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AMERICAN BEE JOURNAL

VOLUME 150 NO. 8 AUGUST 2010

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August Cover Picture

Kathy Keatley Garvey, communications specialist, UC-Davis Dept. of Entomology, took this beautiful photo of a honey bee on seaside daisies at the Haagen-Dazs Honey Bee Haven on campus. The grand opening for the Haagen-Dazs bee garden is scheduled for Sept. 11, 2010. Read more on page 721 of this issue.

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Letters to the Editor

Send your letters to the editor, Attn: Joe Graham, Dadant, 51 S. 2nd Street, Hamilton, IL 62341, Fax: 1-217-847-3660, or email: abj@dadant.com.
Due to size and content, we may be unable to publish all information received. Thank You!

OPEN-AIR COLONY IN MARYLAND

I am sending a few pics of an open-air hive. The hive is located in Carrol County, MD. I've heard through the grape vine it may be up to 8 years old.

Kim Runyon
Maryland

This large feral colony photo was taken by Kim Runyon of Maryland.

HONEY BEE STRESS SYNDROME (HBSS)

(or redefining what's been affecting our bees)

For the past several years, the term *Colony Collapse Disorder* has been so commonly used and bantered about, that it almost seems to describe an identifiable problem that has befallen the honey bee. This perception seems to be particularly true with many of the new beekeepers coming on-line recently, as well as in the mind of the general public. A primary problem with this assumption however, is that it neither accurately describes what has been affecting honey bees, nor has it led to tangible solutions for preventing future losses.

We need to remind ourselves that the current situation with large bee losses is not new. These situations have been occurring with honey bees in about ten (10) year cycles, since accurate historical records on beekeeping have been kept - and which go back to the mid 1800's at least. What has happened over the past 20 years though, and probably just within the past 10 years for the beekeeping community, has been the rapid development and use of instantaneous and unregulated communications, particularly over the Internet.

In listening to and reading about accounts of *CCD* one is reminded about descriptions of "Killer Bees", with all the attendant hype and exaggeration. Such accounts have tended to sensationalize and in some cases, distort the picture of what is actually going on. Some, many perhaps, within the publishing and media industry have unabashedly expressed their belief that the foremost consideration for them is to sell newspapers, magazines and sound bites - not necessarily to provide factual information. Is it any wonder therefore, that the use of the term *Colony Collapse Disorder* may have become distorted and misunderstood?

There also seems to be an *institutionalized mentality* that has developed around the use of the *CCD* terminology. Many, but not all, academics and researcher, as well as many respected figures within the beekeeping community, seem to have adopted an acceptance of the term – as if it were established fact – when in actuality the situation with bee losses seems more complex and enigmatic than when the term was first coined.

Two other situations lend weight to the proposition that perhaps the time has come to retire the general use of the term *Colony Collapse Disorder* in favor of a less ambiguous and more straight-forward description: 1.) A need for greater objectivity/transparency and 2.) A difference of perspective coming from outside of the U.S.

A continual difficulty with the study of *CCD* has been an inability to nail-down a specific set of conditions and variables that may be responsible for the overall losses.

Viruses, parasitic fungi, pesticides, mites, climatic changes and even beekeeping practices have all been implicated as major causes of *CCD* at one time or another. It seems possible, if not probable, that a discrete, repeatable list of causes and factors necessary to initiate symptoms of *CCD* will never be identified - much the same as it has been for the past 150+ years that large bee losses have been reported. The analytical and detection technology we have nowadays (within the past 20 years particularly) are sophisticated indeed. But an accumulation of large amounts of data do not necessarily lead to verifiable and repeatable results, which has been a main drawback with the *CCD* hypothesis up to now.

It is also noteworthy to mention that the degree of concern and importance that we give to *CCD* here in the U.S. is not necessarily shared by beekeepers and researchers outside of this country. With the current domestic concerns that we have here nowadays, there is a perception from outside that we tend to be overly preoccupied with issues of security and perhaps plots against us/the government, rather than actually dealing with what is. This then tends to be interpreted by others as a preoccupation with finding *culprits* and calculated causes for our problems (including bee losses) rather than objectively looking at the variables.

As much as I would like to say that my training in scientific methodology allows me to make informed and objective choices about things affecting honey bees, I have to admit that this is not always the case. I assume that this also happens with many of us at one time or another. The problem seems to be considerably compounded however, when media and anecdotal accounts predominate over a need for statistically significant data.

