MAR 2010

# Bee Culture

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CATCH THE BUZZ

INSIDE . . .

LANGSTROTH'S GADGETS - 25

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NUCS, NOT JUST FOR INCREASE - 47

QUESTIONS TO ASK - 59

Science Of Bee Culture

Vol. 2 No. 1 - Center Section

ROOT PUBLICATIONS

$4.99

*Spring rains have eased drought worries for California almond growers this year, but the increased moisture has made for some soggy, slippery going for those who move bees for a living. This photo by Bret Adee near Bakersfield in mid February clearly demonstrates the difficulty of moving bees out of holding yards and into almonds. That long line of white in the background is actually a huge holding yard, waiting to be moved. Bees will come out of the orchards towards the end of this month and head for other pollination jobs, to honey crops back east or down south, or way back east for more pollination. The incidences of colony losses to Colony Collapse Disorder and other stresses this spring have been much higher than the last two years, and some predict that when all is said and counted, will be the worst year since this malady raised it's ugly head.*

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Bee Culture

THE MAGAZINE OF AMERICAN BEEKEEPING

MARCH 2010 VOLUME 138 NUMBER 3

# FEATURES

## DEPARTMENTS & COLUMNS



Science Of Bee Culture

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## Bees In The Wall

I removed this colony from an old farm house. No insulation in the walls. Note the large bird nest (see arrow) in the upper right corner.

Bruce Sabuda
Pinckney, MI

## Kudos On Digital BC

Congratulations. The first digital issue of Bee Culture is up to the usual high standard. I was quite interested in the article by Marc Hoffman on LLL.

It must have involved a great deal of work.

I was surprised to read that LLL's grandfather Thomas Langstroth came from Langstrothdale in the UK. This dale is only about 50 miles from here. As a long time beekeeper I will have to accumulate good conduct points with my wife and have a trip there.

Colin Taylor
Bury, Lancashire, England

## Bottom Boards

The Bottom Board article on government in the January 2010 issue was right on the mark. All is true, has been true all my life (66 years). Question for Mac Overmyer. Would he have had this opinion six years ago? Question for the Editor. If he did, would you have reprinted it six years ago?

I like and enjoy your magazine. Just renewed last week.

Adrian Susa
Brookfield, WI

***Editor's Response:*** *Probably. And thanks, we're glad you enjoy the magazine.*

## Are Jumbos Better?

I read with great interest Larry Connor's January article in *Bee Culture* concerning hive size and races of bees. For a few years I have been reevaluating my beekeeping success, or lack of, with regards to swarming, Winter survivability and honey crops with the size of the hive. Three deep brood boxes just do not work for me; I'm always taking off a nearly full deep of honey in the Spring and getting a reduced honey crop the previous Summer/Fall (I don't extract from brood combs). Plus they still swarm despite the three brood boxes. This is in the days of the Starline and U. of MN journal articles touting the three deep idea. Two deep brood boxes work better, but I find an even smaller brood area is better yet. My beeyard is divided into three sections: double deeps, one deep with a shallow on bottom, and a single homemade 11½" "Dadant Jumbo" for a brood box. I get more honey from the jumbo and the deep/single, swarming is no more of a problem than with the double deeps and I handle fewer frames with the jumbo. Plus the queens really like those jumbo size frames – lots of brood on a single frame.

The down side is I have to feed more to the jumbo and deep/singles for wintering, but interestingly enough this allows me to medicate with Fumagilin-B better since often some hives won't take the medicated syrup due to their being plugged with honey. I seem to be using more fumagilin-B than ever before; I think the new nosema will be found to be the mysterious culprit behind CCD. I'm not in a farming area and I lose more bees during Winter than I did 15/20 years ago so I don't believe herbicides are behind CCD. I have contacted several of the wooden ware manufacturers about jumbo size boxes and frames and they all say they don't make that size but they all admit they're getting contacted about them. There must be others across the country scratching their heads while looking at those three deep brood box hives and wondering if there isn't something better. Good Luck!

Bob Martin
Superior, WI


## No Electronic Edition

I got the sample of your 2009 online *Bee Culture*. While I am impressed by the magazine in general, I would like to comment on the Inner Cover article that discusses the benefits of an online magazine. Personally, I spend a lot of time at a computer and it is nice to have the opportunity to take a break and pick up a real "live" magazine and flip through its beautiful glossy pages at my leisure. It is relaxing and takes me away from the everyday grind of using a computer for my job.

Another thing I don't like about the concept of online magazines is the effect they have on our nation's job market. As mentioned in the article, a lot of money goes into printing a publication. On the other hand, the publishing industry has a rich history of providing a wide array of jobs to American workers. In these days of people losing their jobs and their homes, wouldn't it be refreshing if a company would focus on what it could do to create or maintain jobs for our citizens?

We export wood to Asia so those countries can create disposable junk that we import, purchase and throw away. Those Asian countries, in turn, create jobs for their citizens using our natural resources. What is wrong with us using our felled trees for the purpose of creating quality magazines and good jobs? Consider all the jobs that are created in the print process: printing press jobs, paper sales jobs, magazine circulation jobs, ink production jobs, shipping jobs, distribution jobs, etc? The cost of producing a magazine is large, but the jobs that result from

its publication are tremendous. In today's economy, wouldn't it be better to focus on producing a high quality tangible magazine that results in keeping a lot of people employed, not creating a less expensive publication that results in job losses?

April Hay
Mission Viejo, CA

## Single Chamber???

For decades beekeepers have wrestled with various ideas about keeping their bees in a single brood chamber or two. In some cases they would use three chambers for brood.

From a family tradition and as a fourth generation beekeeper in 1927 at the age of 10 years I began working with bees aiding my father in his production of queen bees. That continued until in 1936 we moved the bees to Store County in Central Iowa and we converted it all to the production of honey. In 1938 my brother Lloyd joined us in the business. In the late 1930s and early 40s we managed 1300 colonies. It just happened to be the golden years of beekeeping in Iowa and our colonies produced well over 300 pounds regularly. It wasn't because we were extremely good beekeepers because we were losing too many colonies during the Winter. In fact we were lousy beekeepers but the bees produced well in spite of us. That forced us to buy packaged bees by the hundreds every Spring. Packaged bees at that time were selling at $3.00 per package. We sold tons of honey for 4½ and five cents during those years. In January of 1942 I joined the military so that ended my beekeeping for four years. Upon my return we, and as I refer to we, meaning my brother and I rebuilt the business from the colonies he had kept during the war and it was beekeeping anew for us. For a couple of years as we continued to build the business we kept losing too many colonies during the Winter. So, we decided there must be a better way and we began applying tips we had gotten from other beekeepers, tips that we thought reasonable and just might help. One thing we knew for sure was that we were going to need to find a way to determine how much honey stores we were leaving the bees for the months of dormancy. Then and now a majority of colonies lost during the Winter is because of starvation.

Naturally our first thought was to weigh every hive just prior to Winter. To place every hive on a platform scale to obtain the weight was out of the question and required heavy lifting. I just knew there had to be a better way. So, I devised a spring scale with a lever to take all the work out of obtaining the weight we weren't sure just what weight would be necessary but after a year or two of weighing we were certain. Both sides of each hive is weighed and the total is the actual weight used to determine what is needed. Here in Central Iowa we are located at the 42° latitude. We concluded that a double, 10 frame brood chamber with bottom board and inner cover needed to weigh 115 to 120 pounds. Colonies located further north would need additional weight and those south likely less. Is it possible to have a colony with too much honey in October and November? The answer is YES. A colony weighing 160 pounds is what we termed as honey logged and is likely short of brood at the time and would remain that way into Spring leaving no space for brood.

*Glen Stanley*

We provided each colony with a middle entrance which was used at Iowa State College during the years of research there. It was simply two pieces of cedar shingle about 1¼ wide placed along each side of the lower hive body and two pieces of lathe 7½" long along the front which provided an entrance right in the middle between the two hive bodies. This acted as an escape in case the lower entrance became plugged. We tried other kinds of middle entrances but found the one mentioned the best. Last but not least the hives were wrapped with 15 pound asphalt paper. With two hives or more we found it best to wrap two together. The paper would be cut down the middle to make pieces to go around the pair 18" x 112" that left about 6" for the paper to lap at the ends. The cover piece was cut full width of 36" x 48" which allows 8" lap over the entire top. That was folded down at the corners and lathed all the way around. We found on some wintery days the temperature in between the two hives inside the paper was 30° warmer than the outside temperature. Having achieved all this by the year 1951 the next 45 years we no longer needed feeders and didn't buy a pound of sugar or a package of bees throughout all those years. Our actual Winter loss was less than two percent.

O.W. Park during his research at Iowa State College in the 1920s and 30s found the lives of bees raised on sugar syrup were shortened by 10 days. Since the life of the worker bee during the Summer is only 42 days that means that you have about one fourth the bees in the colony to collect honey.

Beekeeping is due for another major change back to some reasonable methods and sugarless years ahead. Beekeepers move one foot ahead and slide back two by the time Winter is over they are back to again feeding sugar and ordering packaged bees. Hobby beekeepers would like their bees to at least pay their way and sideliners expect a little profit. Major beekeeping operations struggle because of the feeding and package expense. Changes in practices are over due.

My brother and I almost perfected wintering bees which would work anywhere in the midwest. We

went 45 years without buying either packages or supplemental feed.

Glen Stanley
Ames, IA

***Editor's Note:*** *Glen Stanley was Apiary Inspector in Iowa for many years and a very successful commercial beekeeper. He still keeps bees at 92. Thanks Glen.*

## Vermont Wind Breaks

Phil Kolvoord of Essex Junction, VT recently decided to protect his hives from 60+ mph cold Winter winds with the campaigns signs of local purveyors of hot air.


## Top Bar Hives

Melanie Kirby's article about Top Bar Hive Management in the December 2009 issue of *Bee Culture* is a good examination of the Langstroth and Top Bar methods of beekeeping. By studying both methods Kirby shows how the beekeeper learns more which no doubt leads the beekeeper to making better decisions. Kirby tells of her partner's work using the Langstroth system in their New Mexico queen and honey business. It would be interesting to know what lead him to make his "Langstroth only" decision.

At this time in 2009 I decided to use a "Long Langstroth" in which Dadant frames fitted easily. One of the deciding factors in my decision making was the crushing of comb in Top Bar hives during every harvest which meant the bees had to make new comb every year. I see that as a major reason to use a renewable frame system that is illustrated well using the Langstroth plan.

I plan to follow any and all writings of Kirby that deal with the bees migrating along a horizontal axis that is necessary in the brood nest development in Top Bar and Long Lang hives.

Tom O'Brien
Mattawa, Ontario

## New Home Sites

Referring to Larry Connor's article in the January 2010 issue on how bees select a new home site – I agree with most of his and Tom Seeley's observations and experiments, but would like to add my own thoughts for whatever they're worth.

I don't know if the size of the cavity has much to do with individual scouts but has most to do about the size of the swarm. Also I believe that old nest sites have a better chance of being reoccupied for the simple reason, nest scouts find them easier because of odor and recruitment is accomplished, because of this smell. The nest scouts "dance" giving distance and direction plus odor on their body. When recruits get close they pick up the odor whereas a cavity without odor would be harder to find.

Also when I put out bait hives they are very seldom over three feet off the ground and I have no trouble picking up swarms if there are any bees around. I'm not saying that several meters above ground wouldn't be better but in my case it doesn't seem to matter, so why do it?

We have lived in our present house for 43 years and nobody has bees within miles but I pick up one to four swarms a year except from 1990-1995. Mites were the main problem. No bees. So all of these swarms came from feral colonies. After the swarming season in late August I would try to find these colonies by using a bee box. The trouble is that we live in a residential area so some old guy packing a small box with bees coming and going might cause people to look at you as some kind of nut. And they're probably right! Anyway the closest colony I found was about 300 yards away going into a cavity under the eaves. The rest of the ones I found were over a mile from home. I'm not saying there weren't any closer, but I didn't find them. I'm sure I did get several swarms from the house 300 yards away.

Several years ago they replaced the roof and consequently killed the bees. Last year I had a bunch of bees looking over my decoy but never came. I took a walk over to this house and they had picked this place instead of mine. The people living there said they all came in a big bunch the day before. So I'm sure were *my* bees. I convinced them not to kill them, as they would probably die anyway. Which in fact they did. Now I'll have to tell them to plug up the entrance so no more swarms come.

One other thing on how bees build comb, my experience shows that a *new swarm* building comb from scratch will build it almost perfect. That is they will start the main comb then use it as a guide to build out on both size each one being smaller than the previous one and if the swarm is large the cavity will be filled. If on the other hand the swarm only builds four or five combs perfect then proceeds to expand these future combs might be built quite haphazardly like the hive shown on page 39 in the same January issue. My theory is that when bees in a swarm start building comb they are all gorged with honey for this purpose. Hence straight comb but when a honey flow is coming in, small groups start festooning at different locations, that is if there are no frames with foundation some real interesting configurations are the result.

In the past 50 years I believe I've picked up over 400 swarms in bait hives.

Jim Cowan
Aberdeen, WA

## No Stamp For LLL, This Year

I received my *Bee Culture* with the request to "Let's get Langstroth a postage stamp" requesting all beekeepers' assistance since this will be the 200th anniversary of his birth.

I hastily complied with a written request to the USPS Stamp Committee.

The thought was good and I'm not sorry for my effort but the drive behind the movement certainly missed the boat or "stamp" so to speak.

The card I received from the USPS stated that the Committee decides on stamps two to three years in advance.

Thanks for all you do.

Stanford Brantley
Jefferson, TX

***Editor's Note:*** *And thanks to everybody who sent in letters. The stamp may not get made this year, but the Post Office is on Official Notice that we want one ASAP.*

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# INNER COVER

Have you ever gone to a meeting between a group of beekeepers and some contingent of government or industry officials? The government folks could be at any level. Local officials often have to deal with some business or zoning problem they are having with you, or you are having with them. State officials tend toward the regulatory bent, when you want something changed, or you don't want them to make proposed changes. Industry people are often in a similar regulatory bent when they show up, wanting to get something implemented that will make their life easier, or your life harder . . . which always makes their life easier.

Higher ups . . . the Feds . . . can be sitting at the table for any of a million reasons. I've attended meetings with EPA officials when beekeepers wanted more regulation, and when they wanted faster action, and when they wanted more, or less oversight. Often associated industry and government agencies are there too . . . attorneys, assistants, interns and trainees, and often industry reps, all of them making sure their bosses are protected, their costs contained or their profits insured.

Just as often government people are there to help beekeepers though. I was at the Pollinator meeting last Fall and all the government people there were looking out for pollinators . . . honey bees certainly among them . . . all trying to make sure pollinators would be protected from problems with pesticides, environmental degradation, and agricultural and urban encroachment on habitat locales. But those industries were at the table too. Just to be sure what came out was balanced and fair . . . and didn't do too much to change the bottom line.

Maybe you've been to these kinds of meetings that weren't allied with beekeeping, but rather some other advocacy group trying to make changes for the better. To make that work you had to convince some level of government to actually change the way they've been doing things. For nearly ever, usually.

My experience has always been with beekeepers though. I've sat in meetings trying to get state officials to not change label laws, to ease up on food safety oversight relative to honey and maple syrup, to continue to fund state level inspection programs, to make pesticide enforcement more uniform and then to actually enforce the regulations on the books, or to change existing laws to make them enforceable and at least look like they were looking out for honey bees and pollinators and beekeepers.

I've been to meetings with EPA and industry people trying to hurry them along on allowing certain honey bee-safe mite control chemicals to be used, and to encourage them to talk to each other so one hand knew what the other was doing when it came to getting registrations moving along. I've sat in meetings with county officials trying to convince them to continue funding, and even to increase funding for county inspection services. And I've testified at local hearings where zoning was being considered . . . to allow bees, or to outlaw bees . . . and always there were beekeepers there, and people who wanted all the beekeepers dead, and some who just wanted everybody to take a deep breath and settle down.

There have been others over the years, lots of them. I remember the parking lots and the very big buildings, the security checks at the doors and the badges and the elevators and the numbered rooms, and most of all I remember the suits.

If you've been there you know what I mean. If you haven't let me explain.

Suits. When you sit at one of the big tables in one of these rooms in one of these buildings in some city somewhere, you see two kinds of people. It's always only two. One kind has suits. Nice suits. Suits that cost more than I make in five or six months. They almost always have silk ties and light blue shirts and shiny shoes. And somebody, somewhere is paying them to be there. Paying them to arrive in the morning from home, and to go back home right on schedule. They don't travel far to get there. They have a parking spot, and they have assistants to help. They go back to an office at the end of the meeting, or when a messenger comes in and calls them away after whispering a long message, with a note to reinforce the message.

And the others? The others have beesuits on. Not really of course, but if you look hard, you'll see beesuits. You'll smell smoke and see dirt under their fingernails, callouses on their hands and bruises and sunburn. And you know that they had to pay to be there. They paid for the plane ticket, the hotel room, the cab ride or the parking fee, the lunch and supper and the cab ride back to the airport when all is said but still undone.

One group gets paid to be there . . . those who have the power to fix things. And one group has to pay to be there . . . the group that needs to get things fixed.

If you ask me, if Haagen Dazs and Burt's Bees and all the others that want to help honey bees really want to help honey bees, they should be helping the beesuits who have to pay to sit in that room. The beesuits who can't get their real work done because they are waiting for the suits to get it together to show up on time and be prepared to do the job at hand.

If you want to help honey bees . . . help the beesuits sitting in that room. Help the Honey Bee Advisory Committee who all wear beesuits and only want justice from the government and the chemical companies. Help the beesuits that want government to do the right thing and get something done on time the right way. Help the beesuits who don't know why their

*Continued on Page 78*

## Suits

# New For Beekeepers

**Pecks Support Pins**. There's a new support pin in town. After decades of rusty, poor fitting, bendable metal split rivet pins used as support pins, Tom Peck, a teacher and bee supply dealer had had enough and designed these plastic, colored pins. Removable and reusable and cleanable they insert easily and come in five colors, to keep track of when the foundation was installed. Check frames to be sure pre-drilled holes are large enough to accommodate pins. Available from some bee supply dealers, and from Pecks Bee Suppliers, 5700 Ridgeview Dr., Harrisburg, PA 17112 **tpeckbees@aol.com**

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IBRA released in January this year a Special Issue: **International Studies on Honey Bee Colony Losses.** This is Issue 49(1), ISSN 0021 8839, and contains a comprehensive mixture of evidence based review articles, original research articles, and reports of colony losses in many partner countries of the COST funded COLOSS Network (representing 40 countries, www.coloss.org). The issue is edited by Norman Carreck, Scientific Director, IBRA, and the University of Sussex, UK, and Dr. Peter Neumann, Chair of the global COLOSS network (Prevention of honey bee COlony LOSSes)

32 articles are contained in the 140 page edition, covering honey bee loss studies including losses from pesticides, viruses, nosema, *Varroa*, diversity, colony collapse disorder, and wintering. Losses and analyses are reported from the U.S., Europe in general, Austria, France, the UK, Bosnia, Bulgaria, Canada, Croatia, Denmark, Greece, Italy, the Netherlands, Norway, Poland, Scotland, Switzerland, and studies on non-Apis bees in Europe. $30.30 US funds, plus shipping. www.IBRA.org.uk for info on IBRA in general, the Journal Of Apicultural Research and the other IBRA Journals and books, and this particular issue of JAR.


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Inspired by having to deal with a troublesome smoker that was hard to light and harder to keep lit, the folks at Bee-Z took a different route to get their smoker lit, and to always have it available when working hives. The photo shows the design. Basically, the traditional smoker can has a heating element in the bottom. When the heat trigger is pressed the element heats up, igniting the wood shavings or wood pellets in the canister. As soon as the fuel is ignited and begins to smoke, the heat element is released, and the built-in-the-handle-fan button is pushed, moving air into the smoker and keeping the fuel burning. As soon as both are released the fuel will quit burning, and to extinguish the fuel faster, simply toss it around a bit and it's out almost immediately. Comes with battery and charger. Battery takes 10 – 30 minutes to recharge. Length of charge dependant on use in the field.

**EKO Beekeeping Supplies** offers a variety of new products, and has expanded the lines of some existing products. Nozevit feed supplement is now available in a variety of sizes to supply the hobby to commercial operator. A newly designed beesuit and gloves are available, along with a practical and easy to use veil, and an entire line of organic candies using honey. The extractor and honey and wax handling equipment however are something very new to U.S. beekeepers.

This Apitotal 2000 extractor uses radial, tangential, gravity and inertial forces to remove honey from the 24 frames it holds. Larger capacity models are available. Frames are loaded sideways flat and spun at a slight angle. Extraction takes far less time because of the angle of the frames and the spinning speed, and more honey is removed from the frames than in conventional extractors. It holds any size frame and because of the angle does not blow out frames. It is programmable in several modes for speed and timing. The optional baffle tank holds over 600 pounds of honey and is heatable and comes with a filter. The unit collapses when not in use for easy storage and movement.

Along with the extractor is a new Apitotoal 2005 uncapper. Adjustable in several ways to accomodate any width and style of frame the unheated vibrating knives operate on 220V, 370W system. Holds up to 20 uncapped frames, and has a tank beneath to capture honey/wax, and separate them. Up to 200 frames per hour can be uncapped, and when coupled with the Apitotal 2000 extractor, a single person can handle a significant amount of honey. Examine in detail at **www.EKObeekeeping.com**, or **info@ekobeekeepingsupply.com**

Introducing **Bee Villa**, a high density polystyrene foam box that works in all climates suitable for bees. The no-assembly-required boxes create a temperature regulating habitat keeping bees cooler in Summer and warmer in Winter. The manufacturers claim that with Bee Villa boxes, there is no need to wrap hives in Winter, there is more honey production since bees can work on collecting nectar, rather than cooling the hive. There is greatly reduced propolization due to a special feature where the hive bodies come together. The high density polystyrene material can last up to 30 years – it does not decay, warp or shrink, and is resistant to damage from visible light. Hive bodies work as nucs with special divider board, and screened bottom board is standard. The lid works as a platform so additional hives can be stacked right on top, and the handles are easy to use, and work with a special dual tool to help separate the boxes, avoiding damage. Contact **www.beevilla.com**, or 763.434.3189. Bee Villa, LLc, P.O. Box 522, Circle Pines, MN 55014.

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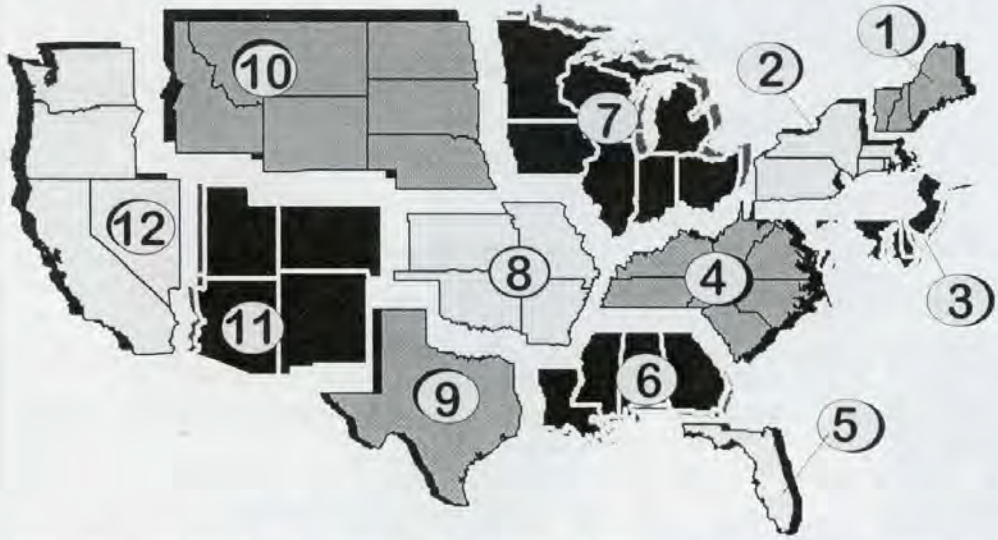
# MARCH – REGIONAL HONEY PRICE REPORT




Everything but the buzz is what most beekeepers try to get out their bees, anyway they can. And, it seems, there's lots of ways to squeeze another nickel out of those boxes out back. We polled our reporters this month on all the ways they try and make money keeping bees. Recall, our reporters are not quite a cross section of beekeepers everywhere because for the most part they are in the business, even if it's a small, part time business, of keeping bees. But the numbers are telling in the ways we use bees generally, and in some cases very specifically. We didn't ask about pollination for a fee in this survey because we cover that activity later in the season.

Bulk and blocks of beeswax are a healthy way to make money…54% sell those commonly seen blocks of beeswax, and 48% sell bulk wax, mostly to candle and soap makers. A 35 pound chunk isn't uncommon, which, on average sells wholesale for $4.00 and often more a pound…That's nearly $150.00. Not surprisingly, liquid honey is sold by the greatest number of our reporters…90% in fact. That it wasn't 100% was a bit of a surprise, but since 35% sell cremed honey (more than we would have thought, actually), and fully 66% sell comb honey. That's a steady increase in sales of this product over that last 10 years, and even 38% sell chunk honey now, a healthy increase also.

Nuc sales are increasing every year, and the number of beekeepers taking advantage of that demand is increasing at the same rate…28% of our reporters sell these now, and that will only grow over the next few years.

When making honey with bees seems more a challenge than you thought it would, look over the products sold by our reporters….there's more than one way to get the buzz out of your bees.

| | Candles | Ornaments | Wax Blocks | Honey Stix | Pollen | Propolis | Bee Supplies | Packages | Queens | Bulk Wax | Lotions | Soap | Creme Honey | Liquid Honey | Comb Honey | Chunk Honey | Nucs |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| % Reporters Selling 2010 | 28 | 17 | 54 | 28 | 28 | 13 | 20 | 9 | 15 | 48 | 20 | 10 | 35 | 90 | 66 | 38 | 28 |

| REPORTING REGIONS | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | SUMMARY Range | SUMMARY Avg. | History Last Month | History Last Year |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **EXTRACTED HONEY PRICES SOLD BULK TO PACKERS OR PROCESSORS** | | | | | | | | | | | | | | | | |
| 55 Gal. Drum, Light | 1.55 | 1.65 | 1.55 | 1.50 | 1.53 | 1.52 | 1.65 | 1.60 | 1.40 | 1.55 | 1.41 | 1.54 | 1.40-1.65 | 1.54 | 1.58 | 1.52 |
| 55 Gal. Drum, Ambr | 1.48 | 1.55 | 1.48 | 1.48 | 1.43 | 1.35 | 1.58 | 1.50 | 1.35 | 1.48 | 1.30 | 1.42 | 1.30-1.58 | 1.45 | 1.50 | 1.31 |
| 60# Light (retail) | 125.00 | 138.00 | 130.00 | 131.00 | 125.00 | 127.50 | 130.50 | 127.50 | 134.17 | 134.17 | 134.20 | 144.00 | 125.00-144.00 | 131.75 | 128.02 | 122.81 |
| 60# Amber (retail) | 125.00 | 128.33 | 130.00 | 128.00 | 120.00 | 118.00 | 124.43 | 130.00 | 117.50 | 129.33 | 129.50 | 145.00 | 117.50-145.00 | 127.09 | 129.24 | 119.88 |
| **WHOLESALE PRICES SOLD TO STORES OR DISTRIBUTORS IN CASE LOTS** | | | | | | | | | | | | | | | | |
| 1/2# 24/case | 52.08 | 65.32 | 50.00 | 53.00 | 66.44 | 50.75 | 49.95 | 66.44 | 66.44 | 45.36 | 52.27 | 86.87 | 45.36-86.87 | 58.74 | 63.55 | 57.00 |
| 1# 24/case | 65.52 | 83.02 | 74.40 | 70.70 | 98.00 | 72.93 | 71.67 | 76.20 | 78.00 | 97.44 | 80.76 | 103.50 | 65.52-103.50 | 81.01 | 79.31 | 77.23 |
| 2# 12/case | 69.72 | 74.72 | 66.90 | 63.33 | 69.00 | 67.50 | 62.40 | 75.91 | 57.50 | 75.00 | 60.85 | 75.00 | 57.50-75.91 | 68.15 | 68.95 | 60.07 |
| 12.oz. Plas. 24/cs | 64.32 | 76.78 | 64.00 | 69.47 | 58.75 | 60.67 | 58.70 | 60.60 | 60.00 | 57.60 | 66.48 | 73.00 | 57.60-76.78 | 64.20 | 65.28 | 58.09 |
| 5# 6/case | 76.41 | 83.99 | 77.40 | 71.75 | 81.11 | 71.00 | 70.00 | 64.80 | 72.00 | 80.40 | 71.60 | 89.33 | 64.80-89.33 | 75.82 | 76.68 | 73.21 |
| Quarts 12/case | 122.50 | 151.44 | 112.20 | 104.27 | 96.00 | 95.15 | 89.22 | 91.90 | 122.50 | 107.94 | 94.23 | 117.00 | 89.22-151.44 | 108.70 | 104.18 | 94.87 |
| Pints 12/case | 69.01 | 76.48 | 66.00 | 70.40 | 58.00 | 52.50 | 70.49 | 53.10 | 69.01 | 69.30 | 54.00 | 67.50 | 52.50-76.48 | 64.65 | 63.86 | 65.61 |
| **RETAIL SHELF PRICES** | | | | | | | | | | | | | | | | |
| 1/2# | 3.13 | 3.55 | 2.37 | 3.30 | 2.29 | 3.00 | 2.94 | 1.79 | 3.97 | 3.00 | 2.83 | 3.50 | 1.79-3.97 | 2.97 | 3.01 | 3.01 |
| 12 oz. Plastic | 3.25 | 4.30 | 3.52 | 3.86 | 4.33 | 3.73 | 3.39 | 3.38 | 3.50 | 3.57 | 3.64 | 5.75 | 3.25-5.75 | 3.85 | 3.71 | 3.63 |
| 1# Glass/Plastic | 3.92 | 4.91 | 5.22 | 4.52 | 5.25 | 5.45 | 4.75 | 4.59 | 5.00 | 4.86 | 5.01 | 5.75 | 3.92-5.75 | 4.93 | 4.77 | 4.59 |
| 2# Glass/Plastic | 8.50 | 7.70 | 9.80 | 7.01 | 8.15 | 8.19 | 7.14 | 8.29 | 6.48 | 8.03 | 7.89 | 9.60 | 6.48-9.80 | 8.06 | 7.78 | 7.31 |
| Pint | 10.40 | 7.42 | 7.50 | 7.38 | 7.99 | 6.15 | 8.40 | 6.45 | 15.00 | 7.25 | 7.22 | 13.08 | 6.15-15.00 | 8.69 | 7.40 | 6.67 |
| Quart | 14.49 | 14.98 | 11.00 | 10.45 | 10.45 | 10.40 | 8.72 | 11.37 | 11.75 | 12.07 | 9.37 | 14.50 | 8.72-14.98 | 11.63 | 11.66 | 10.70 |
| 5# Glass/Plastic | 17.00 | 15.79 | 19.30 | 15.99 | 20.00 | 18.00 | 16.00 | 19.99 | 20.00 | 15.77 | 17.74 | 21.85 | 15.77-21.85 | 18.12 | 17.38 | 15.86 |
| 1# Cream | 5.50 | 6.04 | 8.10 | 5.54 | 6.51 | 5.99 | 5.66 | 5.94 | 6.51 | 5.84 | 5.81 | 7.50 | 5.50-8.10 | 6.24 | 5.85 | 5.7[illegible] |
| 1# Cut Comb | 5.50 | 5.97 | 6.50 | 5.25 | 7.00 | 7.00 | 6.58 | 6.00 | 6.42 | 10.00 | 6.88 | 8.00 | 5.25-10.00 | 6.76 | 6.72 | 6.3[illegible] |
| Ross Round | 7.31 | 4.65 | 6.50 | 5.50 | 6.00 | 7.31 | 6.60 | 6.10 | 7.31 | 7.31 | 7.04 | 9.62 | 4.65-9.62 | 6.77 | 6.29 | 6.28 |
| Wholesale Wax (Lt) | 2.00 | 3.69 | 3.50 | 3.10 | 2.15 | 4.38 | 4.47 | 5.43 | 4.50 | 4.15 | 2.91 | 3.94 | 2.00-5.43 | 3.68 | 4.01 | 3.05 |
| Wholesale Wax (Dk) | 2.00 | 3.24 | 2.50 | 2.77 | 2.00 | 4.00 | 2.57 | 3.06 | 3.00 | 3.06 | 2.50 | 3.00 | 2.00-4.00 | 2.81 | 3.55 | 2.68 |
| Pollination Fee/Col. | 80.00 | 82.50 | 70.00 | 42.20 | 150.00 | 45.00 | 53.17 | 88.51 | 88.51 | 88.51 | 57.50 | 113.00 | 42.20-150.00 | 79.91 | 78.71 | 79.31 |

# A Closer Look

# VSH TRAIT

Clarence Collison
Audrey Sheridan

## Honey bees bred to express the VSH trait are able to detect a variety of problems in brood cells and may respond by uncapping the cells and removing affected individuals.

Genetically-based resistance to *Varroa* mites (*Varroa destructor*) is regarded as the most valuable tool available for sustained management of mites (Danka et al. 2008). Honey bees have been selectively bred to express high levels of *Varroa*-sensitive hygiene (VSH); VSH is manifested in the systematic removal of *Varroa*-infested pupae from capped worker brood cells by house bees. This hygienic behavior is a complex interaction of bees and brood in which brood cells are inspected, and brood is either removed if *Varroa* infested, or recapped if healthy (Harris 2008ab). Initially, this resistance trait was believed to be associated with suppressed mite reproduction, and bees bred for this trait were referred to as SMR honey bees.

Harbo and Harris (2005) found that suppressed mite reproduction is a heritable trait. Further investigations (Ibrahim and Spivak 2004) found that the bees that were selected for the SMR trait were very hygienic and were able to remove *Varroa* mites from capped brood cells. Additional testing indicated that SMR bees did not remove mites from brood cells if the mites did not lay eggs (Harbo and Harris 2005).

