six commercial honey bee (*Apis mellifera *L.) stocks used in Minnesota. Part I – Wintering ability and queen longevity*. American Bee Journal 122:105-109.

Sugden, MA, B Furgala, SR Duff 1988 *A comparison of four methods of wintering honey bee colonies outdoors in Minnesota*. American Bee Journal 128:483-487.

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Effect of GSM Cellular Phone Radiation on the Behavior of Honey Bees (*Apis mellifera*)

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SUMMARY

This study consists of a series of experiments that investigate the effects of radiation emitted by GSM cellular phones (Global System for Mobile Telecommunications) on the behavior of harnessed and free-flying forager honey bees. A unique aspect of this study is that three subspecies – *Apis mellifera carnica, Apis mellifera caucasiaca,* and *Apis mellifera syriaca* – were employed. In the first series of experiments, we investigated its effects on proboscis extension and feeding in harnessed foragers. Relative to control animals, exposure did not influence proboscis extension or feeding. In a second series of experiments, free-flying foragers were trained to visit a target with the question of interest being whether exposure to cell phone radiation would influence flight navigation. Relative to control animals, the results indicated that a 45 minute radiation exposure did not influence return to the target. In the final series of experiments, the effect of GSM radiation on aggression was investigated. As in the previous experiments, no effect of radiation exposure was found. To our knowledge, this is the first study to investigate the effects of GSM cellular phone radiation on honey bees.

Keywords: aggression, insect, microwave radiation, navigation, proboscis

INTRODUCTION

The primary objective of this study was to elucidate the effects of GSM cellular phone radiation on the behavior of honey bees. GSM (Global System for Mobile Telecommunications) is one of the most common and fastest growing wireless network standards. Recent research has revealed that there are currently 2.8 billion GSM cellular phone subscribers worldwide (Wireless Intelligence, 2007). A pervasive media report asserted that cellular phones were a possible cause of honey bee colony collapse disorder in April 2007 (Good Morning America, 2007; Lean and Shawcross, 2007). An investigation of this report revealed that the media misinterpreted the findings of a study conducted by Kimmel *et al.* (2007) at Koblenz-Landau University in Germany. The study made no reference to CCD and did not look at the effects of cellular phone radiation on honey bees. It did, however, demonstrate a decrease in the number of return visits made by bees to observation hives into which active DECT (Digital Enhanced Cordless Telecommunications) phone base stations had been placed. However, caution must be employed when generalizing the findings of the Kimmel et al. (2007) study to other wireless communication technologies, namely those employed by cellular phone networks (i.e., GSM technology).

GSM technology utilizes bands of non-ionizing microwave frequencies in the range of 850, 900, 1800, and 1900 MHz. This study, which was conducted in the Republic of Turkey, looks at the 900 and 1800 MHz bands utilized by European GSM networks (Hamid et al. 2003; Ozyalcin et al. 2002). In addition to the ICNIRP (International Commission on Non-Ionizing Radiation Protection) emission limit guidelines, government-sanctioned wireless telecommunication regulations, and stringent handset tests carried out by cellular phone manufacturers have helped to ensure the safety of these devices. In fact, many recent studies have demonstrated that various tissues, cellular activities, memory, and learning in humans, rats, and mice are not affected when subjected to GSM or GSM-like microwave radiation (Cobb *et al.* 2004; Dasdag *et al.* 2003, 2004, 2008; Dubreil et al. 2002, 2003; Forgacs et al. 2006; Joubert et al. 2007; Kumlin *et al.* 2007; Sienkiewicz *et al.* 2000; Smith *et al.* 2007; Thorlin *et al.* 2006; Tillmann *et al.* 2007). Nevertheless, these findings should not downplay the potential health hazards involved with the use of cellular phones.

GSM or GSM-like radiation has been found to negatively affect the neural and reproductive tissues in both vertebrate and invertebrate species including humans, mice, rats, snails, and fruit flies (Atli *et al.* 2006; Erogul *et al.* 2006; Field *et al.* 1993; Lopez-Martin *et al.* 2006; Panagopoulos *et al.* 2004, 2007a, 2007b; Salford *et al.* 2003; Zhao *et al.* 2006). These studies provide compelling evidence that GSM radiation could in fact have negative biological effects on honey bees. Although the invertebrate data are insufficient to justify a directional argument, the potential for negative biological effects on learning and behavioral processes in honey bees caused by GSM radiation has important ecological ramifications: the honey bee is a keystone pollinator species. Sharp declines in honey bee populations due to GSM radiation could considerably weaken the infrastructure of food webs across the globe.

Another potential behavioral change resulting from GSM exposure could include an increase in aggression (e.g., increased potential for colony defense behavior). Aside from this risk factor alone, 22.2% of individuals surveyed in the United States report an intense fear of animals (Curtis et al., 1998). Specific phobias of animals including insects were reported by 5.7% of these individuals. According to the DSM-IV (Diagnostic and Statistical Manual of Mental Disorders), specific phobias can invoke powerful involuntary responses including intense anxiety or distress, panic attacks, or avoidance behavior. The elicitation of such responses could place individual cellular phone users who suffer from insect phobias at an elevated risk of suffering from multiple stings.

Trash receptacles found in frequented areas such as zoos, amusement parks, and university campuses are likely to contain discarded soft drinks that are attractive to foraging honey bees (Abramson *et al.* 1997). It has been estimated that nearly 1% of children and 3% of adult sting victims have systemic reactions to insect venom (Golden *et al.* 1989). Multiple stings can culminate in acute renal failure (Bresolin *et al.* 2002; Daher 2003; Ramanathan 1990), rhabdomyolosis (Hiran 1994), hepatic complications (Kini 1994), and although rare, even death. A case study conducted by Thiruventhiran (1999) revealed that 25% of individuals afflicted by acute renal failure induced by insect stings ultimately died, and it has been estimated 0.4% of bee stings in the United States are fatal (Reisman 1992).

In an attempt to establish a definitive investigation of the potential consequence of GSM radiation on honey bee health, we have proposed three fundamental questions: (a) Does GSM radiation exposure affect the proboscis extension reflex or the ability to imbibe a sucrose solution? (b) Does GSM radiation exposure affect flight navigation and foraging ability? (c) Does GSM radiation elicit aggressive behavior?

MATERIALS AND METHODS

Four experiments were conducted during the months of June and July 2007 at the main campus of the Middle East Technical University (Orta Doğu Teknik Üniversitesi) in Ankara, Turkey. In Experiment 1, three different makes and models of cellular phone handsets were utilized, including the Motorola SLVR L7, Samsung SGH-i670, and Sony-Ericsson J100i. The respective specific absorption rate (SAR) values reported by each phone's manufacturer are as follows: Motorola SLVR L7 = 1.34, Samsung SGH-i670 = 0.95, Sony-Ericsson J100i = 0.96. A SAR rating is the ratio of the number of watts of energy absorbed per kilogram of living tissue. A brief review of the results from Experiment 1 and a revaluation of the employed design revealed it unnecessary to utilize all three cellular phones in remaining experiments. Only the Motorola SLVR L7, was utilized in the remaining experiments. This decision was reached, in part, by an incompatibility with the use of non-domestic cellular phones on the Turkish wireless telecommunications network.

The mean power density of the Motorola SLVR L7 was determined to be 1.41 ± 0.483 μW/cm2 at the 1900 MHz frequency band. It is important to note, however, that we were unable to obtain the mean power density readings of the cellular phones in Turkey due to a lack of necessary equipment. Measurements were obtained in the United States using a radio frequency power density meter developed by Alpha Lab Detector Technologies, Inc. The RF power density meter was placed 2 cm from the top of the cellular phone, which was the same distance at which the bees were placed in all harnessed forager experiments. The mean power density emission was calculated by averaging the values of 25 separate measurements collected during a 5 minute period. The methodology we employed for these calculations is similar to that utilized by Panagopoulos *et al.* (2007). Refer to this article for more information on expected field strength emissions of cellular phone handsets operating on 900/1800 MHz European GSM networks. Despite this setback, it is critical to note that actual power density emissions of cellular phones are never constant and depend on a number of technical variables (Hyland 2000, Panagopoulos *et al.* 2007).

We opted to utilize GSM handsets instead of GSM base stations for multiple reasons. First, handsets are easily accessible and they have been employed as radiation sources in previous radiobiology studies (Barteri *et al.* 2005; Diem *et al.* 2005; Panagopoulos *et al.* 2007; Salford *et al.* 2003; Weisbrot *et al.* 2003; Zhao *et al.* 2006). Second, base stations are static objects that nearly continuously emit radiation which makes it difficult to employ experimental controls. Third, we felt that the use of GSM handsets most closely mirrored real-life situations involving honey bee exposure to cellular phone radiation. Honey bees are arguably more likely to encounter a motile human using an active GSM handset than individual static GSM base stations, especially in densely populated areas. Other wireless communication network standards including CDMA, WCDMA, UTMS, OFDM, DECT, etc. were not considered in the present study because of the ubiquity of GSM wireless networks throughout the globe.

Harnessed Forager Experiments:

Experiment 1 - Effects of GSM Radiation on the Proboscis Extension Reflex

A minimum of four forager bees were collected from five observation hives of each subspecies for both the sham-exposed (control) and experimental groups. In total, 217 bees were collected and included this experiment: *A. m. caucasica* (control, n = 34; experimental, n = 50); *A. m. carnica* (control, n = 30; experimental, n = 36); *A. m. syriaca* (control, n = 37; experimental, n = 30). Bees in this experiment were harnessed in plastic straws cut into tubes approximately 2.5 cm in height. Plastic straws were selected as a substitute to the metal casings traditionally used in this harnessing procedure (Abramson *et al.* 2001). The rationale behind the use of plastic tubes was to prevent deflection of the radiation emitted by the cellular phone that would otherwise occur. A 2M sucrose solution, 1 cm x 1 cm filter paper squares, and plastic forceps were also employed in this experiment.

Each day between late morning and early afternoon, forager honey bees were captured in glass vials from hives located in the biology department's apiary and placed into appropriately labeled plastic storage bags. To prevent overheating and possible mortality, the bees were periodically transported to the laboratory and immediately placed into an ice bath. After the bees were rendered motionless they were harnessed in the plastic tubes with a strip of duct tape placed behind the head and thorax as demonstrated by Abramson *et al.* (2001). After harnessing, bees were placed around the top half of the experimental cellular phone in such a way that a semi-circle was formed. The bees were then carefully positioned with their ventral surface facing the phone. The rationale for this arrangement was to ensure the bees were directly irradiated by the phone's antenna.

An ABA design with an 11-minute interval per phase was implemented. The bees were randomly divided into control and experimental groups. One group served as a control, in which the bees were placed around a sham and received antenna stimulation once every minute for the duration of 33 min. This was accomplished via direct contact of the filter paper saturated in the 2M sucrose solution to the antennae. In the experimental group, bees were subjected to GSM radiation during the treatment phase (phase B – onset of minute 12) by establishing a voice connection between the experimental phone and a second cellular phone. The second phone was removed from the experimental area to reduce the possibility of additional radiation exposure, and the connection was immediately terminated at the end of minute 22. The dependent variable in this experiment was the proportion of bees that extended their proboscis following sucrose stimulation. A clearly visible extension of the proboscis was recorded as a "1" and the absence of a response was recorded as a "0" This procedure was repeated once every minute for the duration of the experiment in both the sham-exposed and experimental groups.

Experiment 2 - Effects of GSM Radiation on Feeding

As in the proboscis extension experiment, a minimum of four forager bees were collected from five observations hives of each subspecies for both the sham-exposed and experimental groups. A total of 170 bees were collected and employed in this experiment: *A. m. caucasica* (control, n = 27; experimental, n = 31); A. m. carnica (control, n = 25; experimental, n = 26); *A. m. syriaca* (control, n =

27; experimental, n = 34). The materials and harnessing procedures were also identical to those utilized in the first experiment. However, to obtain a measure of feeding, the filter paper was immediately moved into contact with the proboscis upon its extension following antenna excitation. Thus, an additional dependent variable in this experiment was the proportion of honey bees that imbibed the 2 M sucrose solution. All responses were recorded visually. If the solution was imbibed a "1" was recorded. A "0" was recorded if the proboscis was immediately retracted following stimulation or if the bee did not imbibe the solution.

Free-Flying Forager Experiments:

Experiment 3 - Effects of GSM Radiation on Flight Navigation

Subjects for this experiment consisted of free-flying forager honey bees from two colonies of each subspecies. A total of 109 bees were observed: *A. m. caucasica* (control, n = 13; experimental, n = 25); *A. m. carnica* (control, n = 12; experimental, n = 22); *A. m. syriaca* (control, n = 19; experimental, n = 18). Two observation hives of each subspecies were moved from the biology department's apiary and placed adjacent to one another in isolated sites to prevent subspecies interactions. Each site was geographically distanced by approximately 2.5 km. Bees at each site were trained to forage from a petri dish placed 20 m in front of the hive entrance. To accomplish this, the entrance of each hive was first sprayed with a lavender scented sucrose solution. A petri dish filled with the scented solution was then placed near the entrance of the hives and slowly moved away as the bees began to forage from it. Once depleted of the scented solution, the dish was subsequently refilled with an unscented sucrose solution for the remainder of the experiment. Each bee was carefully demarcated with the enamel model paint so we would be able to identify individual bees. After the bees were marked, the experimental cellular phone was placed beneath the petri dish and experimentation began.

An ABA design with 45-minute intervals was employed. This 45-minute flight time interval was selected in an attempt to replicate the methodology employed by Kimmel *et al.* (2007). For all three phases of the experiment, each marked bee's return was visually recorded. At the onset of the treatment phase (phase B – onset of minute 46), a voice connection between the experimental cellular phone and a second cellular phone was established. The second phone was moved to a location 30 m away and positioned with its antenna pointing away from the bee colonies and experimental area. The connection was immediately terminated at the onset of the post-treatment phase. Control data (sham-exposed condition) was also collected by following the same procedure, with the exception that no voice connection was initiated during the treatment phase. As in the harnessed experiments, failure to implement such a control would make it impossible to rule out the effects of confounds. A confounding effect of particular interest in this experiment included the possibility of a naturally occurring decrease in the number of returning foragers over time. Experimental and control data collections were not simultaneously conducted. Instead, the condition was randomly chosen. The dependent variable in both conditions was the total number of return visits made per bee in each treatment condition.

Experiment 4 - GSM Induced Aggressive Behavior

Forager and guard bees from a total of five hives of each subspecies were observed for this experiment. A small foam block was used as an observation and rest platform for the cellular phone, and a six mega-pixel digital camera was used to measure the dependent variable. To investigate the effects of GSM radiation on aggressive behavior in honey bees, the experimental cellular phone was set on a foam block that was placed 10 cm from the hive's entrance. As in Experiments one and two, an ABA design with 11-minute intervals was implemented. To quantifiably measure aggression as a dependent variable, a photograph of the platform was taken from the side of the hive once every 30 s. Photography stopped 33 min after the first image was captured. Photographs taken from in front of the hive would have produced a possible confounding effect, as the bees would likely become excited by a blocked hive entrance.

During the treatment phase, bees were subjected to GSM radiation by establishing a voice connection between the experimental phone and a second cellular phone. The second phone was placed at a distance of 20 m from the experimental area with its antenna positioned away to reduce the possibility of additional GSM radiation exposure. This procedure was repeated for five hives of each subspecies. At the end of the experiment, the number of bees in flight, and the number of bees on the platform or phone in each photograph was recorded. This distinction was made, because of the difficulty in discerning the difference between flying worker and guard bees. Therefore, aggression was measured by counting the number of both free-flying worker and guard bees on and off the phone.

RESULTS

Harnessed Forager Experiments:

Experiment 1 - Effects of GSM Radiation on the Proboscis Extension Reflex

A 3 X 3 X 2 X (3) split-plot ANOVA with trials as the repeated measure and experimental treatment condition, cellular phone model, and honey bee subspecies as the between-subjects variables was performed. The relationship of interest, experimental treatment condition by trial, revealed no significant interactions, with the largest $\eta 2 = 0.034$. This effect size was obtained by the formula $\eta 2 = 1 - \text{Wilks'}\ \Lambda$. Figure 1 illustrates the trial by condition interaction.