Therefore, it is my suggestion that the term ***Honey Bee Stress Syndrome*** be adopted as a clearer, less ambiguous way to describe what's been happening with our honey bees for the past several years, particularly in the U.S. Hopefully, by implementation of new terminology, we can free ourselves from many of the self-limiting preconceptions that have been associated with the term *CCD*, while at the same time gaining a fresh perspective on what is actually involved with this syndrome. Besides that, *Honey Bee Stress Syndrome* sounds much less ominous and foreboding than *CCD* – doesn't it?

Allen Summers
Colorado

MORE ON LEXAN COVERS FOR SMALL HIVE BEETLE CONTROL

Several things: No. 1: I just bought a piece of Lexan from Lowes, and the protective film on the Lexan provided the opaque part of the experiment. Yes, I used this instead of an inner cover or an outer cover; the plastic is the cover. I would assume that a replacement piece of opaque plastic for a light fixture would work.

No. 2: Since the discovery by my friends, and my application of their idea, I have found that putting the cover on one hive, then the next and so on, I ran the little buggers off. However, I have one hive that is very weak and the nasty bugs moved to the weak hive. I noticed also that the plastic was getting very dirty from propolis and etc.—that less light was coming into the box, so there were a few hold outs. I then pulled off the protective film cover from the Lexan and now have an observation hive as viewed from the top bars down...clear Lexan. This really ran them off.

Since my apiary faces the sun's track, I have noticed that a very few of the nasty little buggers would hide in the right hand bottom edge of the hive bottom board; the light just doesn't get down to that part of the hive. I have used the anti-DNA method of control, hive tool to the body, and mash'em. However, the horrible billions and billions of hive beetles that infested my boxes are gone. The strong hives, and mine are really strong, 3 deeps and 4 to 5 supers on each, I think are the real factors in keeping the bad bugs at bay. The light just moves them out of one box and into another that is weak.

Anyhow, as an experiment the opaque cover seems to work for me..I would hope that this will work for you also. Please keep ABJ apprised of your findings. Maybe we can build a body of evidence for or against this method of beetle control...Oh how I wish for the good old days when it was just foulbrood, or chalkbrood, nosema, lizards and dragonflies eating up the working girls. Anyhow, the best of beekeeping to all yours.

Stephen Homewood
Florida
lhomewood@cox.net

CALIFORNIA FAMILY BEES

My son and I just started beekeeping this year and are subscribers to your Journal. Our first hive is doing very well and hopefully we will add a second. My son, Michael Pollock, took this picture with his Polaroid digital camera.

We got our bees locally from Bloomfield Bees in Sebastopol (about 50 minutes from Saint Helena). Bloomfield captures local swarms and we wanted local bees because we felt they were already well adapted to our environment. We had an interesting time driving the hive home in the mini-van in our bee suits and had to stop a few times to reinforce the screening.

The bees made it home and we have planted many bee-friendly flowers around the house so the hive continues to rapidly expand. I have attached a picture of Michael and the hive. Michael joined our family from Colombia so he painted the Colombian flag on the hive.

Tom Pollock
California

Michael Pollock of California took this nice photo of one of his honey bees on one of the many flowers planted in his yard for bee forage.

Michael Pollock with his new hive. Since Michael is originally from Colombia, he painted the Colombian flag on the hive. (Photo courtesy of Tom Pollock)

HANOI BEEKEEPING CONFERENCE SCHEDULED

On behalf of the Apimondia Standing commissions' Presidents, Dr. Nicola Bradbear (Beekeeping for Rural Development) and Mr. Dinh Quyet Tam (Beekeeping Economy), we are pleased to invite you to attend the "International Conference on Beekeeping Development and Honey Marketing" to be held in Hanoi (Vietnam) from October 30 to November 2, 2010.

This important international event will

provide valuable insights and viewpoints to people working in international development, local and international NGOs, honey traders, personnel working for import and export companies and people involved in quality control of honey.