Honey bees bred to express the VSH trait are able to detect a variety of problems in brood cells and may respond by uncapping the cells and removing affected individuals. *Varroa* sensitive hygiene is probably similar to other hygienic behaviors, such as removing dead brood, brood infected with bacteria or fungi, and brood infested with eggs or larvae of the small hive beetle or larvae of the greater wax moth. As with other forms of hygiene, VSH varies among different races and lines of honey bees (Harris 2007).

Hygienic behavior is a multi-step process carried out by several house bees which involves detection of infested pupae, uncapping of brood cells and removal of the pupae (Arathi et al. 2000). On some occasions, brood cells are uncapped and then recapped without removal of the parasitized pupae (Boecking and Spivak 1999, Aumeier and Rosenkranz 2001, Aumeier et al. 2000, Boecking et al. 2000, Arathi et al. 2006, Villegas and Villa 2006). One explanation for this is that the foundress mite escapes during uncapping, or is removed by bees before an uncapped pupa is re-sealed (Boecking et al. 2000, Aumeier and Rosenkranz 2001). However, VSH bees have also been observed to uncap some cells containing uninfested pupae (Vandame et al. 2000). Although VSH target mite-infested pupae, we do not know how the bees actually detect infested pupae.

"It appears that stimuli eliciting the maximal hygienic removal of mite infested brood by VSH bees were associated with hosts aged less than or equal to five days post-capping."

Harris (2007) compared the removal of infested brood by VSH and control bees to determine whether VSH bees removed infested pupae of different ages at similar rates. A pair of infested combs containing all stages of pupae were transferred into host colonies (either VSH or control colonies) for 40 hours. VSH bees removed significantly more (55%) infested cells (singly and multiply infested), than controls (13%). They removed significantly more (66%) singly infested pupae aged from one to five days post-capping than did controls (16%). The two groups did not differ in the removal of singly infested pupae aged five to 10 days post-capping. It appears that stimuli eliciting the maximal hygienic removal of mite infested brood by VSH bees were associated with hosts aged less than or equal to five days post-capping. Many pupae were found in uncapped cells at the end of the test,

**"Mite populations in VSH colonies can increase more rapidly when drone brood is available."**

and most of the uncapped pupae were infested with mites. None of the uncapped cells contained prepupae, the developmental stage occurring during the first three days post-capping. Thus, removal of infested pupae may be triggered by stimuli elicited from cells with pupae aged three to five days post-capping. It appears hygienic bees do not immediately respond to newly infested cells, which implies that they may not respond to foundress mites. Aumeier and Rosenkranz (2001) found that odors and movements of invading foundress mites are not significant stimuli for hygienic removal of mite infested brood by Africanized and Carniolan bees.

Previous work has shown that VSH bees uncap and remove significantly more *Varroa*-infested worker pupae than do non-hygienic bees, but nothing is known about the reactions of VSH bees to mite-infested drone brood (Harris 2008b). Brood combs of both types were chosen so that the majority of host pupae had white bodies and non-pigmented eyes. The infestation rate for each comb was estimated before and after placing it into the center of the broodnest of a VSH colony for one week. Each colony was given a comb of worker brood followed by a comb of capped drone brood within one to two weeks of the first trial. This study compared the reactions of VSH bees with mite-infested worker and drone brood in a laboratory test and a field test. VSH bees inspected brood cells containing mite-infested pupae of both types of brood, but they removed significantly fewer mite-infested drone pupae than mite-infested worker pupae after one week. This result suggests that mite populations in VSH colonies can increase more rapidly when drone brood is available. Additionally, the percentages of uncapped pupae and uncapped mite-infested pupae were positively correlated to the natural infestation rate of brood after a 24-hour exposure, but not after an exposure of one week. This result suggests that the rate of uncapping brood by hygienic bees may depend on the infestation rate, which gradually decreases with longer exposures to bees that remove mite-infested pupae from capped brood.

Various hypotheses have been proposed to explain why hygienic bees respond to infested cells only after a few days of natural cell invasion or the artificial introduction of mites. These explanations suggest that the stimuli triggering hygiene may be derived from time dependent processes, such as the development of stress responses in infested pupae. Such responses include: pheromone release or increased pupal movement, the development of bacterial and /or viral diseases vectored by mites to the host pupa, and the odors associated with the development of the mite family (particularly, those produced by mite offspring and fecal accumulation), which may be detected by VSH bees (Boot et al. 1999, Boecking and Spivak 1999, Vandame et al. 2002 and Nazzi et al. 2004). VSH bees seem to preferentially remove mite infested pupae with foundress mites that produce families (Harbo and Harris 2005), which supports the ideas that VSH is related to development of the mite family. Whatever the stimulus, it must be present in a cell from one to five days post-capping. Since no prepupae were found in uncapped cells, this time range can probably be narrowed to an interval of three to five days post-capping, which corresponds to oviposition of the first few mite eggs (Martin 1994).

There are lingering concerns with VSH bees. First the trait is not easy to monitor for the typical beekeeper because evaluation currently requires microscopic examination of mite-infested brood. Second, there is an infrequent problem of poor brood production in highly selected, pure VSH bees. Selection for VSH has removed lines which tended to show this problem early in the program. Recent field tests in Alabama found that honey production by VSH equaled that of the other two stocks involved in the test. Therefore, these results suggest that broader beekeeping utility was not hampered in these bees selected for strong *Varroa* resistance (Danka et al. 2008).

VSH breeding material developed and selected for at the USDA-ARS

Honey Bee Breeding, Genetics and Physiology Laboratory at Baton Rouge, LA was transferred to the beekeeping industry beginning in 2001 through a cooperative agreement with Glenn Apiaries (Danka et al. 2008). They receive germplasm from the USDA laboratory, maintain the material, do some selection, and distribute breeder queens containing VSH to queen producers. Queen producers graft from the breeder queens and outcross VSH daughters to unselected drones. These hybrid VSH queens are available to beekeepers to be incorporated in their operations as an integral part of their *Varroa* mite management programs. One clear attribute of the VSH trait is that VSH queens mated to other types of bees produce colonies that maintain significant levels of *Varroa* resistance, while retaining good brood production. BC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# Honey & Infant Botulism A Response & Update

Bruce **Tompkin**

This is in response to the question raised in the September issue of *Bee Culture*, "Why is honey the only food that is singled out for a warning label stating that it should not be fed to infants less than a year old?", in an article written by Ross Conrad.

*Clostridium botulinum* is a bacterium that lives in the soil, produces spores that are exceptionally heat resistant and also the most potent poison known. The disease, botulism, is life-threatening and, if left untreated, can lead to death. Improvements in diagnosis and treatment have reduced the death rate from foodborne botulism from about 50% during 1899-1977 to 5% during 2002-2006. The duration of illness among patients who survive can vary from a few days to months.

The Centers for Disease Control (CDC) data for 2002 - 2006 list 80 cases of botulism from food, 155 from wound infections and 460 from infant botulism (CDC, 2009). One infant is known to have died. All cases of infant botulism have occurred in infants less than one year of age with about 95% in the first six months (Arnon, 2004). A new orphan drug (BIG-IV) for treating infant botulism has been found to reduce hospital stays from 5.7 weeks to 2.6 weeks and reduce the severity of illness, mean duration for intensive care and tube or intravenous feeding. The reduction in cost per infant was estimated to be $88,600 per infant in 2004 dollars (Arnon et al, 2006).

In the late 1970s it was estimated that honey accounted for about 35% of the cases of infant botulism in the U.S. The remaining cases were thought to be from the environment in which infants live. Two types of *C. botulinum* (types A and B) are involved in infant botulism. In the Eastern coastal states from MA to GA there were 150 cases; all but 4 were due to type B (97%). In the six Western-most states there were 228 cases; largely due to type A (65%). This pattern matches results from soil surveys in which type B was more common in the East and type A was more common in the West.

Two recent cases in upstate New York have been attributed to markedly dusty conditions (Domingo et al, 2008). In Finland *C. botulinum* recovered from a deceased infant and dust from a vacuum cleaner were found by genetic testing to match (Nevas et al, 2005). These recent incidents agree with previous reports that indicate soil, nearby building construction, dusty and windy locales may be factors. Such exposures, however, have not been fully evaluated by case-control studies.

Globally, 2,943 cases of infant botulism were reported from 1976 to 2006 with the US accounting for 82.2% of the total (Koepke et al, 2008). The lower incidence outside the US is likely due to improper diagnosis and/or reporting of cases. Other possible factors might involve differences in the prevalence, numbers and types of *C. botulinum* in the soil of different regions of the world.

The opinion was expressed in the September article that *C. botulinum* spores are "present in many foods besides honey" and "high concentrations of spores have been found in honey at times – the same can be said for many other foods". Yes, *C. botulinum* does occur in some foods other than honey. That is evident from the variety of foods involved in foodborne botulism over the past hundred years. However, from the few published surveys of foods in the U.S., including our own, it can be concluded that *C. botulinum* is rarely present at detectable levels. Surveys of honey, however, have revealed an entirely different result. The prevalence rate for all the surveys from around the world was reported to be 5.1% of 2,033 samples (Snowdon and Cliver, 1996). Both prevalence rate and numbers of spores varied widely among the surveys.

Infant botulism occurs when a susceptible infant consumes by some pathway a sufficient number of cells or spores to result in the establishment and multiplication of *C. botulinum* within the intestinal tract. From investigations of honey in homes where cases have occurred, the infectious dose was estimated to be as low as 10 to 100 spores per serving (Arnon, 1978). This low number is well within the levels reported for some honey samples. Similar low numbers of other bacterial pathogens cause infections in highly susceptible population groups. For example, children under five years of age are considered to be highly susceptible to infection by *E. coli* O157:H7, the pathogen associated with ground beef and other sources. It has been estimated that fewer than 100 cells of *E. coli* O157:H7 can cause disease.

Why don't other foods carry a warning label? The risk of botulism from other foods is managed by other means. Other foods are of concern when improper processing allows *C. botulinum* to survive, multiply and produce toxin in the food (e.g., home canned foods). For commercially processed foods the risk of botulism is controlled by regulations that specify how foods must be processed and, if perishable, how they should be labeled (e.g., Keep Refrigerated). If the foods are implicated as a source of botulism or other foodborne disease, the affected production lots are recalled from the market. Code dating and other detailed information enable manufacturers to know the sources of their ingredients and where finished products have been shipped.

Whether other foods contain *C. botulinum* spores, however, is not likely relevant because infants less than six months of age are fed a limited diet. During the discovery of infant botulism hundreds of samples of traditional and non-traditional infant food items were analyzed, including formula milk and all tested negative for *C. botulinum* spores (Midura, 1979). In households with infant botulism only honey was found to test positive. In every instance in which *C. botulinum* was isolated from the honey the same toxin type was found in the infant (Arnon, 1980).

The September article states that "one of the most basic principles of science is that correlation does not prove causation." Finding a pathogen in food that matches a pathogen recovered from a patient who has eaten the food has been used for decades by the public health community to identify foods causing foodborne disease, force recalls of the implicated foods and close food operations until adequate corrections have been implemented. This policy has been very successful in preventing additional cases of foodborne disease and deaths. Thus, a finding of *C. botulinum* in honey that matches the type that is isolated from infants with botulism is consistent with public health policy and considered evidence of causation. Such evidence is admissible in court to link an implicated food to a specific manufacturer or foodservice establishment. Infant botulism from honey is a foodborne disease.

Recent expansion of the EU and the fact that some countries did not require labeling honey led to the formation of a scientific panel of experts. The panel was asked to determine whether it was advisable to provide information about the risk associated with honey. At the time only 49 cases of infant botulism had been reported in Europe. Honey had been fed to 30 of the infants (61%). In five cases the same toxin type has been found in the honey and the infant. After a comprehensive review of the available information from around the world the panel concluded: "It is recommended that effective and targeted information regarding the risks of infant botulism from the consumption of honey should be provided, e.g., via leaflets, labeling and via advice to health-care professionals." (SCVMPH, 2002).

Honey is treated very differently from other foods that have been implicated as a source of illness among consumers. Regulations have not been imposed on honey processors as a means to control the risk of infant botulism. Instead, education is the only means used to protect this highly susceptible population group. Labeling is an important component of the educational message because it appears on the container. The effectiveness of education about honey as a unique source of infant botulism is evident from data in California, the state with the highest annual number of cases. The proportion of cases with a history of honey was 39.7% in the 1970s, 14.7% in the 1980s, 5.3% in the 1990s and 4.7% in the 2000s. This is a very favorable trend but the results also indicate that honey continues to be fed to some infants in a state where public health officials are keenly aware of the risk. Such progress has not been made outside the U.S. where honey has been implicated in 59% of the cases (Koepke et al, 2008). In fact, the link between honey and infant botulism is still being discovered in other regions of the world such as Denmark in 2001, the Arabian Gulf States in 2006 and India in 2009.

The September article concluded that "it is most likely that contamination occurs sometime during the honey harvesting, extracting, and bottling processes." This opinion is not correct and the suggestions on how to minimize contamination of honey during processing will have no effect on the presence of *C. botulinum* in honey. Contamination from the processing environment is not the source of *C. botulinum* in honey. Being an anaerobe, *C. botulinum* cannot grow on floors, walls, tables and other surfaces to which honey is exposed during processing.

Research has demonstrated that growth within the hive is the more likely factor influencing the levels of *C. botulinum* in honey. The available science indicates that *C. botulinum* is a soil-borne microorganism that can be brought to the hive by bees. The number of cells or spores introduced into the hive would be low and multiplication would have to occur within the hive to reach the levels reported in honey. Due to the low moisture, acidity and other factors, *C. botulinum* cannot multiply in honey. Also, since *C. botulinum* is an anaerobe it would require a harborage site that has a low redox potential (e.g., little or no oxygen). This possible scenario led researchers in Japan to demonstrate that *C. botulinum* spores can germinate and multiply in dead bees and pupae. They also found that growth was enhanced when other bacteria are present (Nakano et al, 1994). Rapid growth could be expected because the optimum temperature for growth of most strains of *C. botulinum* types A and B (35 - 40°C; 95-104°F) is close to the internal temperature of a hive. Although not proven, it is likely that *C. botulinum* spores would be localized within a hive and the spores would not be uniformly distributed within a given lot of honey during processing. Additional research is needed to better understand the factors within the hive that influence the prevalence and numbers of *C. botulinum* spores. Whether this information could lead to practical measures that could minimize the levels of *C. botulinum* in honey is questionable.

In light of the information available it is evident that honey can be an important source of infant botulism. Dr. Arnon, one of the scientists credited with demonstrating the role of honey as a source of infant botulism, reached the following conclusion

(Arnon, 1980):

"Honey is the one identified, avoidable source of *C botulinum* spores for susceptible infants. Because honey is not essential for infant nourishment, it may be omitted from infants' diet, and should be. As 65 percent of cases had no honey exposure, elimination of honey from infant foods will not eradicate all infant botulism. However, omission of honey from infants' diet is the first step and, at present, the only practical preventive measure for infant botulism that parents and health care providers can practice. The safety of honey for older persons with normal intestinal physiology remains unquestioned."

Dr. Arnon's advice is still valid today. It is still prudent to continue to treat honey for its uniqueness as a potential source of infant botulism and provide the information that is needed to help protect infants. BC

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Dr. Tompkin is a microbiologist with 45 years experience in the food industry including 20 years of research with *C. botulinum.* Now semi-retired, he has maintained three to six hives over the past five years in Wisconsin.


# Ross Conrad Continues The Discussion . . .

I appreciate Mr. Tompkin's answer to the question: "Why don't other foods carry a warning label?" As a layperson, only having access to abstracts of studies or third-party reviews of research rather than the original papers is limiting. If I understand Mr Tomkins correctly, contamination of food products by dirt and dust is not considered a major source of C. botulinum based on the available data, even though botulism spores are known to exist in soil and dust particles and have contaminated foods other than honey in the past. This is despite the fact that logic would indicate that botulism contaminated debris entering a food source like honey could act as a source of contamination.

I constantly remind myself that even the best science has its limitations. Science provides us with the best explanation we can come up with regarding the true nature of the world around us based upon what we learn through the scientific process. Since what we learn from science is constantly changing (depending on the questions asked and the advancement of technology), our understanding of the world and what we think we know is constantly evolving as well. A recent example can be found in the research and statements surrounding Varroa jacobsoni, once considered the source of our mite problems. It took about 10 years and hundreds of thousands of dollars in research before we realized that Varroa destructor is the actual source of trouble.

In the September issue, I did not dwell on the fact that under certain conditions dead bees have been found to harbor large numbers of C. botulinum since no beekeeper I know harvests honey from supers containing dead bees. However, live bees that are left behind in honey supers when harvested, or robber bees that get caught in a super, or honey house do sometimes drown in honey, or get accidentally crushed during honey processing. This raises all kinds of additional questions.

Do healthy living bees carry significant numbers of botulism spores? Knowing that bees are like flying dust mops, is it possible for live bees carrying enough C. botulinum contaminated dust particles to contaminate honey should they drown in it during extraction? Additional questions also pop up: How long does a drowned bee have to float in honey before C. botulinum multiplies significantly? Do the majority of spores exist on the outside or inside of the bee? If they are on the inside of the bee, do the spores evacuate the dead bee on their own or does the bee need to be crushed in order to release the C. botulinum into the honey?

While it is true that C. botulinum can not grow on floors, tables, and other surfaces to which honey is exposed during processing, the spores can and do exist in dirt and dust. Until there is some research data that specifically indicates that contamination in the processing environment does not effect honey, I will still keep my honey house and extracting areas as clean as possible. As noted, "Additional research is needed to better understand the factors within the hive that influence the prevalence and numbers of C. botulinum spores." Until that research is conducted, everyone's entitled to have an opinion on the subject. We're lucky we have a publication like Bee Culture that allows us to explore such questions, share our opinions, and stimulate thoughtful discussion.

# LANGSTROTH'S GADGETS

Roger Hoopingarner

## In the later editions, many of the insights and ideas that were Langstroth's were lost. The early editions are the Gems.

When I started to re-read, a few years ago, an early edition of Rev. Langstroth's *The Hive and the Honey Bee*, (HHB) I did remember much of the story of the movable-comb hive. What I did not remember was first, that he was an unbelievably good observer, and second, he was a great inventor of gadgets and devices to make it easier to keep bees. It was the third edition of his book (and the last one that he wrote himself) that I started to re-read about 40 years after the first time I had read it as a teenager. After 40 years I could not remember the edition of the HHB that I had initially read. It may have been a later edition where the Dadant's did much of the writing and editing. I have nothing against the later editions, it is just that many of the insights and ideas that were Langstroth's were lost.

There is another aspect to what I am going to relate and that is without the convenience and accessibility of the movable-comb hive most of these little inventions would not, or could not, have happened. The same can be said for the later inventions of comb foundation by Mehring, and the extractor by Hruska. Neither invention would have been necessary without the invention of the modern hive. Let us look at some of L.L. Langstroth's other inventions.

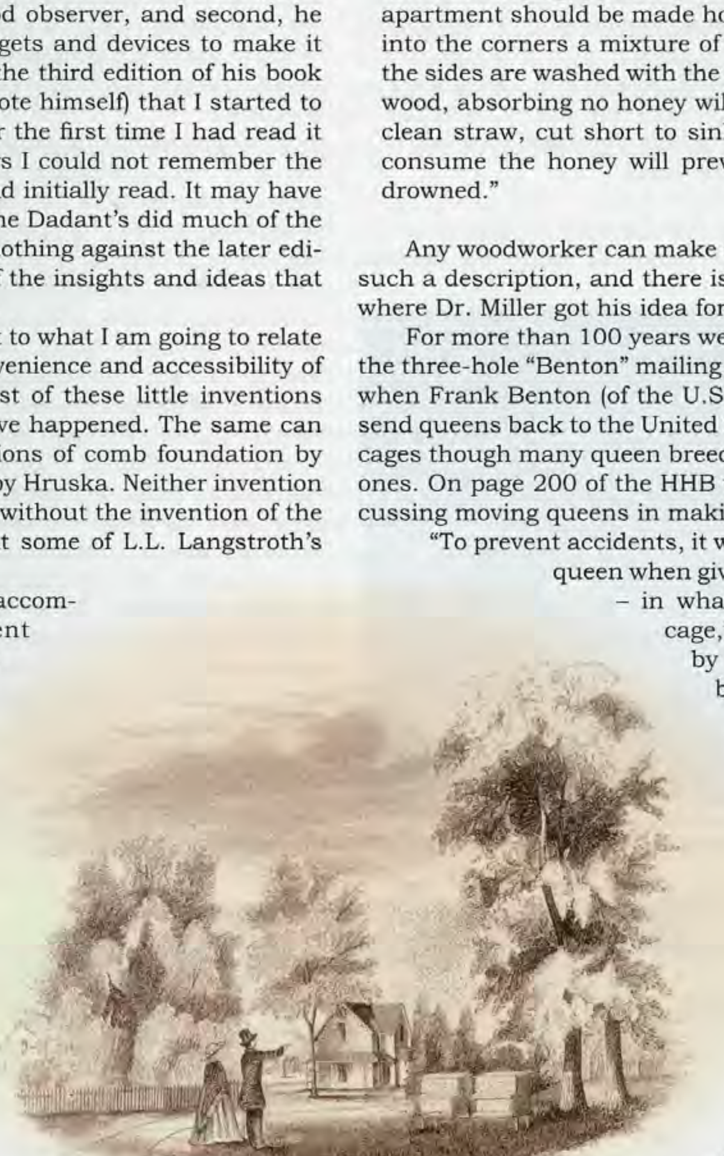
Feeding bees can be accomplished in several different ways. One of the best and surest ways to feed a single colony is by use of the hive-top feeder. Modern developments of this feeder usually attribute the design to Dr. C. C. Miller, of Illinois, who himself was an outstanding beekeeping pioneer. But let me quote from the 3rd edition of the HHB:

"...take any wooden box holding at least two quarts; about two inches from one end put in a thin partition, coming within half an inch of the top; cut a hole in the bottom of the small apartment, so that when the feeder is put over any hole, the bees can pass into it and get access to the division holding the food. The joints of the feeding apartment should be made honey-tight, by running into the corners a mixture of wax and rosin; and if the sides are washed with the same hot mixture, the wood, absorbing no honey will keep sweet. . . Some clean straw, cut short to sink readily, as the bees consume the honey will prevent them from being drowned."

Any woodworker can make this hive-top feeder from such a description, and there is little doubt in my mind where Dr. Miller got his idea for a feeder.

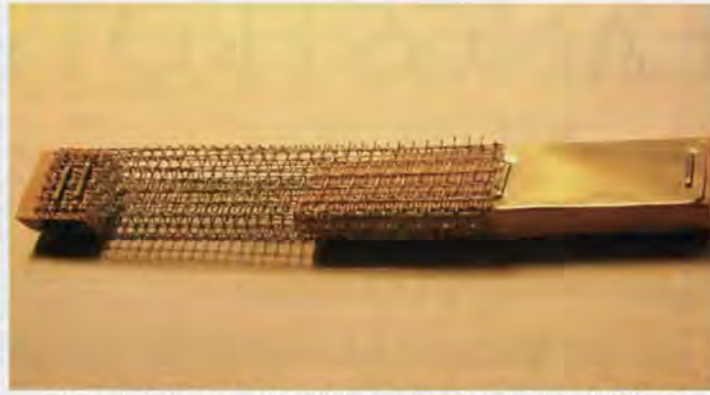
For more than 100 years we have shipped queens in the three-hole "Benton" mailing cage. The initial use was when Frank Benton (of the U.S.D.A.) went to Europe to send queens back to the United States. We still use these cages though many queen breeders now also use plastic ones. On page 200 of the HHB where Langstroth is discussing moving queens in making artificial swarms.

"To prevent accidents, it will be well to confine a queen when given to a strange colony – in what is called a "queen–cage," which may be made by boring a hole into a block, and covering it with wire gauze... (Two paragraphs later he adds.) ...she must be fed by the Apiarian, or have a few bees, gorged with honey given to her to supply her wants. One which I sent by express in a queen-cage with a suite of well fed workers, arrived in safety, at the Apiary of a friend, on the next day."



So work the Honey Bees,
Creatures that, by a rule in Nature, teach
The art of order to a peopled kingdom. – *Shakespeare*

*Commercially made hive-top feeder. Bees come up the center slot, and wire mesh is used to keep bees from drowning in the syrup.*



*Queen holding cage. The thickness is approximately 3/8 inches so that it fits between the to bars of the hive which holds it in place while the bees become accustomed to the new queen.*

It is to Benton's credit that he probably enlarged the cage by making it have three holes, not drilling the holes all the way through the wood, and also by adding queen candy. But wait, what about queen candy? Langstroth described that too, on page 274.

> "Take a pint of honey and four pounds of pounded lump sugar; heat the honey, without adding water, and mix it with the sugar, working it together to a stiff doughy mass."

Thus, it would seem that Langstroth put forth the idea of the cage and the food that today has allowed queens to be shipped all over the world.

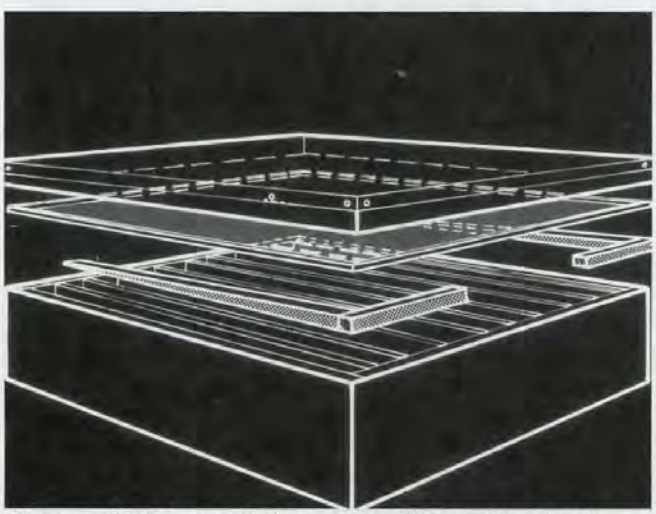


*Diagram of Winter ventilation wedges. Wedges fit under the inner cover and outer cover comes down to block wind that might enter directly.*

On the same pages of the description of the mailing cage, he describes holding a queen in a "cage" until the bees accept her. I suspect that is the basis for the "Butler" holding cage that was developed in more recent times, though Langstroth's description of the cage is not this fancy.

Langstroth was adamant about proper ventilation of the hive. Yet in primitive box hives or skeps there was only an entrance for any air flow. He often speaks of proper ventilation, but he is especially emphatic in the chapter on wintering bees. His means of getting upward ventilation was to put two blocks of wood under the cover to allow air to flow out the top of the hive. Almost all beekeeping books today recommend upper ventilation and/or entrance for moist air to escape. I took the idea of the two blocks of wood and made tapered wedges that fit under an inner cover to provide for the upper ventilation as well as an upper entrance. By moving the telescoping cover forward the moist air can escape, the bees have an upper entrance, and the lip of the cover provides for protection from the wind.

Lorenzo Lorrain Langstroth was obviously an important contributor to beekeeping as evidence the movable-comb hive. What we often do not remember are these other "little" inventions and techniques that also were important to beekeeping. I hope I have given you some insight into the man's genius. BC

*Roger Hoopingarner is Michigan State University Extension Specialist in Apiculture, retired, and the author of* The Hive & The Honey Bee, Revisited *– An Annotated edition of LL's 3rd edition.*

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# OBSERVATIONS ON BEES[1]

shared by
William E. Butler

## By the President of the Germantown Society for Promoting Domestic Manufactures[2]

An address delivered by George Logan to the Germantown [Pennsylvania] Society for Promoting Domestic Manufactures, a society of which he was the leading founder and first President (and architect of its Constitution). Logan kept bees at Stenton, his country estate now in greater Philadelphia, and open to the public. This essay is regarded as the most "literary" and "philosophical" of all his considerable writings on matters of agriculture: "written in the authentic spirit of Virgil's fourth *Georgic,* complete with appropriate aphorisms and allusions to classical literature"[3] together with practical advice for intending beekeepers. Whatever the "new method" of extracting honey from hives to which he alludes actually was, the implication is compelling that the experience was painful for George Logan. Logan was "... in the front rank of America's early scientific agriculturalists", most particularly for his writings on crop rotation.[4] The Publisher of the journal *American Museum* (1787-1792) was Mathew Carey (1760-1839); at the time this was the most successful journal in the United States with more than 850 subscribers. Logan contributed from time to time, his being among the few original contributions – WEB[5]

**GENTLEMEN,**

At the last meeting of the Society, a resolution was adopted, recommending to the members to procure the best information respecting the raising of bees; the Society being of the opinion that the profit and advantage to be derived from this source of domestic riches merited some attention.

It is a received opinion, that the bee provides itself with wax and honey from the flowers of plants; therefore the number of bees which may be kept to advantage in a neighborhood, must depend on the quantum of pasture afforded by the surrounding fields. Whenever a particular district of country becomes overstocked, the bees suffer, and the quantity of wax and honey collected does not recompence the farmer for his attention. The ancients were so sensible of this, that Columella[6] informs us, that as few places are so happily situated as to afford plenty of pasture, it was the advice of Celsus,[7] that after the vernal pastures are consumed, the bees should be transported to places abounding with autumnal flowers, as was practiced by conveying the bees from Achaia to Attica; and also in Sicily, where they were brought to Hybia[8] from other parts of the island. Maillet,[9] in his curious description of Egypt, relates, that one of their most admirable contrivances, is their sending their bees annually into distant countries, in order to procure them pasture at a time when they could not find any at home, and afterwards bringing them back, like shepherds who travel with their flocks, and making them feed as they go. The hives are placed in a boat prepared for the purpose: and after they have remained some days at their farthest station, and are supposed to have gathered all the wax and honey they could find in the fields within two or three leagues around, their conductors convey them in the same boats two or three leagues lower down the river. The author of the natural history of bees,[10] gives the following account of what is practiced in this way in France. M. Proutau, says he, keeps a great number of hives; his situation is one of those in which flowers are very soon scarce, and where few or none are seen after the corn is ripened, he then sends his bees into Beauce, or Gatinois. This is a journey of 20 miles – the hives are placed on a cart, and removed with great care.

As it is more than probable that the members of this Society will not think it proper to remove their hives in order to procure pasture for their bees, it is necessary that the number of hives kept should be in proportion to the pasture afforded by the neighborhood; a little experience and observation would soon ascertain this point when every neighbor confining himself to his proportion, the raising of bees might be carried out to the advantage of all.

I have conversed with several elderly men who have been attentive to bees for 40 or 50 years. They say the raising of bees is not attended with the success of former years; and that this is owing to the want of pasture for these valuable insects.

[1]Reprinted from *The American Museum, or, Universal Magazine, Containing Essays on Agriculture . . .* (July 1792), XII, no. 1, pp. 22-23.

[2]George Logan, M.D. (1753-1821), called by Thomas Jefferson "the best farmer in Pennsylvania, both in theory and practice."

[3]See F. B. Tolles, "George Logan: Agrarian Democrat", *Pennsylvania Magazine of History and Biography*, LXXV (1951), pp. 264-265.

[4]See generally F. B. Tolles, *George Logan of Philadelphia* (1953), pp. 88-104.

[5]William E. Butler, John Edward Fowler Distinguished Professor of Law, Pennsylvania State University.

[6]The reference is to Lucius Iunius Moderatus Columella (4-70 AD), a Roman writer born at what is now Cadiz, Spain, who took up farming after service in Syria as tribune in the year 35 AD. He composed, among others, a twelve-volume work *De Re Rustica*, which is the most important surviving record on Roman agriculture. Volume 9 is devoted to beekeeping and the production of honey and wax. Logan would have read Columella in Latin.

[7]The reference is to Aulus Cornelius Celsus (ca. 25-50 AD), a Roman encyclopedist whose works on medicine survive but also wrote, inter alia, on agriculture. Presumably Logan found a reference to Celsus in another work, as his writings on agriculture have apparently not survived.

[8]A community mentioned in Virgil's Eclogues.

[9]The reference is to Benoit de Maillet (1656-1738), French diplomat and natural historian who published his *Description de l'Egypte* (1735).

[10]Logan's reference is unclear; there are several possible works he may have had in mind, including those by Thomas Wildman (d. 1781) and/or by John Belchier and Nathaniel Polhill which appeared in London respectively in 1768 and the 1780s.

Straw hives are preferable to any other habitations, because the straw is not as liable to be heated by the rays of the sun; and is a better security against the cold, than any kind of wood. The form and fashion of the common straw hive is sufficiently known; but they are often made too high for their width. The best size is such as would hold about six gallons. Whoever makes use of hives should at all times have them well secured from the inclemency of the weather; by means of a substantial straw cap; which not only preserves the bees from wet, than which nothing is more injurious, but also preserves the hive in a more equal temperature during the severity of Summer heats and Winter colds.

A variety of opinions have been entertained, respecting the situation and form of an apiary; experience has pointed out the most simple plan to be the best. It is now generally allowed, that the best situation for a hive of bees, is on a stool raised about two feet from the ground, and placed not exactly level, but a little slanting, that the water which falls on the stool may not incommode the bees. If the straw cap is properly formed, it will extend over the edges of the stool and prevent any such injury.

The latter end of August, or the beginning of September, the combs are fullest of honey. This points out the proper season for taking it. The old way is to kill the bees – but many methods have been recommended for taking the honey without destroying the insect. I attempted this new plan, and injured by stock of bees. Mr. George Shoemaker and Mr. Lukens,[11] who have had great experience in raising bees, met with no better success; both these gentlemen prefer the old method of destroying them. There can be no great purpose answered in preserving the bees, when their food is taken away; for in these circumstances they frequently require more care and attention than the farmer can bestow, to preserve them from perishing. The practice of killing the bees, when you take their wax and honey, is not so cruel as it may appear on the first view, to persons of great humanity. The life of the bee is naturally but short, and with the best management they must pass but an uncomfortable Winter, after they are robbed of their provision.