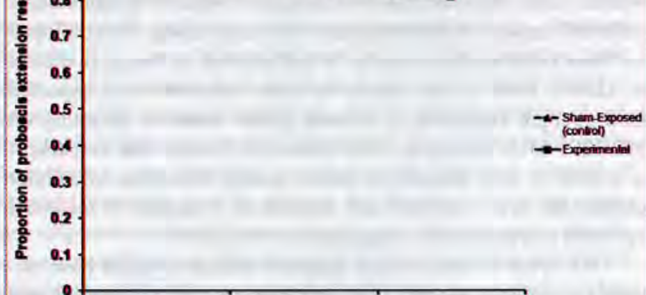

Figure 1. *Trials by experimental treatment condition reveals no effect on proboscis extension.*

Experiment 2 - Effects of GSM Radiation on Feeding

The primary dependent variable of interest in this experiment was whether the bees would feed on a 1.5 M sucrose solution when irradiated by the cellular phone. As a result of measuring feeding responses, the proboscis extension reflex investigated in Experiment one was again measured. Due to no significant main effects between the three utilized cell phone models in the Experiment one, only the Motorola SLVR L7 was employed in this and the remaining experiments.

A 3 X 2 X (6) split-plot ANOVA with trials as the repeated measure and honey bee subspecies and experimental treatment condition as the between-subjects variables was performed. As in Experiment 1, the relationship of interest was the experimental treatment condition by trial interaction. No significant interactions were found, with the largest $\eta 2 = 0.034$.

Free-Flying Forager Experiments:

Experiment 3 Effects of GSM Radiation on Flight Navigation

A 3 X 2 X (3) split-plot ANOVA with trials as the repeated measure and honey bee subspecies and condition as the between-subject variables was conducted in attempt to identify any possible main or interaction effects. As with the previous two experiments, the trial by experimental treatment condition relationship was of primary interest. The analysis revealed that this interaction was non-significant, with the largest $\eta 2 = 0.008$. The average number of return visits made to the artificial feeder can be seen in Figure 2.

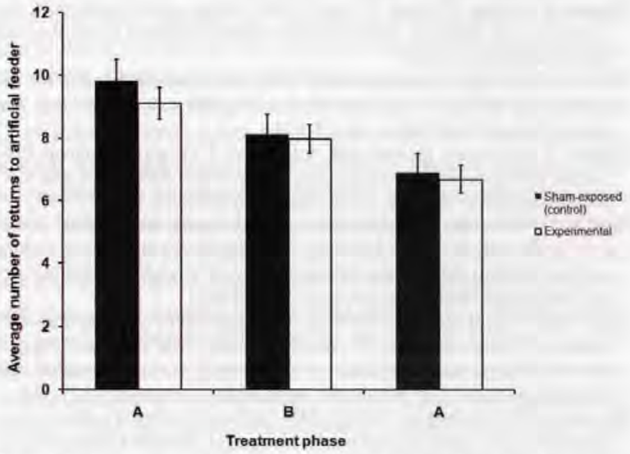

Figure 2. *Average number of return visits made by all marked bees to the trained feeding site (subspecies aggregated). Bars represent the standard error of the mean.*

Experiment 4 GSM Induced Aggressive Behavior

A 3 X 3 univariate ANOVA was conducted to determine whether GSM radiation can elicit aggressive behavior. The dependent variable in this analysis was aggression as defined by the number of bees on the phone per thirty seconds. The subspecies [$F = 2.03$, $p = .13$, partial $\eta 2 = .004$, power $= .42$] and treatment condition [$F = 0.45$, $p = .64$, partial $\eta 2 = .001$, power $= .12$] main effects were not significant. A second 3 X 3 univariate ANOVA was conducted to analyze aggressive behavior as defined by the number of bees in flight per thirty seconds. Results of this analysis revealed a significant subspecies [$F = 6.93$, $p = .001$, partial $\eta 2 = .01$, power $= .93$] main effect. However, the experimental treatment condition main effect was not significant [$F = 2.15$, $p = .12$, partial $\eta 2 = .004$, power $= .44$]. These results are summarized in Figure 3, which shows the average number of bees on the phone and in flight during each treatment phase (trial).

DISCUSSION

The results of these experiments demonstrate that exposure to 900/1800 MHz GSM radiation does not influence the antennae response to sucrose or the feeding response in harnessed foragers. In experiments designed with free-flying foragers the ability of marked bees to return to a feeding location was also not affected. Moreover, unmarked foragers were continuously recruited to the experimental feeder throughout the duration of each experiment, thus indicating that exposure to GSM radiation at the feeding site did not affect communication within the observation hive. Despite this interesting observation, recruitment behavior was not included as a dependent variable in our study. Additional research is required to experimentally verify this finding. Finally, in an experiment designed to study whether GSM radiation acts as a stressor capable of inducing aggression in honey bees (i.e., increased propensity to attack and/or sting), no effect was found.

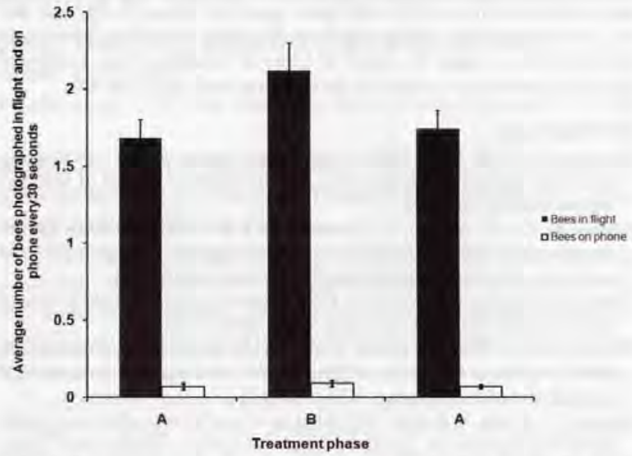

Figure 3. *Average number of bees photographed in flight and on the phone (subspecies aggregated). Bars represent the standard error of the mean.*

As previously mentioned, Kimmel *et al.* (2007) observed that DECT phone base stations activated from within bee colonies had fewer returning bees than colonies in which no base stations were placed. Our study suggests that GSM radiation does not have the same effect. Although we employed GSM cellular phones, the study of Kimmel *et al.* (2007) did not consider confounds attributed to the use of a non-ionizing radiation source, namely a potential increase in hive temperature caused by the base station's radiation emissions. The null results of our study suggest that it is not the radiation, but another stimulus that deterred reentry.

Negative results are never appealing; however, no uniform consensus on the effects of microwave radiation on biological processes has been demonstrated in the extant literature. Given the experimental parameters employed in our study (e.g., within and between subject designs, use of three subspecies, large sample sizes), we believe that any potential effects of GSM radiation on honey bee behavior should have been detected. Contrary to the media reports, our results also suggest that the 900 and 1800 MHz frequencies utilized by GSM technology are not a likely cause of, or a contributing factor in, colony collapse disorder. Other possible causes of CCD and factors contributing to honey bee population declines including biological pathogens (Cox-Foster *et al.* 2007), agrochemicals, climate change, and genetically modified crops must continue to be investigated. Moreover, the copious disagreement among published findings of the effects of cellular phone radiation on humans and other animals necessitates that researchers continue to investigate the biophysical interactions between microwave radiation and biological systems.

CONCLUSIONS AND RECOMMENDATIONS

Our experiments suggest that beekeepers are not at an increased risk of being stung or initiating nest defense behavior while using cellular phones near hives. Our results also suggest that GSM cellular phone radiation emissions do not inhibit the foraging behaviors or navigational ability of honey bees, and are thus unlikely to affect colony health.

ACKNOWLEDGEMENTS

This research was funded by a National Science Foundation Research Experience for Undergraduates Grant (DBI 0552717). Mixson was additionally supported by a National Institutes of Health Initiative to Maximize Student Diversity grant (5 R25 GM069516). We would like to extend our deep gratitude to the Middle East Technical University's biology department for generously providing us with laboratory facilities and apiary access. The data collection efforts of NSF-REU participants Ms. Meredith Clement, Ms. Amy Savitski, and Mr. Daniel Song are also much appreciated. We would especially like to thank Dr. James W. Grice of Oklahoma State University for his suggestions and advice on the statistical analysis of our data.

REFERENCES

Abramson, C I, BJ Boyd 2001 *An automated apparatus for conditioning proboscis extension in honey bees,* Apis mellifera *L.* Journal of Entomological Science 36:78-92.

Abramson, C I, IS Aquino, GA Azeredo, JR Filho, JM Price 1997 *The attraction of Africanized honey bees (Apis mellifera L.) to soft drinks and perfumes.* The Journal of General Psychology 124:166-181.

American Psychiatric Association 1994 *Diagnostic and statistical manual of mental disorders (4th ed.)* APA, Washington, D.C.

Atli, E, H Unlu 2006 *The effects of microwave frequency electromagnetic fields on the development of Drosophila melanogaster.* International Journal of Radiation Biology 82(6):435-441.

Barteri, M, A Pala, S Rotella 2005 *Structural and kinetic effects of mobile phone microwaves on acetylcholinesterase activity.* Biophysical Chemistry 113:245-253.

Bresolin, N L, FL Carvalho, JE Goes, VR Fernandes, AM Barotto 2002 *Acute renal failure following massive attack by Africanized bee stings.* Pediatric Nephrology 17:625-627.

Cobb, B L, JR Jauchem, ER Adair 2004 *Radial arm maze performance of rats following repeated low level microwave radiation exposure.* Bioelectromagnetics 25:49-57.

Cox-Foster, D L, S Conlan, EC Holmes, G Palacios, JD Evans, NA Moran, et al. 2007 *A metagenomic survey of microbes in honey bee colony collapse disorder.* Science 318(5848):283-287.

Curtis, G, WJ Magee, WW Eaton, HU Wittchen, RC Kessler 1998 *Specific fears and phobias epidemiology and classification.* British Journal of Psychiatry 173:212-217.

Daher, E D, GB Silva-Junior, GP Bezerra, LB Pontes, AM Martins, JA Guimaraes 2003 *Acute renal failure after massive honeybee stings.* Revista do Instituto de Medicina Tropical de São Paulo 45:45-50.

Dasdag, S, MZ Akdag, F Aksen, M Bashan, H Buyukbayram 2004 *Does 900 MHZ GSM mobile phone exposure affect rat brain?* Electromagnetic Biology and Medicine 23(3):201-214.

Dasdag, S, MZ Akdag, F Aksen, F Yilmaz, M Bashan, MM Dasdag et al. 2003 *Whole body exposure of rats to microwaves emitted from a cell phone does not affect the testes.* Bioelectromagnetics 24:182-188.

Dasdag, S, MZ Akdag, E Ulukaya, AK Uzunlar, D Yegin 2008 *Mobile phone exposure does not induce apoptosis on spermatogenesis in rats.* Archives of Medical Research 39:40-44.

Diem, E, C Schwarz, F Adlkofer, O Jahn, H Rudiger 2005 *Non-thermal DNA breakage by mobile-phone radiation (1800 MHz) in human fibroblasts and in transformed GFSH-R17 rat granulosa cells in vitro.* Mutation Research 583:178-183.

Dubreuil, D, T Jay, J Edeline 2002 *Does head-only exposure to GSM-900 electromagnetic fields affect the performance of rats in spatial learning tasks?* Behavioural Brain Research 129:203-210.

Dubreuil, D, T Jay, J Edeline 2003 *Head-only exposure to GSM 900-MHz electromagnetic fields does not alter rat's memory in spatial and non-spatial tasks.* Behavioural Brain Research 145:51-61.

Erogul, O, E Oztas, I Yildirim, T Kir, E Aydur, G Komesli, et al. 2006 *Effects of electromagnetic radiation from a cellular phone on human sperm motility: An in vitro study.* Archives of Medical Research 37:840-843.

Field, A S, K Ginsburg, JC Lin 1993 *The effect of pulsed microwaves on passive electrical properties and interspike intervals of snail neurons.* Bioelectromagnetics 14:503-520.

Forgacs, Z, Z Somosy, G Kubinyi, J Bakos, A Hudak, A Surjan, et al. 2006 *Effect of whole-body 1800 MHz GSM-like microwave exposure on testicular steroidogenesis and histology in mice.* Reproductive Toxicology 22:111-117.

Giray, T, I Cakmak, L Aydin, I Kandemir, I Ahmet, D Oskay, et al. 2007 *Preliminary survey results on 2006 - 2007 colony losses in Turkey.* Uludag Bee Journal August(2007):101-107.

Golden, D B 2003 *Stinging insect allergy.* American Family Physician 67:2541-2546.

Good Morning America 2007 *Where have the bees gone? Cell phones are linked to the mysterious disappearance of honey bees.* http://abcnews.go.com/video/playerIndex?id=3044826

Hamid, R, M Cetintas, H Karacadag, A Gedik, M Yogun, M Celik, et al. 2003 *Measurement of electromagnetic radiation from GSM base stations.* IEEE Transactions on Electromagnetic Compatibility (pp. 1211-1214) Istanbul, Turkey: IEEE.

Hiran, S, TK Pande, S Pani, R Gupta, KA Vishwanathan 1994 *Rhabdomyolysis due to multiple honey bee stings.* Postgraduate Medical Journal 70:937.

Hyland, G J 2000 *Physics and biology of mobile telephony.* Lancet 356:1833-1836.

Joubert, V, P Leveque, M Cueille, S Burthoumieu, C Yardin 2007 *No apoptosis is induced in rat cortical neurons exposed to GSM phone fields.* Bioelectromagnetics 28:115-121.

Kimmel, S, J Kuhn, W Harst, H Stever 2007 *Effects of electromagnetic exposition on the behavior of the honeybee* (Apis mellifera). Environmental Systems Research 8:1-8.

Kini, P G, M Baliga, N Bhaskaranand 1994 *Severe derangement of the coagulation profile following multiple bee stings in a 2-year-old boy.* Annals of Tropical Paediatrics 14:153-155.

Kumlin, T, H Iivonen, P Miettinen, A Juvonen, T Groen, L Puranen 2007 *Mobile phone radiation and the developing brain: Behavioral and morphological effects in juvenile rats.* Radiation Research 168:471-479.

Lean, G, H Shawcross 2007 *Are mobile phones wiping out our bees? Scientists claim radiation from handsets are to blame for mysterious 'colony collpase' of bees.* http://www.independent.co.uk/environment/nature/are-mobile-phones-wiping-out-our-bees-444768.html

Lopez-Martin, E, JL Relova-Quinteiro, R Gallego-Gomez, M Peleteiro-Fernandez, FJ Jorge-Barreiro, FJ Ares-Pena 2006 *GSM radiation triggers seizures and increases cerebral c-Fos positivity in rats pretreated with subconvulsive doses of picrotoxin.* Neuroscience Letters 398:139-144.

Ozyalcin, M O, F Akleman, L Sevgi 2002 *SAR simulations in wireless communication and safety discussions in the society.* Turkish Journal of Electrical Engineering 10(2):411-426.

Panagopoulos, D J, ED Chavdoula, A Karabarbounis, LH Margaritis 2007 *Comparison of bioactivity between GSM 900 MHz and DCS 1800 MHz mobile telephony radiation.* Electromagnetic Biology and Medicine 26(1):33-44.

Panagopoulos, D J, ED Chavdoula, IP Nezis, LH Margaritis 2007 *Cell death induced by GSM 900-MHz and DCS 1800-MHz mobile telephony radiation.* Mutation Research 626:69-78.

Panagopoulos, D J, A Karabarbounis, LH Margaritis 2004 *Effect of GSM 900-MHz mobile phone radiation on the reproductive capacity of Drosophila melanogaster.* Electromagnetic Biology and Medicine 23(1):29-43.

Ramanathan, M, HS Lam 1990 *Acute renal failure due to multiple bee stings case reports.* The Medical Journal of Malaysia 45:344-346.

Reisman, R E 1992 *Stinging insect allergy.* The Medical Clinics of North America 76:883-894.

Salford, L G, A E Brun, JL Eberhardt, L Malmgren, BR Persson 2003 *Nerve cell damage in mammalian brain after exposure to microwaves from GSM mobile phones.* Environmental Health Perspectives 111(7):881-883.

Sienkiewicz, Z J, RP Blackwell, RG Haylock, RD Saunders, BL Cobb 2000 *Low-level exposure to pulsed 900 MHz microwave radiation does not cause deficits in the performance of a spatial learning task in mice.* Bioelectromagnetics 21:151-158.

Smith, P, N Kuster, S Ebert, H Chevalier 2007 *GSM and DCS wireless communication signals: Combined chronic toxicity/carcinogenicity study in the winstar rat.* Radiation Research 168:480-492.

Thiruventhiran, T, BL Goh, CL Leong, PL Cheah, ML Looi, SY Tan 1999 *Acute renal failure following multiple wasp stings.* Nephrology Dialysis Transplantation 14:214-217.