For any further details you may require on this conference please visit the following website: **http://ias2010hanoi.com** or E-mail: **isa2010hanoi@gmail.com**

Looking forward to welcoming you to Hanoi in autumn, we remain,

Yours sincerely,

Richardo Jannoni-Sebastianini
Apimondia Secretary-General

BEEKEEPERS IN THE ROCHESTER LILAC PARADE

Members of the Ontario Finger Lakes Beekeepers Club and the Empire State Honey Producers Association and their families participated in the annual Lilac Parade, the opening event for the Rochester NY Lilac Festival in May. The parade attracted about 5,000 spectators for 125 parade entries. We had the honey bee mascot,Winnie the Pooh, and beekeepers of all ages wearing their beesuits and veils. Fantastically painted bee hives were also showcased. Everyone had more fun than we thought we would, with lots of hand waving.

A great, inexpensive way to promote beekeeping.

Pat Bono
Seaway Trail Honey
Rochester NY

Photos of members of the Finger Lakes Beekeepers Club and the Empire State Honey Producers Association who participated in the annual Lilac Parade in Rochester, NY

APIMONDIA RAISING FUNDS TO HELP HAITIAN BEEKEEPERS

Haiti is a Caribbean nation of 9 million people, sharing the island of Hispaniola with neighboring Dominican Republic. According to United Nations data, Haiti is the poorest country in the Western Hemisphere.

On 12 January this year, Haiti suffered a catastrophic earthquake of magnitude 7.0, with the epicenter in the most populated part of the country, 25 km (16 miles) west of the capital city Port-au-Prince. Around 100,000 people lost their lives, while countless more lost their homes and possessions.

Beehives in Haiti are made from the hollow trunks of palm trees. Beekeepers in Haiti have been successfully keeping bees this way for a long time, perhaps since Spanish or French explorers first introduced bees 500 years ago. Today, Haiti's bee populations are apparently healthy, with empty hives readily occupied by bees from the wild honey bee population. Varroa is present.

Apimondia is raising funds to support beekeepers in Haiti to rebuild their lives after the devastating earthquake. Any funds that you can give will be sent directly to beekeepers in Haiti, to support them as they rebuild their lives.

Apimondia is working with Bees for Development Trust to raise funds for this appeal. Please go to <**http://www.justgiving.com/Haitibeekeepers**> if you can help.

With kind regards.

Riccardo Jannoni-Sebastianini
Apimondia Secretary-General

A Haitian beekeeper smokes a rustic hollow trunk hive (Photo by Bo Sterk)

A hollow tree trunk apiary in Haiti (Photo by Bo Sterk)

TEXAS OAK TREE COLONY

This photo shows a feral bee colony in a Post Oak in Robinson County, TX. They have survived for at least eight years. John Rushing Wharton, Franklin, TX.

BEE THEFT IN NE FLORIDA

For several years someone has been stealing bees and nucs in my outyards in two counties in NE Florida.

On June 3, 2010 Ruben Josey was arrested and charged with theft of bees and bee equipment. Since that arrest a large amount of beekeeping equipment belonging to eight different beekeepers in Florida and Georgia has been recovered. It has, however, been impossible to locate someone of the outyards of Ruben Josey that may or may not contain stolen items.

Anyone with knowledge of bee locations belonging to Ruben Josey is asked to contact the Putnam County Sheriff's Office investigator TC Timpe at (386) 329-0800 or Mike Thomas at (386) 752-6979 or 14767 N US Hwy 441, Lake City, FL. 32055.

Thank you,
Mike Thomas
Owner- Thomas Honey

DATE SET FOR GRAND OPENING OF HONEY BEE HAVEN AT UC DAVIS

DAVIS--The grand opening celebration of the Haagen-Dazs Honey Bee Haven at the Harry H. Laidlaw Jr. Honey Bee Research Facility, University of California, Davis, is set for Saturday, Sept. 11.

The event, initially slated for June 19, was rescheduled to allow the bee friendly garden to grow, said Lynn Kimsey, director of the Bohart Museum of Entomology and professor of entomology, UC Davis Department of Entomology.

The public opening, expected to draw a large crowd, will take place from 10 a.m. to 2 p.m. at the site on Bee Biology Road, and will include speakers, honey tasting, hand-outs, children's activities, and tours of the apiary, haven, and nearby Campus Buzzway, a field of wildflowers.

"We've delayed the Haagen-Dazs bee garden opening until Sept. 11 to give the plants more time to grow and fill out," Kimsey said. The half-acre bee friendly garden, planted last fall next to the Laidlaw facility, 1 Bee Biology Road, is designed to be a year-around food source for bees and other pollinators, to raise public awareness about the plight of the honey bees and their importance, and to show what area residents can plant in their own gardens.