We have not thought it necessary to take notice of the natural history, of the economy of the bee. We may just observe, that the hive is a school, to which number of people ought to be sent; prudence, industry, benevolence, public spiritedness, economy, neatness, and temperance, are all visible among the bees. These little animals are all actuated by a social spirit, which forms them into a body politic, intimately united, and perfectly happy. They all labor for the general advantage; having no partial interest, no selfish distinction to support, they are happy, because the concurrence of their several labors inevitably produces abundance, which contributes to the riches of the individual. Let us compare human societies to this, and they will appear altogether monstrous. Necessity, reason, and philosophy, have established them for the commendable purposes of mutual aid and benefits; but a spirit of selfishness destroys all; and one half of mankind to load themselves with superfluities, leave the other destitute of common necessaries. BC

[11]Possibly the reference is to Mr. John Lukens (1720-1789), at one timer the Surveyor-General of Pennsylvania, known to have an interest in husbandry. See W. J. Bell, Jr., *Patriot-Improves: Biographical Sketches of Members of the American Philosophical Society* (1997), I, pp. 314-320.


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# IPM FOR SMALL HIVE BEETLE

Mike Hood

## *Part Two Of This Series Covers Additional IPM Techniques To Conrol This Pest*

**This is the conclusion of a two part series discussing the integrated management of small hive beetles in the context of the eight basic IPM beekeeping principles.**

Small hive beetles can be present in a colony in low numbers and not be a problem. However, beekeepers should monitor their colonies closely and be prepared to take action, especially during certain times of the year when beetle reproduction tends to increase. Beetles do have the ability to reproduce quickly when conditions are favorable and colonies are stressed. There are many IPM tools and recommendations available to the beekeeper to manage this hive pest. In this article, we will discuss physical control, genetic control, and lastly chemical control.

**Physical control.** Beekeepers often smash small hive beetles with their hive tools as a form of physical control. If a beekeeper has the time and patience, this activity can reduce the beetle population and contribute to holding the beetle population in check. Battery operated vacuums are also available for beetle removal, however this form of control is for the part-time beekeeper who only has a few colonies. These activities can give you a tremendous source of satisfaction, but it can be a futile effort when colonies are overrun with beetles.

In some of our SHB research, we have used vacuums and aspirators to remove beetles from colonies in the Fall (before bees begin to cluster) to obtain a total colony beetle count. This is a laborious and time consuming task that requires a minimum of two people, but may pay big dividends for the part-time beekeeper to reduce the number of overwintering beetles. The procedure begins by finding and placing the queen in a cage for safe keeping. Then each hive frame is removed and shaken on an 8x3 feet white plastic table to free bees and beetles. Next, the frame top bar edge is lightly bounced a couple of times on the table top to free any remaining beetles that are hiding in the cells. The frame is then turned over and the frame top bar bounced again on the table top to remove any beetles from the other side. While one person manipulates the frames, another person stands on the opposite side of the table and vacuums or uses an aspirator to collect the beetles from the table top, counts beetles and brushes bees to the side. The boxes, bottom, and hive top should also be bounced on the table to remove and capture beetles. After all the equipment has been processed in this manner, the frames are reloaded into the hive, queen released, and bees remaining on the table brushed back into the hive. For research purposes, we released the captured beetles back into the hive to continue the project.

This radical technique is no doubt very stressful to a colony, but has proven to remove at least 80% of the beetles, as reported by scientists who have used this approach. A few beetles will get by undetected and a few will fly away safely and return to a colony. This technique has been used to only count beetle numbers in bee colonies and its effectiveness as a control tool has not been investigated. As a beetle control technique, simply smashing beetles with a hive tool will likely be preferred as opposed to safely removing the beetles. The beekeeper can expect to kill a few bees during the process of eliminating the beetles.

Another physical control technique is to move beetle-infested colonies to a new location at least a few miles away. Some migratory

*Fun in the beeyard shaking frames of bees on table and removing beetles.*

*Battery operated vacuum for Small Hive Beetles.*

beekeepers report having few beetle problems, as long as they keep colonies on the move. Moving colonies simply breaks the beetle life cycle by leaving the mature larvae and pupae behind in the soil. Leaving colonies in the same apiary where beetles have been a major problem for years is not recommended.

If it is evident that several hundred adult beetles are present in a colony and beetle larvae are present, the entire hive should be removed from the apiary and treated in a remote location. Or, placement of the hive and its contents into a freezer for a couple of days will kill all beetle life stages. Regardless, the entire hive should be removed from the apiary before more larvae exit the hive to pupate in the soil.

Anything that reduces the ratio of bees-to-comb surface when beetles are present can lead to major beetle problems. Over-supering and swarming are two examples that can result in increased beetle problems, as well as wax moth problems.

In areas where beetles are problematic, beekeepers should not use a Porter bee escape to remove the honey crop. Honey supers left above a Porter bee escape for more than a day or two stand a high chance of destruction by beetles which thrive in the warm conditions that are free of bee activity. Pollen traps should also be serviced regularly and maintained carefully because the pollen serves as a necessary protein for beetle reproduction and it is unprotected by bees.

Freezing individual frames containing beetle larvae from live bee colonies is recommended, but this will rarely result in successfully salvaging a colony that also shows signs of weakness and low morale. A close examination of these beetle larvae infested frames will often reveal wax moth larvae too. Two measures that may help increase the chance of success are: 1) to replace the larvae-infested frames with frames with bees from other healthy colonies that show a high bee-to-comb ratio to boost the bee colony population or 2) to move the remaining frames down to a nuc-size (four or five frame) box where the bees can better cover the remaining frames.

When honey-filled supers are removed from colonies that are beetle-infested, it is highly recommended to extract the honey within two days. However, if this is not possible, the beekeeper is advised to maintain a relative humidity of 50% or less inside the honey house. The low humidity results in desiccation of beetle eggs and larvae that were transported into the honey house inside the honey supers. Beetle larvae can cause complete loss of the honey crop inside the honey house, if these guidelines are not followed. Frames of honey which have been used in the past as brood frames are more vulnerable to beetle problems.

Beekeepers are also advised to practice good sanitation around the honey house to avoid beetle problems. Timely removal of bits of comb, cappings, and pollen is highly recommended because these materials are highly attractive to beetles.

A 50% bleach/water solution has been shown to kill beetle larvae in honey houses and for use in cleaning or salvaging larvae-infested comb after four hours of treatment. Treated comb should be set aside for at least 24 hours to allow the bleach odor to dissipate.

**Biological Control.** Research investigations have been conducted to find an effective form of biological control for small hive beetles. Infectivity tests under laboratory conditions found that SHB larvae were susceptible to soil infesting entomopathogenic nematodes, but field tests have yet to confirm their reliability in the field. An infectious fungus *(Aspergillus flavus)* has been identified that infects SHB, however the utilization of the fungus for beetle control has not proven to be safe because of its side effects on bees and fear of honey contamination.

Imported fire ants (*Solenopsis invicta*) which are found throughout the southern U.S. feed on other soil infesting insects and likely feed on SHB as the beetles enter the soil to pupate. Fire ants are opportunists and may play a role in conjunction with other IPM tools, but they have not been found to be relied upon as a stand-alone beetle control option, even when ant mounds are present in the apiary.

**Chemical control.** There are two pesticides that are registered in many states for SHB control. Check Mite + is registered for in-hive beetle control but can only be used during a non-nectar flow period. A single strip of the product is cut in half and attached underneath a 4" x 4" inch piece of corrugated plastic or cardboard and placed near the back of the hive on the bottom board. The piece of plastic or cardboard serves as a hiding place or trap and the beetles receive a lethal dose of the pesticide

*Small Hive Beetle smasher.*

*Graduate student Brett Nolan moving a highly Small Hive Beetle-infested colony from the apiary.*

*CheckMite+ strip cut into and secured to a piece of corrugated plastic for placement in beehive.*

upon contact. Varying results have been reported by beekeepers using this product. This product stands little chance of controlling beetles in late Winter, early Spring or late Fall when adult beetles are normally inactive or confined to the bee cluster. Beekeepers should carefully use this product only when other forms of control have failed. Beekeepers must follow label directions and resist the temptation of using the product in other locations in the hive. The product must be removed from the hive in a timely manner according to the directions.

Gard Star is marketed as a soil drench pesticide and is used to kill mature beetle larvae as they exit the hive to pupate in the soil. Care should be taken to avoid spraying this pesticide on the hive entrance which would result in killing bees. Gard Star can also be used to treat the soil underneath dead-out colonies to prevent adult beetles from emerging and entering other nearby colonies. Since this product is not used inside the hive, there is little chance of hive product contamination. Therefore, the use of this pesticide may be used more freely in an IPM program until we can find a more suitable and efficient biological soil agent for killing beetles. From a beetle reproductive control approach, Gard Star should be used only when beetle larvae are present in the colony. In my experiences in the Southeast U.S., I have seen very few beetle larvae in colonies in April and May, but June and July are normally the months when beetle reproduction is increasing, so beekeepers need to more vigilant these two months. However, one problem with the use of Gard Star is that we simply do not know how long the product will remain lethal to beetles in the soil, which is likely dependent on temperature, soil type, and rainfall. The other concern is that widespread overuse of Gard Star will likely lead to beetle tolerance or resistance to the product in a few years, similar to the current problem with *Varroa* mite resistance to Apistan in many states.

**NOTE**. *Beekeepers should resist the temptation of using off-brand or unregistered pesticides for SHB control. There are great risks involved when a beekeeper breaks the law (federal and state) when using a pesticide that is not registered for its labeled application. The pesticide label is the law and should be followed carefully by the beekeeper. We have found that beeswax readily absorbs chemicals and may harbor toxic materials for long periods of time. Using illegal pesticides for SHB control may lead to contaminated hive products and can result in injury to the consumer as well as the beekeeper. Our beekeeping industry can ill afford the public outcry over the news of pesticide-contaminated honey.*

**Summary**. Sometimes when conditions are favorable for small hive beetle immigration and beetle reproduction is high, the beekeeper is in for a real challenge to control this hive pest. Large numbers of beetles have been known to enter single colonies which can overcome the natural defenses of even a strong colony. There are a few reports in the literature of migrating swarms of beetles entering a single hive. Fortunately, this occurs very infrequently, so it is up to the beekeeper to help the bees in maintaining low beetle populations by using a combination of safe and effective IPM tools and recommendations. In most cases, the integrated management of small hive beetles will serve well to control this hive pest.

Winter is a good time for you to sit back and evaluate how well your beetle management efforts worked last year. Maybe the beetle levels increased to the point of negatively impacting your colonies or perhaps colonies seemed to be overrun in some apiaries. On the other hand, beetles may have been present but in very low numbers. Regardless, it is well worth your time to make some decisions now for the coming year. There are many IPM tools available for you to consider and maybe it is time to try a combination of control options and not depend on a single method. For a quick review, here are a few recommendations on how to control small hive beetles:

**Do's**

-maintain healthy, strong colonies to promote high bee-to-comb ratio
-monitor colonies for beetle infestation levels
-trap beetles using one or more of the trapping devices presently marketed
-physically kill or remove beetles when inspecting a colony, but do not leave equipment exposed for long periods of time which may lead to robbing
-remove weak colonies from an apiary when infested with beetle larvae and treat the soil
-extract honey from supers within two days of hive removal
-maintain good sanitary conditions inside and outside the honey house
-treat soil with Gard Star, if beetle larvae are present in the hive
-use Check Mite + in the hive as a last resort

**Don't's**

-do not place colonies in shady, damp locations
-do not over-manipulate colonies when beetles are present
-do not leave colonies exposed during extended hive inspections
-do not over-super colonies when beetles are present
-do not hesitate to move colonies to a new location away from an old apiary which has a history of beetle problems
-do not use pesticides that are not registered for SHB control BC

# HONEY DELIGHTS

## An Easy Way To Eat Honey Candy

John Rowe of Montague, Prince Edward Island (Canada) is delighted with all the attention his Honey Drop product has received over the past two plus years.

An alternative to the sugar cube, Honey Drop is being marketed to PEI chain stores and gift shops, as well as national chain stores. In fact, Rowe said where his company, Island Abbey Foods, Ltd., used to ship cases, they are now shipping pallets weekly. "We are growing slowly, but the key is, we are growing!"

On the heels of the Honey Drop success, Rowe introduced a new product, Honey Delights, late last year. He is confident this honey candy will sell just as well, if not better then his coffee and tea sweetener.


Marketed under the company name (Island Abbey Foods, Ltd.), Rowe said the idea for other products were always there. "It was just a matter of which one we would launch first."

He said getting honey into a pure cube state so you can put it in your tea and coffee solves the honey problem (of stickiness). "It's an individual portion of dry honey and if you need to monitor your calorie of sugar intake . . . you can do it with this form of honey," said Rowe last fall at his new honey packing plant in the West Royalty Business Park in Charlottetown.

The honey drop has been marketed and sold directly through the company's website over the past two years and also directly to retailers and distributors across Canada and into the U.S. "We've managed to get it into several major chain stores over the past year. They include Sobeys, Safeway, Metro, London Drugs in Alberta and into Superstores in PEI," Rowe said.

He noted that the Honey Drop is not only on store shelves with other honeys; it is teamed up with teas or coffees, and is now in gift shops too. "Because it makes a great gift."

The sugar cube replacement is in all Sobey's and Co-op stores in PEI and several gift shops . . . some, in fact, where there are no other signs of a food type product . . . just the solid packaged honey.

Rowe pointed out that the company continues to get media exposure from the most interesting places. "We were featured in Bon Appetite, Health Magazine, Rachel Rae's magazine and Canadian living...and of course Food in Canada which was the story that got us attention from all these other publications."

Island Abbey Foods, Ltd., also got national TV coverage on Canada A.M., A national CBC news show, as well as being a feature on the popular Atlantic TV news how, Live at 5 out of Halifax, Nova Scotia. "This is the most watched show on Canada's east coast," Rowe said and added that he was featured on the Island's local 6 o'clock news, Compass.

With all this exposure and a new plant already up and running, launching the new product seems timely. Rowe said he and his father, John Senior, who is a business partner, always had an idea for a (honey) candy and when deciding what product to introduce first they went with the one that was readily processed with the equipment they had at that time.

"Honey Drop was the "world's first." It was the first alternative to the sugar cube made from pure honey. As a start-up company we thought it would gain the most interest . . . get the most traction," said Rowe.

The honey entrepreneur reiterated that he and his father had always planned to introduce other products . . . honey candies, honey lozenges and honey sprinkles.

"It's something that can be sprinkled on dessert and used in baking, so we will introduce that in early 2010," said Rowe. He explained that when Chef Allan (Williams) of the Culinary Institute of Canada in Charlottetown, was using the Honey Drop, the first thing he did was crush it and sprinkle it on cookies. "That foretold us what we are going to be doing in the New Year. We are coming out with Honey Sprinkles in a bottle. It can be used in baking and cooking, on cereal or as a dessert topping," said Rowe who seems to be inspired every time someone tries his Honey Drop in a new recipe.

With plans to introduce another "world's first" pure honey lozenges, Rowe talks about money the company was able to tap into through the PEI Provincial government. "There was a Pilot Fund that helped us research into some (new) equipment we were designing and building for our production line. That fund gave us $25,000," he said. Another fund, the Discovery and Development Fund, gave PEI Abbey Foods, Ltd., $100,000 that has helped further their research. "We incur expenses and then get reimbursed," said Rowe.

This money will enable Rowe and his partners, (father and brother) to research using active ingredients – that is pharmaceuticals – with the honey in order to be able to produce the cough drops that will have more health benefits then honey on its own. Obtaining the money meant going into a competition for the awards and Rowe is grateful he was successful.

The success in obtaining funding allowed Rowe to go on to other successes . . . such as the launching of Honey Delights.

He noted that the plan had been to wait until 2010 to introduce the candy, but there was so much feedback on people eating Honey Drop candy that the company accelerated the launching of Honey Delights pure honey candy in early Fall.

The difference in the Honey Drop and Honey Delights is the size and shape. Otherwise there is no difference . . . it is also all pure (dry) honey.

"It's shaped differently and is a smaller size," said Rowe, adding that the 3½ grams size makes it easier to eat than the Honey Drop, which is honey comb shaped and weighs five grams. "The Honey Drop is a little too big for kids to eat, so the honey candy is easier for kids (to eat)."

The Honey Candy, in its bright pink packaging, will be available individually for 25 cents each in stores where candy is sold. "We will be going into candy sections of stores where we have Honey Drop, and also going to pharmacies, gas stations, and convenience stores."

As for the Honey Drop, he is not letting it "drop" out of sight.

With the increase in retail outlets carrying the product, sales have increased and Rowe said, "With the growth of our company and the increase in volumes, we are able to pass the savings along to our customers."

Hence, the Honey Drop package of 20 that was retailing for about $11.99, is now anywhere from $7 to $10, depending on where you buy it.

Rowe talks about the lemon Honey Drop, which is different than the other two honey products. It has meant blending honey with organic lemon oil . . ." It's truly delicious," Rowe said endorsing his own product just as any honey lover would do. The lemon Honey Drop is also available wherever Honey Drop is sold.

The method to make the sweetener and the candy is "mostly" the same. "There may be a slight variation, but essentially, we are using the same production method."

With all the research Rowe has done over the past 10-12 years into honey, he is able to offer up the medicinal purposes of honey. He said it is well documented that honey has medicinal properties. "Not only does it contain active components that are high in antioxidants, it is also anti-microbial. People actually used it for cuts (at one time), and it is antibacterial . . . you can actually clean with it."

Rowe is not suggesting that we take our supply of honey and clean house with it, in fact, he is just letting everyone know that honey, down through history had been a necessary part of daily life.

Admitting honey is 95 percent sugar; he said this sugar is easier for one's body to utilize. "It's a complex carbohydrate . . . a diversity of sugars unlike refined white sugar. The body absorbs honey more evenly, more slowly, so we are able to burn it off."

In fact, Rowe believes that honey is a good alternative for diabetics who need to consume sugars that are lower on the glycimic index.

To add proof that honey is still widely sought after and has many variations Rowe mentions that he sent his Honey Drop to the largest food show in the world in October 2009. "My brother, Allen, attended the Anuga in Cologne, Germany and the varieties of honey at that show was incredible. There were hundreds and all very distinct in flavor."

With several trade shows and events across Canada and in the U.S. now behind him, Rowe is settling into his role of activities at the production plant. One of those activities is making sure pallets get shipped out on time and delivered to the various destinations.

On this interview day, he is overseeing a shipment to one Wolfgang Puckett in Texas. "He is a chef with a chain of catering companies and restaurants," he said.

Rowe credits U.S. cooking shows for contributing to his success in selling into the U.S. "We have made steady progress since the launching of Honey Drop and given the state of the economy over the past 15 months – to do what we have done in one of the worst recessions in many years . . ."

With 15-25 employees under the roof and new products in the offing, it could be said the Rowe's of Island Abbey Foods, Ltd., are "sticklers" at producing a good product that is fast garnering worldwide attention. BC

*Kathy Birt is a freelance writer from Prince Edward Island and is a frequent contributor to these pages.*


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# BEEYARDS . . .

# Some You Keep, Some You Don't

*There are few perfect beeyards. Too often we put bees were we can rather than where we should.*

Beeyard locations are all over the page. Some are great while others are severely lacking. It's just a bee fact of life – enjoy the good yards and tolerate the marginal yards. Most likely, sooner or later, they will all have to be moved. Much like some old, bad joke long past, the question, *"Where does a beekeeper put a beeyard?"* frequently seems to have the logical answer, *"Anywhere he can."* Urbanization, modern farming practices and legal fears have made getting new apiary sites more of a challenge.

In reality, a hive or two can probably survive anywhere with exceptions being either of the arctic poles or any of the world's major oceans. The second reality is that most beekeepers put their home apiary (or their principle apiary) in the only spot they have. So . . . why all the discussion about finding the "perfect" location? From the hobby perspective, it's the principle of the thing. By knowing what the perfect location should look like, you'll be able to rate your own location. If you could have anything you want for an apiary site, I would suggest the following characteristics – in no order of importance.

**Ten Characteristics of a Good Beeyard Location**

1. Dependable season-long nectar and pollen flow
2. Dependable yard accessibility
3. Constant clean water availability
4. Clear long-term commitment from land owner
5. Minimal pesticide exposure
6. Protection from Summer heat and Winter cold.
7. Minimal danger from wildfires
8. Good air drainage (no frost pockets), generally flat
9. Not near other major beeyards (prevention of bee diseases and robbing by other bees)
10. Pleasant scenic surroundings

Finding a location having all 10 characteristics listed is only possible for the heavenly beekeeper – especially the listing about minimal pesticide exposure.

James E. Tew

**A yard you can always get to**

Of all the items on my list, one of my long-term favorites has always been #2 – Dependable yard accessibility. The amalgamation of multiple conversations I've had with land owners would go something like this, *"Well, I don't suppose I would mind having some bees on the place. My Dad kept bees when I was just a young boy."* [Landowner removes cap, scratches head and, without making eye contact with me, ponders the next obvious question – but where would you put them?]. *"Why don't you put them over back behind that watermelon field (while pointing generally toward South America)?* Or maybe the favorite, *"You can set'em down there by that wood line"* [Then the next comment should make your hair stand on end] *"It's always dry over there."* You name it. Through the years, I've stuck every kind of vehicle (or I know someone who has) while getting into locations that are *"never wet."* There's not much you can really do. The owner is trying to think of a place that is never used for anything else. Getting prime, accessible property is the exception.

It's going to be hard to find 1-10 above when talking about locations that *"can never be used for anything else."* But, be careful for what you wish, you may get it. If the yard is readily accessible to you and your hives, then it is readily accessible to everyone else, too.

**Wire Fencing**

For the most part, wire fencing is a good thing. It tends to limit accessibility, keep out larger domestic animals and possibly inhibit humans from plundering through your yard. However, wire fencing requires some kind of gate – and gates can be a pain. For instance, if the gate is narrow, it can be difficult to navigate a truck that is towing the occasional trailer through the opening. Gates require you –frequently wearing your entire bee garb – to fiddle with improvised gate latches and locks. If someone else should leave it open, you will sometimes be accused of the being negligent. Gates and fencing are not reasons to select or not select a yard, but are factors for consideration.

**Too much good can be bad**

Years ago, my youngest brother took me to a new apiary site he had found. It definitely met the running water requirement for it was situated on the southeast bank of the Omusse Creek, which was just 20 feet away. When I pointed out that these hives were bound to face frequent Spring floods, my brother authoritatively responded, *"I asked him about that. This spot only floods about once every 10 years."* So we are only going to lose our shirt every 10 years? I was not reassured. Though my brother was huffy, we didn't set up the yard. Too much of #3, clean water, can be a bad thing.

**Shade and wind breaks**

For those of you who keep bees in warm/hot climates, having afternoon shade is great; however, it's probably more of a benefit to the beekeeper rather than the bees. Conversely, having a good wind break for those of us in cool/cold climates is also a good feature – again mainly for the beekeeper. Shade from the sun might not be a great feature in cold climates where day temperature is low. Even in Ohio, I have found that colonies seem to thrive more in open sun or in partial shade – but not full shade. And, then there's the problem with small hive beetles when the colony is in the shade.

### Neighbors – a fact of bee life

Neighbors are a fact of societal existence – you can't get away from them. But in their defense, it is not the norm in the community for someone to don a full-length white suit, build a smoldering fire in a bellows-driven smudge pot (our smoker), cover one's face with what appears to be part of an astronaut outfit, reinforce the entire garb with duct tape, and then meander across the backyard. Neighbors notice things like that. Try to keep your yard out of your neighbor's sight. Tall shrubbery is good not only for wind breaks, but also for getting the bee's landing approach above the heads of everything and everybody within the community. Obviously, it will take years for the shrubbery to grow large enough, so you may need to search for such plantings already in place. Try to protect the hives from curious kids – who are little more than baby neighbors. Always avoid property lines for apiary sites and always avoid neighborly disputes. Even when you win, you lose.

### Good luck helps

Ultimately, finding a good location requires investigation and good luck. Usually, as your colony numbers grow, your reputation as a beekeeper will grow. In conversations with others, always be listening for someone suggesting new locations. Many times one may simply ask a land-owner for permission to use a location that is convenient to the beekeeper's operation. Sometimes, if the land-owner has a need for supplemental crop pollination, he may ask you to put bees on the place. I have had good luck in Ohio putting bee yards near oil wells. Such locations have access roads that are maintained by the oil companies and are usually in isolated areas.

### The right time to set up a yard

"When to set the yard up" depends on the beekeeper. Practically any time of the year is okay for moving bees to a permanent location. In the springtime colonies are lightest and easiest to move; but even easier, a yard can be established using newly hived swarms or packages of bees. The best time for setting up a permanent yard is not really a beekeeping question so much as a beekeeper question.

### Identifying the yard

At one point in our lives, my brother, my Dad, and I had nearly 200 hives. Though there were three of us in the project, it always seemed that there was a shortage of help – not necessarily good help – just any help. Cousins, friends, spouses, aunts, other brothers (I don't have any sisters), uncles – we tried them all (or should I say, we abused them all?) It was rare to get someone out more than twice. We went through so many people that

*An accessible, nicely spaced Tennessee beeyard.*

I named our little beekeeping operation *"Target Apiaries"* – because so many people had a "shot" at working with our colonies. It was a good name with a lot of visual potential for future labels and marketing advertisements. However, an unanticipated problem was that ownership signs, *"Target Apiaries,"* along with our phone number and address, were an enticing *"target"* for frustrated hunters who had given out of trophy pine cones to take home on their bumpers. Time and again, remote apiary sites were vandalized by young hunters, whose parents were paying for the shotgun shells; blasting away first at our signs, *Target Apiaries*, and then victimizing the hives. The name faded away being replaced only with our name and phone number. That too, was shot, but not as often. Even so, it's good to have your name and contact information posted in the apiary. Some states even require ownership identification.

### How many hives in one location?

How many hives can be kept in one apiary? Now there's a question requiring a common sense answer. I have known of an urban beekeeper who kept a couple of hives on his roof. To get to the "apiary," we had to climb out his bathroom window. It wasn't a large roof, so by definition it had to be a small apiary. Another beekeeper kept one hive on his sixth floor balcony. Not a large apiary, but it *was* accessible. Generally, a large apiary in most of the rural continental U.S. would be about 25 - 45 colonies; fewer in a suburban setting and, fewer still in an urban setting. At what point is per-colony production lowered due to high colony numbers? I don't have a clue. That strictly depends on the nectar and pollen sources available within an approximately two mile radius of the yard. Keep location records. Production seasons vary

*Nicely shaded Alabama beeyard.* (Carmack photo)

> *We used to have a beeyard right over there.*

greatly. After a few seasons, you will begin to know the quality of your locations.

My high-water mark for a beekeeper establishing a large yard was a budding commercial beekeeper who kept hundreds (and hundreds) of hives in one location. The hives were so near each other that the keeper had to sit on the neighboring hive while manipulating the hive beside it. Now that's too many in one location. Hives, in large apiaries, should be approximately three feet apart and should have enough space between rows to allow for a truck or mower to move around freely. Keeping hives in nice rows is a beekeeper convention. Bees can find home easier if colonies are staggered about, but such an apiary doesn't look very neat. I've noticed that hives in an established apiary tend to get scattered in direct relationship to where a swarm was captured (or "hived").

**Beeyards are not permanent locations**

As I established beeyards in past years, I usually felt a bit of a pioneer spirit. Preparations were made, weeds and brush cut back. Trees pruned. Hive stands were set up. All was made ready for the arrival of the bees. During that time and while feeling that pride, it seemed impossible that I would ever have to relocate that yard.

During my tenure at Ohio State, I estimate that I have moved the University home beeyard about 10 times. Each time I moved the yard, I initially had a feeling that I had finally found the ultimate spot. But a little part of me always pointed out that eventually, this yard, too, would probably once again be moved. The reasons for having to move an established yard are myriad. Something happens that puts the hives in the wrong place. Though I have moved my home yard many times, I can say that every time I moved, something "new and improved" went in where the bees had been. It truly was as though I was pioneering the area.

Frequently, as I drive by an old bee location, I take a moment to reflect, *"We used to have a beeyard over there."* On my university campus there are apartment buildings, conservatories, parking lots, and horticultural operations where I and my students originally opened up space for a beeyard. But I presently have a great home yard and several "okay" outyards.

**The personality of an apiary**

After several years in a particular location, a yard takes on a personality. It becomes a source of memories. It becomes familiar. It becomes a full-featured beeyard. Enjoy it as long as it lasts. But if it doesn't last, no worries; there's plenty more places out there waiting for bee pioneers. Finding and abandoning beeyards is all part of normal beekeeping. BC

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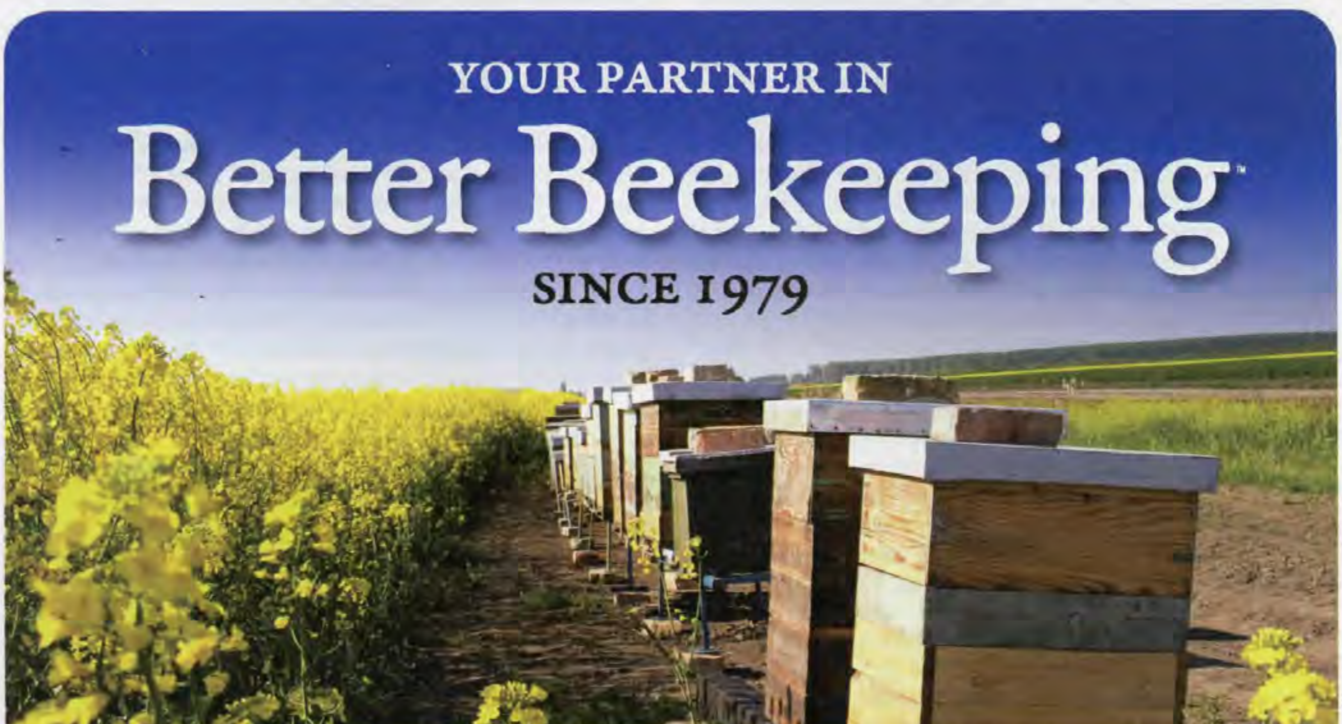


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# Science Of Bee Culture

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## INSIDE



## The Effects of Hive Size, Feeding and Nosema ceranae on the Size of Winter Clusters of Russian Honey Bee Colonies

**Thomas E. Rinderer, Lilia I. de Guzman, Lanie Bourgeois, Amanda M. Frake**
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**Summary**

In a first experiment, from August 2007 to February 2008, colonies of Russian honey bees were housed in eight- or 10-frame hives and fed or not fed sugar syrup and protein supplement patties. From August to November when a natural nectar and pollen flow occurred, the colonies were not fed. From August to November colonies in 8-frame hives grew significantly more than colonies housed in 10-frame hives. Colonies that were in eight-frame hives or were fed three pounds (1.36 Kg) of protein supplement for three weeks in November were larger in late January in comparison to their size in November.

In a second experiment, colonies were housed in eight- or 10-frame hives and fed or not fed sugar syrup and protein supplement patties from November 2008 to early February 2009. Colonies in eight-frame hives grew more than colonies in 10-frame hives. Colonies that were fed grew significantly more than colonies that were not fed.

In the second experiment, smaller colonies grew significantly more than larger colonies. Nearly all colonies were tracheal mite-free with the exception of two colonies that had high tracheal mite infestations. Although most colonies did have *Nosema ceranae* infestations, about 80% of the colonies had spore count averages below the commonly accepted treatment level of 1 x $10^6$ spores/bee. Nevertheless, differences among colonies in numbers of N. *ceranae* spores were not associated with different hive sizes, different feeding treatments or different colony growths.

**Key Words**: *Apis mellifera*, tracheal mites, eight-frame hive, 10-frame hive, protein substitute, almond pollination

**Introduction**

The importation and subsequent selective breeding of Russian honey bees from far-eastern Russia has resulted in a stock of honey bees which has strong resistance to the parasitic mites *Varroa* *destructor* and *Acarapis woodi,* good honey production and strong overwintering abilities (de Guzman *et al.* 2001, 2002, Rinderer *et al.* 2001a, 2001b, 2001c). These characteristics were the breeding goals of the selection program which was begun in 1998 and remain as the breeding goals in the continuing selective breeding of the Russian honey bee stock (Brachman 2009).