Thorlin, T, J Rouquette, Y Hamnerius, E Hansson, M Persson, U Bjorklund, et al. 2006 *Exposure of cultured astroglial and microglial brain cells to*

900 MHz microwave radiation. Radiation Research 166:409-421.
Tillmann, T, H Ernst, S Ebert, N Kuster, W Behnke, S Rittinghausen, et al. 2007 *Carcinogenicity study of GSM and DCS wireless communication signals in B6C3F1 mice*. Bioelectromagnetics 28:173-187.
Weisbrot, D, H Lin, L Ye, M Blank, R Goodman 2003 *Effects of mobile phone radiation on reproduction and development in Drosophila melanogaster*. Journal of Cellular Biochemistry 89:48-55.
Wireless Intelligence 2007 Subscriber *Statistics End Q4 2007*. http://www.gsmworld.com/news/statistics/pdf/gsma_stats_q4_07.pdf
Zhao, T, S Zou, P Knapp 2007 *Exposure to cell phone radiation up-regulates apoptosis genes in primary cultures of neurons and astrocytes*. Neuroscience Letters 412:34-38.

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Preliminary observations of autumn feeding of USDA-ARS Russian honey bees to enhance flight performance during almond pollination

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Summary

We attempted to increase bee populations of Russian and Italian honey bee colonies by feeding two pounds of patties of bee-collected pollen in October and November, and comparing fed colonies to unfed colonies of both types (n=16 per treatment group) in late winter. Flight activity of colonies in the four treatment groups was monitored electronically with ApiSCAN Plus® counters on 17-25 February 2006 while the colonies were used for almond pollination. At the beginning of almond bloom, the mean area of sealed brood was 56% greater in the fed colonies (both bee types) than in the unfed colonies. Adult bee populations were 17% larger in the fed group but this increase was not significant. Bee populations and brood populations both were similar for Russian and Italian bees (i.e., when feeding groups were combined). Changes in bee and brood populations did not differ statistically between Russian and Italian colonies. Flight activity during almond pollination was affected neither by feeding treatment nor by bee stock, presumably because these factors did not influence populations of adult bees. Flight activity was significantly affected by temperature, adult bee population and period of the day. The results showed that supplemental feeding maintained adult bee populations in Russian colonies through winter; more extensive or earlier feeding may increase bee populations.

Keywords: pollen supplement, foraging

Introduction

USDA-ARS developed Russian honey bees (*Apis mellifera*) primarily to provide U.S. beekeepers with a stock that resists parasitic mites and that has good honey production (Rinderer *et al.* 2005). These bees are now being used to help fill the recent increased demand for colonies to pollinate almonds in California in late winter. We previously found that Russian and Italian colonies that had equal adult bee populations during almond bloom had similar flight activity (Danka *et al.* 2006). However, Russian colonies often had less flight activity because they were less populous on average than Italian colonies. Those observations raised the issue of whether stimulative feeding of Russian colonies before almond pollination can enhance bee populations and flight activity during almond bloom. The situation is of practical importance for beekeepers who need to meet rental contracts. It also is of interest from the standpoint of behavioral ecology, as it is unknown whether these northern-adapted bees can be made to expand their populations in the autumn or winter. Supplemental protein supplied in the autumn or winter previously has been shown to boost non-Russian bee populations during the time of almond bloom (Peng *et al.* 1984, DeGrandi-Hoffman *et al.* 2008).

We began to address this question with exploratory feeding trials with colonies overwintering in Louisiana in two years prior to the results presented here. Mid-winter (January) feeding of two formulations of a commercial pollen substitute yielded no appreciable population expansion in either Russian or Italian bees in February or March 2004; Italian colonies were larger than Russian colonies whether fed or not. We then chose to evaluate natural bee-collected pollen as a supplement. A test of feeding one pound of pollen in November 2004 indicated that fed Russian colonies had greater populations of bees and brood than unfed Russian colonies in February and March 2005. The trial described here is a larger investigation of the effect of feeding pollen in autumn on population expansion and resultant flight activity of Russian bees during almond pollination. There is no standard regime among beekeepers for feeding supplemental protein in autumn. We chose to feed two pounds of supplement because this amount sometimes is given by commercial beekeepers, and also was the amount used in a recent autumn feeding test of a new protein supplement (Feedbee®; Saffari *et al.* 2004) which resulted in larger bee populations in the following April (A. Saffari, pers. comm.).

Materials and Methods

Colonies were established in spring and summer 2005 in cooperation with a commercial beekeeper in central Louisiana. Russian queens from four commercially available lines (Rinderer et al. 2005) were mated to Russian drones at isolated research mating stations maintained by our laboratory. Italian queens were reared from commercial stock [Bordelon Apiaries (Moreauville, LA) and Ohio Queen Breeders (Worthington, OH)] and open-mated to drones of the same sources. All colonies were kept on six-way pallets, with colonies of one stock per pallet and with colonies of both stocks kept in two apiaries.

The population of adult bees and the area of sealed brood of each colony were measured to the nearest 10% coverage of a deep Langstroth comb in late October 2005. The 32 Russian and 32 Italian colonies selected for use, and the fed and unfed groups within these stocks, initially had equal populations of adult bees and equal amounts of sealed brood (Fig. 1). Half of the colonies of each stock were given supplemental pollen in the form of patties made of bee-collected, autumn pollen mixed with 15% sucrose syrup (66% solids) by volume. The 'fed' colonies each were given

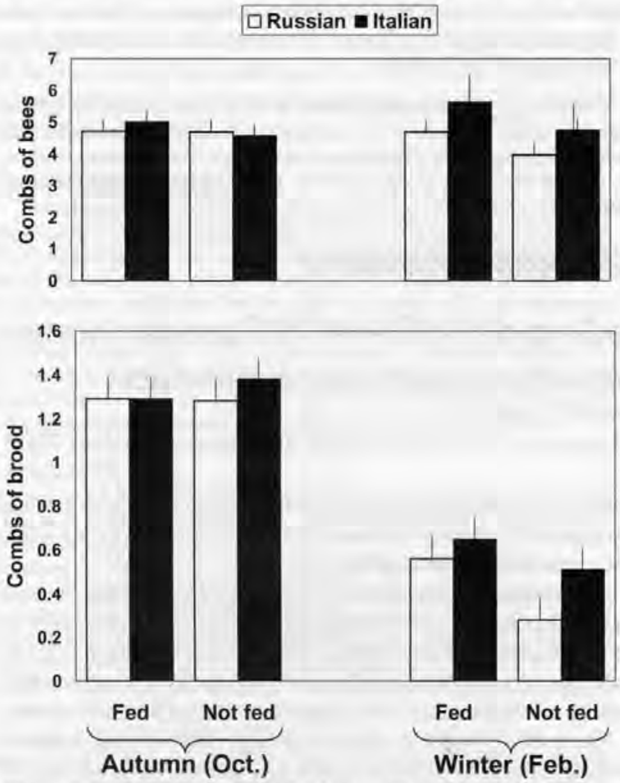

Figure 1. Mean populations of adult bees and brood in colonies of Russian and Italian bees either fed two pounds of supplemental pollen in autumn or not fed supplement. Error bars represent one SE. The only difference between fed colonies and unfed colonies occurred in brood populations in winter. For reference, one deep comb has about 273 sq in (1760 sq cm) of surface area.

1-lb (454-g) pollen patties on 27 October and 9 November. This feeding schedule coincides with the last normal cycle of brood rearing in the region. All colonies were given 2 gal (7.6 liters) of high fructose corn syrup during the feeding period. The bees were held over winter in the two Louisiana apiaries until they were moved for almond pollination.

The colonies were trucked directly to an almond orchard near Lost Hills, CA, and distributed along a quarter mile (ca. 400 m) of one central orchard road on 30 January 2006. The orchard had ca. 500 acres each of 'Nonpareil' and 'Monterey' Bee and brood populations were measured on 16 February at the start of bloom. Six colonies were not included further because their queens had superseded.

Flight activity was measured during nine days of the major bloom period (17-25 February) using ApiSCAN-Plus® electronic counters (Lowland Electronics; Leffinge, Belgium). These counters are mounted at the hive entrance and register interference of infrared light beams to quantify the activity of outgoing and incoming bees. The principal and design were described by Struye *et al.* (1994). The data obtained from 0700 through 2000 h were converted to an average hourly count of bee flights per minute. ApiSCAN counts were adjusted by multiplying by 0.67 to account for the average effect of bees clustering at the hive entrance (Danka and Beaman 2007). Temperatures were recorded at 5-min intervals as black globe temperatures (Corbet *et al.* 1993) 39 inches (1 m) above ground using HOBO dataloggers (#H08-00804) and thermocouples (# TMC6-HB) (Onset Corp., Bourne, MA). Temperatures were converted to hourly averages for analysis.

Populations of adult bees and sealed brood were evaluated with analysis of variance (Proc Mixed; SAS 2000) for effects of stock and feeding treatment; season was included in the analysis of adult bee populations. Bee populations were transformed to $\log_{10}$ counts to make variances homogeneous. Comparisons of means following a significant ($\alpha = 0.05$) F-test were made by Fisher's protected least significant difference (LSD) test. Flight activity was analyzed as a completely randomized design involving a split-plot treatment arrangement (colonies within type as the main unit; repeated measures of colonies through time as the subunit). Regression analysis followed analysis of variance to evaluate how flight activity was influenced by bee stock, feeding treatment, adult bee population, brood population, temperature and period of the day. Period of day was a classification variable that segregated observations into morning (before 1100 h), midday (1100 – 1359 h) and afternoon (1400 h and later) counts. The full model analysis evaluated the main effects, squares of main effects and all 2-way interactions. Effects found to be highly significant at $P < 0.01$ were retained in the reduced model. The model was further reduced by eliminating terms found to contribute to less than 10% of variation for each main effect according to Type I sums of squares. Retained terms were used as regressor variables to model the number of bees leaving a colony under defined conditions of the significant effects.

Results

At the beginning of almond pollination (three and a half months after feeding), the mean area of sealed brood was 56% greater in the 28 fed colonies (0.61 ± 0.09 (SE) combs of brood) than in the 30 unfed colonies (0.39 ± 0.06 combs of brood) (Fig. 1); this was a significant increase (Table 1). (Note that here 1.0 comb means a comb that is fully covered with bees, not a comb that is as little as 2/3 covered, as is commonly used for strength inspections during pollination rentals.) The brood increases of fed colonies within the two bee stocks did not differ statistically despite varying by nearly four-fold (100% for Russians, 27% for Italians). When feeding treatment groups were pooled within each stock for analysis, brood populations were statistically similar for Russian and Italian bees.

Populations of adult bees were 19% larger in the fed group but this increase was not significant (Table 1, Fig. 1). Feeding increased adult bee populations similarly in Russian and Italian colonies, and bee populations were similar for Russian and Italian colonies of

Table 1. Results of analysis of variance of the effects of bee stock and feeding treatment on populations of adult bees and brood. There were 32 colonies each of Russian and Italian colonies, and half of each type were given 2 lbs (0.91kg)of supplemental pollen beginning in late October 2005. Bee and brood populations were measured at feeding and at the beginning of almond pollination in mid February 2006.

Parameter	Effect	F	df	$P > F$
sealed brood	stock	2.26	1,54	0.139
	feeding	4.05	1,54	0.049
	stock × feeding	0.42	1,54	0.521
adult bees	stock	0.10	1,55	0.754
	feeding	2.10	1,55	0.153
	season	1.43	1,55	0.237
	stock × feeding	0.36	1,55	0.553
	stock × season	0.04	1,55	0.839
	feeding × season	1.31	1,55	0.184

combined feeding treatment groups. Bee populations in February did not differ significantly from those in November (P=0.237 for all colonies; P=0.883 for fed colonies; P=0.128 for unfed colonies), but some trends we apparent. First, bee populations of fed colonies (combined bee stocks) were about 7% larger in February than in November, while unfed colonies were about 6% smaller. Second, fed Italian colonies were 12% larger in February than in November while fed Russian colonies showed no change in bee population. Third, unfed Russian colonies showed a loss of about 16% while unfed Italian colonies gained about 4%.

Flight activity during almond pollination was affected neither by feeding treatment nor by bee stock, presumably because these factors did not influence populations of adult bees. Flight activity was significantly affected by temperature, adult bee population and period of the day (Table 2). Flight was greater at higher temperatures, and temperature and colony size interacted such that flight responses to temperature were more pronounced in large colonies. For example, Fig. 2 shows responses of colonies grouped as "large" (average of 6.55 combs of bees) and "small" colonies (average of 2.84 combs of bees) by segregating all colonies at the overall average size of 4.76 combs of bees. A 1.8° F (1° C) rise yielded 6.6 more flights per minute in large colonies and 2.5 more flights per minute in small colonies when all other factors were equal. Temperature effects, regardless of colony size, were more pronounced in the morning than in the midday and afternoon (Fig. 3). An additional comb of bees yielded 8.0 more flights per minute in the morning, but only ca. 3.6 more in the midday and afternoon. Flight was inhibited by factors other than temperature later in the day (e.g., depletion of nectar and pollen), as activity at all but the lowest temperatures recorded in the afternoon was much lower than at the same temperatures earlier in the day.

Table 2. Test results from analysis of variance of a reduced model of honey bee flight activity. Shown are Type 1 SS, F-tests from Type 3 tests from GLM, and parameter estimates for regression equations that describe the influences of temperature, adult bee population and time of day on flight.

Effect	SS (× 1000)	F	df	$P > F$	Parameter estimate
bees	1,398	24.19	1,4402	<0.001	-5.36
temp	10,005	7.58	1,4402	0.006	-1.37
time	1,262	45.17	2,24	<0.001	am=-28.81[1]
bees*temp	792	1165.84	1,4402	<0.001	0.91
temp*time	742	390.71	2,4402	<0.001	am=4.29[2]
col(type)	719	NA	NA	NA	NA
time(day)	639	NA	NA	NA	NA
day(col, type)	250	NA	NA	NA	NA
residual	2,996	NA	NA	NA	NA

[1] midday = 61.19, pm = 4.26
[2] midday = -0.17, pm = -0.00

Discussion

Feeding two pounds of bee-collected pollen in autumn affected brood populations more than it affected adult bee populations in late winter. This suggests that bees stored the food, ceased brood rearing as usual in late autumn, and then used the stored nutrients when brood rearing resumed in mid winter. Feeding appeared to stimulate brood rearing in the Russian colonies in particular. Fed Russian colonies had twice as much brood as unfed Russian colonies, whereas the feeding yielded a 27% increase in brood of Italian colonies (Fig. 1). This is interesting because it might be expected that bees from northern areas, where the brood rearing cycle around winter is expected to be highly programmed, would be less likely to respond to winter feeding. The value of feeding Russian colonies was further supported by the observation that fed Russian colonies tended to maintain their adult bee populations through the winter, while unfed colonies tended to lose bees (Fig. 1). The current high rental fees being paid for colonies in almond pollination thus may make more intensive feeding regimes cost effective.

Flight activity of Russian colonies was consistent with what we observed previously in comparisons of Russian and Italian bees during pollination of almonds (Danka *et al.* 2006) and lowbush blueberries (Danka and Beaman 2007). The environmental effects of temperature, colony population and period of the day affected flight, but bee stock did not. Furthermore, Russian and Italian bees

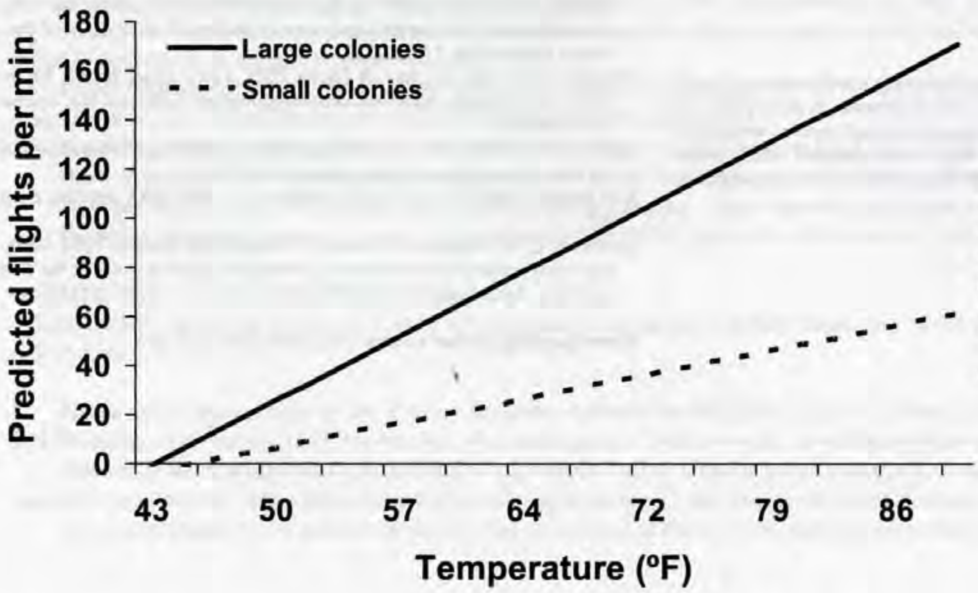

Figure 2. Flight activity of large and small colonies of honey bees in relation to temperature. These are flight responses modeled using regression parameter estimates and the average adult bee populations of "large" (mean of 6.55 combs fully covered with bees) and "small" (mean of 2.84 combs of bees) colonies.