Kimsey expects it to be a "campus destination."

Art created by students and the community in the UC Davis Art/Science Fusion Program, founded and directed by UC Davis entomologist-artist Diane Ullman and artist Donna Billick, will be permanently displayed at the garden. The entrance will feature two towering bee-hive sculptures, one sculpture painted to depict the work that bees do inside the hive and the other, the work outside the hive.

Another highlight is a large bee sculpture, being created by Billick for a pedestal beneath an almond tree.

A Sausalito-based team created a series of interconnected gardens with such names as "Honeycomb Hideout," "Nectar Nook," "Pollinator Patch" and "My Backyard" to win the international bee-friendly garden design competition, a gift to UC Davis from the Haagen-Dazs. The design is the work of landscape architects Donald Sibbett and Ann F. Baker, interpretative planner Jessica Brainard and exhibit designer Chika Kurotaki.

Among the other features: a "Learning Center" "Save the Bees Sanctuary," "Round Dance Circle" and "Waggle Dance Way."

The bee haven design can be downloaded at http://beebiology.ucdavis.edu/HAVEN/honeybeehaven.html.

More details on the opening will be forthcoming, Kimsey said.

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Honey bee on seaside daisies at the Haagen-Dazs Honey Bee Haven. (Photo by Kathy Keatley Garvey)

Plans are under way for the grand opening celebration of the Haagen-Dazs Honey Bee Haven at the Harry H. Laidlaw Jr. Honey bee Research Facility, University of California, Davis. It was rescheduled from June 19 to Sept. 11. (Photo by Kathy Keatley Garvey)

LANGSTROTH GRADUATE FELLOWSHIP IN ENTOMOLOGY ENDOWED WITH $250,000 GIFT

University Park, Pa. -- Penn State has received a $250,000 gift to endow a graduate fellowship in entomology in the College of Agricultural Sciences.

At the request of the donor, who wishes to remain anonymous, the endowment will be named the Lorenzo L. Langstroth Graduate Fellowship in Entomology, in honor of the 19th century apiarist widely considered to be the "father of American beekeeping."

Income from the endowment will be used to recruit and retain outstanding graduate students pursuing an entomology degree, with first preference given to students conducting research related to honey bees.

One of the most pressing problems facing researchers is Colony Collapse Disorder (CCD), a phenomenon in which the majority of adult honey bees of a hive disappear, often spelling death for the colony. Still not fully understood, CCD in the last four years has affected honey bee colonies all across the nation, with losses ranging from 30 percent to near 100 percent in apiaries with CCD symptoms.

Penn State researchers, including Diana Cox-Foster, professor of entomology and a member of the University's Center for Pollinator Research, have been investigating why CCD happens while at the same time working on ways to strengthen the pollinator population.

"We are really grateful for this new graduate fellowship in entomology," she said, "which will make a huge difference in our ability to train future researchers to help improve the health of honey bees and other essential pollinators."

The Rev. Lorenzo L. Langstroth was a

Philadelphia-born apiarist, clergyman and teacher who in 1851 revolutionized the beekeeping industry in the United States with the invention of a new beehive. His top-opened, movable-frame structure effectively used what he called "bee space" and allowed the beekeeper to easily inspect and manage the hive in a way that previously had not been possible without disturbing the bees and their home. The "Langstroth Hive" continues to be the standard used by beekeepers all over the United States.

He also published several books on practical hive management, beginning with "Langstroth's Hive and The Honey-bee, The Classic Beekeeper's Manual" in 1853, which is still in print.

Langstroth's lifelong observations, numerous discoveries and further inventions helped to turn beekeeping into a large-scale, cost-effective and sustainable industry. The fellowship is being created to honor his 200th birthday.

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USDA BEGINS NATIONAL SURVEY OF HONEY BEE PESTS AND DISEASES

WASHINGTON, June 7, 2010 -- The U.S. Department of Agriculture today announced the beginning of a 13-state survey of honey bee pests and diseases conducted cooperatively by USDA's Animal and Plant Health Inspection Service (APHIS), USDA's Agricultural Research Service (ARS) and Pennsylvania State University (PSU). The survey will help USDA scientists to determine the prevalence of parasites and disease-causing microorganisms that may be contributing to the decline of honey bee colonies nationwide.