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

Russian honey bee colonies are known to build large colonies in the spring after reliable natural pollen becomes available (Tubbs *et al.* 2003). Until then, the colonies are generally small and exhibit traits that favor winter survival such as using food frugally and producing a restricted winter brood nest. That is, the colonies do not tend to grow in late winter and produce large colonies that are often in danger of starvation in early spring. These traits are desirable for high rates of winter survival and general beekeeping practices to produce honey or pollinate crops that bloom in April or later. Indeed, it may be that restricted brood rearing in late winter contributes to overall resistance to *V. destructor* by favoring a winter reduction in the numbers of mites infesting colònies. However, these characteristics of Russian honey bees, which are strengths for most beekeeping, may be viewed as weaknesses in regard to the special goals for almond pollination of producing large colonies by mid-February (Danka *et al.* 2006).

Typically, most beekeepers rely on special management procedures to build large colonies by mid-February. Italian honey bee stocks usually respond favorably to these techniques and large proportions of them become or stay large enough to be rented for almond pollination. Mostly these management techniques involve feeding individual colonies both a liquid sugar feed and a protein substitute, usually in patty form. Protein feeding (Danka and Beaman 2009, Degrandi-Hoffman *et al.* 2008, Mattila and Otis 2007, Nabors 2000, Peng *et al.* 1984 Standifer *et al.* 1973) is known to stimulate brood rearing. The timing, frequency and duration of feeding to prepare colonies for almond pollination rental are less well studied. In one study (Degrandi-Hoffman *et al.* 2008) intermittent feeding of protein and carbohydrate syrup resulted in colonies that dwindled slightly while unfed controls dwindled by half.

Many beekeepers also provide bees with treatments for parasitic mites (*V. destructor* and *A. woodi*), American foulbrood and the two species of *Nosema, N. apis and N. ceranae.* If uncontrolled, these parasites and diseases can kill colonies in a longer term. In the shorter term, sub-lethal effects of infections and infestations may debilitate colonies, reducing the value of stimulative feeding.

A pioneer in American beekeeping, C. C. Miller, called for research to test the assertion of R. L. Taylor that colonies in eight-frame hives produced larger colonies earlier in the season than colonies in 10-frame hives (Taylor, Miller 1894). Taylor asserted that less space required less effort to heat which resulted in larger and earlier brood nests. Although the debate continued (Taylor *et al.* 1894), no research was reported. However, a complex interaction of multiple opinions, marketing, and a need for an industry standard resulted in most beekeepers having 10-frame hives. Currently, modern advocates of 8-frame hives are challenging the 10-frame convention (Flottum 2005, Forrest 2008). While various advantages and disadvantages of different hive sizes guide preferences, no published data seem to be available concerning the hypothesis that eight-frame hives produce larger colonies earlier.

One of our research goals is to identify management procedures which will improve the ability of Russian honey bees to meet the needs of pollination and especially almond pollination. The experiments reported here were undertaken to determine: 1) the effects of feeding both sugar and protein to Russian honey bee colonies in late fall and in late fall and winter on colony size in early to mid-February, 2) the effects of using eight-frame hives on the size of Russian colonies in early to mid-February, 3) the relationship between colony growth in fall and winter to the size of colonies in autumn, and 4) the association of February rates of *Nosema* spp. and tracheal mite infestations in colonies to colony growth rates.

## Materials and Methods

### Experiment 1

Experiment 1 was begun in August 2007 and ended in February 2008. Four apiaries each having 8 colonies with pure-mated Russian queens were established. In each apiary, four colonies were placed in two 8-frame hive bodies with 16 Langstroth "deep" (9 5/8 in) frames of comb. Four other colonies were placed in two 10-frame hive bodies with 20 Langstroth "deep" frames

Within a week of being established, the colonies were evaluated for the presence of the queen and colony size. The numbers of bees on each side of each frame were estimated as tenths of the frame side covered with bees. Since commercial inspections of colony size for almond pollination consider 3/4 of a frame covered by bees to be one commercial frame of bees (Traynor, 1993), we calculated frames of bees by multiplying our estimate of full frames of bees by 1.25 to estimate commercial frames of bees. Although efforts were made to begin all colonies with about the same numbers of bees, the average colony size was $8.5 \pm 3.1$ frames.

The colonies encountered an autumn pollen and nectar flow principally from goldenrod (*Solidago* spp.). When the flow was mostly ended in October, colony size data were collected with the same procedures used in August. We then began feeding two randomly selected colonies in 10-frame hives and two randomly selected colonies in eight-frame hives in each apiary. Colonies were fed a 1.1 pound (500 g) patty of Megabee® feed made from dry feed according to manufacturers recommendations and a one gallon (3.8 liter) pail of syrup [60% (W:W) sucrose in water]. Feed was given on October 29, November 8 and November 19. Each time, any remaining food from prior feedings was removed. Generally, the bees consumed over 90% of the patties and removed all the syrup from the pails. This feeding was intended to test the effect of attempting to extend the autumn brood rearing period using supplemental feeding.

Final colony evaluations were made on February 5, 2008. Once again colonies were inspected frame by frame and the numbers of bees were estimated using the same procedures.

Colony size data were converted to changes in size (growth = October size -August size/ August size) for the period from August to October. Since no artificial feeding occurred during this period, only the effect of hive size was analyzed by *t*-test. Feeding began in October so the changes in the period from October to February could be effected by both hive size and feeding. Changes in colony size were analyzed by a two-factor analysis of variance (SAS 8.2, SAS Institute 2001).

**Experiment 2**

By dividing, moving colonies and transferring colonies to new hives, four apiaries were established in October 2008. Each apiary had 32 colonies, 16 in eight-frame hives (16 frames in two hive bodies) and 16 in 10-frame hives (20 frames in two hive bodies). All colonies had Russian queens that were either pure-mated, mated in areas having only apiaries with Russian queens or purchased from commercial sources. Different types of queens were distributed randomly among colonies.

Within a week of being established, the colonies were evaluated for the presence of the queen and colony size. The numbers of bees were estimated by the same methods used in experiment 1. Efforts were made to begin all colonies with about the same numbers of bees; the average colony size was 6.72 ± 0.31 frames.

In the first week of November 2008, eight randomly selected colonies in eight-frame hives and eight randomly selected colonies in 10-frame hives in each apiary were each fed one commercially prepared Megabee® patty (1 pound (454 g)) and a one gallon (3.8 L) pail of syrup [60% (W:W) sucrose in water]. The other colonies were not fed any protein food but some were fed syrup as needed to assure enough carbohydrate food to survive winter. The apiaries were visited weekly from November 2008 to early February 2009. Colonies being fed were given a continual supply of both Megabee® patties and syrup. This method of feeding was intended to test the effects of providing a continuous supply of food as is done in at least one large commercial beekeeping enterprise which specializes in almond and other crop pollination (Card 2008).

Final colony evaluations were made from February 11 to February 13, 2008. Once again colonies were inspected frame by frame and the numbers of bees were estimated. A sample of worker bees was taken from each colony, frozen and later analyzed for the presence of *Nosema* spp. and tracheal mites. The colonies were never treated to reduce the numbers of these parasites.

For *Nosema* spp. evaluations, 50 bees from each colony were pooled and processed as described by Bourgeois *et al*. (In Preparation). Briefly, abdomens were homogenized, filtered, and DNA was subsequently extracted. DNA fragments unique to *N. ceranae* and *N. apis* were simultaneously amplified and quantified using real-time PCR. The data were converted to "spore equivalents" per bee using a calibration factor derived from direct spore counts using a compound microscope.

For tracheal mite evaluations, 30 bees from each colony were dissected as described by Lorenzen and Gary (1986). All tracheae were pulled and placed on a glass slide with double-sided tape. The tracheae were then dissected and examined microscopically for the presence of mites. The proportion of infested bees (prevalence) was calculated for each colony.

Data were standardized to correct for apiary differences. Size data were converted to changes in size (growth = February size -October size/ October size). Changes in size could be affected by hive size and feeding, so the data were analyzed by a randomized block, two-factor analysis of variance. Data from 128 colonies were analyzed. Sixteen colonies were lost owing to queen losses and storm related mishaps. A linear regression was used to determine the relationship between initial colony size and colony growth (SAS 8.2, SAS Institute 2001).

**Results**

**Experiment 1**

During the natural nectar and pollen flow from August to October colonies generally grew. Overall, colonies gained an average of 2.2 ± 0.80 (mean ± SE) frames of bees. Colonies in eight-frame hives gained about four-fold more frames of bees than colonies in 10-frame hives (Fig. 1a). Although the variance was high, statistical analysis detected that colonies in the eight-frame hive grew more ($P = 0.05$) during the natural nectar flow.

In the period during which colonies were fed (October to February), colony sizes generally declined. However, colonies in eight-frame hives that were fed lost six-fold fewer frames of bees than colonies in 8-frame hives that were not fed. Colonies in 10-frame hives that were fed lost two-fold fewerframes of bees than colonies in 10-frame hives that were not fed (Fig.1b). Owing to the large variation in the growth of colonies and small sample sizes, differences are not statistically different between either hive type

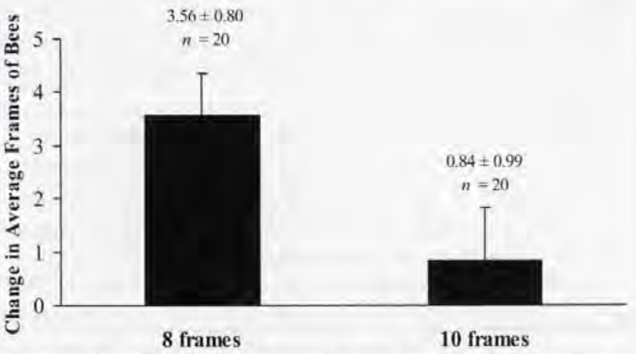


***Figure 1a**. Growth measured in frames of bees (mean ± SE) for colonies in 8-frame and 10-frame hives from August to October (P = 0.05) (Experiment 1).*

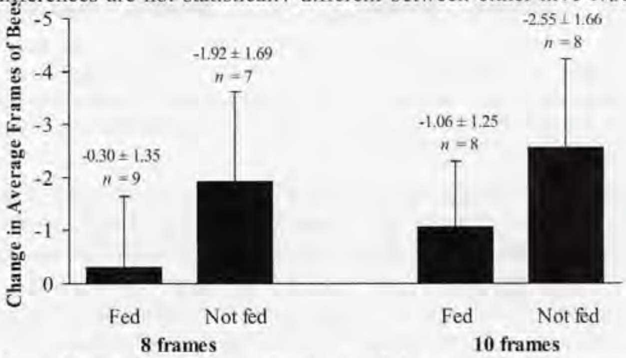


***Figure 1b**. Dwindling between October and February measured in frames of bees (mean ± SE) for colonies in 8-frame and 10-frame hives that were either fed or not fed sugar syrup and MegaBee® patties (Experiment 1).*

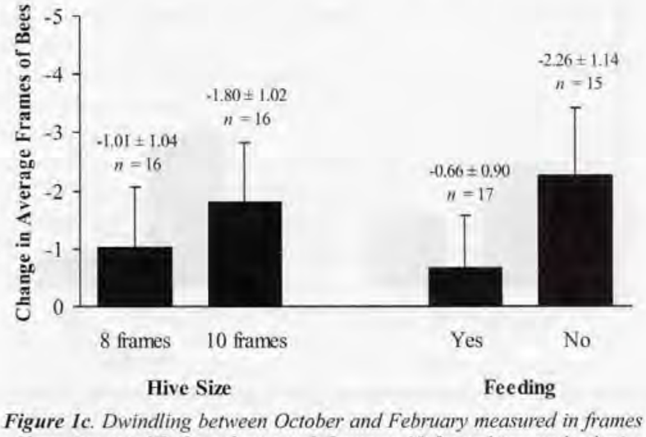


***Figure 1c**. Dwindling between October and February measured in frames of bees (mean ± SE) for colonies in 8-frame or 10-frame hives and colonies fed or not fed sugar syrup and MegaBee® patties (Experiment 1).*

**Table 1**. The sizes of colonies in February that were housed in eight-frame or 10-frame hives and either fed or not fed sucrose syrup and Megabee® protein patties for three consecutive weeks in November (Experiment 1).

| Hive Size | Fed | N | Average frames of bees ± standard error |
|---|---|---|---|
| 8 | yes | 9 | 11.6 ± 1.28 |
| | no | 7 | 10.2 ± 1.99 |
| 10 | yes | 8 | 9.84 ± 1.59 |
| | no | 8 | 9.06 ± 0.86 |

**Table 2**. The sizes of colonies in February that were housed in eight-frame or 10-frame hives and either fed or not fed sucrose syrup and Megabee® protein patties continuously from November to February (Experiment 2).

| Hive Size | Fed | N | Average frames of bees ± standard error |
|---|---|---|---|
| 8 | yes | 29 | 9.64 ± 0.72 |
| | no | 24 | 8.72 ± 0.65 |
| 10 | yes | 28 | 8.59 ± 0.79 |
| | no | 31 | 7.06 ± 0.58 |

or feeding (Fig. 1c). Despite the general dwindling in colony size, the colonies were still large in February and suitable for rental for almond pollination (Table 1).

**Experiment 2**

All colonies grew during the course of experiment 2. Colonies in eight-frame hives that were not fed increased in size by only

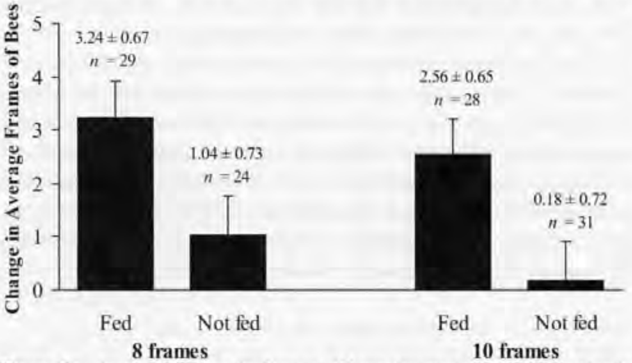


***Figure 2a**. Average change in frames of bees (mean ± SE) for colonies in 8-frame and 10-frame hives that were either fed or not fed sugar syrup and MegaBee® patties (Experiment 2).*

a third of the increase observed for colonies in eight-frame hives that were fed. Colonies in 10-frame hives that were fed increased fourteen fold more than colonies in 10 frame-hives that were not fed (Fig.2a). Although colonies in eight-frame hives grew by almost a frame of bees more than colonies in 10-frame hives (Fig. 2b) the difference was not significant. Colonies which were fed grew by 2.3 more frames of bees than colonies which were not fed ($P = 0.05$) (Fig. 2b). Although the initial average colony size in October was somewhat small (6.72 ± 0.31 frames of bees) the overall average

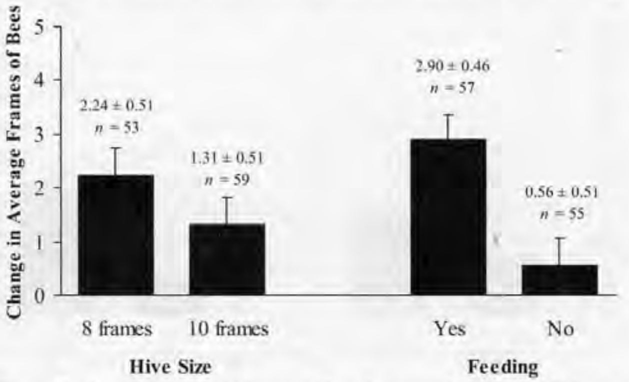


*Figure 2b. Average change in frames of bees between October and February in frames of bees (mean ± SE) for colonies in eight- frame or 10-frame hives (ns) and colonies fed or not fed sugar syrup and MegaBee® patties ($P$ = 0.05) (Experiment 2).*

colony size in February (8.47 ± 0.35 frames of bees) was suitable for rental for almond pollination. Only colonies in 10-frame hives which were not fed both syrup and Megabee® patties had hive sizes averaging less than eight frames of bees (Table 2).


***Figure 3**. Relationship between the starting size of colonies and their growth. There was a strongly negative ($r$ = -0.53) and significant ($P$ = 0.0001) relationship between the two variables. In general, smaller colonies tended to grow more.*

The analysis of the relationship between the starting size of colonies and their growth indicated a strongly negative ($r$ = -0.53) and significant ($P = 0.0001$) relationship. In general, smaller colonies tended to grow more (Fig 3).

Most colonies had no or very few tracheal mites indicating that the Russian stock retains resistance to tracheal mites. Only two colonies had high rates of infestation (100% and 97%). The colonies had sister queens.

No *N. apis* was found. However, all colonies had *N. ceranae*. The estimated average number of spores per bee in colonies ranged from 8.0 x $10^4$ to 3.1 x $10^6$ and averaged 6.4 x $10^5$ ± 0.06 x $10^5$. Twenty percent of the colonies had >1 x $10^6$ spores per bee. Analysis of variance indicated that neither hive size ($P = 0.49$) nor feeding ($P = 0.30$) was associated with differences in numbers of spores. Also, regression analysis found no relationship ($R^2 = 0.0009$) between colony growth and average numbers of *N. ceranae* spores present at the end of the test.

**Discussion**

Smaller hive size had a consistently positive effect through both experiments. This effect was most pronounced when the colonies experienced a strong autumn nectar and pollen flow in experiment 1. During that period, colonies in eight-frame hives grew 4.24 times ($P = 0.05$) more than colonies in 10-frame colonies. During the second period of experiment 1, colonies were fed only for a short period in October and November and not fed from November to

February. During this period, all colonies dwindled with colonies in 10-frame hives losing numerically more bees than colonies in eight-frame hives. In the second experiment, colonies were fed from November to February during which colonies in eight-frame hives grew more than colonies in 10-frame hives. Overall, the consistency of the results as well as a significant difference during a natural nectar and pollen flow suggest that eight-frame hives do support greater colony growth of Russian honey bees than we found in 10-frame hives.

This result should not be extrapolated to be a general recommendation for using eight-frame hives. Their use is beneficial in growing larger colonies from August to February. This observation is helpful for producing colonies suitable for almond pollination and probably is helpful for queen rearing by producing colonies likely to produce drones earlier. However, this study is restricted to the specific goal of producing larger colonies early. Eight-frame hives may not be optimum for all beekeeping goals.

These differences in growth in different sized hives occurred from August to February when temperatures range from hot through cool to cold. Taylor (Taylor *et al.* 1894) asserted that the eight-frame hive size favored better heat regulation in winter and thereby better brood nest conditions which resulted in larger colonies earlier in spring. The temperature regulation hypothesis is still reasonable if it includes more efficient cooling as well as heating. However, no study has been done to test the effect of a smaller hive on temperature regulation. Also, while many beekeepers (pers. communication) offer the opinion that colonies grow more quickly in smaller hives, especially in the spring, this is the first experimental confirmation of this favorable effect of smaller hives.

Feeding colonies also had generally favorable effects. In Experiment 1, colonies were fed only for a brief period in October-November. By February, all colonies had become smaller but colonies that were fed lost the smallest number of bees. In Experiment 2 feeding began in November and continued to February. In this experiment all colonies increased in size with the colonies which were fed becoming significantly larger. Hence, a combination of statistical significance and a consistency of trends in the two experiments support the conclusion that autumn and winter feeding produces larger colonies of Russian honey bees in February.

For Experiment 2, the analysis clearly supported the conclusion that smaller colonies tended to grow the most. Colonies in the range of five to eight frames of bees at the beginning of the experiment in October grew well and attained sizes exceeding eight frames of bees in February. Despite the effects of hive size and feeding, larger colonies grew less or dwindled slightly although most of them also exceeded eight frames of bees in February. This suggests that colonies regulate their size during autumn and winter such that it is very difficult to provide management which will increase the size of Russian colonies from large colonies to very large colonies. It further suggests that summer and autumn colony divisions that are reasonably robust can be managed to increase the numbers of colonies that will achieve a rentable size in February. However, these experiments were conducted in Louisiana where periods of moderate weather during winter permit honey bees to collect small amounts of natural pollen and nectar. Colony divisions are not likely to grow as well in areas with less favorable autumn and winter weather.

The relationship between initial colony size and colony growth suggests additional honey bee management opportunities. Smaller colonies (five to eight frames of bees) in October grew substantially and typically exceeded eight frames of bees in February. Reducing the size of very large colonies in August or September by splitting and requeening with young queens would take advantage of the tendency of smaller colonies to grow when stimulated to do so through autumn and winter. This would increase the number of colonies suitable for rental for almond pollination in February.

Results of the tracheal mite analysis indicate that Russian honey bees generally retain their resistance to tracheal mites. However, the discovery of two sister queens heading colonies with high tracheal mite infestations indicates that caution still must be maintained in the selection of Russian honey bee stock. Potential breeders must be screened for tracheal mite resistance to assure that the trait continues in high frequency in the stock.

Malone and Stefanovic (1999) found that percentage of *N. apis* infection and longevity of infected bees are not influenced by honey bee race. However, individual colonies apparently vary in resistance to *Nosema* (Rinderer, Sylvester 1978) and genetic parameters suggest that resistance to *Nosema* can be improved with selective breeding (Rinderer *et al.* 1983). The results of our *Nosema* spp. analysis contain no information to evaluate the comparative *Nosema* resistance status of Russian honey bees. Hence, Russian honey bees, like other stocks of honey bees, should be periodically surveyed for the presence of Nosema and treated as required. The variation in rates of infestation may suggest the stock has some resistance to *Nosema* that could serve as a starting place for breeding for resistance. However, this remains to be determined through more rigorous experimentation.

Although *N. apis* is reported to cause weakening of colonies during winter months (Farrar 1942), the potential negative effects of *N. ceranae* infestations on Russian honey bees remain unclear. The lack of relationship between estimated spore numbers and colony growth suggests that Russian colonies remained healthy enough to grow, despite a fifth of them having high infestations. This lack of an effect of *Nosema* infestation rates on colony growth is somewhat puzzling. It is reasonable that a higher *Nosema* infestation would retard growth of colonies by debilitating and reducing the longevity of bees. These two consequences of *Nosema* infestation should have resulted in reduced colony growth. However, since 80% of the colonies had spore count averages below the commonly accepted treatment level of $1 \times 10^6$ recommended by B. Furgala (Mussen 2009), it may be that the overall infection rates were too low for negative effects on colonies to be apparent. Also, higher spore counts may only have occurred near the end of the test. In contrast to the observations of Eischen and Graham (2008) feeding had no effect on *Nosema* levels. It may be that only a small number of bees in the general colony populations were highly infested. Or perhaps very large numbers of spores, which elevated the estimates of average per bee spore counts, only occurred in bees that had diminished individual resistance since they were near death from another cause. Nonetheless, caution suggests that *N. ceranae* infestations in Russian colonies should be presumed to be harmful. Knowledge concerning the structure of the variation of *N. ceranae* infestation within the colony and studies of the long term effects of *N. ceranae* infestation on Russian honey bees may suggest more appropriate treatment procedures.

These results may expand the range of management options for some beekeepers. The knowledge that Russian honey bee colonies can be caused to be larger in February through management may encourage some beekeepers that pollinate almonds to consider using this mite resistant stock. Both the use of eight-frame hives and feeding encourage the development of larger colonies for almond pollination. This is likely to be true for all stocks of honey bees. In our experiments both eight-frame hives and feeding, especially prolonged and continual feeding, each produced an additional one to two frames of bees in February. These increases in average colony size probably would result in a higher proportion of colonies being large enough to rent for almond pollination and a larger average size for colonies that are rented.

**Conclusions and Recommendations**

Russian honey bee colonies can be managed through autumn and winter to produce colonies which average 8 frames or more of bees in February.

Colonies kept in eight-frame hives grow larger than colonies kept in 10 -frame hives through autumn and winter.

Colonies that are fed both sucrose syrup and protein supplement grow larger through autumn and winter with prolonged and continual feeding being especially favorable.

Small colonies (five to eight frames of bees) tend to grow more during autumn and winter than larger colonies.

Tracheal mite infestations in Russian honey bee colonies are of little concern. However, Russian colonies can have high infestations of *N. ceranae*. Surveys of *Nosema* infestation levels to guide treatment decisions are recommended.

Every successful change in beekeeping procedures requires learning and refinements by individual beekeepers. Beekeepers interested in changing their methods to include Russian honey bees, eight-frame hives or different feeding regimes should first attempt to make changes in one or a few apiaries. This will provide both an opportunity to evaluate the usefulness of changes in individual beekeeping enterprises and the experience needed to perfect and adapt the changes to specific environments.

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# A Simplified Technique Using Microsoft Paint for Counting Cell Numbers in Honey Bee and Stingless Bee Colonies

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**Running Title**: Counting bee cells using Microsoft Paint

**Key Words**: MS Paint / *Apis mellifera*/*Apis cerana*/*Lepidotrigona doipaensis*/Bee frame

One of the most important ecological aspects of honey bee colony structure and composition is the number of the occupied cells utilized for brood (eggs, larvae, pupae), and food stores (nectar/honey and pollen). The ability to accurately count the number of occupied cells can provide essential data that relate to colony health and population demography. Earlier literature describing procedures for population estimates of adult and/or brood involves laborious procedures that often require invasive techniques that would be time consuming and could destroy or seriously disturb the whole colony (e.g., Nolan, 1925; Seeley and Morse, 1976; Rogers *et al.*, 1983; Burgett and Burikam, 1985). Here we present a unique technique utilizing a free and commonly used software program in Microsoft Windows Operating System; Microsoft Paint or MS Paint, that results in population counts that are highly accurate, relatively non-invasive and frugal in time.

MS Paint is a graphics program that is included in almost all versions of MS Windows. Because of its simplicity to use, MS Paint has been wildly applied to many basic artistic applications. Rarely has this program been used for biological applications since other advanced graphic programs such as Adobe Photoshop, can provide more sophisticated tools to help the illustrators in preparing their

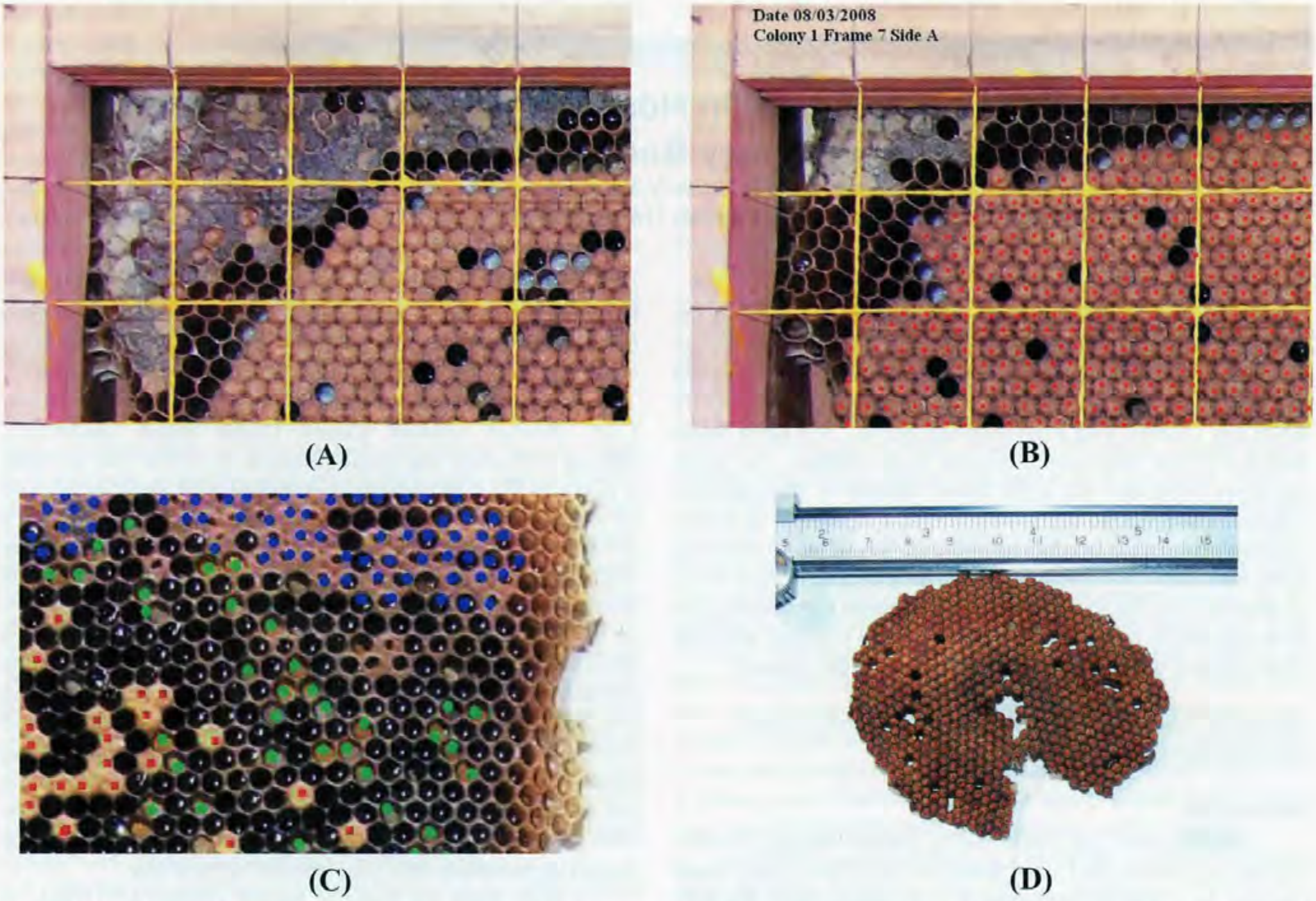


**Figure 1** (A) *Apis mellifera* brood frame with brood grid (B) *A. mellifera* brood frame displaying counted sealed brood cells (marked with red dots) (C) Natural frame of *A. cerana* (red dots indicate sealed brood, green dots indicate pollen cells, and blue dots indicate capped honey/nectar cells) (D) Brood comb of *Lepidotrigona doipaensis*

desired images. MS Paint can open and save files *e.g.*, bitmap, GIF, JPEG, PNG, and TIFF, which are standard file formats that can be found in other more advanced graphic programs. In our study, we use MS Paint version 5.1 (2006) running on the MS Windows XP platform.

A digital camera (FUJI FinePix S5600) was used to photograph *Apis mellifera* and *A. cerana* and *Lepidotrigona doipaensis* brood combs. We experimented with different camera resolutions to find that which gives an optimal quality image. We found that by using at least a five mega pixels resolution, even the small brood cells of stingless bee brood combs (Figure 1D), are easily resolved. The captured pictures are then imported to the computer. Once imported, the digitized images are viewed in MS Paint (we use the JPEG picture format for faster processing time). Using the "Brush" command and selecting an icon of a circular dot then we select the paint color (in our case we use red for sealed brood, blue for capped honey/nectar cells, and green for pollen cells [Figure 1]). When viewing an individual cell, a "left-click" places a colored dot on the cell, while simultaneously using a hand counter to tally the number of marked cells. The dots signify counted cells and therefore provide a permanent visual image that eliminates double counting cells, or missing (skipping) a cell.

We have used this computer aided counting method to accurately record the number of brood cells in *Apis mellifera*, *A. cerana*, and *Lepidotrigona doipaensis* colonies (Figure 1). For *A. mellifera* this system can be used with both standard Langstroth and natural combs.

Recently, an analogous method using free software called Pixcavatar to estimate number of sealed brood, was published online (Saveliev, 2009). This method uses an indirect approximation of sealed brood cell numbers based on the measurement of cell area. The accuracy of the Pixcavatar for cell number estimation putatively has an error rate of only 1%. However, with the use of MS Paint, we can count the exact number of occupied cells more precisely. The only disadvantage for using MS Paint for cell counts, compared to the measuring method using Pixcavatar, is time consumption. Our digitized imaging, computer-assisted method is probably more time consuming, however, the results are highly accurate.

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# Trapping Small Hive Beetle In Honey Supers & Brood Chambers of Honey Bee Colonies

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**Summary**

To develop an effective, safe, and user-friendly trap for the small hive beetle, *Aethina tumida* (Murray), the vertical distribution of this pest within a honey bee, *Apis mellifera,* colony was examined by observation sampling and trapping in the top and bottom of honey bee colonies over a seven-month period. Two Hood beetle traps per colony were used to monitor beetle numbers, one in the top honey super and one in the brood chamber of 25 honey bee colonies. There was no significant difference in number of beetles captured between the two trap locations for any of the 10 sampling dates. Most small hive beetle traps that have been developed focus on trapping near the hive floor. Our data suggests that trapping can be as effective in honey supers above the brood chamber, although slight seasonal differences in trapping effectiveness occurred.

**Keywords:** Apis mellifera, Aethina tumida (Murray), beetle sampling, pest control

**Introduction**

Since the small hive beetle (SHB), *Aethina tumida* (Murray), was first collected in the United States in Charleston County, South Carolina, by a hobbyist beekeeper in 1996 (Hood 2004), the SHB has spread over much of the United States, and has the potential to become a serious pest in many beekeeping operations. The SHB has been documented in the southeastern United States to affect even strong honey bee colonies (Hood 2004). To combat this new honey bee pest, various traps have been developed with no convenient device found (Hood and Miller 2005). Although several SHB traps have been developed, few have been field-tested and compared.

One control technique using a 10% Coumaphos strip (Bayer Corp, Shawnee Mission, Kansas, United States) significantly reduced SHB adults and larvae (Elzen et. al. 1999). The trap used a 15x15cm piece of corrugated cardboard with one side stripped off exposing the corrugations. It was positioned on the rear-floor of the bottom board, creating a dark environment attractive to the SHB adults and larvae. A 10% Coumaphos strip was stapled to the corrugated side of the cardboard and placed Coumaphos side down on the hive floor in the rear of the colony. The trap was stapled down to prevent bees from removing it. This method proved to be effective in killing both larvae and adult SHB, with one trial having a 94.2% mortality rate. However, the use of insecticides around and within honey bee colonies should be used as a last resort and non pesticide methods are preferred. When using insecticides, there is risk of honey and wax contamination, beekeeper exposure to the toxic material, risk to bee health, and possible development of insecticide resistance following repeated applications.