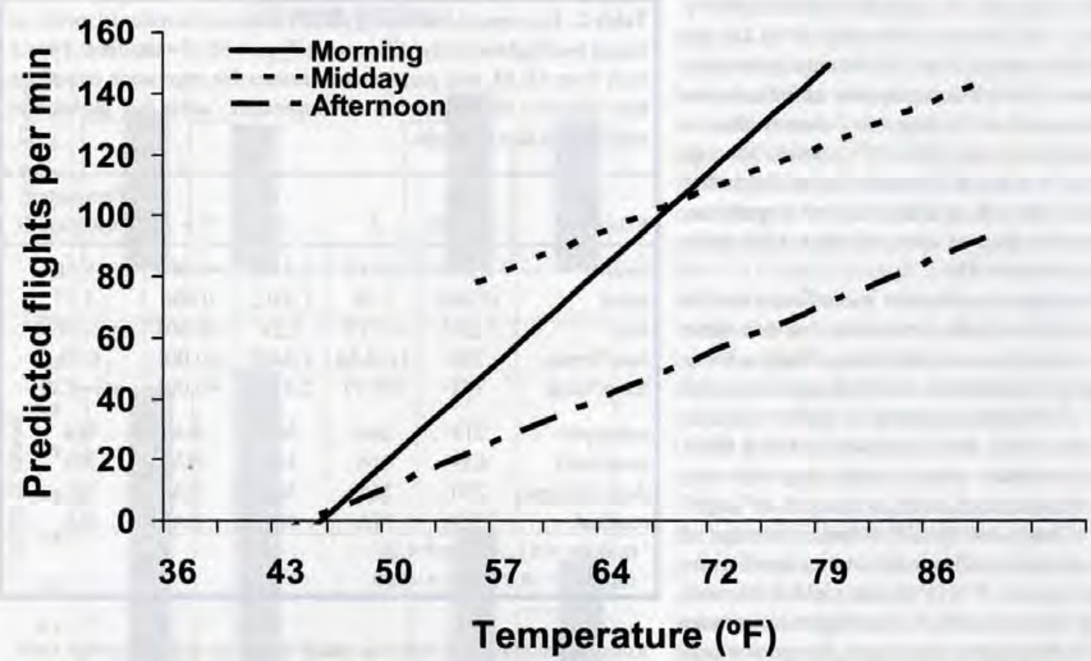

Figure 3. *Honey bee flight activity as influenced by temperature and time of day. Colonies responded more strongly to varying (rising) temperatures in the morning than they did later in the day. The results shown are predicted responses of colonies that have an overall average population of adult bees (4.76 combs of bees).*

responded similarly to varying environmental effects. Our cumulative observations indicate that Russian colonies of adequate size are useful pollinators of almonds.

Conclusions and Recommendations

Russian colonies that were fed two pounds of supplemental pollen in the autumn had larger brood populations than unfed colonies in late winter. Although this feeding program did not increase the populations of adult bees, the results indicate the potential to do so. We recommend feeding a minimum of two pounds of supplemental protein to maintain bee populations in Russian colonies. Population increases perhaps could be obtained if feeding is begun earlier than late autumn and if more than two pounds of supplement is given.

Acknowledgements

We thank Joe Sanroma (Evergreen Honey Co.) and Andy and Crystal Card (Merrimack Valley Apiaries) for close cooperation in many phases of the work in Louisiana. Rob Baker (Paramount Farming) enabled work in the almond orchard. Lionel Cashman and Roger James handled colony placement. This work was completed in cooperation with the Louisiana Agricultural Experiment Station.

References

Corbet, S A, M Fussell, R Ake, A Fraser, C Gunson, A Savage, K Smith 1993 *Temperature and the pollinating activity of social bees.* Ecological Entomology 18:17-30.

Danka, R G, H A Sylvester, D Boykin 2006 *Environmental influences on flight activity of USDA-ARS Russian and Italian stocks of honey bees* (Hymenoptera: Apidae) *during almond pollination.* Journal of Economic Entomology 99:1565-1570.

Danka, R G, L D Beaman 2007 *Flight activity of USDA-ARS Russian honey bees* (Hymenoptera: Apidae) *during pollination of lowbush blueberries in Maine.* Journal of Economic Entomology 100:267-272.

DeGrandi-Hoffman, G, G Wardell, F Ahumada-Secura, T Rinderer, R Danka, J Pettis 2008 *Comparisons of pollen substitute diets for honey bees: consumption rates by colonies and effects on brood and adult populations.* Journal of Apicultural Research 47:265-270.

Peng, Y-S, J M Marston, O Kaftanoglu 1984 *Effect of supplemental feeding of honeybee* (Hymenoptera: Apidae) *populations and the economic value of supplemental feeding for production of package bees.* Journal of Economic Entomology 77:632-636.

Rinderer, T E, L de Guzman, R Danka 2005 *A new phase begins for the USDA-ARS Russian honey bee breeding program.* American Bee Journal 145:579-582.

Saffari, A M, P G Kevan, J L Atkinson 2004 *A promising pollen substitute for honey bees.* American Bee Journal 144:230-231.

SAS Institute 2000 *The SAS System Version 8.01. 2000.* SAS Institute, Cary, NC.

Struye, M H, H J Mortier, G Arnold, C Miniggio, R Borneck 1994 *Microprocessor-controlled monitoring of honeybee flight activity at the hive entrance.* Apidologie 25:384-395.

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Paper in a book: Rinderer, T E 1986 Selection. In *Bee Genetics and Breeding Rinderer*, T E ed. Academic Press, NY, 305-322.

Book: Ruttner, F 1988 Biogeography and taxonomy of honeybees Springer-Verlag, Berlin, Germany, 284 pp.

Internet: Hood, W M 2000 Varroa mite control in South Carolina. http://entweb.clemson.edu/cuentres/eiis/pdfs/ap5.pdf

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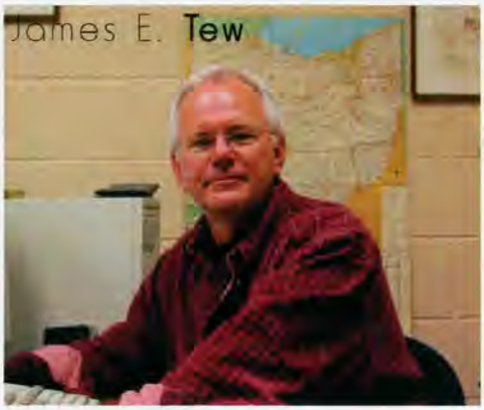

Beekeeping – When The Year Is 2025

Will 16 years make really that much of a difference?

What's so special about 2025?

Well, being unable to foresee the future, I don't know of anything that will be special about the year 2025. The truth is that I have been asked to present a keynote presentation at an Ohio Spring bee meeting next weekend and this was the topic on which I was asked to speak. The group wanted something pertaining to the near future rather than a look at beekeeping far into the future. I suppose some guesses can be made about the randomly chosen year – 2025. I want to see if I can look backwards – which at one time was the future – to see if I can see trends that will predict events 16 years from today

Those who are older, please help me out.

I am shocked to do the simple arithmetic and realize that I will be 77 years old in 2025. Simply stated – wow! But looked at another way, sixteen years ago, I was 45. Simply stated again – wow! In the talk I am to give next weekend, I realize that the bee program planners are looking for optimistic predictions and hopes for a bright, meaningful future, but I am trying to imagine a 77 year-old Jim Tew sitting at a progressive, modern bee meeting in 2025. Give me just a minute to accept the mental image I have of that meeting. I have written in previous articles that those of us who stay in beekeeping become inexonerably incorporated into beekeeping. While you and I age, beekeeping evolves and changes into something "newish." We as human beekeepers just grow into older beekeepers. I got my first two hives of bees in 1973. That means I have – roughly – lived through two 16-year cycles. Maybe I can take selected beekeeping attributes from my first two cycles to shoot a trend-line out to 2025. *(Really – will anyone remember this article in 2025? What do I have to lose?)*

But first, some comments on predicting the unpredictable.

Sometime during 1946, two years before my birth, Dr Percy Spencer[1], a scientist with the Raytheon Corporation, was researching radar technologies – specifically a vacuum tube called a magnetron. He noticed that a chocolate candy bar had melted in his shirt pocket as he was standing near the vacuum tube device when it was being tested. Sensing something odd was on-going, he placed some popcorn kernels near the tube. Within a few minutes, popped corn apparently splattered all over his lab. Later he put an egg near the device to show a co-worker the effects of the magnetron. The hot egg exploded on the face of the curious on-looker Could a device with potential use in radar technology be used instead to cook food in the average home kitchen? We all know the answer to that. The very first microwave was six feet tall and weighed 750 pounds.

In 1928, Alexander Flemming[2] noticed that a common mold *Penicillium notatum* destroyed colonies of *Staphylococcus aureus*. Though it had been observed innumerable times before, this casual observation was the beginning of the antibiotic era of medicine. Though others had noticed the mold's effects, until then it was only considered to be a laboratory contaminant.

On a much more mundane – but important to me – subject, some of the best advances I have made in my use of computer software programs such as PowerPoint and Photoshop have been due to key stroke errors. I call them the, *"I didn't know that would do that."* moment. Spencer was not trying to build a new type of oven. Flemming was not trying to develop an entirely new medical concept. And me – I was just trying to get my talks ready for the next meeting. My point is that a lot of science and technology is highly predictable while a lot is simply blind luck – even mistaken luck. We depend on that unanticipated luck as a way to advance science. Though helpful, such breakthroughs are unpredictable. In this article, there is no way for me to predict such future blind-luck beekeeping happenings. Maybe I should just make some up.

Bee meetings in 1977, 1993, and 2025

1977· Beekeeping was enjoying a cyclic growth boom. People wanted healthy food with healthy sugars. I ate bean sprout sandwiches and had long, dark, slightly wavy hair In fact, long hair was in style and angry bees loved it. New beekeepers wanted their own hives. Package bees and good quality queens were plentiful. Traditional beekeeping was a hot item. Local honey sold well. Attendance at meetings was good and was growing. Presenters used slide projectors or overhead projectors. Talks had to be assembled weeks in advance. Since slides could not be edited, audiences accepted the frequent bad slide as a way of life. There were no laser pointers.

1993: Sixteen years later, the *Varroa* mite was in the final stages of redesigning the bee industry of North America. Shock and dismay were common features of beekeeping as keepers who thought they would never

Who Invented Microwaves? http://www.gallawa.com/microtech/history.html

[2]Bellis, Mary. The History of Penicillin. http://inventors.about.com/od/pstartinventions/a/Penicillin.htm

get either tracheal or *Varroa* mites had to accept the fact that their colonies would succumb to the mite invasion. Yet the public was fascinated by the concept of the ***Killer Bee***. Pollination and concern for all bees' welfare was treated shabbily by the public. But how could the public be blamed? Everywhere they were told that they would be stung to death by marauding killer bees. Beekeepers and land owners were concerned about legal issues. In some instances, it was difficult to find beeyards. Attendance at meetings dropped. Beekeepers left the industry. Numbers of both bees and beekeepers declined. From an income standpoint, honey production was still more important than pollination. In 1993, computers were just beginning to change the way bee programs were presented. The world-wide-web was still very young.

2025: Beekeepers as old as Jim Tew, now 77 in 2025, will still be at meetings and still remember the old bee days of the 60s and 70s. Unfortunately, much of that old information is nearly useless. Most presentations will be electronic and streamed from the web in real-time with immediate feedback between the audience and the speaker In 2025, there will be fewer full-time university bee scientists and state regulators. Much of the program will make use of virtual speakers. In fact, many of the older people – like Jim – won't actually attend the meeting but merely be there in electronic format. Actual attendance at the meeting will no longer be required. Electronic devices that are a combination of today's cell phone, Blackberry, computer, television and wrist watch will be used to gather bee information and participate in bee meetings.

Varroa mites will still be around but are not much of an issue. Enough time has passed that an improved relationship has been developed between bee strains that are more mite resistant and mites that are more bee tolerant. This will allow more time and effort to be directed to issues of virus infections and other pathogenic issues. Pending an unexpected breakthrough in genetic procedures, bees and queens will be pretty much as they are today; however, the way information is delivered will be significantly different.

Bees In 1977, 1993, and 2025

1977· I could buy 3# packages bees for$18-$25. The options of 2#, 3#, 4#, and 5# packages were common. (This season, I will be paying about $72 for a three-pound package.) In 1977, the U.S. Mail Service was the primary source of delivery The Railroad Express Agency (REA) had been an option for delivering bees and equipment, but it was waning in importance.

Will bee meetings look like this in 2025?

Many "races" of queen stocks were available. Caucasian and Carniolan queens could still be purchased from several producers. Midnight and Starline queens were popular and were high quality queens. American foulbrood was the frightful disease of the day but antibiotics and sulfa drugs were seen as modern techniques for combating such diseases. A.I. Root, Dadant, and Kelley were the major equipment producers and were helpful in getting new beekeepers off the ground and supporting established beekeepers. The A.G. Woodman Company in Grand Rapids, Michigan manufactured quality smokers for many years. During the 70s, the Woodman Company was bought out by the Dadant Company All-in-all, this was a beekeeping Golden Age. I am happy I was there for the experience.

1993: Package bees were still readily available and reasonably affordable. In 1990, Africanized honey bees had colonized southern Texas. By 1993, the infamous bee would turn West, much to the temporary relief of Eastern beekeepers. Some beekeepers and some states were still killing bees in order to save them. During the late 80s and early 90s, honey bees afflicted with tracheal mites or *Varroa* mites stood a good chance of being killed in order to control the spread of mites. Even today, 2009, Africanized bees are normally killed as a way to protect the European honey bee population. To the honey bee population, this was much like *"removing bad blood from an ailing patient."* In and around 1993, there was much confusion about the best type of bee to have. It should be hygienic but the science was not yet perfected to breed hygienic bees. By 1995, all U.S. states had documented *Varroa* mite finds. During the 1990s, beekeepers loved their bees as much as the beekeepers of 2009, but mites and Africanized honey bees made it a tough love.

2025: Sixteen years from today, bees and their keepers will still be here. It will be more difficult to get package bees. Shipping and handling packages will be expensive. However, in 2025, many beekeepers will make Autumn splits and Winter them in special insulated nucleus hive boxes. The nutritional needs of these overwintered bees will be better understood. The funding made available to study Colony Collapse Disorder will make these advances possible. Trace elements and vitamin needs will be better met. Instrumental insemination techniques will have been improved to the point that many queens are instrumentally mated. This will improve bee genetics and allow for resistance to migration of *Killer Bee* genes. In 2025, bees still sting, but genetic techniques will soon be available to breed stingless honey bees. While beekeepers of the 70s wouldn't care for such neutered bees, modern beekeepers of the 2025 think they will love them.

Though Africanized honey bees are no longer a major social issue in 2025, they will have firmly colonized most of the package bee areas. There will, however, be reason to hope that within a few more years adequate control procedures will be developed for insects like Africanized honey bees, fire ants, beetle pests.

Bee management and pollination in 1977, 1993, & 2025

1977· Bee stocks were hardy and seemingly thrived even under the worst conditions. Many – if not most – new beekeepers took up bees because they found a swarm on their property Pioneers of the day, like Brother Adam, were busy selecting for the perfect strain of honey bees. Bee breeders have used this selection process since the very beginnings of our bee industry In 1977, chemicals were freely used but not as much as in the years immediately following World War II. Sodium sulfathiazole was still available from bee supply companies. In 1977, bee strains seemed strong and well adapted to their environment. American foulbrood was the biggest pathogenic fear Commercial beekeepers and sideline beekeepers enjoyed significant numbers. It appeared that the industry was poised to grow Though pollination was touted and honey bees were called, *"angels of agriculture,"* commercial bee pollination was still small. Income from pollination subsidized honey prices. Otherwise, it was business as usual. In fact, the beekeeper of 2009 could readily work bee 1977 colonies. (Don't expect to see plastic frames in 1977 hives.)