"Bee health is critical for the success of pollination-based agriculture, which produces about a third of our diet in the United States," said Agriculture Secretary Tom Vilsack. "There has been a disturbing drop in the number of U.S. bee colonies over the last few years while the demand for commercial bee pollination services continues to grow, and this survey will help us to better understand the factors threatening our honey bees so we can take effective action to protect them and the crops that they pollinate."

The voluntary survey includes 350 apiaries across 13 states and will last through the end of the year. APHIS developed the survey protocol jointly with ARS and PSU and allocated $550,000, provided by Section 10201 of the 2008 Farm Bill, for the survey. Survey kits have been mailed to state apiary specialists, who will collect samples of bees and debris from the apiaries in their states. ARS and PSU scientists will test the samples for specific pests and pathogens. APHIS is particularly interested to know whether foreign mites of the genus *Tropilaelaps* have entered the United States.

The survey will take place in Alabama, California, Georgia, Indiana, Florida, Hawaii, Michigan, New York, Pennsylvania, South Dakota, Tennessee, Texas and Washington. Once all the samples have been analyzed, APHIS will summarize the results and post the summary on its Web site.

Beekeeping is an essential component of modern U.S. agriculture, providing pollination services for more than 90 commercial crops and adding $15 billion in value. Since the 1980s, however, a number of factors have contributed to the declining health of U.S. honey bee colonies. These include the introduction of several honey bee pests into the United States, such as the small hive beetle, which can damage honey comb, stored honey and pollen, as well as deadly bee parasites such as the Varroa mite (*Varroa destructor*), tracheal mite (*Acarapis woodi*) and single-celled gut parasite *Nosema ceranae*. Honey bees also face a number of newly introduced diseases caused by viruses, bacteria and fungi.

In addition, beekeepers began to report in 2006 a new threat to honey bee health that scientists have named colony collapse disorder (CCD). In colonies exhibiting CCD, adult bees leave the hive and never return, abandoning the queen and eggs. APHIS, ARS, USDA's National Institute of Food and Agriculture and a number of other organizations have formed a CCD working group, which is researching the possible causal agent(s) of CCD. The survey results will provide valuable information in this effort.

For more information about the survey, please visit the APHIS Web site at **http://www.aphis.usda.gov/plant_health/plant_pest_info/honey_bees/survey.shtml**

BEE PHOTO COMPETITION

Become part of a global bee education resource

With the continuing success of the Vita Gallery, a free photo gallery for beekeepers, honeybee health company Vita (Europe) Ltd is launching a photography competition. Anyone can submit up to three photos relating to bees or beekeeping to try to win a cash prize, while at the same time contributing to the enormously popular Gallery (www.vita-europe.com) which is benefitting beekeepers across the globe.

Since its launch last September, the Vita Gallery - which contains more than 300 images of bees and beekeeping - has received huge interest from beekeepers across the globe.

"The Gallery has users from more than 600 beekeepers in 40 countries and we've been delighted by the spontaneous feedback from may of them," said Jeremy Owen, sales director of Vita (Europe) Ltd. "We knew that many beekeepers needed images to accompany their talks on bees and beekeeping – but we never quite realized just how many people give such talks. The Vita Gallery is turning into an important educational tool and we therefore want to expand it by inviting anyone to contribute their best bee-related photos."

The winner of the competition will receive a 50 euro cash prize, plus Vita anti-varroa products for 10 colonies. There is also a special prize for the winner of the under 16 category.

The deadline for entries to the competition is 1 December 2010, allowing plenty of time for people to take some photos this season, or select ones from their collection.

How To Enter

To enter the competition, just email up to three digital photographs (no larger than 1mb each) relating to bees or beekeeping to **vitagallery@vita-europe.com**. The theme is broad, with current photographs in the gallery ranging from vintage beekeeping equipment to shots of active colonies and foraging bees.

Please include your name, postcode (or equivalent) and country in your email. You may also include captions for your photographs if you wish. Please state if you are under 16 and eligible for the Young Person's Prize.

Terms and Conditions

The deadline for entries to the competition is 1 December 2010.