A study using the pesticide fipronil (300mg $L^{-1}$; 1.5mL of REGENT® 200SC $L^{-1}$ of water), housed in a plastic harborage trap, reduced the mean adult beetle numbers in infested honey bee hives by 96% and caused an estimated 62% overall beetle mortality

(Levot 2008). Fipronil is not registered for use within honey bee colonies at this time; however, this study showed that within the confines of the plastic harborage trap, the mean fipronil residues found in honey after one month of treatment did not exceed 1 $\mu g\ kg^{-1}$ and no ill effects to honey bee health were reported. The harborage device was constructed from two plastic halves that snap together holding the fipronil treated cardboard, and placed on the bottom board of a bee hive. The plastic harborage had a slit large enough for SHB to enter while excluding honey bees. SHB sought refuge within the harborage where they come in contact with a lethal dose of fipronil.

Various materials have been tested for effectiveness in attracting the SHB into traps (Hood and Miller 2003). These materials consist of alcohol, beer, ethylene glycol, mineral oil, honey, and cider vinegar. A plastic reservoir box trap was attached to a solid bottom bar of a brood frame, using two screws. The results showed cider vinegar as the most attractive and mineral oil as the most lethal. An improved three reservoir plastic trap, the Hood beetle trap, was developed and uses cider vinegar as an attractant and mineral oil as a killing agent (Nolan and Hood 2008). Vinegar and mineral oil were placed in the middle and side reservoirs, respectively. Beetles were lured into the trap, encountered the mineral oil, and could not escape through the lid opening.

The Hood trap has also been baited with a pollen/honey mixture inoculated with the yeast *Kodamaea ohmeri* (NRRL Y-30722), which is derived from the SHB (Torto *et al.* 2007a);(Nolan and Hood 2008). While this trap does not completely eliminate SHB from a colony, it may help maintain the beetle population below an economic threshold.

A trap developed from a modified bottom board significantly reduced the number of SHB found within honey bee colonies (Torto *et al.* 2007b). This trap required a hole be cut in the hive bottom with the trap fitted to a container under the hive. The trap was baited with the yeast *Kodamaea ohmeri* (NRRL Y-30722). This study also compared beetles caught in the hive-bottom trap versus a different trap located in an empty top honey super. Eight colonies per apiary were selected for testing, four colonies with the bottom-style trap and four colonies with the top honey super trap. The bottom trap captured significantly more SHBs than did the top trap.

Hive entrance modifications have also been studied as a possible SHB control method, trapping SHB larvae within the hive and preventing their exit from the hive to pupate in the soil. Upper hive entrances consisting of 2 cm-i.d. PVC pipe, placed 7.6-10.2 cm above the bottom board in place of a regular hive entrance, have been developed and tested (Ellis et al. 2002). While SHB numbers decreased using the PVC pipe entrance, the colonies had lower brood numbers, along with a buildup of water and debris within the hive that negated the positive effects of lower SHB numbers. Attempting to alleviate the buildup of this debris caused by the PVC entrance, a separate study using screened bottom boards was conducted (Ellis et al. 2003). Results showed that even with screened bottom boards there were still more negative side effects from the PVC pipe entrance. A long-term study was also conducted using 3.5 cm-i.d. PVC pipe positioned 20 cm above the hive bottom (Hood and Miller 2005). This study confirmed a reduction of brood numbers for colonies with the upper hive entrance.

The present study used the Hood beetle trap as a SHB control device, by placement of one trap in the top-most super and another in the brood chamber. A comparison was made of captured beetle numbers from top honey super traps versus brood chamber traps. Our hypothesis was that more adult beetles would occur in the bottom of a colony where food resources are more abundant and available for beetle reproduction.

**Materials and Methods**

Five apiaries were established between 31 March and 2 April 2007. Apiaries were located in the Clemson Experimental Forest in Pickens and Oconee Counties, South Carolina, United States. Apiaries were spaced approximately 2.4 km apart and consisted of five honey bee test colonies. All apiaries were in partial shade. Each colony was started from 0.9-kg (2-lb) packages of honey bees and a mated queen (Wilbanks Apiaries, Claxton, Georgia, United States). Colonies were housed in a 10-frame Langstroth beehive with a honey super. Colonies in each apiary were spaced approximately 0.76 meters apart in a strait line, with each colony facing the same cardinal direction. Although natural SHB immigration likely occurred from nearby apiaries, 150 lab-reared beetles were released into the two end colonies and middle colony, for a total of 450 beetles added to each apiary. The SHB were introduced on 3 May for two apiaries and on 4 May for the other three apiaries. Beetles were introduced on the top bars of the upper-most honey super and covered with an inner cover to prevent beetle escape. The additional beetles in each apiary increased the likelihood of beetles trapped.

On 1 May, Hood beetle traps (Brushy Mountain Bee Farm Inc., Moravian Falls, North Carolina, United States), were randomly installed in all 25 colonies in either the first or tenth frame position of each brood chamber and top honey super. The Hood beetle trap was attached to the bottom bar of new frames with two pan-head sheet metal screws (#6 x 12.7mm). The Hood beetle trap was a plastic box with three separate compartments. The middle compartment was filled to 80 percent capacity with attractant, cider vinegar (White House®, National Fruit Product Co., INC. Winchester, United States). The outer two compartments were filled to 40 percent capacity with mineral oil, used as a killing agent (Mineral Oil, U.S.P., packaged by: Cumberland Swan Smyrna, Tennessee, United States).

Each colony was serviced on 15 May, 1 June, 15 June, 6 July, 27 July, 17 August, 7 September, 28 September, 29 October, and 19 November. During servicing, traps were replaced with traps containing fresh attractant and mineral oil. Colony strength was determined by counting the number of 25 $cm^2$ of capped brood. Each brood chamber frame was examined for capped brood, using a sheet of Plexiglas (DOW®, Midland, Michigan, United States), scribed with 25 $cm^2$ placed over each side of the frame. Each 25 $cm^2$ of brood was counted as one unit of brood. The total number of brood units was used to estimate colony strength. Adult beetles were counted from two areas of each colony. The inner cover was carefully removed and turned over to expose beetles on the bottom side. Only beetles on the bottom of the inner cover were counted. The inner covers were gently bounced two times on the hive to initiate SHB movement. Next, five adjacent frames from one side of the brood chamber were removed. The number of adult beetles counted on the bottom board and the three exposed walls of the interior sides of the brood chamber were added together for a second count. The inner cover and brood chamber beetle counts were used for beetle population comparison within the hive.

Data were analyzed based on a model for a randomized block with repeated measures. Analysis of variance (ANOVA) was used to determine significance of trap location, beetle sampling location, and sampling dates. Means were separated with Fishers least significant difference test, with $P \leq 0.05$ considered significant. Correlations were done using Pearson correlation coefficients, with

P> 0.05. All analyses were conducted using the software package SAS (SAS Institute 1992).

**Results**

There was no overall significant difference in number of SHB captured in traps in the top honey super and those in the brood chamber during the seven-month investigation (Figure 1). While no significant differences were observed, more beetles were caught consistently in the super traps during late summer through early fall, where as more beetles were caught in the brood chamber traps during early to mid-summer. Over the seven-month study a total of 12,705 SHB were trapped in the top honey super and 12,505 beetles were trapped in the brood chamber. Figure 2 compares the mean number of beetles counted under the inner cover and the mean number of beetles counted in the brood chamber. Significant differences were found between all sampling dates except 1 June, 17 August, 7 September, and 19 November (Figure 2). Between 15 May and 28 September, average colony strength fluctuated between a high of 160 cm² and a low of 96 cm². Following 28 September, brood numbers decreased to a low of 11 cm² on 19 November. No correlations were found between the number of SHB sampled from the inner cover and SHB trapped in the top honey super (Pearson's correlation R=0.04, n=50, P>0.05). Brood chamber SHB sampling numbers and number of beetles trapped in brood chamber also showed no correlations (Pearson's correlation R=0.14, n=50, P>0.05).

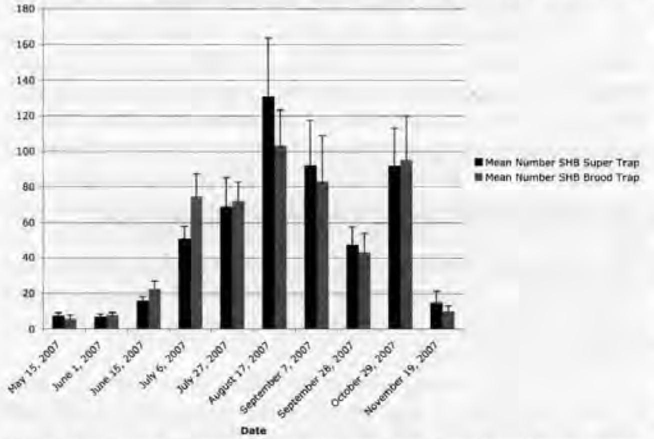


***Figure 1****. Mean number of SHB adults caught in Hood beetle traps during 10 sampling periods in Oconee and Pickens County, South Carolina, May-November 2007. No significant differences were found over the seven-month trapping investigation (P>0.05).*

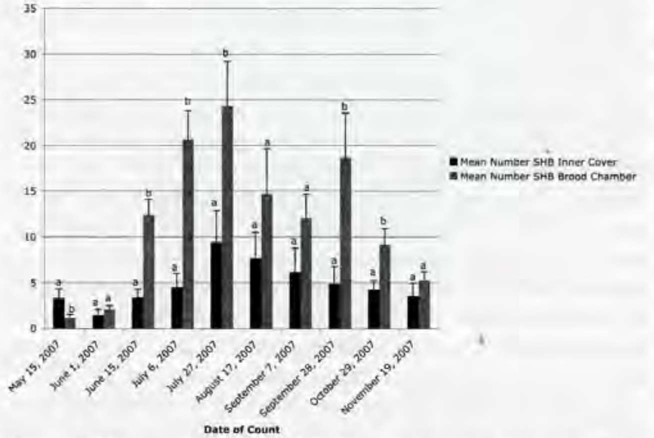


***Figure 2****. Mean number of SHB adults from inner cover and brood chamber over 10 sampling periods in Oconee and Pickens County, South Carolina, May-November 2007. Significant differences (P<0.05), observed on all dates excluding 1 June, 17 August, 7 September and 19 November; means followed by the same letter are not different.*

**Discussion**

Trapping data showed no significant difference between trapped SHB numbers in the top-most super and in the brood chamber. This information can be applied when developing a trapping system for this pest. Torto *et al.* 2007b found that a trap in the bottom of a honey bee colony caught significantly more beetles than a trap in the upper regions of the hive during four-week and seven-week trials. However, having different trap designs for the top and bottom traps may explain the discrepancy between their results and our investigation. Our study used identical traps in the top honey super and brood chamber. Our research suggests that trapping SHB in the upper area of a honey bee colony is as effective as trapping in the brood chamber when using the Hood beetle trap with cider vinegar as an attractant and mineral oil as the lethal agent. In addition to being equally effective, the convenience of servicing traps in the top-most honey super, when compared with the brood chamber, should be considered. To maximize the number of SHB removed from a colony, a beekeeper is advised to place traps in both the top and bottom of a hive.

Counting beetles under the inner cover and in the brood chamber suggested an increase in beetle numbers as the season progressed until 27 July when the maximum number of beetles was recorded (Figure 2). After 27 July, both the inner cover and brood chamber sampling numbers began to decrease, suggesting a decline in the SHB adult population. However, in the brood chamber sample on 28 September, there was an increase in beetles. This increase in number of beetles occurred one sampling date before the drastic increase in both super trap and brood chamber trap numbers on 29 October (Figure 1). While the number of beetles counted under the inner cover was consistently lower than the number of beetles counted in the brood chamber throughout the study, the inner cover did not have the large increase in beetle numbers on 28 September that occurred in the brood chamber. The trapping increase could be explained partially by the extra week the traps were allowed to remain in the colonies between 28 September and 29 October. The previous four samplings were conducted at 21-day intervals while the time between 28 September and 29 October date was 28 days. While this is one possible explanation for the increase in trapping numbers, it does not explain the increase in beetle numbers in the brood chamber on 28 September, or the reason for the inner cover beetle count to remain low. One possible explanation could be a single colony outlier. Colony number 20 had a count of 65 beetles in the brood chamber for 28 September. With this colony removed from the average, the mean number of beetles in the brood chamber drops from a mean of 15 beetles to a mean of 13. With this decrease, beetle numbers were similar to the data collected in another study in 2006 (Nolan and Hood 2008). Inner cover and brood chamber SHB counts from our present study (Figure 2), and from a similar study in 2006 (Nolan and Hood 2008), allows for a two-year comparison of beetle population growth rate. Both studies were performed over seven months and in the same general location. They showed a pattern of adult beetle population increase until the end of July and then a steady decline into fall. The mean number of SHB sampled from the brood chamber is significantly greater than that from the inner cover on all sampling dates except 1 June and 7 September. Greater beetle numbers sampled from the brood chamber is somewhat misleading, as the surface area counted in the brood chamber is larger than that of the inner cover.

Colonies showed a normal build-up of brood throughout the summer and reduction of brood in fall and winter. As colony strength increased, beetle numbers also increased as observed from this study and a previous investigation (Nolan and Hood 2008). While SHB population increased over the summer months, only two test colonies died during the study, however, the minimum colony losses could not be conclusively linked to SHB pressure. Trapping in both the bottom and top of the colonies may have contributed to the high survival rate (92%).

Apiary location was considered as a possible variable in beetle numbers and colony strength. Care was taken to select locations with similar sun and shade; however, other factors not realized might have played a role in both beetle and honey bee colony survivorship. Regardless of the unrealized differences in apiary location, the results show that beetle numbers and colony strength were similar in all five apiaries. This result is based on similar sun and shade exposure, similar colony strength measured in 25cm$^2$ brood units, and similar existing beetle populations. Individual colonies did have different beetle numbers; however, the mechanism by which beetles "choose" one colony over another still needs to be investigated.

**Conclusion and Recommendations**

Our results support the practice of trapping small hive beetles in honey supers. Traps placed in the top honey super preformed equally to traps placed in the brood chamber. By trapping in the top honey super beekeepers can avoid damaging the queen and the lifting of heavy honey supers. Several traps are available for purchase that can be utilized in the top honey supers, as well as the brood chamber, including the Hood beetle trap used in this study. While trapping small hive beetles is one method of beetle control it is best used as part of an IPM program. Tapping will not eliminate small hive beetles from a colony but can decrease the population to below a critical level. The best method for small hive beetle control is to maintain strong healthy colonies by using good beekeeping practices.

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# Hygienic responses to Varroa destructor by commercial and feral honey bees from the Big Island of Hawaii before exposure to mites

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**Summary**

The important honey bee queen production industry on the Big Island of Hawaii is threatened by the recent discovery of *Varroa destructor* on the island. We tested the pre-exposure level of resistance to mites of three sources of commercial Hawaiian bees and feral Hawaiian bees based on their expression of varroa sensitive hygiene (VSH), i.e., the removal of mite infested brood. Experimental colonies were started in Baton Rouge, LA, from local mite infested bees and test queens from Hawaii. We included reference groups of bees with high VSH, and mite susceptible bees. After worker populations represented the test queens, we added a comb of mite infested brood to each colony for one week and measured the subsequent change in infestation resulting from hygiene. Colonies started from commercial and feral Hawaiian queens hygienically removed similar amounts (33-45% on average per source) of mite infested brood in one week. These responses were numerically intermediate between those of the resistant VSH bees (91% removal) and the susceptible bees (9% removal). There was large colony-to-colony variation within each commercial and feral source. We also measured the mite population growth in colonies during nine weeks. Mite population growth did not differ among the sources although it ranged from -51% for VSH bees to -11 to +53% for the other types. The results indicate that existing commercial and feral Hawaiian bees have some resistance to *V. destructor* based on hygienic response to mite infested brood. This response in commercial stock probably is derived from selection for general hygiene and from importations of germplasm from the U.S. mainland. The variable response of individual colonies suggests that resistance could be improved by testing and selection within the existing Hawaiian bee population.

**Keywords:** *Apis mellifera*, mite resistance, varroa sensitive hygiene, VSH, bee breeding

**Introduction**

Hawaii supports an important honey bee (*Apis mellifera*) queen rearing industry that produces more than 250,000 queens annually. The parasitic mite *Varroa destructor* only recently was discovered on the Big Island of Hawaii (August 2008) but is expected to soon threaten the bees used for queen production. Mites were found on the eastern side of the island, away from the three queen production operations on the western side. We sought to gauge the potential impact of *V. destructor* on managed colonies used for queen production when the mite population expands to the west. Commercially produced queens in Hawaii are propagated from a variety of breeder sources, most of which have been selected for hygienic response to freeze-killed brood. Such selection for general hygiene improves resistance to *V. destructor* (Spivak and Reuter 2001). Information about the relative mite resistance of the island's bees, even before the bees experience direct selection pressure from the mite, could help guide beekeeper decisions about strategies for managing mites and what breeding sources to use for queen production. Simple variation in response to *V. destructor* among existing colonies would suggest that there is an opportunity to select for improved mite resistance.

The extensive population of feral honey bees on Hawaii could impact the dynamics of infestation there. These bees may be descended largely from bees that survived the extensive colony mortality caused by American foulbrood disease that occurred in the islands beginning about 1930 (Roddy and Arita-Tsutsumi 1997, Eckert 1950). The existing feral population may have hygiene that was enhanced by this selection event. Hygiene against brood diseases also affords some resistance to *V. destructor* (Spivak 1996).

We tested commercial and feral bees of Hawaii for their hygienic response to *V. destructor* when colonies are challenged with mite infested brood. We routinely make such measurements as part of a breeding program that is focused on enhancing varroa sensitive hygiene (VSH), a well-characterized mechanism that confers significant mite resistance (Harbo and Harris 2005, Villa et al. 2009). In colonies with bees expressing high VSH, mite infested pupae are removed and there is poor fecundity of remaining mites; mite populations therefore tend to decline or grow only slowly. Our measures of VSH should serve to show the status of, and potential for, one means of resistance to *V. destructor* mites in Hawaiian bees.

**Materials and Methods**

Thirty-two colonies were made by dividing colonies infested with *V. destructor* at Baton Rouge, LA in late April 2009. Each colony was started with three to four combs having adhering bees, unsealed brood, honey, pollen and empty cells. Colonies were in single story, 10-frame standard hives. Small hive beetles, *Aethina tumida*, were managed by placing a treatment station (half of a coumaphos [CheckMite®; Mann Lake, Hackensack, MN] strip under a piece of corrugated plastic) on the bottom board for the first week after colonies were established. The density of *V. destructor* was measured on samples of adult bees (324 ± 89 [std. dev.] bees per colony), and then colonies were assigned to six treatment groups (queen sources) that had similar average mite density (8.7 ± 0.3 mites per 100 bees). Each of the three commercial sources (Hawaiian Queen Co., Kona Queen Co. and Olivarez Honey Bees) and the feral Hawaiian population were represented by six queens. Two reference types, mite resistant VSH and a mite susceptible control, were represented by four queens each. Feral queens were captured by Hawaii Department of Agriculture (HDOA) personnel from colonies in swarm traps around Hilo, HI, within the three weeks prior to the test. These queens produced colonies of dark bees that often were nervous on the combs. VSH queens were pure VSH from our breeding program. The susceptible queens were purchased from a commercial, U.S. mainland source whose bees in previous testing showed relatively little resistance to *V. destructor* (unpub. obs.). For nine weeks, empty combs were added to the colonies as needed. Queens that failed were replaced with queens of the same type when possible. Data from commercial sources are reported anonymously.

VSH activity was evaluated in each colony 10 weeks after the test was set up (when all bees were from the resident queen). Mite infestation was measured in a brood comb from a donor colony (not in the test), and then the comb was inserted into the broodnest of a test colony. The comb was retrieved after one week and mite infestation was measured again in bees of the same age cohort. We measured initial infestation in 150 cells containing larvae, prepupae or white-eyed pupae; beginning infestation was 14.4 ± 4.4%. We measured final infestation in 200 cells containing bees that ranged from purple-eyed, tan-bodied pupae to pre-emergent adults. The percentage removal of infested brood was calculated as ([initial infestation – final infestation] / initial infestation)*100.

We also estimated the mite population growth for colonies that still had original queens nine weeks after the test was started ($n$ = 5-6 for commercial and feral bees, and $n$ = 2 for susceptible and VSH bees). The initial mite population of each colony in April was calculated from the total weight of adult bees (measuring hives with bees and then after removing bees) and the mite density in a sample of bees (66.7 ± 10.1 g). After nine weeks, we repeated the calculation of mites on adult bees, and also calculated mites in brood based on a measurement of the total area of sealed brood per colony and infestation in a sample of 200 cells of sealed brood. The percentage change in the mite population was calculated as ([final population – initial population] / initial population)*100.

Effects of queen types on response variables were made with analysis of variance (PROC MIXED; SAS Institute 2000) after verifying normality and homogeneity of variances between queen types. Means separation was based on $t$-tests of least square means. Pearson's correlation (PROC CORR) was used to assess linear relationships between variables.

**Results**

Colonies of the various queen sources differed in their expression of VSH ($P < 0.001$). Hawaiian commercial and feral colonies hygienically removed similar amounts of mite infested brood within one week ($P$ = 0.433 – 0.932 for pairwise

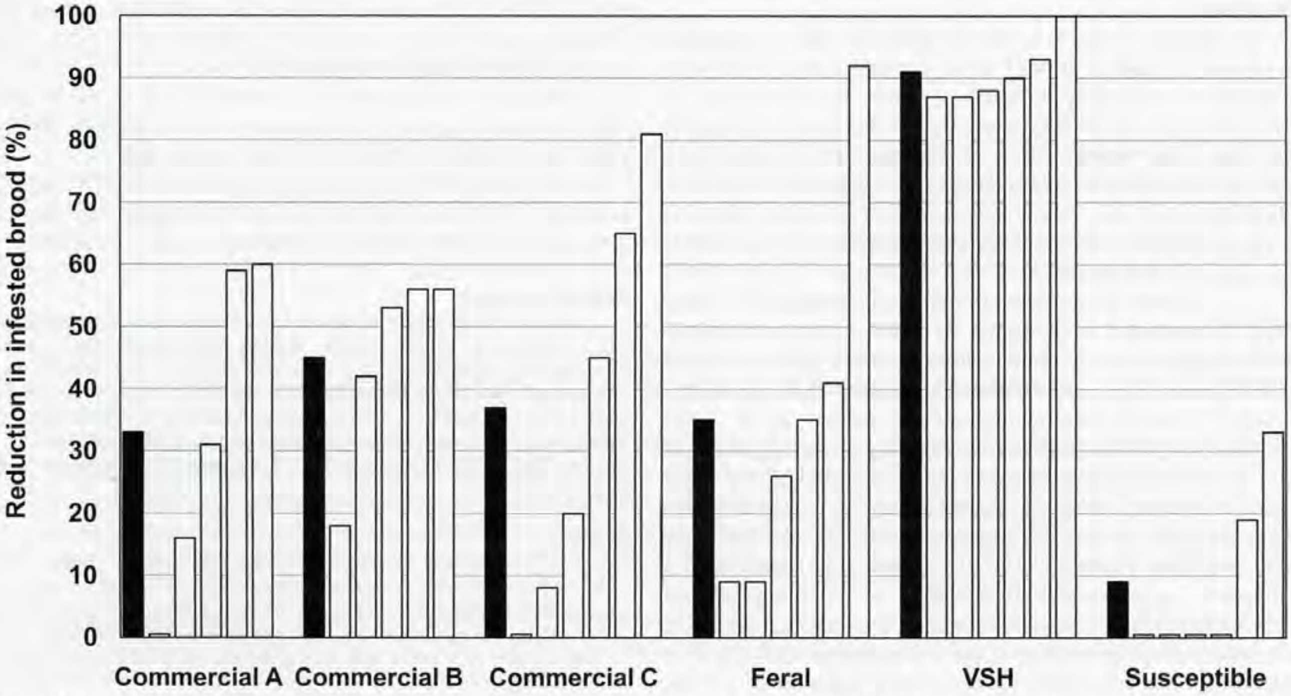


***Figure 1.*** *Decrease in infestation of V. destructor in brood after a 1-week exposure in test colonies. Black bars are the average response of each queen source. White bars are data for individual colonies, arranged in ascending order within each queen source.*

comparisons), with averages of 33-45% removal per group (Figure 1). These responses were numerically intermediate between those of the resistant VSH (91% removal) and the susceptible control (9% removal). Commercial source B removed significantly more mites than the susceptible control ($P = 0.020$). Responses of the two other commercial sources and the feral bees trended toward greater removal than the susceptible control but did not differ significantly ($P$ = 0.059 - 0.112) from it. There was large colony-to-colony variation within each of the commercial and feral sources. Pure VSH colonies removed significantly more mite infested pupae than all other bee types did ($P$ <0.001 - 0.005).

Mite population growth during nine weeks did not differ among the queen sources ($P = 0.683$) (Figure 2) and was quite variable among colonies. On average, mite populations declined by 51% in VSH colonies and either declined slightly (-11 to -16%) or increased (31 to 53%) in the other groups. Mite population growth was related inversely to removal of infested brood ($r = -0.411$, $n = 27$, $P = 0.033$).

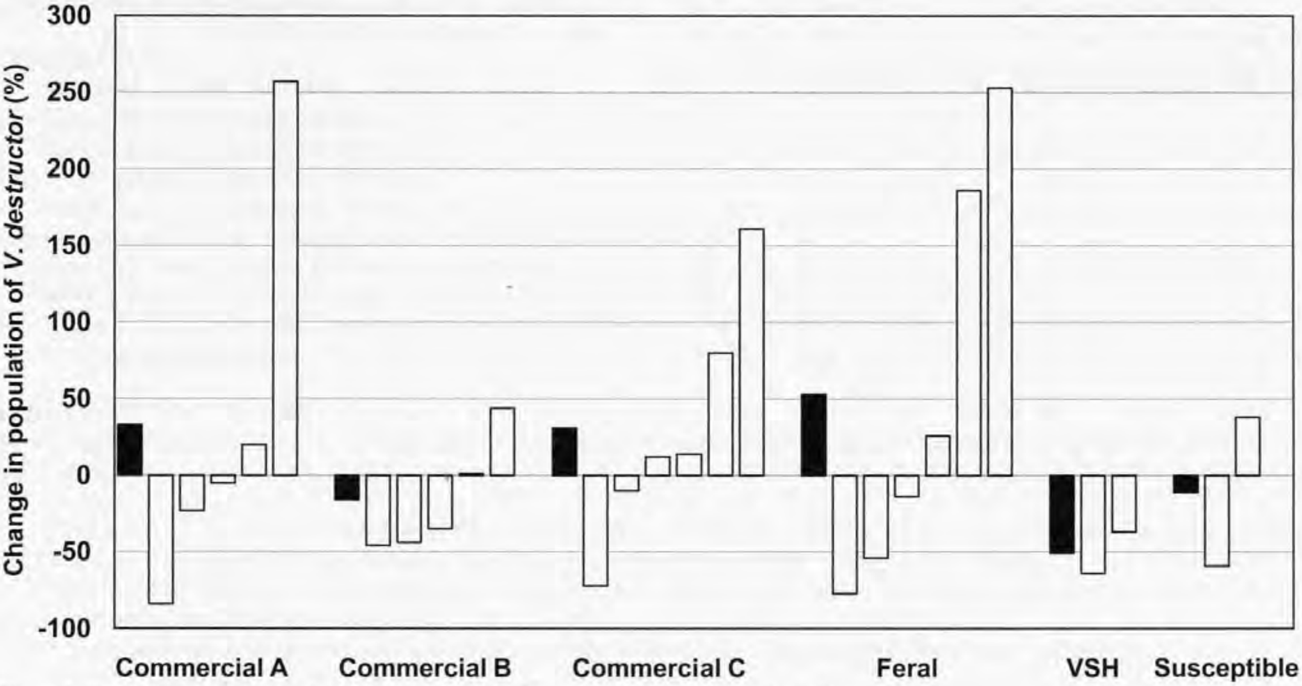


***Figure 2.*** *Change in populations of V. destructor during the nine-week test. Data arranged as in Figure 1.*

**Discussion**

Commercial honey bees used for large-scale queen production in Hawaii in general showed some resistance to *V. destructor* (relative to a susceptible stock of commercial bees from the U.S. mainland), even though these bees from the Big Island have not yet been exposed to the mite. This resistance presumably comes from ongoing selection by the queen breeders for hygiene toward freeze-killed brood, and from annual importations of germplasm (semen) of mainland bees that have more resistance than the susceptible stock we used as a reference.

The variation in responses of individual commercial colonies could be exploited in breeding for mite resistance. Reliably identifying the most resistant colonies would require a supply of mite infested bees and the ability to monitor mite infestations or test for specific traits of resistance. A faster route to useful resistance may be to breed with germplasm of existing resistant bees. A first generation hybrid of a Hawaiian commercial X VSH cross, for example, would be expected to improve resistance by 50-100% above the level in the commercial sources, based on prior performance of outcrossed VSH bees (Harbo and Harris 2001). Subsequent generations of backcrossing to VSH bees should achieve even greater resistance. The goals of breeding, whether or not it involves incorporating resistant-bee germplasm, should be to obtain resistance while retaining the desirable characteristics of the bees currently produced in Hawaii.

Feral Hawaiian bees responded to *V. destructor* about the same as the commercial bees did, and therefore do not appear to offer an immediate source of mite resistant breeding material. The mechanism of resistance in the feral bees is unknown. If these bees have a resistance mechanism other than that found in the commercial bees, some feral bees might be beneficial breeding sources. We only monitored expression of VSH based resistance to *V. destructor*, but other mechanisms of resistance occur (Spivak and Boecking 2001).

**Conclusions and Recommendations**

1. Honey bees representing the current commercial and feral bee populations of Hawaii were somewhat resistant to *V. destructor* as judged by hygienic response to mite infested brood. They were more responsive than those of a known susceptible stock from the U.S. mainland but less responsive than those of resistant bees with the trait of varroa sensitive hygiene (VSH).

2. Responses among individual commercial Hawaiian colonies were variable, suggesting that resistance could be improved by testing and selection within the existing bee population.

3. Breeding by incorporating germplasm of highly resistant bees (e.g., VSH) may improve resistance more quickly than by selecting only from within the existing bee population of Hawaii.

**Acknowledgments**

Technical assistance was provided by Garrett Dodds, David Dodge, Victor Rainey and Daniel Winfrey (USDA-ARS). Commercial queens were supplied by Michael Krones (Hawaiian Queen Co.), Russel and Ray Olivarez (Olivarez Honey Bees) and Gus Rouse (Kona Queen Co.). Feral queens were supplied by L. Michael Klungness, Maria Diaz (University of Hawaii) and Pat Conant (HDOA). Lilia de Guzman (USDA-ARS) and Eric Mussen (University of California, Davis) suggested improvements to the manuscript.

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# Science of Bee Culture
## Supplementing *Bee Culture* Magazine

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All submissions to the journal undergo review by editors and independent peer referees. Papers are accepted for publication only if they concern research on applied bee culture, meet scientific and writing standards and have not been published elsewhere.

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Papers should be organized as follows: Title, Authors, Authors' Affiliation, Summary, Keywords (six maximum; none from the title), Introduction, Materials and Methods, Results, Discussion, Conclusion and Recommendations, Acknowledgments, References, short title, figure legends.

Papers must be written in clear, concise English. First person active voice is preferred. Minimally, the Summary, Introduction, Discussion, and Conclusion and Recommendations sections must avoid excessive scientific terminology and be understandable to non-scientists. Scientific complexities of experimental design, statistical evaluations and interpretation should appear only in Material and Methods and Results sections and provide sufficient information for experiments to be repeated. Broader interpretation of findings should appear in the Discussion section. The text of each paper should end with a short set of "Conclusions and Recommendations" that can be used by practicing beekeepers to apply research results.

The full scientific name for a species is required at its first mention in the body of the paper. Titles will use common names for widely recognized organisms. Units of measure should be English, followed by Metric in parentheses.The Summary should be 250 words maximum and free of technical terms.

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Do not embed tables or figures within the text file. Submit each table and figure as a separate file. A list of figure legends should be given at the end of the text file. For tables: DO NOT USE MS WORD TABLE FORMAT. Do not include lines, colors or shaded areas. Use tabs to set columns, and use line spacing to set rows. Save each table individually as a pdf file, named according to its number in the manuscript (e.g., "table1.pdf").

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These sections are for brief research reports or constructive comments about other research papers. They should not be longer than 1000 words (including references) with no more than one table or figure and 10 references. They should include Keywords, but not section headings. Notes will be reviewed in the same way as papers.

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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

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

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# Managed Pollinator CAP
## Coordinated Agricultural Project

# Honey Bee Medical Records

Marla **Spivak**

Why are so many honey bee colonies dying across the U.S.? Wouldn't it be great if we could download medical records for every honey bee colony that died over the last 25 years, or even the last four years, to piece together the primary factors or patterns of factors that correspond with colony death?

Thanks to funding from the USDA-CAP project, a number of researchers are compiling the first of four years worth of medical records on 420 colonies located across seven states. Our objective is to determine the role of pests, pathogens and pesticides in causing death in these stationary honey bee colonies. We chose to study colonies that are not transported for pollination and honey production because researchers involved in USDA-ARS Area Wide projects, funded by a different branch of the USDA, are studying the health of migratory colonies. This study will provide unprecedented and very important data on colony health within stationary apiaries across the U.S.

In April and May 2009 we established 30 colonies in each of seven apiaries located in Washington, California, Texas, Florida, Maine, Pennsylvania, and Minnesota. The apiary sites were situated in a variety of urban, suburban and rural landscapes including areas surrounded by agricultural fields, organic farms, wooded areas and nature reserves. The cooperating researchers in each state are: Steve Sheppard, Washington State University; Kirk Visscher, University of California-Riverside; Kate Aronstein, USDA-ARS Weslaco; Jamie Ellis, University of Florida; Frank Drummond, University of Maine; Nancy Ostiguy, Penn State University; and Marla Spivak, University Minnesota. Brian Eitzer from the Connecticut Agricultural Experimental Station. is in charge of analyzing pesticide exposure from pollen samples collected by the honey bees in each of the states. Anne Averill from University of Massachusetts is studying the health of bumblebees that are nesting naturally in the area surrounding the apiaries.