1993: While the *Varroa*/tracheal mite issue was still hot in 1993, for many U.S. beekeepers the shock was beginning to wear off. Six years earlier (1987), Canada had closed its border to the importation of bees from the U.S. This was a staggering blow to U.S. package and queen producers – one that would take years for recovery Some operations didn't recover

Bee management was in odd place in 1993. States without Africanized honey bees (AHB) wanted nothing to do with them. States that had them really didn't know what to do with them. There was much talk about restricting incoming bees from AHB areas. This never formally happened, but beekeepers were frequently hostile toward other beekeepers who migrated from AHB areas. Making matters worse were *Varroa* and tracheal mite infestations. No one knew what to do with them either Across the U.S., some bee colonies were strong and healthy while others harbored exotic pests or exotic genetics. Beekeeping was a patchwork of management schemes across the country The Internet was playing an increasing role in information dispersal – both correct and incorrect information. Oddly, it was an exciting time to be in beekeeping but not exactly a happy time for beekeeping. Pollination was frequently mentioned as a necessity to U.S. food production, but other battles had to be fought first.

2025: Improvements and advances in honey bee genetics and nutrition will have made bee stocks healthier Pheromone and odor sensors will become important in telling the beekeeper what is happening inside the hive without having to open it. The chemical profile can be fed into a computer program that will show the characteristics of the hive. Aspects of this technology will also allow the queen to be more easily found and replaced.

A plastic foam hive beside a traditional wooden hive.

Beehives will be made from composite (manufactured) wood/plastic products and will be better insulated against Winter cold and Summer heat. While bees – of all species – will still be important for pollination, increasingly, genetically modified plants will not require the high levels of pollinator populations of years past. New versions of artificial sweeteners will be developed and nutritionally enhanced foods will be readily available, but natural honey will still be coveted as it becomes more of an antiquated oddity The management schemes of commercial beekeepers will be significantly different from backyard beekeepers. The Web will be the go-to source for most beekeeping instruction and information.

Obviously, I have been playing with this topic.

Just as obviously, no one can tell anyone else what will be happening in 2025. But I am truly comfortable predicting this: in sixteen years, the bees will be pretty much as they are today as they were in 1993 as they were in 1977 Beekeepers and their gadgetry and understanding will be what will change. These have been some of the thoughts of Jim "Nostradamus" Tew. BC

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D ck Marron

The box was one of four on a pallet. It didn't have any real character to set it apart; it had lines and peeling paint but was aging as well as any old lady could be expected to; especially one that had been out in the weather in almost every state in the union. On one corner there was a faint, stenciled number, hardly noticeable. Number 97 had been in a study long forgotten. It was enough though to make the beekeeper notice on his rounds, like washing a bent fork when doing the dishes. Inside 97 was a colony of bees.

The clock ticked its way through the year and it was January again. The bees were content. They had come south a couple of months before. Even with sufficient stores intact, they were already thinking Spring. There were six frames of brood and 10 frames of bees. In January it gets cold, even in Florida but with sufficient breaks for flight, they were fine. Having been treated for mites the previous Fall, they were healthy

Suddenly the bottom fell out of their little world. Rather, the top came off. A cold, unceremonious wind blew through, threatening the brood. Guards leaped to the attack only to get lost in a cloud of smoke. Quickly two frames of brood and two of honey disappeared into a new box. One frame of unrelated brood was already there. Terrible enough, but the queen! Where was the QUEEN? Oh, there she is, safe as houses. All worked to clear the smoke.

This new box moved to a different location. They would not be leaving for California. These bees tried to make sense of things. A new box, strange bees and no queen; this was bad! Wait a minute. Is that a weak queen odor? We have a queen-cell!! This message passed throughout the split. Centering on this cell the bees huddled together. But that's the new colony, and that's another story. Old 97 was in better shape. Let's stay with her. That's why she has the number.

It's February.

If the split wasn't insult enough, worse things were to come. A few days later a forest fire occurred. Well, it wasn't really, but it felt like it. Heavy smoke poured through the hive, in fact all of the hives on the pallet and all the pallets in the yard. There was a cacophony (some of it due to smoke; pun) of tractor sound. The vibrations were the worst. Slammed and clunked around, the bees had only one thing they could do. They did what any mother would do. They clustered around the babies. They hung tight, as their home became airborne and with a thump of a landing, became part of a truck. Other pallets landed on top of them. More were on the sides.

All through the yard, bees were complaining; the roar was a constant thing. Rootless bees tried to enter the wrong hives. Fighting went on. It was night now and loose bees were crawling everywhere. To a bee, this was mindless bedlam. (The beekeeper thinks:"Well oiled machine"). Then, the most insulting thing of all occurred. The truck

On The Road Again

was screened in. A fine plastic mesh, that allowed air and water to enter, covered the world. In all of beedom, nothing is worse for a bee. Hold any wild thing helpless and it is marked forever; it must be worse for creatures with wings. The entire 480 colonies of bees bewailed their fate in a dirge of helplessness. It's probably pushing it, to say bees have feelings. OK, you explain the moan that comes from a truck full of bees.

Gradually they calmed. They got used to the exhaust smoke and the constant motion and the noise. Much of the route was through cooler country so they did what bees do best; they clustered. Once a heavy bump made the cluster break but they managed to get together again. They comforted themselves with the thought that "better days were coming." Could things get worse? Where would they end up?

"California, where the rain doesn't rain, it just drizzles champagne." This particular year there may be some almond growers considering the champagne, as they don't have enough water for the trees. Anyway, our 97 came to the almond orchards intact. It's a big place. 600,000 acres is a fair sized patch of ground. Between one and two million colonies of bees get to look at a desert with nothing but almonds in it. If the almonds don't provide it, the bees don't get it. If the trees aren't putting out, it's a case of, "eat what you brought with you," like a day-laborer on a lunch break, Or it's a case of starvation. The constant equalization of colonies, that a beekeeper does, pays off at this point. A weak colony could be quickly overrun by robbing.

A crew of men and a loader (OK, unloader) were waiting. The nets were removed that night and the pallets of bees were placed with an eye to providing two hives per acre. The bees woke to a new world. One could imagine a huge sigh of relief but bees have no time for sentiment. They began immediately to orient to this new world. In a half-hour they had found the buds that would become blossoms. Cold and rain had held them back a little. They had travelled 3000+ miles to forage in a dearth. They began to sniff out weaker or queenless colonies. The first flights would be euphoric. There's nothing like a good cleansing flight. They told me something like that in the army.

Having escaped snow, black ice and overheating, the poised spring of bee energy can be felt. New bees had been emerging on the way. Too much in stores and the truck would be overweight; too little, and there wouldn't be enough to carry them through. (Too good a harvest and they would be too heavy coming back.)The new bees needed to eat. The older ones would work themselves to death before they could leave. The corpses of those that died on the way were cleaned out.

Finally the trees began to blossom. The early varieties promised a good set. Soon the bees were doing what they came for. They have a way of quickly establishing the cost-benefit ratio of a source of nectar so that they travel the least distance for the richest nectar. We know something about how they dance that out. But they also have a way to prevent all the foragers from jumping on the nearest blossoms. If anyone knows how they spread the work force over the broad area of a single crop, please let me know. They do it, and the earth sings. Everything to this point was totally unnatural. Bees on blossoms make it right for the most cynical beekeeper

The bees that would leave would have no memory of any other place. The queen may be the same but the Winter bees have served their purpose and their last duty is to die and do it away from the colony With all this bounty, the hive strengthens. Eggs are laid and brood is brought along. Almonds are serviced. In time the trucks arrive again. The new, heavier colony, still in box 97, learns from scratch the trip that their sisters took to get here. There is no way a colony could get "used" to travelling. New and innocent bees are emerging daily.

It's Mar. 15th. "Five days to Florida," could be the slogan of a tour guide. "Along the way we will see mountains and deserts and multi acres of every crop there is, just being planted. There will be traffic jams and lay-overs where the diesel fumes will amaze you. Boil in the sun and shiver in the cold. Use all of your potential!"

Sister hives went north to Washington, Oregon and other states to work apples. Others veered away to keep different promises. 97 went back to the original holding yard in the great sunshine state. Another round of snarling engines and ghost- ➤

Bees and trucks lined up and ready to get started.

ly, white-clad workers in a cloud of smoke and the world was new again. With some of that good almond honey as a back-up the foragers set out to learn the country Ever see or taste almond honey? There's a reason. It's bitter and the keeper is glad to see it used to raise brood. If extracted, it gets mixed 20 to 1 to hide the taste. It's light so it improves the color

Every once-in-a-while, the penetrating smell of ether would stain things, as the beekeeper sacrificed 300 bees in a killing spree. Oops, I meant spray The number of mites washed off is a tell-tale in a ritual that may save the life of the hive. It's hard to pin down the number of dead mites that tips the scale into a mite-control action because it must be interpreted against the backdrop of where in the season, the colony strength and the timing of the next move. With torture, I got one keeper to admit that eight could be a number that would make him look closer Another gave a higher number

If you "nurse" or "rake" a split from a colony, you do it carefully, at least making an attempt to keep the queen in the original hive. It will remain a producing colony even if the product is pollination. (This is by far the most important product). At this point old 97 was about to experience the meaning of a new term. She was about to get "trashed." It has nothing to do with drinking too much.

This is why package bees don't have a normal appeal to a commercial 'beek. (In a disaster they would buy some). They roll their own. Each colony is split into two, three and sometimes four units Available honey is parceled out. Pollen patties are added. The coup-de-grace is the addition of a new queen to each unit. This cherry on top of the cake arrives with all the innocence of the unborn.

The new matriarchs come into town by the hundreds from the queen breeder They are maintained in an incubator or (If mailed), by a small colony of attendants. Each is protected by a plastic cell protector In one of the few gentle operations in beekeeping these cells are inserted in the center of a comb of brood and left to emerge. What about the old queens, you ask. I hate to tell you this but they are ignored. My source tells me that 80% of the time the young queen prevails. If not, the old queen is only six months old anyway "No worries mate." Sure, some of the splits don't make it but that's the cost of doing business. The queenless and the weak ones will be either shaken out or combined later The equipment will be subsumed in the constant swirl of splitting and building up. Speaking of swirling, can you see that disease would normally occur by yards? Share and share alike.

Old 97 only has about two frames left of the original hive. But there she is: a couple of frames of brood, a pollen patty and a brand new queen, rarin' to go. Add a dollop of Florida sunshine and about a million acres of orange blossoms, Brazilian Peppers, Gallberrry etc, etc...and she will rise from the ashes like a Phoenix. This is not to mention the HFCS or liquid sugar the beekeeper provides to fill in the empty places.

I'm starting to scare myself. All this work and we are still in Florida. We have to be in **Maine on May 15th.**

OK we got the bees trashed and building up. Splits raked in January came along fine. There are a whole bunch of small colonies in the yards. Efforts are all now toward the move to blueberries in Maine. The blueberry barrens aren't almonds but they pay too. Something like 60,000 colonies of bees head for this area close to the Canadian border The bees need to be ready By the **middle of May**, they have built to eight frames of bees/ brood plus honey. I'm told bees would

The long bumpy ride begins with being loaded on the back of the truck.

work blueberries last, if there was anything else. Guess what? There isn't anything else there.

Another round of coughing engines and beekeepers and these new bees get to know what the purpose of bee-life is. They are herded, slammed and thumped aboard a number of semis; they are smoked, screened in and smell of diesel. Unhappy, they set off for Maine. A few thousand miles later, the process is reversed. Once again the bees find a new home they need to get used to. As the blossoms emerge the bees reset their tiny GPS units and perform their service. 97 is in the thick of it.

About a month later (**Early June**) old 97 is bundled aboard again and moved to cranberries in Massachusetts. There are June contracts to fill. The "bogs" are just as distinctive a form of agriculture as the "barrens." The bees do their sexy duty You have to give the cranberry people credit. For a tart little berry, they seem to have gotten into everything. They couldn't have done it without the bees. I'm now eating them like raisins. I know there's added sugar to this confection regardless of what those hip-boot guys say!

Sometime about the middle of July the bees (the ones I have in mind) move to New York State. Others move to vast clover fields near the Canadian border Pennsylvania is a popular place for others. Now it's time to catch upon some beekeeping. Mite populations have been building. Some dead-outs show up and they need a Nosema treatment. They are trashed again into three frame splits. Queen-cells were shipped in; they are cared for in a number of packages. This second requeening of the year is another interruption in the brood cycle but they are treated for mites at this point. They are left to scarf up the goldenrod. Pollen patties are provided four times a year to make life easier

Loaded and ready to move on down the road.

Sometime in **October or November** these travelers are moved back to Florida. There can be as many as 20% losses from queens not taking or other mishaps. By the time 97 is unloaded and settled back where we started, total losses of 50% wouldn't be unexpected. The odometer on the truck reads 12,000 miles more. They are fed, split, pattied and treated. They will be inspected at least 4 times and equalized. It's hard work but must be done. We have to be ready for California by February BC

Disclaimer: I've told this from the point of view of the bee. The device could be called projection or personification; go long and it's anthropomorphism. I used it to make things readable. (Kim likes that) There is no evidence that bees have emotion. Thus, they don't feel put upon by all this and it's not fair to call it abuse. The requeening is what they would do as swarming. Sure, they have brood 12 months of the year but it's not the same bees or the same queen! Neither is there any way to know that all this travel "stresses" the bees. After all, they are good at hunkering down. AHBs evolved a travel regimen on their own that can take a swarm 20 miles in one shot, moving to forage. Thus, the feast or famine of migratory beekeeping may actually have a "natural" component Thanks to Dave Arters, Wade Fisher and Dave Hackenberg for help with the background.

Dick Marron lives in someone elses' beeyard in the Winter. The rest of the year he's in Danbury, Connecticut.

Propolis – Another 5 Percenter

Walt Wright

Several years ago the first article on "five percenters" appeared in this magazine. That submittal dealt with the gains of adequate hive ventilation. It was stated that other 5% subjects existed, but this beekeeper has been preoccupied with more important subjects since that time – like CCD. Having had my say on nutrition as a factor in the CCD epidemic, we can return to general beekeeping considerations.

To recap the classification of five percenters, several worker jobs can be considered as occupying hive populations in activities that do not directly support honey production. The effects of a large portion of hive population engaged in non-production activities is difficult to measure, and is definitely not obvious to observation. But it should be easy to understand that bees engaged in work not related to your goal of honey production would make some dent in that production. Since the diversion of that portion of the work force is not readily measurable, we just arbitrarily assign that consideration to the 5% classification. Some will be more or less of that much impact, but the combination of all of them could be worth the effort to minimize the effects.

The subject here is propolis – that stuff that glues everything together in a beehive. It gets a fair amount of bad press in the literature, and is reported to be collected from plant resins. I personally have never seen bees collecting those resins at their natural source, but I see the effects. I have occasionally seen them retrieving some propolis from boxes left in the hot sun long enough for the propolis to warm to its tacky state. They carry it on the spurs of the "pollen basket" – much like a pollen load. Once applied in the hive, it hardens into a brittle solid that often defies removal by a standard hive tool.

Just yesterday I showed a local beekeeper how to checkerboard a colony for swarm prevention and increased production. He Winters in a deep and a shallow – 10 frames. Since it was my game, he watched and I worked. Who knows how long those shallow frames had been in the same position, but they were well propolized. To shorten a long story, it took four hours to do eight colonies, but I was careful not to wreck any frames in the process. When we were done, I told him it is much simpler and quicker with nine frame brood box spacing. He muttered some negative comment and I left for home. I don't think there is any danger that he will ever adopt my management approach.

Yes. Propolis is a problem for the keeper, but a valuable defensive asset for the bees. The intent of this submittal is to provide some recommendations for a compromise between you and your bees.

First, we need to understand the defensive nature of the use of propolis by the bees. Consider for a moment the size of larvae of the wax moth or small hive beetle. They are tiny at hatching. If that pest larvae hatchling can find a crack or crevice of a size that the bees can not penetrate, it is safe for the moment. Often, the adult pest actually deposits her eggs in a protected spot to start the process.

To roust the pest from the colony, whether adult or larvae, the bees use their mandibles. That means they need head room for access. Any space, from a crack up to bee access space is filled with propolis Even an inside 90° angle, like the inside corners of the hive box, are rounded (construction jargon – coved) to insure access to the deepest part of the angle.