Entrants must certify that the image/s they are submitting is their own work and that they own the copyright for it. It is the responsibility of each entrant to ensure that any images they submit have been taken with the permission of the subject and do not infringe the copyright of any third party or any laws. In providing images for the competition, each entrant agrees that Vita can put it in the online Vita Gallery for others to use.

SAVING THE BEES THROUGH ART

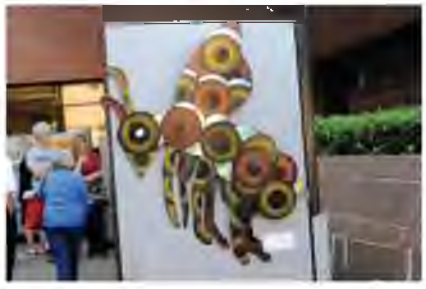
Saving the Bees— One Art Piece At A Time

DAVIS--They are artists with a honey of a heart—a honey of a heart for the plight of honey bees.

Artists showing their work at the recent "Bees at The Bee" art show in Sacramento donated a total of $900 from gross sales of $1560 to honey bee research at the Harry H. Laidlaw Jr. Honey Bee Research Facility, University of California, Davis.

"The art work was peered at, pored over, perused, examined, appreciated, loved and admired by hundreds of eyes on Saturday,"

SAVING THE BEES—Lynn Kimsey (far left), professor and vice chair of the UC Davis Department of Entomology, and Pam Dinsmore (center), community affairs director at the Sacramento Bee, watch as art show coordinator Laurelin Gilmore opens a gift of appreciation from the entomology department. Gilmore coordinated an art show that raised $900 for UC Davis honey bee research. (Photo by Kathy Keatley Garvey)



The "CD Bee" by Sacramento artist Matt Evans, drew attention at the "Bees at The Bee" art show, a benefit for honey bee research at the University of California, Davis. (Photo by Kathy Keatley Garvey)

DANCING BEES—Scoopy, the Sacramento Bee's bumble bee mascot, danced with honey bee Olivia Gilmore, 3, of Sacramento at the art show benefit for the UC Davis honey bee research. (Photo by Kathy Keatley Garvey)

said Sacramento artist and art show coordinator Laurelin Gilmore who thought of the bee-themed show as a way to help honey bee research and boost awareness of the declining bee population ravaged by colony collapse disorder (CCD).

"We were applauded and congratulated on every aspect of this little event, and I for one am bursting with pride for having been any part of it." The event, sponsored by the Sacramento Bee, drew hundreds of visitors to The Bee's open courtyard.

"This was a marvelous event, altogether educational and entertaining, greatly benefiting honey bees and our bee research program at UC Davis," said Lynn Kimsey, professor and vice chair of the UC Davis Department of Entomology. Laurelin did a terrific job planning the event, with the support the Sacramento Bee, to support the bees."

Gilmore invited artists from within a 12-county area to submit their work. Some 60 artists submitted a variety of work, including acrylic paintings, watercolors, pen and ink drawings, metal and paper sculptures, photographs, fused glass plates, pendants, a fleece blanket, crocheted multimedia, collages, monoprint-woodcut, neckpiece, individually painted CDs, and a scrimshaw engraving on a mammoth ivory.

A portion of the proceeds from the sale went to UC Davis honey bee research. Artists grossed $1560, of which $900 "is going directly to the UC Davis bee research," Gilmore said. Gilmore praised the artists for their "willingness and eagerness to participate in making my little idea grow so tall."

"The plight of the honey bees is filtered through each artist in a different way, and the results run the gamut from funny to beautiful to profound," she said. The "Bees at The Bee" also included live music, refreshments, and educational information about bees. Scoopy, The Bee's mascot, handed out chocolate bees.

Extension apiculturist Eric Mussen, member of the UC Davis Department of Entomology faculty, displayed a bee observation hive and answered questions about bees, including CCD, the mysterious malady in which adult bees abandon the hive, leaving behind the queen bee, brood and food stores. Honey bees pollinate a third of the food we eat, he said.

Mussen also handed out free samples of Honey Lovers, a new line of candy (fruit chews) by Gimbal's Fine Candies, San Francisco. Gimbal's is donating 5 percent of the proceeds from the sale of its Honey Lovers for UC Davis research. Other handouts were from Burt's Bees, Häagen-Dazs and the Partners for Sustainable Pollination.