Each of us purchased package bees from our closest or region-specific distributor: the Washington, California and Minnesota packages came from two suppliers in California; the Florida, Maine, and Pennsylvania packages came from two suppliers in Georgia; and the Texas packages came from Texas. This was done for two reasons. First, it is not possible to have packages shipped from a single supplier to all of the seven states involved in this study. Second, we wanted to know the initial disease and mite levels in packages bees from different sources. The 210 colonies were hived in new wood boxes, and we used new wax-coated plastic foundation purchased from Pierco® Beekeeping Equipment. In May we replaced the queens in each of the packages with queens of Italian descent purchased from a single operation in northern California (C. F. Koehnen and Sons, Inc.) to establish relatively uniform genetics among the colonies. We are not treating any of the experimental colonies for diseases or mites. Each of us are using management practices typical to our different climate and resource conditions. We initially fed the packages sugar syrup and pollen substitute (MegaBee®) as needed, and later provided supplementary syrup to some colonies in Fall to bring them up to weight for Winter, but otherwise all colonies have been left to develop on their own. Beginning when the packages were hived and continuing throughout the duration of the bee season in each state, we have been collecting an enormous amount of data from each colony every month. We will follow the colonies until they die, which unfortunately may not take too long. In 2011, we will start up again with a new set of 210 colonies, and will use one or more different queen sources.

As an example of what is involved in this experiment, I describe one of the monthly data collection trips to our stationary apiary in Minnesota on July 28. Each of us in the seven locations conducted similar collection trips once a month starting in April or May. Most of our colonies by that time had grown to occupy three deep brood chambers. In addition, some of the colonies were provided honey supers as needed. The collection trip began the day before when Mike Goblirsch, one of my students who took primary responsibility for this project, prepared and labeled 150 collection vials, copied data sheets and assembled all other necessary equipment. We met at 8:00 a.m., loaded our gear into the University truck, stopped to put dry ice in three different coolers and drove 45 miles to our site located at the Carver Nature Reserve, west of the Twin Cities. This is traditionally a great location for honey production and we thought would give our colonies the best possible resource conditions.

When we arrived on site, Mike reviewed the protocol with us: 1) Collect a sample of 40 foragers return- ➢

**Table 1.** Initial measures (May 2009) of parasites, pests and pathogens from package bees used to initiate colonies for the Stationary Apiary Project. The packages in Minnesota and Washington were purchased from two locations in California. Packages in Texas were purchased from Texas, and those in Florida, Pennsylvania and Maine were purchased from two locations in Georgia. Data are not yet included from the apiary in California. NA refers to data not yet available.

| Site | n | Varroa mites (mites /100 bees) | Tracheal mites (% bees infested ) | Small Hive Beetle (presence/absence) | *Nosema ceranae* (spores in millions/bee) | Virus prevalence (positive samples) | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | BQCV | DWV | IAPV | SBV |
| MN | 32 | 0 | 0.2 ± 0.9 | No | 3.4 ± 2.3 | 87% | 56% | 2% | 16% |
| WA | 30 | 0.1 ± 0.2 | 0.3 ± 1.1 | No | 1.5 ±1.0 | 58% | 61% | 7% | 77% |
| TX | 30 | 2.8 ± 6.0 | 0 | No | 0.03 ± 0.06 | 24% | 96% | 0 | 0 |
| FL | 30 | 1.5 ±1.2 | 1.7 ± 3.1 | No | 0.9 ± 2.4 | 20% | 83% | 0 | 20% |
| PA | 30 | NA | 0.5 ± 1.6 | No | 0.03 ± 0.07 | 67% | 74% | 1% | 10% |
| ME | 30 | 0.5 ±1.9 | 0 | No | 0.4 ± 0.5 | 29% | 55% | 0 | 22% |

ing to the colony to test for *Nosema* load and species (*Nosema ceranae* or *N. apis*) and put the vials immediately on dry ice; 2) Collect samples of 40 foragers, 40 nurse bees and 20 drones to test for viruses and place these vials in separate coolers of dry ice; 3) Collect a sample of 50 bees from the inner cover into a vial of alcohol to sample for tracheal mites; 4) Collect 300 bees to sample *Varroa* using the powdered sugar method to dislodge and count the mites (at least we could return these bees to each colony); 5) Determine presence or absence of small hive beetles; 6) record observed disease symptoms in colony; 7) Estimate the number of adult bees on every frame in every box and the amount of sealed brood on each frame using a standard procedure; 8) Check for the presence of the marked queen, and mark any new queens resulting from supercedure; and 9) Collect pollen from the traps placed on five of the 30 colonies to analyze for pesticide residues.

We worked in pairs; one person conducted the adult bee and brood area estimates, while the other took samples and recorded data. We worked slowly and methodically, taking extra care not to damage the queens. By 4:00 p.m. we were hot, sticky and giddy. I won't tell you about the stupid songs we started singing, including one about 99 bottles of beer on the wall, and another about finding a peanut.

Preliminary findings from this large-scale experiment were presented at the American Bee Research Conference, held in conjunction with the American Beekeeping Federation meeting in Orlando, Florida, January 14-15. While much of the data are still being analyzed, some interesting information is emerging from the data at hand.

*The stationary apiary located at Carver Nature Reserve in Minnesota at the end of July 2009 during our monthly data collecting trip. Variation in colony strength is evident but most colonies were strong and apparently healthy by the end of Summer. The colony in two-deep brood chambers, next to the large colony with supers, is one of vie randomly chosen colonies in the apiary fitted with a pollen trap so we could sample pesticide residues in incoming pollen.*

**Package bees:**

The prevalence of parasites, pests and pathogens varied widely among the original bees that came in the packages. Although the package bees were replaced with workers from the new queens by June, it is important to know the health status of the bees that were hived at the beginning of the experiment.

For the most part, the bees in the packages had low or no detectable *Varroa* and tracheal mites, except for those from TX that had relatively high levels of *Varroa* (**Table 1**). All samples were positive for *N. ceranae* and negative for *N. apis*. The *Nosema* levels varied greatly among packages, being highest in MN and non-detectable in TX and PA. All samples tested positive for at least three viruses: Black Queen Cell Virus (BQCV), Deformed Wing Virus (DWV) and Sacbrood virus (SBV), while Israeli Acute Paralysis Virus (IAPV) was detected in only a few bees in some locations.

**Colony Growth:**

Colony populations of adult bees and brood increased at different rates in each state (**Figure 3**). The colonies in MN became the most populous by July with an average of 22,000 bees and 10,000 cells of sealed worker brood. Population growth of colonies in ME was probably hindered by cold, wet weather conditions, and in TX

**Table 2.** Late season measures (Sept-Nov 2009) of parasites, pests, and pathogens from the remaining colonies in the Stationary Apiary Project. Data are not yet included from the apiary in CA and on virus prevalence. NA refers to data not yet available.

| Site | n | Superceded colonies | *Varroa* mites (Sept- Nov) (mites/100 bees) (% bees infested) | Tracheal mites (Aug) | Small Hive Beetle (presence/absence) | *Nosema ceranae* (Aug) (spores in millions/bee) |
|---|---|---|---|---|---|---|
| MN | 29 | 16 | 2.5 ± 3.4 | 0.2 ± 0.9 | No | 0.02 ± 0.5 |
| WA | 29 | NA | 0.5 ± 0.7 | 0.5 ± 2.1 | No | 0.03 ± 0.1 |
| TX | 14 | 12 | 17.9 ±15.7 | 4.1 ± 5.5 | Yes | 0 |
| FL | 23 | 6 | 7.1 ± 6.6 | 2.6 ± 3.8 | Yes | 0.2 ± 0.7 |
| PA | 18 | 6 | NA | 1.5 ± 2.4 | No | 0.25 ± 0.24 |
| ME | 20 | 7 | 0.9 ± 2.3 | 0.6 ± 2.2 | No | 0.26 ± 0.43 |

by very hot and dry weather. We will be factoring landscape and climate conditions into our analysis when we analyze all the data together.

**Pesticides:**

Pollen was sampled with traps one day per week from five hives in each of the stationary apiaries. Initially samples were combined to generate a monthly composite sample for each apiary. Brian Eitzer in CT used a technique known as QuEChERS (for Quick, Easy, Cheap, Effective, Rugged and Safe) to analyze the samples using high performance liquid chromatography/mass spectrometry. This technique allows over 140 different pesticides to be analyzed in the parts per billion (ppb) concentration range.

To date 29 of the monthly composite samples have been analyzed. Within these 29 samples, residues of 32 different pesticides or pesticide metabolites have been observed including: 14 insecticides plus one insecticide metabolite, nine fungicides and eight herbicides. The average composite pollen sample had an average of 4.1 pesticide residues detected. The concentration of residues when detected was mostly in the low PPB range (1< to 30 ppb) but some residues were substantially higher.

The results indicate that honey bees at the stationary apiaries are being exposed to varying amounts of pesticides within and across locations. This variability of pesticide exposure will be further examined as we continue to monitor these hives over the next several years.

**Queen Supercedures:**

Throughout the Summer, there were a number of colonies that superceded the queens. In MN, 16 of the 30 colonies replaced their queens, eight of them twice. In PA, 12 colonies superceded queens, in Maine there were seven colonies that superceded, two of them twice, and in both TX and FL, six colonies superceded queens. The high number of queen replacements did not appear to affect the development of the colonies in MN; they still became quite populous. Beekeepers have been claiming that many queens are superceded. Our findings show that queen replacement is something that deserves more research attention.

**Status of native bumble bees?**

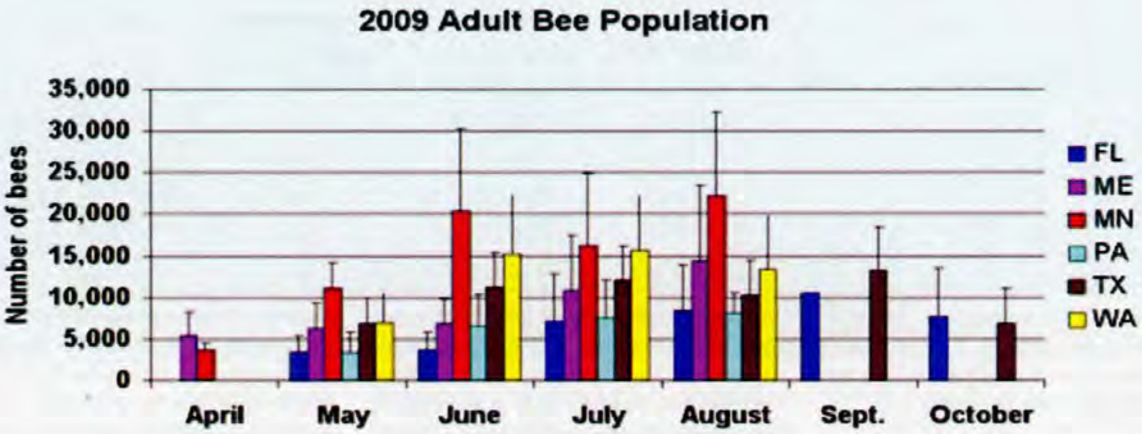
Anne Averill will be monitoring native bee populations that forage near the stationary apiaries for known pathogens of both honey bees and bumble bees. It has previously been shown that honey bee viruses as well as *Nosema ceranae* can infect bumble bees. We will be able to compare pathogen presence and/or titer data with similar data collected from the stationary honey beehives at each of the apiaries. In addition, pollen collected from the bumble bees sampled will be analyzed by Brian Eitzer to determine if bumble bees and honey bees are being exposed to the same pesticide composition.

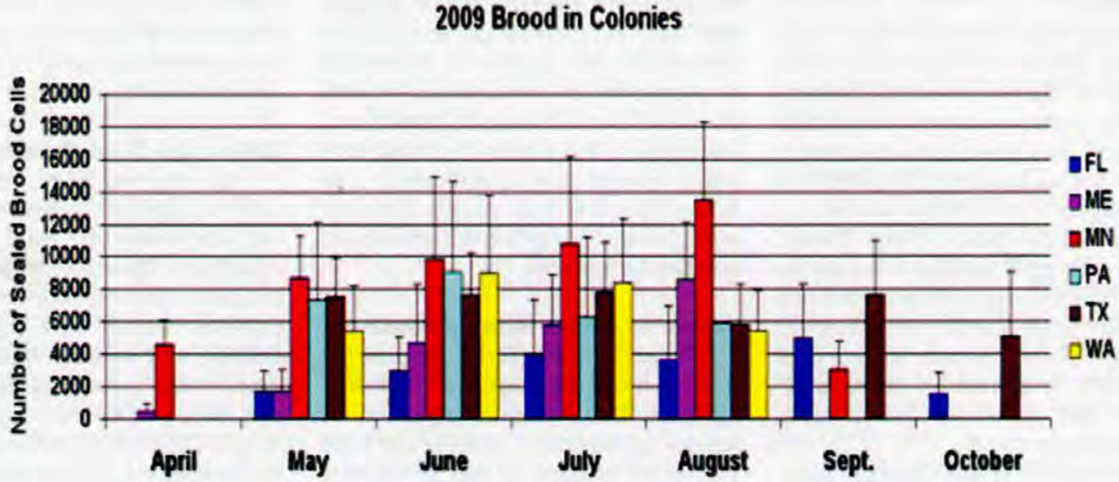
**End of the First Summer:**

By the end of the Summer, TX and FL had the highest levels of *Varroa,* and were the only states with small hive beetles **(Table 2).** The tracheal mite levels in the Maine colonies, which were subject to the coldest and wettest weather conditions, were quite high (27%) in July but dropped to very low levels by August. The levels of *Nosema* dropped to low levels in all locations, and only *N. ceranae* was detected throughout the season. The virus data is being analyzed, but early results show

*Mike Goblirsch, graduate student in charge of organizing the data collection trips, reviewing the sample collection procedure at the start of the long day. Clockwise, starting from the far left: Mike Goblirsch, Gary Reuter, Encarna Garrido (visiting from Spain), Katie Lee and Betsy Ranum.*

***Figure 3.*** *Monthly averages of adult bees (top graph) and sealed brood (bottom graph) in the colonies in six of the seven stationary apiary locations. Each apiary was initiated with 30 colonies in Spring. When all the data is compiled, we will relate colony strength to the various pest, pathogen and pesticie levels that were measured throughout the testing period. We are using this comparative approach to determine if specific causes for colony losses can be found and to evaluate the possible regional differences in the pressures that honey bees face.*




high virus prevalence in all locations analyzed. The apiaries in TX and PA suffered the largest number of colony deaths, with 14 and 18 colonies left of the original 30, respectively. We will be collecting data on the remaining colonies through 2010, or as long as they survive.

**What can we conclude?**

What was the cause of death of the colonies that were lost? Once our medical records are compiled for this first experimental set-up, we expect to be able to relate colony health (or lack thereof) to the various pest, pathogen and pesticide levels that were measured throughout the testing period. In addition, information about weather and available nutrition will be included. We plan to use this comparative approach to try and determine if specific causes for colony losses can be found and to evaluate the possible regional differences in the pressures that honey bees face. In 2011, we will start the entire experiment up again with a new batch of 210 colonies and new queen sources.

For now, watching the experiment unfold and documenting the variation in the strength and health among colonies in different climatic zones is fascinating in and of itself. It has given me a renewed appreciation for the diversity (or lack of diversity) in the landscapes that our bees experience across the U.S. It has stimulated me to think more about regionally adapted bee stocks. Mostly, the pathogens, parasites and pesticides our bees face on a daily basis gives me pause for thought, and concerns me greatly.

The acronym CAP stands for Coordinated Agricultural Project. This research project is a good example of how multi-institutional funding is realized. In addition to learning about the factors that contribute to colony loss in stationary apiaries, we are learning how to better coordinate our efforts across research institutions. Our goal is to facilitate bee health, best management practices, and productive research collaborations. This is truly a win-win effort. BC

*Marla Spivak is a Professor and Extension Specialist in Apiculture at the University of Minnesota.*

For more information on CAP visit www.extension.org/bee%20health

# NUCS
## NOT Just For Increase Any More

Michael Palmer

## Big colonies with 60,000 bees make more honey than two colonies with 30,000 bees each. IT'S POPULATION!

What makes one colony successful when others in the apiary lag so far behind? Is it blind luck or better bees? Is it all about the weather or some timely manipulation?

I guess you could say that all of the above are true. Good weather always helps, while timely colony manipulations by the beekeeper can make the difference between a swarmed out colony and a top honey producer. It's nice to be lucky, but I think we'd all agree, good stocks are the foundation of successful beekeeping.

In all cases, it seems that there is one common thread among the best of colonies. Population! It's population at the right time that leads to successful honey bee colonies. Are not the bulk of your colony manipulations intended to produce populous colonies for honey production, queen rearing, or wintering?

Think wintering. Winter preparations begin in mid-Summer by seeing that each colony has a prolific queen. A queen that will insure a large population of young bees going into Winter. Do you check the early Fall populations? You can correct a bad situation if you start early enough. Tipping up the top boxes in the apiary for a few minutes will tell you who is strong and who needs help. The bees come right out and present themselves to you. It's quick and less intrusive than looking frame by frame.

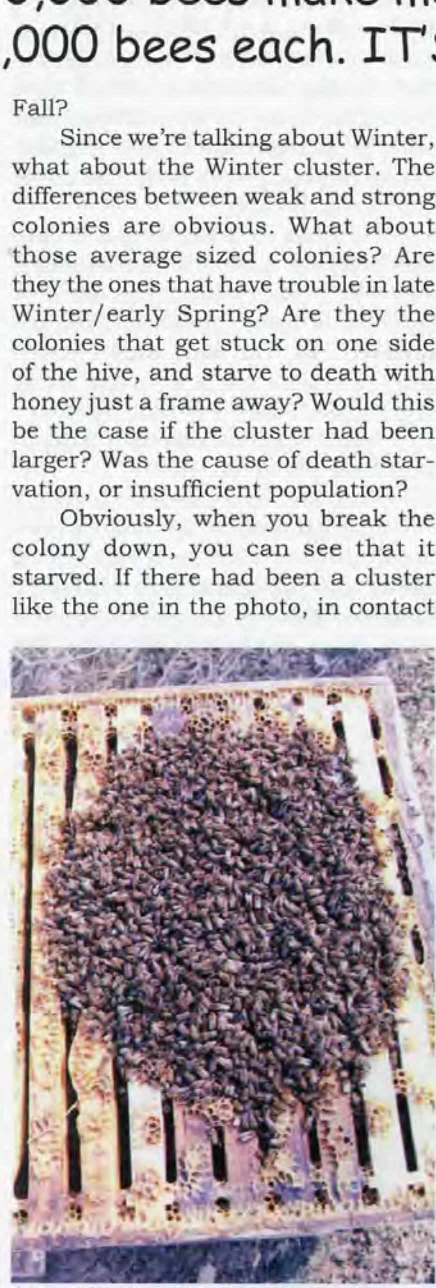
And what do you do with those colonies needing help? Hope for the best and unite them later in the Fall?

Since we're talking about Winter, what about the Winter cluster. The differences between weak and strong colonies are obvious. What about those average sized colonies? Are they the ones that have trouble in late Winter/early Spring? Are they the colonies that get stuck on one side of the hive, and starve to death with honey just a frame away? Would this be the case if the cluster had been larger? Was the cause of death starvation, or insufficient population?

Obviously, when you break the colony down, you can see that it starved. If there had been a cluster like the one in the photo, in contact with all the combs, would the outcome have been different?

We've all read references to colony population, concerning honey production. Populous colonies of 60,000 bees make more surplus honey than two colonies of 30,000 bees each. Or to paraphrase in some way . . . population plus nectar flow equals honey production.

This is especially apparent in a poor year such as 2009. With all the atrocious weather of this past Summer, colonies that lagged behind in building up their population failed to make surplus honey. In fact, they had to be fed large amounts of sugar syrup to get ready for Winter, while



*Large cluster soon after snow melt . . . in contact with all combs.*

*Cell builder ready for graft.*

*Four-way mating nucs in the Fall.*

*Results of a prolific queen.*

the strongest colonies produced a nice honey crop and were heavy with Winter stores.

Swarming, splitting, and poor queens all reduce the eventual population of each colony. Only the strongest of colonies are able to take advantage of what flows actually do materialize. Are you using the resources of your strong, honey producing colonies to help the weak? How much of the crop are you sacrificing to do so?

Do you raise your own queens? Do you set up starters and finishers? It's all about the population of young bees in the cell builders. Population and proper nutrition mean quality cells and quality queens. How do you build the population in your cell builders? Sacrifice brood and bees from good honey producers?

Have you started wintering nucleus colonies yet? Once again, it seems that population is the key to success. Population, and how the bees fit that population to the size of their nesting cavity. Nucs in supers, split hive bodies, and four-way mini-mating nucs can Winter easily in the north if the bees are able to fit their population to the cavity size.

That may be the most important and intriguing thing I've learned in the last dozen years or so. Population fit to cavity size. It's so amazing to me how bees will Winter successfully in the smallest of clusters, if they have been able to set up their Winter nest with proper provisions and a population of young bees to fit the space they must occupy.

Certainly, success of your honey bee colonies is tied to the weather, and your timely manipulations. A little bit of luck stirred into the pot never hurts, but time and again it always comes back to population. Population built by prolific queens.

Prolific queens and their beautiful brood patterns . . .

*And their resistance to disease.*

Colonies headed by these queens build up early, maintain a high level of brood rearing, and Winter with large clusters. Exactly the performance I want from my bees, and what you should be looking for in your breeder selection or queen purchases.

So you've done everything you could for your bees. Last Fall you re-queened all the colonies that would benefit from young prolific queens. You made sure your bees had the proper nutrition going through spring buildup. You performed timely manipulations to reduce swarming and maintain adequate super space. And still you have big'uns and little'uns. Just what's a beekeeper to do? How do you build population?

*Remember those nucleus colonies I've tried to get you to winter? Nucs are not just for increase any more!*

Nope they're not. Think of them as queens, and not as future production colonies. Little brood factories, if you will, cranking out combs of brood. In the Spring, by Dandelion bloom, over wintered nucleus colonies are expanding nicely in their first brood box. At that time, they are perfect for re-queening those colonies that have only a few frames of brood. Rather than waiting half the Summer for them to build up, or robbing frames of brood from your good colonies, why not drop an over wintered nuc on them? Not only does the slow colony get a new queen, it gets a boost of bees and brood. Who says you can't have early queens in the north!

Slow Spring colonies can be boosted and re-queened with your wintered nucs, but what about those slow colonies later in the Summer? What can you do about them?

*Bee Bomb created using mating nuc frames.*

*Bee Bombs*

The use of queenless bees and brood can be a huge benefit in your apiary. I call them "bee bombs." You know . . . up to 50,000 feet . . . Bombs Away! The results are startling. Bombing slow colonies, or colonies that aren't building fast enough for the coming Winter preparations, has immediate results. A body with five to 10 frames of bees and brood added on the bottom board of a slow colony in August means a large cluster going into Winter. That large cluster, if properly provisioned, means a large cluster in the Spring. And if that colony is managed properly, maintaining a large population through the season, it will be able to take advantage of whatever flows do come along.

Over wintered nucs and bee bombs can also be used to your advantage in a cell building/queen rearing scheme. Read Brother Adam, 1975, *Beekeeping At Buckfast Abbey*, p. 67, e. "our own method." Brother Adam used Bee Bombs. Bomb a strong colony, above an excluder, in your cell building yard 10 days before your graft.

Beautiful, well provisioned queen cells are the result!

How does a beekeeper go about creating bee bombs. Is Peter robbed to pay Paul? Again I have to say . . .

**Remember those nucleus colonies I've tried to get you to Winter? Nucs are not just for increase any more!**

You set up your nucs for wintering, on the main flow, earlier than would normally be done. As they expand their little brood nests, swarm control becomes necessary. Remove a frame of brood and bees from each nuc, placing them in a new brood body. Replacing them with frames of comb or foundation relieves the pressure, giving the queen new comb space. You've never seen foundation drawn out like these strong little nucs will do.

If you have ten nucs building up in your apiary, you have the makings of one or two bombs. Add 10 more nucs, and you double the number of bee bombs that you can make. During the active season, when foraging conditions are at their best, you can remove a comb of brood and bees about every two weeks, or so. In mid-August, or so, stop harvesting bees and brood, and allow the nucs to set up their nest for Winter.

Just think what three or four bee bombs every few weeks could do for your apiary. You can have an almost unlimited number of queens producing brood and bees for building strong production colonies, quality queens, and large Winter clusters. No more big'uns and little'uns.

To prove to myself my point about the importance of population, I tried something different this Summer . . . and a bit ridiculous if you want to know. The mating nucs were getting way too strong. Once too crowded, the acceptance of the queen cells goes down. The solution is to remove half the bees after the second round of queens is caught. I use a home made swarm box with a screened bottom hive body, a body with nine frames of foundation and one comb of brood, and an excluder shaker box on top. After the queens are caught in the four frame mini-nucs, two frames of bees are shaken out of each and into the shaker box. The bees go down through the excluder and onto the brood and foundation. The frame of brood helps hold the bees where I want them.

It's really nothing to come up with a 25 or 30 pound swarm with this process. Usually, I would make up three or four packages and give each a caged queen. Instead, the entire 30 pound cluster of bees was installed in the same hive. A caged queen and two additional deep boxes of foundation were given immediately.

As the first three boxes were drawn and filled with brood and honey, a cut comb super was added, and then a medium extracting super. And then another. This monstrous colony that started its life in early July with bees and a caged queen, drew out 29 deep frames of foundation, filled a super of cut comb and two medium extracting supers, and put away more than enough honey for Winter.

*Rip VanWinkle's beard.*

Granted, I have a robbing station at my home yard. The dozen or so colonies get to rob extracted supers and extra combs of honey and nectar that are brought in from the field. What could I have expected from a three pound package installed with one frame of brood and a caged queen so late in the year? A swarm in July isn't worth a fly? What's the only difference between the two . . . **POPULATION!** BC

*Mike owns and operates French Hill Apiaries, founded in 1976. Keeping bees in the northern Champlain valley of Vermont and New York has been a thrill and privilege. Once the bread basket of the colonies, the Valley is the land of milk and honey in the Northeast. Ideal for harvesting good honey crops and quality queen bees.*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# RESEARCH REVIEWED

## The Latest In Honey Bee Research

Steve Sheppard

*". . . the very destructive and pervasive nature of the 'threat' is being met by an unprecedented global effort to provide workable solutions to maintain sustainable honey bee populations."*

Unfortunately, reports of unusually high levels of honey bee colony losses by U.S. beekeepers are no longer unusual. Estimated average losses of U.S. managed honey bee colonies over the Winters of 2006-2007, 2007-2008 and 2008-2009 were 32%, 36% and 29%, respectively (vanEngelsdorp et al, 2010). How does this situation compare to the status of honey bee health and reports of "unusual losses" on the worldwide stage? Some insight into the big picture can be found in a recent issue of the Journal of Apicultural Research, "Special Issue: Colony Losses", whereby authors and researchers from numerous countries contributed more than 30 scientific papers addressing this topic (J. Apic. Res. 49: 2010).

In the opening editorial of the issue, researchers from labs in Switzerland and the United Kingdom, summarize the reported losses by continent and show that higher losses are reported almost exclusively from northern hemisphere locations (Neumann and Carreck, 2010). Thus, South America, Africa and Australia appear to have been spared high colony losses or anything resembling CCD. The authors point out that honey bees in these locations have either not been exposed to *Varroa destructor* (Australia) or represent strains of African (Africa) or Africanized (South America) honey bees that survive the presence of *Varroa* without chemical treatment. They go on to note the widespread significant losses of honey bees that occurred in many countries throughout Europe and refer to individual papers in the special issue that deal with survey results from each country. While such detail is beyond the scope of this column, suffice it to say that a number of European countries reported colony losses over the past several years similar to the levels found in the U.S. Neumann and Carreck refer to a global effort that has been initiated to evaluate the possible causes and interactions between factors associated with increased in honey bee colony deaths. This network, known as the international COLOSS effort (prevention of honey bee COlony LOSSes), includes scientists, beekeepers and industry tasked with increasing complementary research efforts, avoiding duplication of research projects and working toward developing a sustainable funding base for the cooperative effort.

In addition to the papers that report survey results on colony losses worldwide, there are also articles in the Special Issue that provide research results on possible factors in colony losses. An area of common ground between two papers written on French colony losses was that higher losses were associated with high levels of *Varroa* mites or with failure to adequately control mite populations. Similar findings were reported for Canada, Croatia and Demark. One interesting report from Norway provides a perspective that is relatively rare in modern temperate zone beekeeping. Dahle reported that parts of Norway still remain naturally free from *Varroa* and, in the areas where *Varroa* mites are absent, the overall Winter losses were significantly less than in areas of Norway where the mites are found, regardless of treatment status (Dahle, 2010).

The role of other pathogens was implicated in a number of reports, either based on surveys or laboratory testing. In Poland, Topolska and colleagues reported that damage from *Varroa* mites, associated viruses and Nosema spp. "were the principal causes of local losses" (Topolska et al, 2010). Likewise Mutinelli and coworkers reported that high losses in Italy were "mainly . . . attributed to insufficient and/or improper control of *V. destructor* . . ." and possibly to interactions of the mites with other pathogens or *Nosema ceranae*. Carreck et al. (2010) reported that colonies in the UK with one or more of three key viruses (cloudy wing virus (CWV), sacbrood virus (SBV), deformed wing virus (DFW)) and *V. destructor* were likely to die at lower mite levels that colonies infested only with mites. That is, the presence of the viruses within the population greatly reduced the number of *Varroa* mites that a colony could withstand without perishing over the Winter. Berthoud et al (2010) reported that ABPV (acute bee paralysis virus) and DWV were significantly correlated with Winter mortality in Switzerland.

Several papers reported case reports of honey bee poisoning from pesticides used by growers, including seed coatings that may have contaminated honey bee colonies in the proximity of planting. Another study reported that honey bees reared at slight lower than suboptimal temperatures were significantly more susceptible to a particular pesticide (dimethoate) than those that were reared at "normal" temperatures.

Taken together, this Special Issue provides a basis for understanding not only that honey bee colony losses of the past several years affects many more beekeepers than those working in the U.S., but also that collaborative approaches across national boundaries can bring together data that permits new information to emerge. In the first editorial of the Special Issue, Neumann and Carreck pointed out that we have not heard reports of high levels of colony losses from places where *Varroa* mites are either tolerated by *Apis mellifera* (Africa, South America) or absent (Australia). In the main, the Special Issue reports of high colony losses around the world largely implicated *Varroa destructor* as one of the causal agents of harm in this scenario. We are left to ponder why . . . after some years of living with and dealing with the mites in the temperate zone, are managed honey bee populations experiencing major difficulties in survival in some areas? While that question remains, the nature of the shared problem itself may provide insight toward finding an answer. That is, one common problem in some locations that reported increased colony losses in the Special Issue was that some *Varroa* mite populations had become increasingly resistant to chemical control measures. This in turn led to higher *Varroa* mite levels, associated viruses and possibly other pathogens. Thus, while the "answer" may be – "we have to get *Varroa* mites back under control", the devil is in the details. How to go about it? Are we reaching a point where continuing to reply on chemical control of mites or frantically searching for new chemistries is effectively digging a deeper hole . . . making the climb back out less certain? Given that mites have such a short generation time, what sort of useful lifespan can we expect from even a supremely new and novel chemical control agent? One paper in the special issue addressed the COLOSS effort toward "Conserving diversity and vitality for honey bee breeding" (Meixner et al. 2010). How much of a role will selective breeding of honey bees for *Varroa* mite tolerance play in the eventual development of temperate zone-adapted honey bees that can maintain sustainable populations in managed beehives?


This special issue provides a good starting place to see that the recent "troubles" faced by honey bees has a global nature. It is clear that numerous scientists working on many aspects of honey bee biology worldwide are actively engaged in working toward solutions. While the answers to the questions posed in the previous paragraph may not come easily, it seems likely that they will come. For perhaps as never before in beekeeping history, the very destructive and pervasive nature of the "threat" is being met by an unprecedented global effort to provide workable solutions to maintain sustainable honey bee populations. BC

**References**:

*Special Issue: Colony Losses, 2010*, Journal of Apicultural Research, Volume 49: 139 pages. *All citations in this month's Research Reviewed column come from this Special Issue.*


# EUROPEAN HORNETS

## Big, hungry, and your bees are on the menu!

Dan Stiles

Two Summers ago I noticed a few European Hornets around our apiary in rural West Virginia. These hornets appear to be about an inch and a half long and their yellow and brown markings make them very easy to identify. Their present range includes just about all of Europe and now all the eastern/north central states in our country. European Hornets were first reported in the United States in the early 1800s.

European Hornets love munching on apples and pears still growing on our trees, and appear especially fond of the fruit that has fallen to the ground. They first got in trouble with me when they girdled and killed both our newly planted lilac trees. I watched them chewing away at the bark in several locations on the trees, including the main stem, and at the time I thought it interesting and unusual. And, we have a sweetgum tree that I had planted – it was 95% girdled last year, and barely survived. Apparently European Hornets get nourishment from the sap of lilacs and sweetgum trees, and no doubt from many other tree species as well.

These giant (as compared with honey bees) hornets fly during the day – and at night. Sometimes if I leave the kitchen door open on a warm Summer night, European Hornets will fly in, apparently attracted to the lights. After a half dozen begin circling around the ceiling and banging into furniture, I close the door, but they are big and noisy enough to be pursued around the kitchen by our Chocolate Lab. This hornet house invasion happens fast – within a minute or two. With the door closed, they bang against the window closest to the light.