Both the wax worms and the beetle larvae have a defensive mechanism to protect them during development. The wax worm builds a webbing to keep the bees at bay Webbing to protect the larval stage is not unique to the wax moth. Many other insects use that technique. You are probably familiar with the tent caterpillar that feeds at night on tree leaves and retreats to the tent during daytime when predatory birds are active. As the wax worm larvae grow, they extend the webbing to eventually completely enclose the whole brood nest where pollen is stored. The bees are helpless to stop the expansion of the larvae base of operations, so they take the preventive approach of stopping them before the larvae get started – by propolizing hiding places for eggs and small larvae.

"The subject here is propolis – that stuff that glues everything together in a beehive."

The beetle larvae have a different defense mechanism against the bee colony invaded during development. When I saw a maturing beetle larvae climb up one cell wall partially filled with nectar, and nonchalantly crawl down into the adjacent cell of nectar, headfirst, it reminded me of the botfly larvae. For those of you unfamiliar with the botfly life cycle, the adult lays an egg on the skin of a warm blooded animal. The larva penetrates the skin and feeds on the flesh below (sometimes called wolves). As it grows, a pocket of fluid (lymph?) develops – making a bump on the skin surface. Often the first clue to the animal's problem is a wet streak from the larva's breathing hole. Existing in a liquid environment, it maintains a port in the outer skin to come up for air – much like the seal's hole in overhead ice. The beetle larvae hatchling only needs to make it to an open cell of nectar/honey to be "home free." (Safe in the kid's game of hide and seek).

As much as I have read about the beetle, I have seen no reference to the larva defensive mechanism of living in a fluid environment. The clues are there. Honey on the honey house floor, larval feces in the honey, and slime on the bottom board are reported vividly. Pictures of larvae frolicking in the bottom board "slime" abound. Do the "experts" not recognize that living in a fluid is the larvae defense mechanism? Bees are not known for their swimming skills. Moving on, it should come to their attention, sooner or later, that the "slime" is caused by honey oozing from the breathing holes of the larvae.

If you paid any attention to my past opinions you will know that I am not enamored with Langstroth hive design. Propolis tends to make the objective of movable frames more difficult than it needs to be. With all the cracks and right angle turns in the frame rest area of the box rabbet, that area is often a solid mass of propolis. The frame spacing shoulders of a frame are cemented together for the full depth of the spacing width of the end bar For either the frame rest area or the spacing shoulders of the frame, when you break the propolis joint, some hardened propolis stays on both pieces of the separated joint. Unless you put it back in the same position it came from, the chunks on both sides will not match up, and the frame will not go into a different slot willingly. Get a bigger hammer! An alternative is to scrape the outside perimeter of each frame down to the wood as removed, all the way around, and clean the frame rest rabbet with your trusty hive tool. Very labor intensive. The bees are certainly entitled to implement their time – honored method of pest control, and to their credit, they often err on the side of safety. Too much is better than too little.

Having wandered through more miscellaneous misinformation than you thought you wanted to know, will try to drift back to the subject of this submittal.

One advantage of the metal nine frame spacers that we use from the bottom board to the cover was not mentioned in the article (BC Jan 06) on nine frame brood chambers. The sides of the position slots are angled up and away from the bottom width. With some gentle leverage off the next adjacent frame the frame lifts up and away from the base of the slot. The primary resistance to upward movement is the propolis between spacing shoulders and excessive propolis at the upper end of the top bar (More is better.) It's easy and quick to remove the excess at the end of the top bar and slicing the propolis between spacing shoulders is not that tough. The eighth inch space will accommodate the thickness of the hive tool. This paragraph is only relevant to upcoming recommendations.

One of my favorite contributors to this magazine years ago was O.B. (Older But) Wiser – an obvious pen name. He was located somewhere in the desert southwest and called 'em like he saw 'em – without regard for other opinions. My kind of guy. However, he wrote one article I was inclined to disagree with. (We're inching back to the subject of this submittal.) He recommended a late winter "clean up" of hive parts "down to the toenails." His description of clean up included scraping all woodenware inside the hive to remove unnecessary wax and propolis, to start the new season with a neat hive. If he lived far enough south that the bees maintained brood all Winter, they would emerge from Winter with wax making capability. In that case it would be okay to remove wax stored as bridging and burr comb. Further north, the colony has uses for their stored wax in early season. Give them credit for limited waste of resources – they are efficiency experts.

(We're back to the subject) Scraping all the propolis internal to the hive would cause the colony to start over on sealing cracks and crannies. If they get a vote, they will not abandon their pest management program.

The literature tells us that propolis workers are a dedicated group of specialists. They gather the goop in the field and putty the cracks. No intermediate bees in the process. I'll take their word for that much. The bees are very good at apportioning the work force to accomplish multiple tasks in parallel. It stands to reason that the greater the need for propolis the more of the work force is applied to the task.

It's the application of that portion of the work force that is the subject of this submittal. To qualify as a five-percenter, there be must ways for the beekeeper to minimize that work force to reduce the number of bees necessary to perform that duty. Presumably, any portion of the work force relieved of that duty will contribute to honey production. That colony has a finite amount of energy to apply to generating surplus honey is the basic premise of the five – percenter classification.

That opens the question of what can we do as beekeepers to reduce propolis needs. This season I will do two things to get started. Since the frame rest rabbet area is a known inconvenience area for me, that problem will be attacked on a priority basis. Frames have been modified to slope the sides and ends of the top bar tab (ear) that supports the frame weight on the box rabbet. It will not be necessary for the bees to fill the space at the end of the frame and should reduce the need for propolis on the base of the tab all way around the tab joint to the frame rest ledge. Propolizing the joint is expected, but there should be less of it. The slopes (45°) open up the angle and should provide more head room without weakening the tab strength much. The figure shows the end tabs of three frames. The center frame is unchanged, while the left and right frames have been modified. The left frame tab is angled at the end only, and the right frame tab is angled on the end and both sides for comparison of effects.

Secondly, on a lower priority, any new boxes assembled this season will have a flat surface, top and bottom. It's easy to assemble a box that does not have a flat surface and causes the bees to fill the cracks left between boxes where there are open spaces. If you look at a propolized box joint, when separated, you can often see evidence that the mating face was propolized from both inside and outside – none in the middle, because the bee pushes the propolis into the crack with its "feet." Occasionally you will see a propolis worker filling a crack on the outside. I am puzzled by the outside work. "Bees are insects and don't think." It is difficult for me to believe that a bee trained to the entry/landing board accidentally stumbles on a crack that needs filling at the back of the hive – four stories up.

To insure flatness of the mating surfaces a test surface is needed. Steel plate would do it. A box on the flat surface will be trimmed until no light is seen between the plate and the box. High spots in mating surfaces can be trimmed in many ways. Small amounts can be done with a power sander with coarse grit, but that is fairly slow. For larger adjustments, I have been known to drag a circular saw backward along the edge to take off the desired amount. Not recommended for the novice circular saw operator Point is: I have been making boxes with relatively flat surfaces for years, but intend to do a better job in the future.

Making the box mating surfaces absolutely flat will pay dividends for the life of the box. Each year, less workers are needed to propolize the box joints which should improve your honey yield by some unknown amount. A more positive gain is that in beekeeper time spent in routine hive management and honey house operations. When honey supers are cycled through the honey house each season, it's nearly mandatory to scrape the box joints, top and bottom, down to the wood. Depending on how well the propolis is cured that can take time and effort, not needed on the tight fitting joint.

If not scraped clean for reuse more propolis accumulates each season because of last season's mismatch of residual accumulation. If you only had a few hives, it might be feasible to put boxes back on in the same sequence they were used last season – forgoing the clean up and reducing propolis work. Otherwise, clean mating surfaces.

It's a little late for this season, but there is another propolis reduction to be implemented. My boxes are ready to go for the build up starting next month. With nine frame spacers mounted on the frame rest, there is no need for the spacing shoulders on frames. The one eighth space is regularly propolized. By shaving a 16th off both sides, the space is increased to a quarter inch (head room) which would obviate the need for propolis. I look forward to getting all – up with these changes and returning to the "joys of beekeeping."

Two other five-percenters on the list remain untreated. Paying attention to bee space between boxes and over-supering are both relevant to the closing comment. When supering "as needed", significant interbar comb results. Over-supering results in very little comb being added between boxes.

Perhaps we'll get around to those other five-percenters and maybe not. But in case you already take care in those areas, a flat mating surface on boxes will make it easier to separate boxes during hive breakdown or harvest. Be advised that my overall approach to hive management is oriented to maximizing honey production with the least time and effort on my part.

The referenced, older articles can be found on line at **www.beesource.com**. Click on Point of View.

In summary, with the beetle spreading across the country, it would behoove us to pay more attention to the merits of propolis. I believe that we can help the bees and our production by taking steps in advance to minimize the need for small pest larvae defense. BC

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

THIS IS NOT YOUR FATHER'S BEEHIVE

Selling Bees To The New Urban Beekeeper

Gwen **Rosenberg**

Joe Girard has sold more new cars than anyone on the planet. He has sold cars to people who didn't know how to drive, and people who should have stopped driving three decades ago. I don't know if Joe is a beekeeper, doubtful, but he would most certainly recognize the tremendous marketing opportunity that has just sprung open in the world of beekeeping, namely, urban beekeeping. Major cities like Chicago and Cleveland are welcoming beekeeping as part of a larger ongoing "green" movement that includes community gardens, water conservation and healthier eating and living. Michelle Obama has even started a garden and apiary on the grounds of the Whitehouse. With the sudden influx of inexperienced city-folk-turned-beekeepers there's plenty of opportunity for supply houses, bee clubs and entrepreneurial minded folks – like Joe Girard. Let's just be sure that our fine pastime is being sold to these newbies by people like Joe, instead of P T "there's a sucker born every minute" Barnum.

Keeping bees in tight places is tricky, but it can be done.

Beekeeping has inhabited the rural landscape for long enough that most of us take for granted the accumulated knowledge of our grandparents and longtime bee club members. The barrier for entry for the new hobbyist, however, is remarkably high. The portrait of a rural beekeeper is generally someone with a few dozen years bee experience, 40 acres, and half a dozen grandkids. Urban beekeepers on the other hand are professionals, with young kids or no kids, and great enthusiasm to "go green." They are usually in possession of more money than acreage. They are intelligent but have not yet learned how to keep bees, and they don't have the social network, 4-H, or Farm Bureau to point them in the right direction. You might say they are ripe for some hornswagglen'

When selling new cars, as Joe will tell you, people want to feel confidence that the salesperson knows the product and will be there if there's a problem a few miles down the road. Bees should be marketed the same way, but they usually aren't because most of us already know what we're doing, and none of us like be told to do something different. The new hobbyist on the other hand, needs a well informed salesperson exuding confidence that bees are not instinctual killers, and that he/she will answer frantic phone calls regarding such scary things as mass-orientation flights on a sunny day I'm not convinced that we beekeepers are currently supplying this to our new friends on the other side of the interstate.

For starters, our beekeeping classes are overly advanced and don't address the concerns of people who have hives on a plot of land the size of a backyard deck. Classes should focus on hive location (maybe even insist students bring pictures of the yard for hive placement), urban camouflage of hives, and hive management geared for the bees' subsistence with the occasional super of cut-comb honey Urbanites are not planning on becoming commercial or even side-line beekeepers. Also, Most classes also over emphasize the threat of deadly disease and bee inspectors with matches.

Joining a club is good advice for anyone with beehives. Clubs should reach out to these urban markets and quash unscrupulous entrepreneurs from starting clubs or subverting clubs for the purpose of fleecing our new compatriots. Meetings should include speakers on the topic of urban nectar sources, watering hives in a concrete landscape, and treating hives as more of an ecological resource rather than honey factories. Most people moved to keep bees in the city have such a tremendous interest minimizing their environmental impact that an overemphasis on chemical treatment of disease could deter them completely Learning a little more about integrated pest management solutions is a good topic for all beekeepers. Besides, let's not forget these are bugs! If a single hive or two dies, these folks can buy more. Theirs is not an agricultural investment measured in terms of mortality rates and peak production tabulations.

Good car salesmen don't sell monster trucks to first time drivers. What we're selling, however, is a box full of flying, stinging bees that are going to buzz the neighborhood all afternoon the day they are installed. I propose that our urban friends purchase a mid-size, driven by a little old lady to church on Sunday, in the form of a new eight or 10 frame deep super, complete with screened bottom board, a couple frames of drone comb, inner cover and telescoping lid. Oh yeah, did I mention that the bees should already be installed in the box. Drop it in the yard, remove the screen over the entrance, and add water- Presto beekeeper! Installing a package of bees is a scary new experience, and potentially upsetting for neighbors who are trying to be cool about the whole thing. Why must the new people install a package themselves when the package can be installed by an experienced beekeeper in about 10 minutes far away from the sand lot baseball game. Even skeptical neighbors would marvel at what little threat the new bees appear to be – if they even know they are there. Spare the new beekeeper worries of absconding queens and neighbors with bee stings and you, the seller, can justify a greater profit than would be realized by the sale of a single package.

Joe Girard didn't sell all those cars because he duped buyers into something they didn't want (or couldn't handle) for an immoral price. Everyone expects businesses to make some profit. Sell an installed package with a smoker, veil and hive tool, and charge more for your efforts. A good rule of thumb is to imagine how you would respond if confronted by a new beekeeping customer who knew your profit margin. Would you feel comfortable explaining the charges? Would you blush? Would you relocate your family into to the witness protection program? Let's get creative and sell complete hives to city dwellers, but let's not get greedy with our products or our advice. This includes the "rust protection package" up-sell that no one needs but they don't realize it yet. As soon as they do realize you sold them something they didn't need you can bet it will come up at the next community garden meeting.

In the country, you see each other once a month at a bee club meeting, if that often. In the city, you see your friends almost every day A single conversation over the fence or in the pub can spread your reputation, good or bad, in hours to an entire neighborhood. Joe Girard sold by word of mouth because he realized that for every sale there were approximately 250 friends and family members who would hear about it. If a new hive visits the community pool for a drink, and you blow off a single new beekeeper who's having a heart attack over it, then you just ticked off 250 potential beekeepers, not to mention all their neighbors too. The sudden market explosion of beekeeping and other enviro-friendly hobbies is going to draw the initial gang of "experts" making a buck off people who don't know better, or are on the wrong side of the supply and demand teeter-totter If you act like a jerk because you're the only game in town, you should expect the cold shoulder at the farmer's market, community garden and neighboring bee clubs.

This backyard is small but certainly has the potential to contain one or two hives.

When choosing your hive location keep in mind where the pets and the kids play.

The bottom line is that we should be thrilled over the recent invitation that the honey bee has received to move to the big city These folks are trying to learn all they can about keeping bees in their unique environment, and we should encourage them with generous advice and meetings (well advertised) addressing urban beekeeping topics. Additionally, everyone with a quality product and good customer service deserves to make a profit. Customize your products to account for the circumstances of an urban setting, but don't oversell, over charge or take a P T Barnum approach. You can sell more bees than Joe Girard ever did. Sell a good product for a good price, give good customer service, and never leave anyone feeling like they got a lemon. BC

Gwen Rosenberg is an urban beekeeper, also raising small boys, chickens and a dog in Kent, Ohio.

TRAPPED

Jason **Nelson**

Get More From Your Beehives Than Just Honey

A Beekeeper should be able to hive a package, catch a swarm, staple a frame, build a box, spot a queen, split a hive, diagnose a disease, destroy a mite, harvest honey, render wax, graft a larva, collect the pollen, take a sting gracefully, work from sun up happily, and die peacefully. Specialization is for honey bees.
- Robert A. Heinlein, (if he had been a beekeeper)

If all you collect from a hive is honey, you had better be prepared. One bad flow and it is over for the year. The hive is capable of producing a lot more than just honey, and diversifying your harvest is a good way to not put all your eggs in one brood comb. "There's more to harvest from a hive than honey," I told my wife as I was contemplating this. "I thought that was just what you said to explain why you never get a decent amount of honey," she said. Pollen seemed a reasonable way to expand my beekeeping horizons. On my next trip to the bee supply store I asked for a pollen trap.

"I've got one," he said, and began to rummage through his shelves. As I waited he began to stack pieces together. I must confess that I didn't know much about traps but I was fairly certain that Pollen traps aren't supposed to be this complicated. First, there was the bottom board mount (which is not the trap.) On that went the frame mount (also not the trap) and the frame mount held the housing (not the trap either). The housing held the entry screen, the collection drawer and the side rails. None of those were the trap. The frame rails, those held an odd piece of plastic with holes in it which was actually the trap. To get the pollen out, one had to un-mount the trap and un-hinge the door guard, then slide the collection tray out to the front. I prefer a trap that has fewer pieces than a '68 Chevy and doesn't require the beekeeping equivalent of an engine overhaul to get the goods.

"I think I'm going to have to pass," I said. He had already started putting away the parts.

"We've had it in stock for a few years. I could make you a real deal." For the sake of my sanity I declined. He didn't seem surprised.

My wife suggested I build a trap. I showed her different plans for building them. "There has to be something simpler," she said, "come up with a plan." The next day I was ready. "You put a dab of honey on this plate. Then we tie a string to this stick, and prop up the box like so. When a bee with pollen lands to drink the honey, you pull on the string. The stick falls, the pollen is inside the box."

"So is the bee."

"Then you take the bee out, remove the pollen from each leg and let it go."

"Try again."

"Two tiny boxes. Inside the other box. One for each leg. Two tiny sticks with strings. The tiny boxes fall on the pollen - "My wife flung a catalog at me.

"Your plan stinks. Order a trap," she said. My plan worked perfectly.

I ordered two traps, one a plastic box that hangs from the front of the hive, one a top mount trap that promised "cleaner and more pollen than any other trap." After converting a colony to a top entrance and giving the bees time to figure out the modifications to their home I applied the top pollen trap to one hive and the front trap to another.

The bees refused to cooperate. They hung in beards from the front of the hives, they covered the top three deep in foragers. In the night I briefly shined a flashlight at the hive top. It was carpeted in bees. The next day the top entrance had only a stubble of bees on it and that evening they retreated into the hive. The second day the front porch bees gave up and started using the trap as their only entrance. The third day I went down and emptied the trays for the first time.

The front mounted trap has a tray that slides out in front. The downside of it is that to slide the tray out, you have to reach over the top of the hive or stand to its side. I haven't figured out the upside to it yet. While you are doing so the bees are wondering exactly why you are tearing apart the front porch they just got used to. Think of it like changing the air filter on your Chevy - you won't do it while there are bees flying in and out of the air filter without wearing the suit. Then again if there are bees flying in and out of your Chevy you have bigger problems. The point is that the front mount trap is not to be emptied without protection.

The top mounted trap has a drawer that opens to the rear, in theory so that you can collect pollen without having to face bees. My hive is so full of bees there's no safe direction that doesn't involve "facing the bees." I removed the tray one evening to discover that a small army of bees were waiting on the handle. It turns out I have a front mounted ➢

Checking a pollen trap tray. (CC Pollen photo)

bee venom trap as well. It's called my arm. Sometimes Diversity hurts.

When I returned with my plastic bags of pollen from each trap my wife was waiting at the door Her look said it all. It was "That's it?" and "You paid how much for it?" rolled into one. "The traps collected some pollen," I said, holding out the bags. She shook her head.

"I think they're designed to collect money The beekeeper passes through the first part of the catalog, then his wallet brushes up against the page with the pollen trap, and the money falls into the order envelope and the beekeeper can't get at it. Isabella has more pollen on her nose from the buttercups than both your traps put together Pollen traps are an excellent way for a beekeeper to diversify the way he spends money on bee equipment."

"It'll get better," I said. I hoped. It did. As the days went by the cadre of striking foragers dwindled and the amount of pollen in the traps went up. As the days went by I fell into a routine of collecting the pollen, freezing the pollen, and rubbing the stings from collecting it. Soon I had two large bags in my freezer, each filled with gray, orange and yellow pollen.

"Now what, Mr Diversity?" asked my wife as I weighed the bag one afternoon.

"This is from the top trap. I'm selling it as 'Pure Pollen.' The stuff from the front trap is 'Pollen Plus.'"

"Plus what?"

"All the bits and pieces I found in the bottom of the drawer That, that's an eye, those are wings, and I'm not sure what that is but whatever it came off of is either dead or in a foul mood."

"My mother wants some for her supplements," she said. I started to weigh it out when she grabbed the scoop, "Not the stuff with bits. Here, I'll measure it. You, get out there and empty the traps. Oh, and get the orange hive ready for a top entrance, we need to stop collecting dead bees and get the good stuff going."

I'd complain but my wife was ordering me to spend time with the bees. Then she pointed to the catalog on the table and said, "Andrea wanted some propolis for a tincture and I saw these on sale here. You just collect them from the hives and freeze them. I want you to put one on each of the hives when they arrive. Diversity, remember?"

"We just got used to collecting pollen. If I put anything else on the hive, the bees are going to" – I stopped. I know that look. That look says "Don't bother arguing." So I put on my suit and went out to my bees. I'm trapped. BC

Jason Nelson gathers pollen and keeps bees at his home in Kirkland, Washington.

So You're An Editor Now –

Exactly what does that mean?

Ann **Harman**

You just volunteered to be the editor of the beekeepers' newsletter That sounds quite professional, doesn't it? And your beekeeping association is expecting great results. So off you go home. Now what? Exactly what are you supposed to do?

We can start at the beginning and look up *editor* in a big, heavy dictionary Here you find out that you will: bring forth, produce, proclaim, publish, revise, correct, arrange contents and style, alter, direct a publication. I would like to add to the list: plead, cajole, browbeat. Perhaps you can think of other tasks of an editor

Did you realize that long list when you volunteered? I'll bet not. Most associations, whether large or small, statewide or local, always seem to be looking for volunteers to make the association function – officers, newsletter editors, meeting organizers. Perhaps becoming the newsletter editor seems, on the surface, an easy task. For some, it may be. For others, it may seem a quick road to insanity

How would an association find someone to take care of the newsletter? Promise them help – and keep the promise. Now this requires other volunteers. Sort of a Catch 22 situation isn't it. I've often wanted to revise the cards in Monopoly®. Instead of a card saying "Go to jail, go directly to jail, do not pass Go. .," it could say "You are now the newsletter editor, give it a go." Since that won't work, see what can be done to help the editor with tasks necessary for your particular newsletter· soliciting articles, folding and stamping, keeping the mailing list, and giving appreciation even along with complaints.

Basically the purpose of a beekeeping newsletter is to bring information to beekeepers. However, that information may then appear in other publications for non-beekeepers or escape to the Internet. In the U S we have two beekeeping magazines, *Bee Culture* and *American Bee Journal,* both appearing monthly A small newspaper, *The Speedy Bee,* appears when something newsworthy appears. These three are all available by subscription. Then there are the newsletters of the national associations, regional associations, state and local ones. All these are available to dues-paying members. Still others, difficult to classify, are the ones by Dr Eric Mussen and Dr Malcolm Sanford.

Here we will be mainly concerned with the state and local association newsletters, generally done by a volunteer from the respective association. However we will learn from other categories of newsletters as well as ones from Canada and other countries.

A newsletter starts with obtaining sufficient articles, basically to fill up the number of pages the newsletter usually has. I said "usually" because the number of pages can vary within the postage limits the association wishes to pay Meet with the association officers, especially the treasurer to see what is possible. Keep in mind that postage will go up, generally before dues rise to cover costs.

Ask your association members what topics they would like to have. Remember, no matter what you choose, someone will be upset about the choice. Smile. Ask the association members for articles on whatever topics they choose but make no promises about when or even whether their articles will appear Something very seasonal, like swarming, is not particularly pertinent in November However it can be saved and put into a late-Winter or early Spring edition.

Depending on the size of your newsletter you could have a Letters to the Editor column. Here you will get pluses (an idea for a full article) and minuses ("I didn't like the article on queens."). If you think your readers would respond you could try a Q & A column. The questions could be the source of ideas for articles or be the encouragement for someone to write an article.

Failing any contributions from would-be authors, you now have to make some decisions. Do you plead, cajole and browbeat Beekeeper Burt to write an article about his really clever swarm catcher? Do you plow through your disorganized files of interesting bee stuff and pull something out? Do you just sit down and write something?

Now we encounter something called a "deadline." Here is where you can be nasty without sounding nasty. Beekeeper Burt said "yes." You told him the deadline is the first of the preceding month. Did you ask in sufficient time for him, or other authors, to compose an article? The only time in his life Beekeeper Burt was on time was when he lost the meeting information and arrived early You can keep some articles on hand to use when contributors do not make the deadline. When contributors fail to meet your deadline, and you have given sufficient time beforehand, you need to point out that "a deadline is a deadline." Stick to it!

Be prepared to accept articles in any form the author chooses. Now computers are usually used but it is still possible to have something written in pencil on notebook paper Smile when you say thanks. No matter how the material is delivered, you are the one to make it fit into your newsletter

You can volunteer to share newsletters with other local and state associations. Sharing, of course, is free. Choose some newsletters from states other than yours. You may see a nice article in another newsletter and decide to use it in yours. Ask! The editor will be pleased that the association's newsletter and article author will be acknowledged and the information shared with beekeepers.

Just because an article arrived via computer does not mean it is ready for publication. You are responsible for good grammar, correct spelling, and correct style. And you are responsible for correct content. If you wrote the article, you are the one responsible. Check your facts and if in question, consult with appropriate sources. If from a contributor, check questionable facts with the author first. A forgotten word can change the entire meaning. If the author insists it is correct as written, check with an appropriate authority Don't be afraid to reject the manuscript or correct it!

"The Moving Finger writes; and having writ, Moves on: nor all your Piety nor Wit Shall lure it back to cancel half a Line, nor all your Tears wash out a Word of it." From *The Rubaiyat of Omar Khayyam* by Edward Fitzgerald.

Keep that in mind, always.

Yes, spellcheck is great, but. .! The little people inside your computer speak Computerese. To them *their* and *there* and *they're* mean the same thing so you will not be notified that it was the wrong word. A spelling dictionary is a time saver – does the word end in –ent or –ant? There are quite a few spelling dictionaries available on amazon.com or at a bookstore. A spelling dictionary is just handy to have, anyway

Good grammar is part of writing style. Although good grammar is fairly constant, style changes over time like fashion in clothes. If you were taught how to use commas in writing when you were in school 20 years ago, you are woefully out of fashion. Style has to do with punctuation, capitalization, plurals and possessives, among many other things. Again, computers do take care of us for some things, but not all. You can buy style manuals on amazon.com or at your local bookstore. Look for the date of publication and choose the most recent one.

Computers have built-in spelling, grammar and some style information. However if these do not suit your needs or answer your questions easily then spelling dictionaries and style manuals may be the better solution.

Here is a caution that perhaps not many have thought about. Copyrights. You cannot just pluck something of interest – cartoon, article in a magazine or newspaper, or another newsletter – without respecting the copyright laws. You must ask permission to use material from another source, acknowledging the author and source. You can phone, write or e-mail to request permission to use the material. If you are an association, especially small and nonprofit you may be granted that permission. If not allowed to use the material, then do not. You are also expected to use the trademark symbols with items that are trademarked, such as Apistan® or Jello™. As a newsletter editor you are expected to have correct usage.

As editor you may well have to field complaints. Smile and thank the complainer Before you ignore the complaint it would be well to find out if any part of the complaint is justified. Were some facts wrong? Oops – being an editor means you are in charge of facts. Did the article seem incomplete or lacking in some information? Perhaps a second article would increase and improve the information given. If the complaint is bizarre and has no merit – well, as I said before, smile and thank the complainer

We are just getting started on your newsletter In the next two articles we will visit some other aspects of producing and sending a truly professional newsletter, no matter whether it is two pages or many more. In the meantime, read below and believe it, but don't take it too seriously

THE EDITORIAL DILEMMA

Getting out a newsletter is no joke.

If I print jokes, people say I am irreverent.

If I don't, they say I am too serious.

If I clip things from other magazines I am too lazy myself.

If I don't, I am stuck on my own stuff.

If I don't print every word of every contribution I "Don't Appreciate Genius."

If I do, "The columns are filled with Junk."

If I make a change in your article, I am "Too Critical."

If I don't, I am blamed for poor editing.

Now, as like it as not, someone will say I swiped this from some other source.

I Did! (Thanks Kim) BC

Cotoneasters

The name is from the Greek word meaning 'like quince.

Conn e Krochmal

There's a lot to like about the cotoneasters. Very popular among bees, these plants can serve various roles in the bee garden.

There are over 200 species of cotoneasters along with many cultivars. Easy to grow, these plants are generally low maintenance. Cotoneasters can tolerate considerable pruning when grown as informal hedges.

The name cotoneaster is from the Greek word meaning 'like quince.' This refers to the quince-like foliage of some species.

When given a choice of different plants in bloom, honey bees eagerly seek out cotoneaster blossoms. These provide nectar and pollen. Though there is rarely enough nectar for surplus honey, the crop helps to sustain the bees. They start blooming in late Spring and continue through mid Summer

The small blossoms are either saucer-like or cup-shaped. With five petals, they can be white, cream, or pink. These occur singly or in small clusters that are several inches in diameter In some species, the clusters only have two or three blossoms. When in full bloom, some cotoneasters put on quite a show.

The size and growth habit of these shrubs can vary widely The prostate, low growing ones are ideal for ground covers. If left unpruned, some species can reach 20 feet in height.

Cotoneasters have small alternate foliage. Depending on the climate and the species, this can be evergreen, semi-evergreen, or deciduous. The leaf shape ranges from lance-like or rounded to oval.

Usually, the fleshy fruits ripen to red or black. In a few cases these can be salmon or yellow The plants with red fruits tend to be more showy The fruits are apple-like with two to five stones. Spherical or oval, these tend to be small – less than one-half inch in diameter Like the blossoms, the fruits can occur either singly or in small sprays. Some plants bear such heavy crops that the branches bend under the weight. The fruits are often eaten by birds.

The different kinds of cotoneaster can vary in hardiness. Generally, these are suitable for bee gardens in zones three through eight. The hardiest ones are suitable for zone two.

Cotoneasters are easy to grow in the bee garden. Give them a reasonably well drained spot. Most any kind of soil is suitable, including clay, loam, and sandy types. Regarding the pH, the cotoneasters can adapt to a broad range from acidic to neutral pH levels. Though the evergreen types are adapted to partial shade, they'll bloom better in full sun.

There are several ways to propagate cotoneasters. All of the species come true from seed. However, this can be challenging. In some cases, they can take a year or more to germinate. The plants are also propagated from cuttings.

For standards, grafting is the preferred method.

Cotoneasters are generally native to the temperate zones – mostly Europe and Asia, particularly China. However, some are also found in North Africa.

These shrubs are related to the apples, pears, and pome fruits. This serves to explain why some species of cotoneasters experience problems with fire blight. This bacterial disease can kill the branches. If this occurs, the affected part should be pruned and destroyed.

Cotoneasters are prone to attack from several kinds of pests. Among these are borers, red spider mites, lacebugs, and scale insects. For whatever reason, the black fruited and deciduous cotoneasters are the most likely to experience insect or disease problems.

When buying cotoneasters, choose container plants over ones that are sold bare root. These shrubs resent transplanting.

The following species of cotoneaster are recommended for bee gardens.

Bearberry cotoneaster (*Cotoneaster dammeri*)

Slightly less cold hardy than some species, bearberry cotoneaster is recommended for zones five through nine. A low growing, vigorous plant, this has a prostate growing habit. Wherever the trailing stems touch the ground, they can form roots. Usually, bearberry cotoneaster is less than 1½ feet in height. But, it can have a spread of six feet or more. This is considered to be one of the best cotoneasters for ground covers.

The white blossoms have vivid red anthers. These flowers open in late May and early June. They can open singly or in small clusters of four or so.

In warm climates this species can be evergreen. Elsewhere it is semi-evergreen. The leaves are one to 1½ inches in length and over one-half inch wide. These turn greenish-purple for the Winter The berries are red.

There are several excellent cultivars of this available. Coral Beauty bearberry cotoneaster produces a heavy crop of fruits.

A vigorous cultivar, Skogsholm is less than three feet tall with a matching or greater spread. The trailing stems can reach three feet in length.

Cranberry cotoneaster (*Cotoneaster apiculatus*)

Suitable for zones five through eight, cranberry cotoneaster is especially recommended for the Midwest. Generally about 1½ to three feet in height, this vigorous plant can be six to eight foot across. Mostly prostate, it has a spreading, dense growth habit that is similar to that of the rockspray cotoneaster The branches have a stiff appearance.

The blooms are either pink or white with red tinges. Occurring singly, these open from late May into mid June as the leaves unfurl.

The deep green, round foliage is deciduous. With wavy edges, this can turn red or purplish-red during the Fall. The foliage is around three-fourths of an inch long and wide. The red berries are solitary

Creeping cotoneaster (*Cotoneaster adpressus*)

Recommended for zones five through eight, this dense plant is slow growing. It has interlacing branches. Though it is only one to 1½ feet in height, this dwarf plant is very wide spreading. It can be up to six feet wide.