Essentially they are overgrown yellow jackets, and a friend who was stung by one said it certainly was a memorable experience! They have no barb so they can sting repeatedly. They build gray colored papery nests in sheltered places out of the wind and rain, like within a hollow tree. (I've never found a nest). Worker hornets forage day and night for liquid nourishment to bring back to their nest, but they also capture and kill a variety of insects to feed their developing larvae. Big insects like grasshoppers and crickets are included on their preferred list of food as are, unfortunately, honey bees.

Switching gears a bit now, I feed my bees at what I call a remote feeder. This feeding system works very well for me. Briefly, I place sugar water into two empty gallon (dill pickle) jars with small holes punched into their metal lids, invert the jars and place them inside an empty nuc box on two, lid-wide narrow wooden rails. The nuc box is placed on a metal table 50 feet away from my five hives. This system worked so well that I also placed a heavy metal screen suspended above the nuc box, and

 

added an additional six, quart-sized jars with punched metal lids filled with sugar water on top of the screen. My hungry honey bees will often completely drain all of the jars each day.

I believe excessive moisture, especially in cool weather, within the hive is deadly to its occupants, so I avoid the many sorts of internal feeding systems. In fact, I keep screened bottoms on all year long as well as fully screened tops, with the telescoping cover propped open, encouraging lots of air circulation. That's the reason I feed them externally. But I'm getting a bit off the main subject here ...

European Hornets first showed up at my remote feeder last Summer. First two or three, and then gradually a regular parade of them. These big fellows are not just interested in tree sap, ripe fruit, and sugar water, they are extremely adept at killing honey bees! Watching their activity at my remote feeder, I was reminded of the video we all have seen of the grizzle bear sitting in a stream with his mouth open, waiting for salmon to jump the waterfall into his mouth – and they are regularly successful. So it is with European Hornets waiting at the entrance of my remote feeding station. Honey bees are an easy and super abundant prey! Two or three hornets would weave and feint on the landing board as hundreds of bees passed by, and suddenly one would latch on to an unlucky bee. The hornet then sometimes flew off out of sight with its victim, or carried the bee to a nearby flat surface to kill it.

Sometimes it was clear that an individual European Hornet was on the prowl as it aggressively attacked bees in flight near my feeder. It all happens very quickly – a clash of wings and the hornet, suddenly burdened by the weight of the bee, could be seen flying away at half speed, presumably in the direction of its nest.

You can be sure I hated to see this when I realized what was happening to many of my good natured, defenseless bees. And, I'm certain there were at least two hornet colonies involved. I watched them arrive and depart from the South and the second group from the West – both a considerable distance away, because the hornet's flight path was at a 45° upward angle – in other words they gained considerable altitude in a hurry until out of sight.

To drive home a point, these European Hornets are big guys, I suspect ten or more times larger and heavier than honey bees. But, at my remote feeder they were not threatening to me at all – I set my camera on super close focus and photographed them at a distance of a couple of inches. They did not seem to mind a bit. In fact, an individual would often rest on my hand while I waited for a good photo opportunity. Nevertheless, these are no friends of mine.

Being perfectly free to indulge in some foolishness in remote West Virginia (I'm three quarters of a century old and then some), I loaded my .22 caliber revolver with shot shells – also the perfect remedy for rattlesnakes and copperheads residing in the immediate vicinity of our cabin. Sometimes the European Hornets had some sort of disagreement with one another just outside the landing board of my feeder. Perhaps they were members of different nests competing for the sugar water and honey bees within the feeder, but they often clashed and hovered together in flight for several seconds – perfect targets. It was very satisfying target practice, but the numbers of hornets far exceeded my supply of shells. A tennis racket worked well, but the hornets had to be swatted to the ground, located and stepped on repeatedly. They are very tough customers!

And, here is the worst news. When I shut down my remote feeder, these European Hornets began appearing at the entrances to my five hives, pouncing on my bees on their landing board and capturing them in flight. I am worried that they may enter the hive at night also, and have closed down the entrances to a small, hopefully more defensible opening. The good news is that every one of these hornets will die in the Fall. Only the fertile hornet queens can be expected to survive the Winter – to begin the cycle all over again next year.

Beekeeping is like farming in many ways. There are plenty of problems out there in the natural world – the weather, mites, diseases, beetles, bears, skunks, mice and now the battle is on with European Hornets. But, the truth be known, I find it to be a challenging, interesting hobby that is also very rewarding – and fun.

---

*Dan Stiles is a retired wildlife biologist in West Virginia.*

# Mountain Honey & Russian Bees

Kim Flottum

## *Carl & Virginia Webb raise tough queens, and the best honey in the world.*

Not 50 yards behind the family home, and directly behind their honey house, is Carl and Virginia Webb's Russian Queen production yard. It is as picturesque as any beeyard you can imagine and I have used the photo I took of this yard in a variety of places. In the Spring, when the apple trees are in bloom the image can only be even more impressive. Looking around the rest of the grounds there is a forest of visual and productive horticultural treats, including ornamental trees, fruit trees and blueberry bushes. Carl's experience in the arborist's world is apparent. But as much as I appreciate visiting a collection of exotic specimen trees, shrubs and plants it was the Russians I came to be with. So it goes.

That queen production yard consists of right about 40 drone source colonies in doubles with each having at least one frame of drone brood built in, and right about 100 three-way mating nucs. This makes about a 1:8 colony ratio for drone colonies:mating nucs. That's about as healthy a ratio as I've ever seen, and is the primary reason Carl was the first Russian queen breeder to be certified by the Russian Honey Bee Breeders Association (**http://russianbreeder.org/**). In addition the all Russian honey production colonies are within a couple of miles of the mating yard. In fact most all of the beehives in the upper Soque River basin belong to the Webb's.

To make it into the mating nucs, once a week Carl prepares starter colonies by combining bees from more than one hive into a broodless and queenless box for each starter. During the Spring rush, several grafts of 40 cells are made each week and rotated into the finisher. During the Summer they settle down to a once each week routine. Virginia grafts weekly so that at least 20, and most often 40 cells are produced and placed into the starters. They use plastic queen cell cups and do a single graft from one day old larvae.

Once started, cells are moved to finishers Carl makes which are strong doubles with a queen in the bottom box below an excluder and young brood, pollen and a syrup feeder above. After 10 days the now-finished cells are placed in the mating nucs. These are deeps, divided into three, three-frame compartments, each comprised of one frame of brood and bees, one frame of honey and one of foundation. These work well but during the Summer brood and honey have to be constantly removed to make room for more. These queens are left in the mating nucs for at least 20 days, usually longer, until Carl is satisfied they are acceptable.

They produce about 20 queens a week and about 1000 Russian queens a year using this procedure. In addition many of the field colonies are requeened with cells each season. But that's not all they do.

Carl also produces and evaluates Russian Breeder stock for the Russian program. When I visited he told me that he had been assigned the White-Green and White-Purple lines. The original breeders and drone source queens from each of the other Russian lines were received from Dr. Tom Rinderer, from the Baton Rouge Bee Lab. As a member of the Russian Honey Bee Breeders Association it is their responsibility to establish test yards each year and select breeder queens for the next season. I visited one of these test yards which consisted of 25 colonies of the white-purple line. This Fall two breeders were selected from this yard and will be the breeder queens for 2010. They were selected for their superior honey production and for mite resistance. Following the selection by the Webbs, bees from the selected colonies were sent to the Baton Rouge Bee Lab for genetic testing in order to verify

*Carl's compact unit is uncapper on left, wax spinner below, frame holder in the center and parallel radial extractor on the right.*

*Uncapper, extractor pipes and storage tanks. This arrangement makes it easy to keep honeys separated.*

that the queen was mated with Russian drones. As for Mite resistance, two breeders were selected from one line and three from the other. *Varroa* counts were not higher than one mite per 100 bees in the Fall and no tracheal mites were found in any bees tested by the Bee Lab.

Last Fall the Webbs established new test yards for testing in 2010. These yards consist of 25 colonies headed by daughters of breeders selected as superior in the 2009 tests. In addition to the queens produced to head these test yards, two queens from each is produced and given to the other 18 members of the Russian Honey Bee Breeders Association to use as their drone source queens for their mating yards. This sharing of queens is reciprocal. There are no treatments applied to any colonies . . . ever.

Much has been said about the difficulty of introducing Russian queens. Carl tells me that he has worked with the University of Georgia on a number of experiments using Russian bees, as well Italian, Minnesota Hygienic and Carniolan stocks. He believes that the only reason they are considered more difficult to introduce is that, because they appear different, acceptance is more

*A typical honey production yard.*

*A good pattern, and lots of brood are key indicators of a good queen, but healthy bees, temperament and other production factors weigh in too.*

apparent. If a queen introduced looks like the queen that was removed then so will the queen daughter raised by the colony look like both or either. Careful introduction is the answer in either case. Carl said that to introduce Russian queens use JZBZ cages, leave the candy closed for four to five days and then go back into the colony and either remove the candy cover or, most usually, simply direct release the queen on top of the brood frames. If the queen is dead in the cage look for a second queen in the colony because anywhere between 15 – 20% of all colonies regardless of stocks have two queens.

Carl, who used to keep Carniolans says their behavior is very similar. They are conservative in their use of stores and in his area are broodless by December and do not resume brood rearing until early pollen is available. Winter clusters vary in size from two to three frames to wall-to-wall clusters. Fall pollen and nectar flows seem to govern the size of clusters. With the first Spring pollen, clusters respond rapidly. In the mountains of North Georgia this is usually late February when the maples bloom. Before April 1, splits are made in order to reduce colony size to about four frames of brood. This helps prevent swarming and results in a colony ready for the surplus honey flow when the tulip poplar blooms on about May first.

Just as Italians eat too much, Russians tend toward eating very little during their down time in the Winter, and into the Spring. They are very, very resource dependant . . . if food isn't available in the environment they shut down . . . brood is reduced to a minimum, and foraging will slow also. But when resources come back, so do the Russians . . . they will begin brooding in a hurry, and foraging in a hurry to supply the brood. If you aren't prepared they may swarm again.

And speaking of swarming; all bees are programmed for Spring swarming and it is up to the beekeeper to intervene for his benefit. Carl works the bees in order to prevent swarming by early Spring manipulation and


*You know you're in a queen producer's kitchen when . . .*

*Honey is a big part of the business*


*Carl's solar powered fence changer, bears, and fences are a way of life.*

supering for the honey flow. Russian bees can build large populations rapidly and sometimes get ahead of the beekeeper. Anticipation of that event is a bit easier because they will wait until the flow is strong, but then be on the watch. Bees are more apt to swarm at the beginning of the heavy honey flow than after the flow is well under way. Nevertheless, an early Spring swarm may not slow down honey production and Spring and Summer honey crops are still made.

Carl lives in sourwood country, and this trait is actually beneficial. They will build for the early flows there and may swarm, but prevention methods can slow or halt that, and then they slow between flows, and the next big flow is sourwood bloom so he gets the benefit of a full, strong colony for that special bloom period.

*Virginia has won the coveted prize of Best In the World twice!*

And honey, or making honey is a big part of the Webb's business. They produce three to four hundred cases of cut comb honey each year for local customers, plus about 20,000 pounds for general sales at their home stand and in stores all over the area. From all this honey comes hundreds of pounds of beeswax each year that gets turned into candles primarily for sales at local outlets and their very small, but very busy home stand.

All told, Carl and Virginia run about 400 colonies in 10 or 11 yards, depending on the season and the year. Carl has 25 – 35 colonies in a yard, and though mites aren't ever a problem, bear are, and fences are a part of life. Honey colonies are singles with an excluder and are not screened. This keeps swarming to a moderate rate, but because of the fast buildup of these bees, this isn't a critical problem, and the time required to really reduce swarming isn't balanced by superior honey production. They just make lots of honey.

Honey is harvested more than once per season to keep the varieties separate. The honey house isn't fancy, but it is clean, and doubles as a classroom for the many tours they do, so it has to be tidy almost all of the time it isn't in full bore production.

Some of this honey has made its way to various and exotic honey shows. The International Apimondia honey show has been kind to Virginia's entries, and twice she has won the grand prize of having the Best Honey In The World.


*The small, but very busy roadside honey stand.*

*Inside the stand.*

# QUESTIONS YOU SHOULD ASK

Larry Connor

*If you aren't asking these questions I worry about your future success.*

New beekeepers, and those thinking about getting bees, ask a lot of questions. Frankly, if they don't, I worry about their long-term success as beekeepers. With the wide range of pests, diseases and parasites combating the contemporary beekeeper, it is important everyone stay informed on the latest information. As a person learns beekeeping it is beneficial to grasp a wide range of intellectual, practical and always essential concepts that will guide them through their beekeeping experience. This is true if you keep only two colonies, or 20,000.

This article is based on questions new and small-scale beekeepers ask, or should, as they start with bees. Beekeepers must focus first on the challenges of deciding to get bees and where and when to get them. They then must move into core bee and beekeeper issues, like how do I know it is time to put on my supers? It includes some of the information you will need if you become a small business with your bees, selling honey, providing pollination services to area farms or wildlife preserves, and even some directions about record keeping, finances and taxes. Sometimes you will need to find someone who is able to 'decode' some high-level bee science to see how it affects bees and the decisions we make as beekeepers. And if you add some fluff and laughter, that is okay too, since it is important to keep beekeeping a lot of fun.

If you are thinking about getting a hive or two of bees, keep reading. If you are a 12 x 12 beekeeper – kept 12 hives for 12 years, this is for you too. Enjoy!

**Can *I* keep bees?**

The decision to keep bees can be sorted out into several areas. First, you need to be able to lift 40-80 pounds when the honey supers are full, although we will talk about smaller, and thus lighter, equipment options. Even wheelchair-bound beekeepers need occasional help with some of the heavy lifting, but otherwise can use a series of ramps and lifting aides to help them check their bees. You can plan to ask for help too, or even pay someone to do the lifting you cannot. Many people start keeping bees in retirement, and should keep the weight limits lower 'for when we get old.' In the past few years there are more and more women entering beekeeping, and the physical lifting is a big concern for some of them.

Second, you need to think about the environment where you plan to keep bees. Bees can and are kept in small city lots, on the tops of large buildings in urban area, and are carefully camouflaged from the public and neighbors with the use of fences, vegetation and thoughtful placement. That is a great development. Yet I have had new beekeepers admit that one of the objectives of keeping bees was the escalating and continued annoyance of a feuding neighbor. I'd like to keep the bees out of property line wars, since it does nothing to promote the image of a highly beneficial but potentially stinging insect, and can bring on some anti-bee legislation or restrictions. There are some places where folks should not start a colony of bees, and the use of beekeeping to annoy a feuding neighbor is not fair to the bees or to the beekeeping community. Such battles almost always end up poorly for the bees and the beekeepers.

Third, a member of your family may be allergic to bee stings, and probably already carries an Epi-Pen R in case of stings. That does not mean you cannot keep bees, but you should

*10 frame size hives in front on the right, and 8 frame size hives, in back on the left.*

# Can I Keep Bees? Where Do I Put Colonies? What Type Of Hive Should I Buy?

speak to experienced beekeepers and minimize the opportunities and risk of stings. That may be as simple as keeping bees on a friend's farm. Many people are looking for beehives for their small farms and are happy to host a small-scale beekeeper. This has been very evident since the appearance of Colony Collapse Disorder (CCD), with a growing number of property owners wanting bees on the property for "for the environment." I suggest you be very clear as to the ownership of the hives, the bees, the honey and other products they produce. Also make sure any pollination service is addressed as either part of the right to place the bees or that a fee will be paid to the beekeeper.

If you are curious about nature, enjoy working outside, and have a natural interest in the way the world works, you should keep bees. If you like to eat honey, and cook with honey, and make mead from honey, then you should keep bees. If you have a wonderful garden and need to provide pollination for your berries, fruits and vegetables, you should keep bees. If you want something exciting to do in your life, you should keep bees. If you are a teacher, and want to share the world with your students, you should keep bees. If you are ready for an amazing adventure in life, and have already climbed tall mountains, swum in deep seas, and jumped from airplanes, keeping bees may be the greatest thrill you will every have.

*Nearby neighbors can be a concern when bees decide to be antisocial.*

**Where to put colonies**

Colony placement can be pretty easy for most small-lot property owners. If you are restricted to a rooftop or a 20x30 ft backyard, you will want to locate the bees so they face south to get the warming sun, and are protected from wind. They should not be placed so that the bees will be forced to fly where humans, dogs and other animals are forced to walk or are confined. A dog in a run is such a case, but don't forget about Aunt Tillie in her walker, and her inability to move very fast if the bees become antisocial.

In suburban and rural locations, I recommend locations that are air and water drained, have a good southern or eastern exposure, and that can be reached after it rains or during the Winter. I don't recommend moving bees by boat, but you can snowshoe into the apiary to check on food stores after a big snow. That can be important if you get a lot of snow in your area.

Bear populations are exploding in all of North America and consider this when you place your bees. Keeping bees nearer to humans will help, but not eliminate bear feeding on bees and their stored honey and developing brood. Check with the local ag agent or sheriff to see if there is a problem with bears in the area where you want to place your bees. If bears are in the area, you can consider putting up an electric fence, or perhaps keeping the bees near the house or barn with a wood fence around the bees. The bees will have no trouble flying over the fence.

Other forms of vandalism can be managed by putting the bees in locations where they are not seen from the road and do not 'advertise' themselves by bright white paint. Some beekeepers stain the hives to match buildings and fences on the property. Others use the brightest and cheapest paint they can find to help with colony orientation, but then locate the bees in such a way that they are easy to access but cannot be seen from the road or by hikers.

**What type of beehive should I buy?**

In North America nearly all the bee hives are based on the Langstroth movable frame hive, usually in 10 frame sizes. There was a period of many hive types in America over 100 years ago that was standardized by major bee equipment manufacturers. The Langstroth is sold in three depths, Deep, Medium and Shallow. There are several configurations for these. Many beekeepers start with two Deep hive bodies for the brood chamber and then multiple Medium hives for honey supers. Others use only Medium equipment. Shallow equipment is popular with some beekeepers for honey production, but I think we can deal with just Deep and Medium equipment just as well.

There is a move by many beekeepers to keep eight-frame hives rather than 10-frame units. This is a nice feature for older and female beekeepers as well as anyone who wants less weight to lift. I want more beekeepers to consider eight-frame hives because I believe they better fit the natural shape of colonies in bee trees and natural nest sites. Part of my logic is based on the observation that many colonies do not use the outside frames of the 10-frame colony, and the honey supers are often empty at the outside in all but the strongest nectar flow. The eight-frame unit means that there is 20% less volume for the bees to manage, which may mean greater energy savings by the highly efficient hive inside.

The downside of eight-frame hives is their resale value. In some areas the eight-frame equipment is harder to sell. But with more and more older and female beekeepers getting started and trying to expand, the eight-frame box may be the way to go. And if you plan to keep bees forever, resale issues are not important, right?

A small but highly passionate group of stationary (non-migratory) beekeepers use the top-bar hives. These can be made inexpensively with recycled materials (their original intent when developed for sustainable agriculture in Africa). But now there are elaborate and expensive models on the market. I think that a top-bar hive should be much less expensive than a Langstroth hive. The top-bar hives have frames with tops only, and no side or bottom boards. They are harder to move and remove honey from. Most beekeepers with top-bar hives are cut comb producers, and that is a premium product. The frames in these hives cannot be uncapped and extracted like in the Langstroth hives.

Biologically, top-bar colonies want to move up as do all colonies, so it may be harder to Winter top bar colonies in cold, northern locations. There are methods of supering top-bar colonies but that makes me think you might as well go Langstroth.

Two questions you need to ask before you buy your first beehive or plan a large expansion:

What is for sale in your area? Can you obtain replacement parts and new equipment? There have been a number of specialty hives developed over the years and the ultimate problem seems to be in your ability to get new parts when old ones give way. That may not sound like a big problem, but in 10 or 20 years, it could cause some serious regret.

*Top Bar Hive.* (Melanie Kirby photo)

What will work for you? If you are not a very independent or adventuresome type, keep with the Langstroth equipment. The industry is built on such colonies, especially for liquid honey production. But if you just want a few hives and are willing to play a bit, and do some research about the bees, maybe the top-bar hive is okay for you. You will be a comb-honey producing beekeeper. You will need to rely on swarms and packages to start your hives (although you could shake bees from a strong hive into a top bar hive to get it started).

*Check **www.wicwas.com** for Dr. Connor's three Essentials books, or ask for them at your local bee supply dealership.*


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# ESSENTIAL OILS AND THE BEEKEEPING INDUSTRY'S SURVIVAL

Ross Conrad

*The Reliance On Essential Oils By Beekeepers Experiencing Symptoms Of Colony Collapse Disorder First Came To My Attention From Michael Meyer, And Then A Whole bunch Of Others.*

The honey bee's relationship with the plant kingdom through its critical role in pollination has established the bee as an indispensable partner in modern agriculture. This is a mixed blessing for beekeepers who are struggling these days to meet the pollination needs of growers. In recent years beekeepers have been able to offset massive yearly colony losses by making up plenty of nucleus colonies each season and breeding lots of queens. Unfortunately, such measures can not sustain the industry in the long run as the annually economic toll of hive losses combined with the costs of rebuilding colony numbers and strength eventually lead to the point of business failure.

In the face of potential disaster, some beekeepers seem to have found what they believe is an answer to keeping their business alive: Essential Oils (EOs). Many beekeepers are already familiar and comfortable using essential oils and their components in the hive. The use of menthol to control tracheal mites has been going on for decades and essential oil products that are designed to control *Varroa* mites utilizing the active ingredient thymol, a component of thyme oil, are now common place.

In recent years a number of beekeepers have turned to essential oils to control the ravages of Colony Collapse Disorder (CCD). The reliance on EOs by beekeepers experiencing CCD symptoms in their hives first came to my attention when I received a phone call from Michael Meyer of Springfield, Missouri. Michael manages about 700 hives and lost about 70% of them over the winter of 2008-2009 due to CCD-like symptoms. In an act of desperation, Michael mixed up a batch of Honey-Bee-Healthy (a mixture of lemongrass and spearmint oils) with sugar syrup at four times the recommended feeding concentration. Since the bees would not eat such a strong mixture, he simply dumped about a cup in each hive wetting the bees and the combs. This forced the bees to take it up as they licked themselves and their combs clean. Michael observed that all work in the hive stopped for about a half hour as the bees dealt with the mess but otherwise, it didn't seem to hurt the bees and their state of health promptly turned around. Michael indicated that others were having similar results.

After speaking with Michael, I started to make some phone calls of my own. I spoke with Gary Mackrill of Cathay, North Dakota, who runs bees between North Dakota, Texas, and California. Gary's bees were going downhill fast. His bees were battling *Varroa*, and while many of his bee yards were dealing with Nosema, tests showed that all his yards had high virus loads as well. Gary mixed a gallon of Honey-B-Healthy into a 55 gallon drum of sugar syrup and drenched the bees and brood area of each colony with 8 oz. about 10 days apart for a total of two treatments. He reports that the health of his bees turned around dramatically and *Varroa* doesn't seem to be as much of a problem any more following the drenching. Gary has also replaced the use of the antibiotic drug Fumidil B with Honey-B-Healthy and reports that he is able to control Nosema effectively. He has since become a Honey-B-Healthy distributor.

David Webb has been keeping bees for about 30 years and manages about 700 hives out of Cocoa, Florida. He was having problems with bee health stemming from their exposure to pesticides from the local orange groves. He mixed up one pint of Honey-B-Healthy in a five-gallon bucket of sugar syrup and poured 10-12 ounces over the bees and the brood chamber in each of his hives. David credits H-B-H with preventing further decline and turning his bees around. He also uses H-B-H when treating his bees with formic acid to control *Varroa* in order to prevent the bees from balling the queen during the treatment.

Al Haarsma shuffles his bees between his headquarters in Grand Rapids, Michigan and Florida. In the Spring of 2008 his operation of about 850 hives dwindled down to around 300. Previous testing of his hives had indicated high virus loads stemming from parasitic mite syndrome (PMS). Using the concentrated dosage, Al drenched his bees with about a cup of H-B-H three times, each four to five days apart. He reports that his bees rebounded and his operation grew back up to 600 hives in 1½ months and all his bees have been looking great ever since.

Richard Adee the owner of Adee Honey Farms in South Dakota is the largest beekeeper in America. Richard consistently runs 80,000 or more colonies between South Dakota, California, Washington, Texas and Mississippi. When it comes to Honey-B-Healthy, Richard says "we wouldn't operate without it."

Adee Honey Farms suffered a 40% loss of bees in 2008 and testing

# Using Food Grade Essential Oils To Mitigate Problems Like Nosema, Varroa And Viruses Is Becoming Common

indicated that numerous viruses were the primary cause. As Richard tells it, he sent the best of what was left of his bees to the almond orchards in California and shipped the rest to Texas. Then he bought a bunch of new bees in an effort to expand and improve the gene pool in his bees and he bred from the best and most resistant of his remaining stock. In the Summer of 2008 his bees were looking pretty good but were not making much honey. He drenched the bees with Honey-B-Honey and the bees seemed to take off, ending the year by producing a nice honey crop. Testing and sampling following the drenching indicated much lower virus levels as well as lower *Varroa* levels. Since then Richard reports that he has had no major health issues with his bees during the past year and a half and he now uses H-B-H regularly in his bee feed and is drenching them once each summer as preventive maintenance. Like his colleagues, he appreciates the fact that H-B-H is a food related natural product and that he does not have to rely on toxic chemistry and drugs to maintain his industrial size operation.

Dirk Heinen from Edmonton in Alberta, Canada, manages about 800 hives. He began using H-B-H prophylactically after his queen supplier, Olivarez Honey Bees, began using a similar product, *Pro-Health* distributed by Mann Lake, and the quality of the queens he was receiving seemed to improve. Dirk uses H-B-H to control Nosema and chalk brood and says that by using it when feeding, the essential oils have a preservative effect and helps prevent mold growth in syrup and on protein patties that do not get eaten up quickly. His bees are overwintered outside and he says his winter losses tend to run much lower than the beekeepers all round him. He also reports a reduction in the amount of mold that grows on the combs of hives that do die over the Winter.

It seems that Dirk is also a dealer of Honey-B-Healthy and the fact that a number of these beekeepers who are reporting such good results with essential oils are also selling it was making me rather skeptical. After all, these anecdotal reports are all well and good but where is the science-based evidence for the efficacy of using essential oils to kill viruses, molds, and fungi, help prevent queen rejection, control Nosema, and aid in reducing *Varroa* issues in the hive?

Well it turns out I was able to find enough studies to suggest that these varied reports are more than just old wive's tales (or old beekeeper's tales as the case may be). Being highly concentrated, plant essential oils have proven antimicrobial, antifungal, and antiviral properties. Lemongrass oil in particular has been shown to have significant antifungal activity (Tzortzakis, 2007, Bona da Silva, 2008) and strong antiviral properties (Minami, et. al.,2003).

Lemongrass oil also contains two honey bee pheromone components, *Geranial* a major component of the Nasonov pheromone, and *Citral* a minor component of the Nasonov pheromone (Shearer 1966). This would help explain successful reports of using lemongrass oil as a lure in baited swarm traps. As it turns out, Geranial is one of the Nasonov pheromone components that have been shown to cause *Varroa* mites to become confused and disoriented (Pernal, et. al., 2005). This could account for the reports of H-B-H having a detrimental effect on *Varroa* levels in hives.

Then I contacted David Wick of BVS, inc. David's company screens and detects all types of viruses using an Integrated Virus Detection System (IVDS). The IVDS is an expensive detection device engineered by the U.S. Army that can detect virus particles by their distinct size. Originally built for virus screening of humans, it is proving to have tremendous value in assisting with furthering our knowledge of Colony Collapse Disorder (CCD) since one of the consistent factors in CCD is the presence of a plethora of honey bee viruses and fungi. As David reports, honey bee viruses can live on the surface of combs. Some of the viruses are quite hardy and can survive on combs for a long time waiting for the right moment to replicate themselves. According to David, the viruses can even live entombed within the bees wax and not just on the surface of the comb.

So far David's work has resulted in observational data that sampled the virus loads of 20 hives over a period of 10 months. The number of the viruses in the hives skyrocketed after being used for Almond pollination and then dropped dramatically following a treatment that utilized LaFore's Essential Oil Patties, a product manufactured by Jeff LaFore of Milton-Freewater, Oregon that contains a mixture of 9 different EOs. At this point the data is only observational and David does not know for sure if the EOs may be effecting the bees, the virus vectors (such as *Varroa*) or just the viruses exposed on the combs.

David has obtained grants to run experimental trials on essential oils and as a part of these trials he is scheduled to collect data specifically on the Honey-B-Healthy and LeFore essential oil products for most of this year and should have empirical data on their effectiveness against viruses in the hive by the beginning of 2011. When I mentioned that beekeepers reporting that their hives were crashing with CCD-like symptoms were able to totally turn them around with H-B-H drenches, he noted that such reports are consistent with what he has observed. So far however, he has no data that can refute or confirm such claims.

Then I had a chat with Dr. Frank Eischen of the USDA Agricultural Research Service out of Weslaco, Texas. Dr. Eischen has used H-B-H in some trials and has found it to have some value against *Nosema ceranae* though not as effetive as Fumidil B. During the trials he conducted H-B-H was only used at the regular feeding strength and he indicated an interest in evaluating the product at the higher drench concentration levels in the future.

At this point it would seem that EOs are what is keeping a large part of our industry healthy in the face of CCD. It should be no surprise to readers that as one who has championed the use of natural approaches over toxic chemicals and drugs, I consider these recent developments welcome news. However, we must remem-

## Eventually, We Need To Figure Out The Underlying Problems So We Can Quit Treating Symptoms

ber that by using EOs, we are only dealing with the symptoms of our problems and not the cause. Even if further testing of EOs prove they are effective in killing off viruses, fungal infections, molds, and diseases while confounding *Varroa* all at the same time, relying on these products is not ultimately the solution. While it's a move in the right direction, eventually we will need to figure out what is stressing the bees immune systems to the point where viruses and diseases threaten to gain the upper hand and resolve the underlying issue. Meanwhile, essential oils seem to be buying the industry time.

*Ross Conrad, author of* Natural Beekeeping, *regularly conducts organic beekeeping workshops, classes and consultations in between taking care of his own bees. Dancing Bee Gardens, P.O. Box 43, Middlebury, VT 05753;* ***www.dancingbeegardens.com; dancingbeegardens@hotmail.com.***

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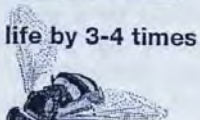

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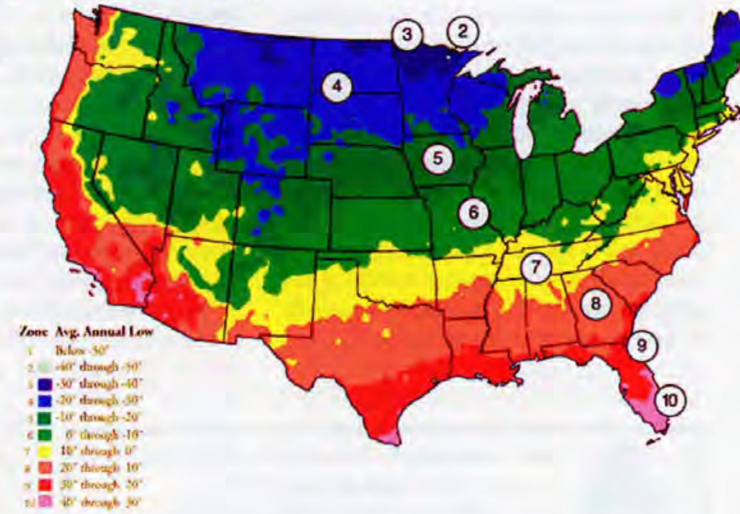
# Come To My Garden

Ann Harman




"Two million flowers to make one pound of honey? Why should I plant anything? I've never planted anything before, so why should I start now? My bees won't make even one drop of honey."

Well, now you are a beekeeper and I am sure we can find a number of reasons to plant some flowers. Small plots of land, such as 50 by 50 feet or even much smaller, in urban environments can grow a surprising number of different flowers, including some fruits and vegetables. Don't ignore a deck. That's actually a very good garden plot, too. It's all a matter of choosing what to plant and, of course, where and how.

I am certain you have read some beekeeping books and magazines and attended some beekeeper's meetings. So I think you have read and heard about bee-friendly plants in your area. Throughout the bee season your bees are in need of both pollen and nectar so you need to keep sources of those in mind while you graze the seed and gardening catalogs. What? You don't have any catalogs? You need to go to the Internet and first visit "gardeners catalogs" and then "seed catalogs."

In the gardeners catalogs site you will discover all sorts of catalogs for equipment. The seed catalogs are, of course, for seeds as well as plants and some equipment. You certainly can visit a local nursery or Big Box store but the catalogs will give you a much more satisfactory experience. Just like beekeeping equipment catalogs that describe the various items, the equipment and seed catalogs give you a good education as well as a huge selection. You can browse the catalogs on line and also get on their mailing list.

I always like the mail I receive in January. There is snow on the ground; the wind howls on my hilltop; my fingers are cold, but the seed and gardening catalogs arrive. Suddenly it seems that the sun is shining; it's not as cold as I thought and Spring is sure to come. Planning my garden in January is almost as much fun as actually planting it in Spring.

I think first of all you need to know what growing zone you live in. Fortunately seed catalogs have maps of the U.S. with zones marked. If you live quite near the border of a zone it would be the best to pick the colder zone as yours. Next, please do find out which way is north, south, east and west for your future garden plot. Equally as important as that, how much sun and shade does your bee garden get throughout the day and where? Map it. Perhaps you have a high wall around your garden – many town houses do. Or perhaps your house or shed has a useful wall. Such a wall opens up some wonderful opportunities. We'll do something with those walls later. How about the soil – it could be desert sand, clay, full of rocks, or wonderful rich loam. Rainfall – including snowfall – how much and when?

You may think all that information is so much to learn. Well, your little bees are quite aware of much of it already. They live there and are quite attuned to their environment. Unfortunately you have to learn about it. Actually learning about your bees' world makes you a much better beekeeper. You will realize when to feed them, when to put honey supers on, when you can expect a swarm, and the best time for various management tasks. Beekeeping will make sense.

Just as you have a small library of beekeeping books you need to have a small library of gardening books. A visit to the gardening section of your local bookstore will probably leave your head spinning. What books do I need? Just consider the size and scope of your garden. If you will be making use of a deck you will find books on container growing so those would be a good choice. Look for books that have some emphasis on your particular growing climate and soil. And, of course, select those that are for beginning gardeners.

While you are browsing the garden bookshelves, look for ones that feature companion plantings and the use of natural insecticides. Plants of all kinds are susceptible to insect damage and various diseases. Actually, so are our bees. Beekeepers are moving toward treatments for


diseases, parasites and pests that avoid the dangerous chemicals used in the past. Your garden will benefit from the same approach. However, just as in beekeeping, you will find some bits of conflicting information about gardening. My recommendation to gardeners is the same as to beekeepers. Go ahead and try.

When considering natural controls for insect pests in your garden, you may surprise yourself. Those spiders that appear unasked and take up residence in your plants are not there to damage plants. Spiders are one of the silent hunters of insects out to harm your plants. Here's another surprise. You will thank yellowjackets and an assortment of wasps for their hard work in eliminating damaging insects. Unlike bees, those stinging insects need to provide protein to their developing larvae and that protein means all the insects out to damage your garden plants.

I will leave it up to you to meld your local bee plant information with the seed catalogs and nurseries selling plants. Unfortunately you will probably not have many matches between what is commonly sold, such as at Big Box stores, and what bees prefer. So you may be starting many of your garden plants from seed. Some of the seed catalogs now are indicating plants that attract hummingbirds and butterflies. It would be nice if they indicated bees, too. However, you can make use of this information. Plants that attract only hummingbirds are probably not a good choice. Plants that attract butterflies, on the other hand, probably do attract bees. Some plants are especially attractive to bumble bees. Many of the small native bees, sometimes called pollen bees, will be attracted also. If you have not noticed these bees in the past, even the very tiny ones, you will enjoy their visits, too.

In your planning you want to have a succession of bloom from very early Spring until late into Autumn, the duration of seasons for your area. It is possible! It just takes a bit of planning. Now here is what that succession will tell you. Your garden will be the indicator of when bee flowers start and end blooming, if too much or too little rain, late Spring, early frost. Your garden flowers will help you care for your bees.

Just a few words about invasive plants. Don't plant them.

Think of yourself, too, when choosing what to plant. Herbs to flavor your cooking are also wonderful bee plants. You, generally, use the leaves but the bees will want you to leave a few stems with flowers. Fruits and berries, as well as vines, can be grown in small areas. Annuals and perennials and vegetables can be started from seeds but woody vines and the various fruits and berries will arrive as rooted plants, ready to put into the ground.

Now for a look at some equipment. The gardening catalogs are full of selections for starting seeds. You will have to select the type and size that fits your needs. I once tried sterilizing some garden soil, to use for seed-starting, by baking it in my oven as per directions in a gardening book. My kitchen did not smell like baking chocolate chip cookies! I never tried that again. Instead I relied on commercial seed-starting mix. Making your own compost from kitchen scraps may work for you, but you really need enough trimmings and scraps plus items from your yard to make it worthwhile. Many, many years ago a rain barrel was an important part of a household. Today we have quite an assortment of rain barrels available with safety features to keep children and animals from drowning. A rain barrel can help in other ways besides using the water for your garden.

As you look through the various catalogs you may see equipment for making raised beds. This approach to gardening is becoming more and more popular for a variety of reasons. You can make some very attractive bed designs to make your back yard interesting. Raised beds do help those with back trouble – not so much bending over. Depending on your available space, raised beds can be arranged so that all four sides are accessible. The various shapes and sizes of raised beds have endless possibilities for creating visual interest.

Raised beds have improved drainage and therefore do not become waterlogged during Winter rains and snows, particularly in areas with dense soil types. In many areas the soil will warm up faster and produce earlier crops. If you have no extra soil and compost available you may need to purchase enough to fill the beds. The cost of doing that may be prohibitive.

Urban gardeners can encounter some interesting problems. Some developments and other neighborhoods may have strict requirements on what you can do in certain parts of your property. Normally front yards are thought of as lawns – expanses of grass – with shrubs framing the house. But suppose that the exposure of your backyard is to the north. That area can receive the least amount of sun and many vegetables and a number of bee flowers need more sun than from a north exposure.

Now what about front yard? I've seen some very attractive front yard gardens, complete with vegetable and flowers. It is all a matter of planning. Beds do not have to be rectangles. Round beds, curved paths between plantings, vegetables and flowers combined in beds, vines supported on decorative frames and trellises can turn a boring expanse of grass into a colorful and interesting area. But if you live in a neighborhood with restrictions, check before you dig.

I promised you we would discuss walls. That will have to wait until May. In the meantime, collect your catalogs and start selecting your bee-friendly plants.

# Hawthorns

Connie Krochmal

## *Hawthorns are hard to beat when it comes to bee garden plants.*


Cockspur hawthorn

When it comes to trees and shrubs for the bee gardens it is really hard to beat the hawthorns. These are reliable, long lived plants.

The native hawthorns are particularly common in the eastern U.S. Members of the rose family, these are related to fruit trees. There are over 200 species of which around 10 to 20 are in cultivation.

These plants are also called thornapple. As the name indicates, these will usually have thorns, which can be three inches or more in length. There is one relatively thornless species as well as some thornless cultivars.

The crooked, horizontal spreading branches can give hawthorns a picturesque look. These have dense growth habits and short, stout trunks. Typically, they're 20 to 30 feet tall with a matching spread.

The leaves are alternately arranged and four inches or so in length. Usually lobed and toothed, these are often glossy. With few exceptions, the foliage is deciduous. The color is usually deep to medium green. The leaf shape can vary somewhat from egg-shaped to oval or oblong. Certain species bring lots of Fall color.

Very free-flowering, hawthorns are covered with small white blooms. In certain species, these have a bad odor. The blossoms, mostly cup-shaped, are typically white. But they can also be pink or red. These appear in clusters at the ends of the stems. They usually emerge during the late Spring and early Summer. With five sepals and petals, the flowers often have pink, yellow, or purple anthers.

The edible fruits are used for jams and jellies. Avoid consuming the seeds as they can cause stomach upset. The fruits are drupes, and look like tiny apples. These mostly consist of a seed covered with a little flesh. Though they usually ripen to red, these can also be blue-green, yellow, or black. In some species the fruits are persistent, lasting throughout the Winter. These ripen in the late Summer and Fall with the exact time varying from one species to another.

In addition to the recommended species of hawthorns, a number of excellent cultivars are available. Double flowering ones aren't beneficial to bees.

### Growing Hawthorns

Hawthorns can sometimes be hard to transplant. Balled and burlapped plants are easier to get established. Full sun is best. However, they will tolerate partial shade. Ideal for exposed sites, these plants will withstand wind, heat, mild drought, and salty soils.

Adapted to poor soils, they will grow in most any well drained soil. They thrive in sandy loams as well as limestone. Though hawthorns will withstand both alkaline and acidic conditions, the best pH is between six and seven. These respond well to shearing, making them suitable for hedges and screens.

Propagation is by seed as well as grafting and root cuttings. The hawthorns are prone to a number of diseases and pests. The most troublesome insects include mites, aphids, and Japanese beetles.

The most common diseases are hawthorn leaf blight, cedar-apple rust, and fire blight. Buy resistant hawthorns if cedar-apple rust is a problem in your area. Cockspur hawthorn shows some resistance to this disease. Hawthorn leaf blight shows up in the spring as spots on the leaves. The English hawthorn is very susceptible.

### Cockspur hawthorn (*Crataegus crus-galli*)

This species is native from Canada to Michigan southward to South Carolina and westward to Kansas. It is hardy to zone four. Especially suitable for hedges, this responds well to shearing. This can be grown as a shrub with multiple stems or a small tree. It is a broad, spreading, flat topped plant that can reach 20 to 30 feet in height with a matching spread.

The sharp, curved thorns are very long – up to four inches. There is a thornless variety.

The sharply toothed, leathery leaves are deep green and shiny. Four inches long, these are 1½ inches wide. The foliage brings vivid red Fall color.

Very floriferous, cockspur hawthorn has white blossoms with pink anthers. Opening in May, the flowers last for over a week. These appear in large, flattened clusters that are three inches wide. These blooms, which are 2/3 inch in diameter, have a slightly unpleasant odor.

The deep red fruits ripen in the Fall. Nearly round, they're one-half inch across. These don't last as long as some hawthorn fruits.

### Dotted hawthorn (*Crataegus punctata*)

Hardy to zone five, this is native from Canada southward into Georgia and westward to Illinois and Kansas. This tree can have a round or flat open top. It reaches 20 to 35 feet in height. Due to its large, horizontal branches, it is wide spreading – up to 40 feet.

This species is often thornless.

When present, the stout thorns appear mostly on the trunk.

The leaves reach 3½ inches in length. They're lobed and toothed with a wedge-like base.

This floriferous tree has white blooms that open in large, branched clusters. Appearing in May and June, these have yellow or pink anthers.

Dotted hawthorn is named for the dull looking, dotted fruits, which are much larger than those of most other native hawthorns. These are either round or pear-like. They're an inch wide. There is a variety with yellow fruits.

**English hawthorn (*Crataegus oxycantha*)**

Hardy to zone five, this is 20 to 30 feet tall with a spread of 25 feet. This shrubby plant has a round top and low growing, dense branches. The toothed leaves with five or so lobes are shiny. Around two inches long and nearly as wide, these are medium to dark green. They provide very little Fall color.

The white blossoms, which are 5/8 inch wide, open in mid-May. These appear in large clusters. In addition to the species, there is also a pink flowering variety as well as numerous red-flowering cultivars. Some of the cultivated forms have double blooms, which aren't good for bees.

The red fruits, which ripen in September and October, are ¾ inch wide. There is also a variety with yellow fruits.

Numerous cultivars are available, including one that is resistant to hawthorn leaf blight. This species was originally native to Europe, India, and northern Africa.

**Fleshy hawthorn (*Crataegus succulenta*)**

Fleshy hawthorn is a dense, rounded tree with stout branches. This reaches about 15 to 25 feet in height. Hardy to zone three, it is among the hardiest of the hawthorns. This species is native to the U.S. and Canada. Its range extends from New England south to Tennessee and North Carolina westward to Illinois, Montana, Utah, and Colorado.

*English hawthorn*

The oval, deep green leaves are shiny. Around three inches in length and two inches wide, these are hairy when young. They have shallow lobes and double toothed edges. The foliage turns reddish-purple during the Fall.

The stout, brown thorns are two inches long. The white blooms, which begin opening in late May, form large clusters. The anthers are pink or yellow.

This plant is best known for its large crop of shiny, globe-shaped fruits. Around 5/8 inch wide, these are pulpy and vivid red. They ripen rather late – in October.

**Glossy hawthorn (*Crataegus x nitida*)**

Notable for the fact that it is nearly thornless, this dense, rounded tree is hardy to zone four. It is native to a large area of the central U.S. from Illinois to Missouri and Arkansas. Glossy hawthorn is a naturally occurring hybrid of cockspur hawthorn and green hawthorn. This tree can reach 20 to 30 feet in height. Some experts consider it to be among the best of the native hawthorns.

The glossy leaves are lobed and sharply toothed. With deep green coloring, these are oblong and three inches wide. They taper to a sharp point. During the Fall, the foliage becomes red or orange. The leaf stalks are winged.

This hybrid is very free flowering. The white blooms, which are 5/8 inch across, have yellow anthers. Opening from mid to late Spring –usually in May – these appear in large, branching, rounded clusters, one inch wide.

The nearly round fruits turn orange or deep red. Around 5/8 inch across, these last all Winter long. They ripen in October.

**Lavalle hawthorn (*Crataegus x lavallei*)**

This is a hybrid of cockspur hawthorn possibly with hairy hawthorn. Hardy to zone five, this has a dense, oval, spreading growth habit. It reaches 20 to 30 feet in height with a spread of 30 feet.

*Singleseed hawthorn*

The oblong, irregularly toothed leaves are four inches in length and 2½ inches wide. Shiny and deep green, these can be semi-evergreen. They turn red or bronze in the Fall.

The showy white flowers have red centers. Around ¾ inch in diameter, these open in erect clusters during June.

The very stout thorns are two inches long. The fruits, which are 5/8 inch wide, are long lasting. These ripen rather late in the year – usually in November. With brownish flecks, these can be red or reddish-orange.

**Singleseed hawthorn (*Crataegus monogyna*)**

This plant is also known as English hawthorn although there is another species that goes by that common name. Singleseed hawthorn can be either a shrub or small tree. It is a round topped, densely branched plant with drooping branches.

Often used for hedges, it is usually only around 15 feet in height. With favorable growing conditions, it can reach as much as 30 feet tall with a spread of 25 feet.

There is a columnar, upright cultivar, typically eight feet wide. This form is relatively slow growing.

Singleseed hawthorn has sharp thorns that are about an inch long. The oval to diamond-shaped leaves have very few teeth. These are very shiny and medium green. With a fine texture, they drop early in the Autumn, providing no fall color. There are usually three to seven deep lobes.

The small, fragrant, white blooms are 5/8 inch wide. Opening in flat clusters during the late Spring, these


*Washington hawthorn*

have pink anthers. There are varieties with red and pink flowers. Some cultivars have double blooms.

This is named for the spherical, shiny fruits, which are ½ inch across. These only have one seed, while the fruits of most hawthorns have two or more. They're less showy than those of some hawthorns.

Hardy to zone three, this plant is originally native to Asia Minor and Europe – particularly the Mediterranean region. Singleseed hawthorn is quite susceptible to fire blight and cedar apple rust.

### Washington hawthorn (*Crataegus phaenopoyrum*)

This dense tree has a round or oval head. It reaches 20 to 30 feet tall with a spread of 30 feet. There is a space-saving, columnar cultivar available. This is hardy to zone four. The long, slender thorns reach three inches in length.

The medium green, shiny leaves can provide great Fall color with the colors ranging from red and orange to purple. The doubly toothed foliage often has three lobes, which can give it a maple-like appearance. However, this can have up to seven lobes. Triangular in outline, the leaves are three inches long. When it first emerges, the foliage is purplish-red.

Washington hawthorn is among the most floriferous of the hawthorns. With pink anthers, the white flowers can last over a week. Opening in mid-June, these are later flowering than some hawthorns. They appear terminally as well as from the leaf axils.

The shiny, vivid red fruits are spherical. One-half inch across, they form large clusters. Very long lasting, they begin ripening in September. This species is native from Pennsylvania south to Virginia, Florida and Alabama westward to Missouri.

**Hawthorn's Value to Bees**

Bees are very fond of hawthorns, and eagerly seek out the blossoms. These plants provide nectar and pollen. There is so much nectar that it visibly glistens in the flowers. These plants compare favorably to fruit trees in terms of nectar/pollen production.

The delicious honey is considered excellent quality. Though the flavor can vary slightly from one species to another, it often has a delicate, nut-like taste. The color can vary as well from white to dark amber.

In addition to the nectar and pollen from the blossoms, bees also get honeydew from the young shoots as well as nectar from the extrafloral nectaries.

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


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# GLEANINGS

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## AAPA STUDENT RESEARCH SCHOLARSHIP

Geoff Williams is a Ph.D. Candidate at Dalhousie University and Acadia University in Nova Scotia, Canada supervised by Dave Shutler, Dick Rogers, and Sandy Walde. For his thesis, he is investigating effects of the antibiotic Fumagilin-B® and the recently-detected fungal parasite Nosema ceranae on honey bee colony strength, while also studying effectiveness of this antibiotic on this parasite. His future work will investigate interactions between Nosema ceranae and western honeybees' historical Nosema parasite, Nosema apis, as well as compare pathology of these two parasites. In addition to his thesis research, Geoff has studied *Varroa* and deformed wing virus in honey bees, and has worked on a number of projects investigating potential effects of crop protection products on honey bee colony health.

Geoff has received numerous national and international awards for his work, including two NSERC Industrial Postgraduate Scholarships from the Government of Canada, the 2008 Canadian Association of Professional Apiculturists' Student Merit Award, the 2008 Eastern Apiculture Society of North America Student Award, and a 2007 Foundation for the Preservation of Honey Bees Scholarship. Since 2007, he has published seven papers in peer-reviewed scientific journals, and he has presented his research findings at >15 local, national, and international scientific conferences and beekeeper meetings.

## OBITUARY

**Mildred Johanna Hogg** passed away peacefully in her home December 31, 2009 surrounded by her loving family. Mildred was born September 10, 1921 in Petersburg, ND, the youngest of five children born to Martin and Lena Hildremyr, both of whom emigrated from Norway. Mildred grew up in Petersburg then graduated from Waldorf College and the University of ND. In 1947 she married John A. Hogg and moved to Kalamazoo, MI where Dr. Hogg was employed as a research chemist at the Upjohn Company (now Pfizer Pharmaceutical). Here they started a family and Mildred became an active member of the First Presbyterian Church of Kalamazoo. In 1959 they settled near Galesburg, MI on 30 beautiful acres and raised their three children among the rolling hills of junipers, maple groves, ponds and meadows. Mildred cultivated the spirit and beauty of the property that became known as Juniper Hill. She loved her rose garden, watching the wildlife around her home and helping her husband in his apiary pursuits.

Mildred is survived by her husband of 62 years, Dr. John A. Hogg of Kalamazoo, MI; children Karen E. Dacey, John T. Hogg and Thomas A. Hogg.

## AHPA FRIEND OF THE INDUSTRY

Christi Heintz was presented with a "Friend of the Industry" plaque in appreciation for her service to theindustry, at the January meeting of the American Honey Producers. Ken Haff (left) president, presents Christi (center), with Dan Cummings, Chair of Project Apism assisting.

## 70 TONS OF MANUKA HONEY LOST IN FIRE

Some 70 tons of high grade manuka honey due to be exported from New Zealand was destroyed in a 10-hour fire in a loss estimated to have cost Kiwi Honey Ltd. almost NZ$1 million.

When firefighters arrived at the scene in Wanganui some 125 miles from Wellington on the North Island, one storage shed was on fire and then a second shed caught fire and was destroyed.

It is believed the fire was caused by an electrical fault.

Company owner Paul Sergent tells reporters the company had lost up to a third of its honey, as well as his sheds full of processing and storage equipment.

The company had been in the process of collecting the honey for a large export order to Japan. It was just two days into extracting honey from the hive frames, which were stored in the destroyed buildings.

The Wanganui Chronicle newspaper reports offers of help have been pouring in for the manuka honey factory.

"We're rebuilding," Sergent tells the newspaper. "We're going to have to start from scratch."

Sergent says there is still 150 tons of honey left to harvest but now there is nowhere to process it.

"Most of the honey has been produced and is sitting on hives, and we still have areas that are producing. So the honey wasn't all in the shed.

Sergent says he's grateful to other honey producers who have offered to help extract and process the honey.

*Alan Harman*

# POLICE BEES

Alan **Harman**

The Nottinghamshire Police Department in Britain is about to become the first police service in the world to produce and sell its own honey.

The East Midlands region of the United Kingdom is home to Sherwood Forest and the legend of Robin Hood, but it's at the police service's rural Sherwood Lodge headquarters, 130 miles north of London, where the first hive will be located.

Detective Inspector Ashley Wilson, an award-winning beekeeper in his own right, is to set up the hive, producing "Chief's Own Honey," with the proceeds from honey sales going to charity.

After a promotion Wilson, a 20-year veteran, moved from the Criminal Investigation Division in urban Sutton-in-Ashfield to the Corporate Development unit at the Sherwood Lodge headquarters.

The HQ is about 12 miles from Sherwood Forest and the Major Oak regarded as Robin Hood's tree is located in Edwinstowe, about five miles from where Wilson lives.

"As a kid I used to climb up and stand inside the tree but they have fenced it off now," he says.

Wilson has been beekeeping in his spare time for four years, working with his father-in-law Peter Straw to operate more than 25 hives. Their honey has won awards at the Derbyshire Honey Show and demand for products through their website outstrips supply.

*Detective Inspector Ashley Wilson with the Nottinghamshire Police "Chief's Own Honey. (Nottinghamshire Police photo).*

Straw lives in the next county, Derbyshire, so he and Wilson are members of the 100-member Derbyshire Beekeepers Association. He is also a member of the British Beekeepers Association.

Wilson says his sales are being helped because local honey can help fight hay fever.

"We get a lot of orders from people whose doctors have told them to find honey produced within a 20 mile radius of where they live because eating it can build up a resistance to pollen in the area," he says.

At his promotion ceremony, Wilson presented Chief Constable Julia Hodson, with a specially made jar of "Chief's Own Honey."

She then agreed to his idea for a beehive to be kept and managed at Sherwood Lodge.

"I'm really looking forward to trying my honey and think it's a great idea to have a hive at force headquarters," the police chief says. "In fact, I'm quite keen to learn more about beekeeping as I might even set up my own hive at home."

He expects the hive to produce 100 to 200 pounds of honey a year, enough to fill more than 100 jars.

"I think local people and tourists will like to buy it as a memento or gift," Wilson says.

Each jar is expected to sell for £3 (US$4.97) with Wilson covering production costs.

He says setting up the hive will be something different, showing the public police do have concerns for the environment and want to contribute.

Nottinghamshire Police, with a strength of 2,500 uniformed and plain clothes police officers, patrols an area of more than 800 square miles and serves a diverse population of more than one million people living in Nottinghamshire's towns, villages and rural areas as well as in the city of Nottingham, the regional capital of the East Midlands.


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## GE CANOLA POLLEN FOUND IN HONEY

Greenpeace Australia says it has found commercial beehives contaminated with genetically engineered (GE) canola pollen near Geelong, Victoria.

The group has set up what it calls a mobile biohazard research center at a GE canola field in southern Victoria and is calling on Federal Health Minister Nicola Roxon to use her powers to properly assess the health and environmental risks of GE crops.

Victoria ended a moratorium on growing GM canola at the end of 2007 after being advised it could be kept separate from non-GM crops.

"Honey samples from the hives meters from a genetically engineered canola field near Geelong were found to contain Monsanto's Roundup Ready canola pollen," Greenpeace GE campaigner Louise Sales says.

Media reports say the hives are owned by Edmonds Honey, the trading name for Geelong Honey Pty. Ltd.

Beekeeper John Edmonds says beekeepers had been using GM cotton for years without negative health impacts. He's quoted as saying he would report the Greenpeace campaigners to police for removing and testing his honey frames.

Sales was more concerned about the honey from the hives.

"This means people buying honey from this hive will be eating GE food without knowing it, and before it has been properly assessed that it's safe to eat.

"The GE canola farmer is not obliged to inform his neighbors about what he is growing, so the beekeeper has been kept as much in the dark as everyone else."

Greenpeace says it will monitor wind speed and pollen flow onsite to determine how far pollen from the GE canola crop is likely to spread.

The group says Roundup Ready canola has been shown to have adverse effects on livers in Monsanto's own rat feeding studies, and has been banned in Europe.

"It's time for Federal Health Minister Nicola Roxon to step in and ensure independent proof that GE crops and food are safe 'beyond reasonable doubt,' Sales says. "We need biodiversity studies to examine the impact on surrounding plants, insects and animals of these new crops and the farming techniques they require. Such studies in the UK found significant impacts on wildlife."

*Alan Harman*

## MANUKA HONEY ISSUES

The New Zealand Food Safety Authority puts a hold on a US$719,000 (NZ$1-million) honey order being packed for export after testing indicated slightly abnormal cane sugar levels.

Timaru-based Honey Valley New Zealand Ltd. one of the country's major Manuka honey exporters, says it had identified a potential problem with several batches of high value Manuka honey it had purchased from a beekeeping supplier.

"The honey comes from hives with very high unique Manuka antibacterial activity," Managing Director Steve Lyttle says in a statement. "All honey processed by Honey Valley undergoes very strict pre-processing checking and testing.

Lyttle says the honey displayed slightly abnormal cane sugar levels when pre-processing testing was carried out.

"My production team set honey aside and we took core samples from the various batches and sent them to the world's top honey quality testing lab: Intertek in Germany," he says. "The results came back suggesting slightly unnatural levels of cane sugar and I advised the NZ Food Safety Authority. They looked at the analyses and placed a hold on the honey subject to the results of their own investigation."

Lyttle says it's important to note the Manuka honey had also been tested for its UMF activity rating by New Zealand laboratories.

"The honey has very good UMF activity," Lyttle says. "So the issue isn't about the honey's UMF Manuka antibacterial activity but about the abnormal presence of cane sugar."

He denies reports the honey had been seized.

"We have been directed by the NZ Food Safety Authority not to process or move the honey until the investigations have been completed," he says. "This is normal procedure in these circumstances when operating a risk management program under the Animal Products Act."

Lyttle says honey testing laboratories have problems using the conventional sugarcane test with Manuka honey. That's because the high and variable protein level in Manuka honey can distort the sugar test.

Authority assistant director Justin Rowlands says the investigation is solely about the honey composition and there is no food safety issue.

Lyttle is one of founding organizers of a special Manuka honey industry group setting standards for Manuka honey. His own company exports UMF Manuka honey to 15 countries around the world.

*Alan Harman*

## FINAL MOMENTS OF BEE LANDING TACTICS REVEALED

Landing is tricky: hit the ground too fast and you will crash and burn; too slow and you may stall and fall. Bees manage their approach by monitoring the speed of images moving across their eyes. By slowing so that the speed of the looming landing pad's image on the retina remains constant, bees manage to control their approach. But what happens in the final few moments before touch down? And how do bees adapt to landing on surfaces ranging from the horizontal to upside-down ceilings? Flies land on a ceiling by simply grabbing hold with their front legs and somersaulting up as they zip along, but a bee's approach is more sedate. Mandyam Srinivasan, an electrical engineer from the Queensland Brain Institute, The University of Queensland and the Australian Research Council's Vision Centre, knew that bees must be doing something different from daredevil flies. Curious to know more about bee landing strategies Srinivasan teamed up with Carla Evangelista, Peter Kraft, and Judith Reinhard from the University of Queensland, and Marie Dacke, visiting from Lund University. The team used a high-speed camera to film the instant of touch down on surfaces at various inclinations and publish their discoveries about bee landing tactics in The Journal of Experimental Biology on December 28 2009 at http://jeb.biologists.org.

First the scientists built a bee-landing platform that could be inclined at any angle from horizontal to inverted (like a ceiling), then they trained bees to land on it and began filming. Having collected movies of the bees landing on surfaces ranging from 0deg. to 180deg., and every 10deg. inclination between, Evangelista began the painstaking task of manually analysing the bees landing strategies, and saw that the bees' approach could be broken down into 3 phases.

Initially the bees approached from almost any direction and at any speed, however, as they got closer to the platforms, they slowed dramatically, almost hovering, until they were 16mm from the platform when they ground to a complete halt, hovering for anything ranging from 50ms to over 140ms. When the surface was horizontal or inclined slightly, the bees' hind legs were almost within touching distance of the surface, so it was simply a matter of the bee gently lowering itself and grabbing hold with its rear feet before lowering the rest of the body.

However, when the insects were landing on surfaces ranging from vertical to 'ceilings', their antennae were closest to the surface during the hover phase. The team saw that the antennae grazed the surface and this contact triggered the bees to reach up with the front legs, grasp hold of the surface and then slowly heave their middle and hind legs up too. 'We had not expected the antennae to play a role and the fact that there is a mechanical aspect of this is something that we hadn't thought about,' admits Srinivasan.

Looking at the antennae's positions, the team realised that in the final stages as the insects approached inverted surfaces, they held their antennae roughly perpendicular to the surface. 'The bee is able to estimate the slope of the surface to orient correctly the antennae, so it is using its visual system,' explains Srinivasan. But this is surprising, because the insects are almost completely stationary while hovering and unable to use image movement across the eye to estimate distances. Srinivasan suspects that the bees could be using stereovision over such a short distance, and is keen to test the idea.

Finally the team realised that bees are almost tailor made to land on surfaces inclined at angles of 60deg. to the horizontal. 'When bees are flying fast their bodies are horizontal, but when they are flying slowly or hovering their abdomen tilts down so that the tips of the legs and antennae lie in a plane that makes an angle of 60deg.' explains Srinivasan: so the legs and antennae all touch down simultaneously on surfaces inclined at 60deg. 'It seems like they are adapted to land on surfaces tilted to 60deg. and we are keen to find out whether many flowers have this natural tilt,' says Srinivasan.

Srinivasan is optimistic that he will eventually be able to use his discoveries in the design of novel flight control systems.

*Journal of Experimental Biology*

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BEEKEEPING published since 1935, by Devon Beekeepers' Association, SW England. 10 issues per year. Subscriptions outside Europe £26. Send to Brian Gant, 2 Abbey Gardens, Buckfast, UK TQ12 0EU. **brian.gantWwhich.net**.

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bees are dead, while the suits keep saying it takes time and money. And for goodness sakes don't buy any more gardens. Don't buy any more posters. Don't build any more beautiful web pages or social network sites. Don't buy anything that gives any more money to the suits and doesn't help a beesuit. Give your money to a beesuit organization. Give your money to the people who really care about honey bees, beekeeping, pollination, food production and your bees and your beekeeping. These are the people who have a vested interest in getting things done. These are the people who are mad as hell and don't want to take it anymore. Have you ever seen a mad suit?

And you know darn well when you're sitting in that room in the middle of the week in the middle of a working day that a suit never, ever has to tighten a veil, check a smoker or sharpen a hive tool just to go to work. Never, ever.

You want to help? Help a beesuit. The suits have it easy. The suits have enough money. And to my way of thinking, the suits have had enough time.

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# Dead Man Walking

Ed Colby

Some days turn out unforgettable, in the oddest and most unpredictable ways!

A few Colorado Octobers ago – never mind how many – we got Paul's bees ready to go to California for the almonds.

We worked in pairs. One of us would tip the hive forward, while the other used a hive tool to pry off the pollen trap. Then the first would lift the hive, while the second removed the trap.

The Bookcliff Range was already white, and snow swirled around us as we worked. The bees were all in the hive, at least until we riled them up. I don't recall that anybody had a smoker going. We just did it. Some hives scarcely stirred, but in others, the little darlings came out with a vengeance.

When I stepped away from the mayhem to relieve myself, I got stung not once, but twice. This really got my attention! I cried out, and Mark said, "Come on! How could any bee find such a small target?!"

The entire crew got a laugh at my expense. They were such a good-natured bunch.

By noon, we were cold and a little beat up by the bees. When Paul said, "I'll buy lunch in Battlement Mesa," nobody objected.

The White Buffalo was the only joint in town.

As we pulled into the parking lot, my old friend Jim Bare came out of the restaurant headed down the sidewalk toward City Market. I saw him clearly from 25 yards away. He walked slightly hunched the way he always did, with his hands in the pockets of his old red ski jacket. I almost jumped out of the truck to say hello. Looking back, I wonder why I didn't.

It didn't surprise me to see Bare, because I knew he hung out at the White Buffalo. We'd had lunch there awhile back. He was in poor health. I'd meant to call him again, but you know how it is.

After we all ordered, I eased over to the bar. The bartender smoked a cigarette as he wiped the bar top. A couple of aging long-hairs sat staring into their beers. I wanted to leave my beekeeper business card with the bartender to give to Bare. I thought he might get a kick out of it.

"Say," I said to the bartender, "You wouldn't happen to know a guy by the name of Jim Bare, would you?"

"Can't say that I do," the bartender said. This set me back, because I knew Bare was a regular here.

I said, "He lives in Battlement Mesa. You'd just about have to know him." Then I described a certain unmistakable physical peculiarity of Bare's. It wasn't something I'd ordinarily mention, but just this one time I did.

"Oh, that guy," the bartender said, "He died last Spring. We had a wake right here in the bar." The old hippies looked up and nodded knowingly. The bartender continued, "You know, he special ordered a bottle of his favorite single malt scotch. It's still here. We're waiting for him to come get it."

All this hit me like a stomach punch. Bare was a friend and an easy man to like. When I was a stonemason, he was my hod carrier. We somehow got into a wrestling match once. We took a road trip together. He was a lover of books, and he had a certain scholarly air. A born storyteller, he spoke only cryptically about his novel – a work in progress. Maybe as a writer I felt a certain kinship.

Walking away from the bar, I had this eerie feeling. Back at our table, I said to Paul and the boys, "I don't get it. I just saw a guy in the parking lot, but the bartender says he's dead. Now who do I believe – a guy who doesn't even know my buddy's name – or my own eyes?"

There had been women in Bare's life, but I was pretty sure he lived alone. I knew he had a grown daughter. When I dialed his number, a woman's voice was on the recording. I left a message for Bare. I said I'd heard a rumor that he might be dead. Would he mind calling and setting me straight? This was an odd message for sure, but if Bare were alive, he'd be most amused.

No one ever called me back.

Finally I called Bare's lifelong friend Kevin in Aspen, and he confirmed the worst. OK. I can accept this. I have to. But who was the man in the red jacket?

My friend Dea is the daughter of Helena Vieira Costa – "Mother Helena" – the legendary psychic and orphanage founder from the Brazilian city of Alagoinhas. Even today, over a decade after her death, Mother Helena's fame as a medium and near-saint rests secure – not only in Alagoinhas, but to the farthest reaches of the state of Bahia.

All this being a way of saying Dea knows her way around the netherworld. No seer herself, for Dea the spirit world nonetheless forms a sort of backdrop to her earthly life.

Over lunch in El Jebel, Dea listened bemusedly to my story about Bare. Maybe her dark eyes twinkled. I said, "What do you make of the guy with the red jacket?"

She said, "That was your friend. He showed himself to you as a way to say hello."

I said, "You really think so?"

Dea laughed that anyone could be so skeptical. "Of course," she said. "Who else could it have been?"

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