The small foliage is deciduous. With wavy edges, the leaves become red in the Fall.

The small flowers open in June. Either pink or reddish-white, these appear singly or in pairs as do the red fruits. There is a variety with larger fruits and foliage.

This species has been in cultivation for nearly a hundred years.

Hedge cotoneaster (*Cotoneaster lucidus*)

A very cold hardy species, this can be grown in zones two through seven. It has a dense growth habit. The slender, spreading branches form a rounded upright plant. This deciduous shrub reaches four to ten feet or so in height with a slightly smaller spread. It is often used for windbreaks, screens, and hedges.

Hedge cotoneaster can bloom later than some – starting in late Spring and extending into early Summer, usually from mid May until late June. The blooms are whitish-pink. With upright petals, they open in clusters of two to five.

The deciduous to evergreen leaves turn orange or red in the Autumn. Up to two inches in length, these are an inch wide. They're hairy on the underside. The black fruits, which are often concealed by the foliage, persist into the Winter

Many flowered cotoneaster (*Cotoneaster multiflorus*)

This vigorous species is recommended for zones four through seven. Suitable as an espalier, it is also used for screens and borders. Many flowered cotoneaster reaches about six to 15 feet in height with a matching or greater spread. With age it can become a mounding or spreading plant with long, graceful arching stems.

It is considered one of the most beautiful cotoneasters because of the flowers and the fruits. The plant looks just spectacular when it is in full bloom. Beginning in mid-May, this is covered with small white blossoms that appear with the leaves. One-half inch in diameter, these often open in large loose bunches containing around two dozen blooms. The flowers have a bad scent.

Many flowered cotoneaster has thin oval foliage. Gray to yellowish-green, the leaves reach two inches in length and 1½ inches across. The young stems are purple.

The fruits are mostly red or pinkish-red. There is a variety that produces lots of showy fruits.

This has been grown in gardens since the 1830s.

Pyrenees cotoneaster (*Cotoneaster congestus*)

Suited for zones six through nine, Pyrenees cotoneaster is a low, mounding or prostate shrub. This dense, creeping compact plant can reach 2½ feet in height with a spread of three feet. The branches are stubby

The blue-green foliage is evergreen. The leaves are less than one-half inch in length. The small, pinkish-white blossoms open in June. The solitary fruits are red.

This has been in cultivation for nearly 150 years.

Rockspray cotoneaster (*Cotoneaster horizontalis*)

Also known as rock cotoneaster, this deciduous shrub is suitable for zones five through eight. Reaching three feet in height, it is by far the best known of the cotoneasters. This dense plant can be quite wide spreading – up to eight feet across. It has horizontal branches that are almost trailing. The stems are arranged in a tiered or herringbone pattern. This is a preferred species for espalier and ground covers.

The whitish-pink blossoms open from late May into early June. These have upright petals. Either solitary or in bunches of two or three, they appear with the foliage.

The deep green leaves turn red or reddish-purple in the Fall. About one-half inch long, these are almost round. Mostly deciduous, the foliage is sometimes semi-evergreen. There is a variegated cultivar with white along the edges of the leaves. Rockspray cotoneaster fruits are red.

Small leaved cotoneaster (*Cotoneaster microphyllus*)

Also called little leaf cotoneaster, this is recommended for zones six through nine. It is around two to three feet in height. This dense, stiff branched plant has a spreading growth habit. It can be 10 feet or more across. Small leaved cotoneaster is useful for espalier

The shiny, dark green foliage is evergreen. Fine textured, this is one-half inch or less in length. The leaves can be notched. The tiny blossoms are white. These have wide spreading petals. The fruits are reddish-pink.

Spreading cotoneaster (*Cotoneaster divaricatus*)

Recommended for zones five through eight, this is a very popular species. It reaches six to eight feet in height with a matching or greater spread. This dense, rounded upright shrub has wide spreading, arching stems. Spreading cotoneaster is often used for hedges and espalier

The white blossoms can have pink or rose tinges. With erect petals, these open from late May through mid June. They appear with the foliage. These can be solitary, in pairs, or in small clusters.

The leaves, up to an inch long, are deciduous. The foliage turns red or purplish-red during the Fall. The abundant, bright red fruits are quite showy

Willowleaf cotoneaster (*Cotoneaster salicifolius*)

This upright, vigorous plant is recommended for zones six through nine. It is used as an espalier, hedge, and screen. This can be 10 to 15 feet in height with an equal spread. It has graceful, arching branches.

Opening in late May and June, the blossoms are white. These are hidden among the leaves. They appear in large, flat topped clusters that are up to two inches across. A flower head can contain around a hundred blooms.

The small narrow leaves are over three inches in length and ¾ of an inch wide. They have a leathery texture. The foliage turns reddish-purple to red during the Fall. This tends to be evergreen in the South and semi-evergreen elsewhere.

The bright red fruits linger into the Winter These are very plentiful. There is also a form with yellow fruits.

Numerous cultivars of willowleaf cotoneaster are available. Autumn Fire is only two to three feet tall. This has lots of vivid orange-red fruits.

Gnom willowleaf cotoneaster is only two feet tall. This vigorous cultivar has a spread of six feet or more.

Wintergreen cotoneaster (*Cotoneaster conspicuous*)

This species is recommended for zones six through nine. Around three to five feet in height, this has a dense round or spreading growth habit. The evergreen leaves are very small and fine textured. These are less than an inch in length.

Wintergreen cotoneaster is noted for the masses of white blooms. These appear during the Summer They can occur singly or in groups of five or so.

Borne freely, the fruits are orange-red. These persist over the Winter BC

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

BUSY IN OREGON

Oregon State University's new honey bee researcher hit the job running when he began work February 27.

Ramesh Sagili, previously with Texas A&M University where he earned a doctorate in entomology, has two main duties: helping the honey bee industry through the OSU Extension Service and conducting research.

Sagili says his first action as an assistant research professor in the university's horticulture department Extension's honey bee specialist will be to meet beekeepers and industry representatives to find out what problems they face.

He also plans to provide educational workshops at locations convenient for agricultural producers and to develop a Master Beekeeper program that will provide training to novice and experienced beekeepers. He also plans to create a honey bee Web site that will provide the latest information on research, management practices and pest control.

As for research, Sagili says he intends to investigate how honeybee health is affected by Varroa mites, pesticides and stress resulting from the migration of hives. He also plans to compare how locating hives near only one source of pollen such as an apple orchard, with several different sources affects their physiology, learning behavior and colony growth.

He will also design a field test that beekeepers can use to determine if their bees are consuming enough protein.

Sagili plans to investigate the use of brood pheromone, which is secreted by honey bee larvae, to stimulate bees' consumption of protein supplements during the winter so they're strong and healthy when the busy days of Spring pollination roll around.

He will also explore the use of brood pheromone to decrease infestations of *Varroa* mites, which are parasites that suppress the immune systems of drone and worker honey bees, thus making them more susceptible to diseases and possible death.

The university says Sagili's appointment is part of an initiative aimed to ensure there are enough healthy honeybees to pollinate Oregon's crops.

The appointment means Oregon State now has the first honeybee expert on its faculty since Michael Burgett retired in 2002.

The new position was created at the request of Oregon agricultural groups worried about the health and supply of honey bees, crucial pollinators for many of the state's crops, including blueberries, pears, cherries, apples and vegetable seeds.

The funding for his salary comes from a $215,000 appropriation approved last year by the state legislature's Emergency Board. The money will also support a faculty research and extension assistant to aid Sagili in gathering and analyzing data about honey bee health, diseases and pests in Oregon. Their positions are funded for one year, but the university is working to identify additional funding to extend their employment.

– Alan Harman

SCIENCE OF BEE CULTURE

We're curious. What do you think about the Science of Bee Culture Insert this month? Let us know with a short email to info@beeculture.com We appreciate your trouble and time. Thanks.

HÄAGEN-DAZS® MAKES SECOND GIFT FOR HONEY BEE RESEARCH & EDUCATION

Last year, Penn State and all-natural, superpremium ice cream manufacturer Häagen-Dazs teamed up to investigate Colony Collapse Disorder (CCD), a mysterious ailment that has decimated honeybee colonies across the United States. This year, Haagen-Dazs has expanded that partnership with a second gift of $125,000 to support ongoing and additional research and educational programs related to honey bees.

The new funds will support the following projects:

• Two Häagen-Dazs Graduate Fellowships in Pollinator Health will be created, each offering $25,000 stipends. One will be awarded to a current graduate student and the other will be used to recruit an additional graduate student, both of whom will be working on topics such as pathogens of bees and native pollinators, the role of pesticides in declining bee health, parasites of bees, effects of infectious disease on bee physiology, and ecology and manipulation of native bees.

• The Citizen-Based Native Bee Survey, an ongoing effort to determine the species and population sizes of native pollinators in Pennsylvania, will receive $15,000.

"The information from this survey is key to helping understand the full impact of declines in honey bee and other native pollinator populations," said Dennis vanEngelsdorp, Penn State senior extension associate and acting state apiarist for the Pennsylvania Department of Agriculture.

• The purchase of high-pressure liquid chromatography equipment for pesticide analysis will be supported with $45,000. According to Diana Cox-Foster, professor of entomology and co-chair of a national working group of CCD researchers, this equipment more easily separates and allows for detection of chemicals in a sample – for example, individual pesticides in pollen, wax, and bee samples – that are potentially harmful to honeybees and other pollinators. Initial screenings can be performed using this equipment before more expensive analyses are undertaken.

"We anticipate that this piece of equipment will greatly facilitate the determination of how pesticides are impacting honeybees and other pollinators," said Cox-Foster.

AVOIDING GM BEET SUGAR

Over 70 companies have vowed not to use or sell genetically modified beet sugar by signing a registry set up by food safety, environmental and corporate watchdog organizations on Saturday.

The first GM sugar beet crops – which were Monsanto's Roundup Ready sugar beets – were harvested in the fall, but signatories of the Non-Genetically Modified (GM) Beet Sugar Registry have said they are worried about a lack of knowledge about the long-term health and environmental impacts of GM beet sugar. The Center for Food Safety (CFS) added that one of the reasons for creating the registry is to give consumers a choice about whether they eat foods containing GM sugar in the absence of mandatory labeling for GM foods.

CFS asserted that the US Environmental Protection Agency increased allowable levels of herbicide residue on GM sugar beet roots "at the request of Monsanto."

Monsanto's Roundup Ready sugar beets are modified so that the crop is resistant to the company's Roundup-brand herbicide, allowing farmers to quickly kill weeds without killing the crop.

CFS has also said that the recent mercury contamination of high fructose corn syrup has made companies particularly nervous about the introduction of unlabeled GM beet sugar to the US food supply.

There are some unusual site restrictions that have to be considered. I've mentioned the four foot hive stand already But the entire hive is strapped down to that hive stand so that prop wash from Marine One doesn't tip it over or blow off the cover And, for good ventilation, Charlie uses a shim between the inner cover and the telescoping outer cover that has two to three-inch ventilation holes bored on all four sides. Because of sprinkler locations that may not work however, and some kind of adjustment is required to avoid water splashing into the hive.

Of course groundskeepers, the First Family, even lawyers had to be comfortable with Charlie's proposal to have bees as part of the garden project. But with the help of Toni Burnham, an enthusiastic local beekeeper, convincing the powers that be was a lot simpler than either thought it would be. Now the bees are part of the educational process going on, on the South Lawn. And local honey and honey-improved recipes will grace the table inside.

You can see the White House bees, Toni gave them the moniker FirstBees, if you look through the fence on the South Side, looking toward the White House. The fountain is nearby, and the new organic garden isn't far away

So now the project begins. As Toni said, if bees can make it there, we can take them anywhere. We'll keep in touch with Charlie and his FirstBees and see how they do, and how they and the rest of the world get acquainted.

The four foot hive stand is fastened to a cement pad, and the hive is strapped to the stand to insure it isn't blown over, or the cover blown off when Marine One flies overhead. This view looks south toward the Washington Monument. The hive gets excellent southeast exposure, with just a little shade from a Magnolia tree.

Charlie is on the White House staff so is nearby if there's ever a visitor who has questions or wants to visit. He's a skilled carpenter and makes equipment he can't buy, and this hive stand. (photo by Charlie Brandt)

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The Passing Of Granny

Ed Colby

Six weeks ago, as I was leaving the familiar clutter of her cigarette-scented kitchen, Granny followed me to the door "You should stop by more often," she said, with the sweetest sincerity

She was a people person. She knew I drove past her house every Sunday evening, and she loved nothing more than company So I promised, and I meant it, but I never saw her again.

She was only 85. People would ask me how she was doing, and I'd always say, "She's great! She looks 100, but she acts only 50!"

She definitely didn't wear those orthopedic granny shoes or use a walker or spend any time getting her hair done. She chopped off her waist-long braid years ago, but she still wore the same work boots or sneakers, Levis, ragged denim jacket and U.S. Ski Team ball cap.

For years Granny didn't have much good to say about honey bees. When she was a child, she "nearly died" from a bee sting. She was "violently allergic" to bee venom. She'd go on and on if you let her

Then, in her golden years, she retired to the garden, and guess what! She decided that she wanted bees to pollinate her beloved raspberries and her squash and her apples.

So would I mind leaving a hive or two behind her shed, on Barbara's vacant lot next door? It would be wonderful for my bees if they could visit her cucumber blossoms, wouldn't it?

To be honest, Granny never was *my* granny, but we did go back to when the world was young. She was a mentor and an icon – an irreverent, mountain-climbing, deer-hunting, powder skiing Aspen ski lodge owner who would rent you a bed for two bucks, or a buck-fifty if you could handle the bunkhouse. Her ski bum tenants called her "Mrs. Mac" or simply "the manager " She was like a mother, but she was oh, so cool. I adored her I still do.

So now, 40 years later, even if putting bees at her place seemed an inconvenience, how could I say no?

Granny's place of retirement is across the river from the edge of Carbondale, in a patchwork of small subdivisions and horse properties. There's some rabbit brush but not a lot of alfalfa or sweet clover I decided that bees would never thrive here, and for a time I made this a self-fulfilling prophesy

I wasn't doing this for me. I was doing it for Granny

The first Summer, when I dropped off a couple of weak-sister hives, Granny said offhandedly, "There's a bear that comes around at night."

Oh, great – a poor location, with a bear I erected a solar electric fence, and then I said to Granny, "Do you have any bacon? I need to drape some on my bear fence, so when the bear comes sniffing, he'll tickle his nose."

"I can get some," Granny said enthusiastically "I can take care of this."

"Are you sure?" I said. "You're allergic, remember?"

"Don't worry about me," she said with a devilish grin.

My bees made no surplus that Summer, but those pathetic little darlings wouldn't have made honey in the Garden of Eden. Yet Granny was ecstatic about her improved yield in the garden.

The following year I again brought two colonies, and right away one went queenless. When I caught a little swarm in town, I united it with the queenless hive. The result was a two-super honey surplus for that hive, mostly on late Summer rabbit brush.

Hey! I was doing this for Granny, but maybe this wasn't such a bad spot. After a few more good seasons, last Summer I dropped off eight strong hives, and they were my overall best producers. The honey was alfalfa-light and mild, not dark and butterscotchy like rabbit brush. Go figure.

Last Wednesday morning I was thinking, "This year I'd better get a pickup load of bees to Granny's in time for the dandelions."

When I went into the house, there was a message from Monk. "I have some bad news," he said, and my heart sank.

Of course. Heart attack or stroke. It had to be. You don't smoke a million-plus unfiltered Pall Malls, live to be 85, and then cheat the cardiologist.

Imagine my consternation when I learned that Granny had been run over right in front of her house!

She was returning from a visit to the home of her best friend Barbara, who lives directly across Highway 82 from Granny At 10 p.m., while crossing the road on her way home, Granny was struck by two cars and killed instantly

Understand that Granny and Barbara were friends for 40 years. They lived 100 yards apart, and they visited every day Barbara always drove across Highway 82 to Granny's, and when Granny visited Barbara, she always walked. That's the way they did it for a quarter-century

As for what actually happened, we'll never know Granny may have had difficulty judging the distance of oncoming cars. She had some recent history of losing her balance. She might have fallen.

Traffic on four-lane Highway 82 can be horrendous. Barbara said Granny sometimes made it halfway across before waiting in the middle turn lane for a break in the last two lanes.

What? Oh, Granny, how could you!?

In my mind's eye, I see the surprise on her face in the headlights. I feel the horrible thud. Her ball cap flies off, as her poor frail granny body floats through the night, her little arms and legs flying every which way, until finally she lands like some rag doll, clear down by Barbara's vacant lot, down where I keep the bees.

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