The Bohart Museum of Entomology displayed "Save the Bees" T-shirts and other gift items. The Sacramento Area Beekeepers Association offered honey and other items. Artists from the UC Davis Art/Science Fusion Program, founded and directed by entomologist-artist Diane Ullman and artist Donna Billick, showed art work that will be permanently installed at the Haagen-Dazs Honey Bee Haven, a half-acre bee friendly garden located next to the Harry H. Laidlaw Jr. Honey Bee Research Facility on Bee Biology Road, UC Davis.

Plans are under way for the grand opening on Sept. 11 of the garden, scheduled from 10 a.m. to 2 p.m. on Bee Biology Road. The garden, a year-around food source for honey bees and other pollinators and an educational experience for visitors, was planted last fall. Featuring a series of interconnected gardens with such names as "Honeycomb Hideout," "Nectar Nook" and "Pollinator Patch," it is the design of a Sausalito team: landscape architects Donald Sibbett and Ann F. Baker, interpretative landscape architects Donald Sibbett and Ann F. Baker, interpretative planner Jessica Brainard and exhibit designer Chika Kurotaki.

At the haven, visitors can glean information about the plight of the honey bee, what plants attract pollinators, and what to plant in their own gardens. The haven is a "bee friendly farm" as designated by the Partners for Sustainable Pollination, directed by Kathy Kellison and headquarted in Santa Rosa. Penny Stockdale of UC Davis is organizing the grand opening of the garden, which will include speakers, apiary and garden tours, children's activities, and educational information.

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NORTH CAROLINA GOVERNOR BEV PERDUE HARVESTS THE FIRST "EXECUTIVE HONEY"

RALEIGH, NC — June 22, 2010, Gov. Bev Perdue suited up in beekeeper attire and approached a job perhaps no other North Carolina governor has tackled – pulling honeycombs from beehives with thousands of honey bees buzzing nearby.

North Carolina Gov. Bev Perdue (center) examines a frame of honey from one of the hives on the executive mansion in Raleigh.

"That's a lot of honey!" Gov. Perdue exclaimed, as she removed a narrow honeycomb literally dripping gold.

The two beehives sitting on the north lawn of the executive mansion in Raleigh were installed late last year, after grounds supervisor Gerald Adams decided to explore the benefits of having bees to pollinate the gardens on the grounds. Adams, who oversees production of a number of crops used by the first family and donated to local area food banks, has already seen a dramatic difference.

"Apple trees that have never had more than a handful of apples on them now show 50 or 60 or more," he said. "The pollination benefits of the bees have been clear already within the first six months of having the hives."

The honey bees, which may fly up to a 2-mile radius around the hive every day, were sprayed with non-harmful smoke to subdue them; then the governor assisted Danny and Mary Jaynes as they removed the frames of honeycombs from the hives. Danny Jaynes is the president of the Wake County Beekeepers Association and has mentored Adams during his introduction to beekeeping.

"The honey bee is not only North Carolina's state insect, but also a crucial player in North Carolina agriculture. Their role in pollinating our crops is essential, and often overlooked by people who don't know the important part they play," said Gov. Perdue. "Having the bees here on the mansion grounds not only gives us a chance to boost our own fruit and vegetable production, but also serves as an education tool for the school groups and tours who visit the mansion regularly."

So just how much honey did the group harvest? According to the Jaynes, nearly 12 gallons, or some 150 pounds. The honey, which was inspected and deemed "Grade A," will be bottled and used at the mansion, given as gifts from the governor and first gentleman, and donated to local food banks. (Press release courtesy of Alana Allen, Press Office, Office of the Governor)

GEORGE WASHINGTON MOUNT VERNON CAMPUS IS HOME SWEET HOME FOR FOUR HIVES

Donated by Local Cooperative, Beehives Promote Urban Agriculture and Importance of Pollinators During 4th Annual National Pollinator Week, June 21-27, 2010

WASHINGTON – The George Washington (GW) University's Mount Vernon Campus has 120,000 new residents – four hives of Italian honey bees, just in time to celebrate National Pollinator Week. According to the Pollinator Partnership's (P2) North American Pollinator Protection Campaign (NAPPC), bees are vital to the ecosystem of urban areas and provide important habitats for many bee species.

Donated by local beekeeping cooperative Sweet Virginia, the bees' journey to GW began this spring when junior Melissa Eddison, inspired in part by the installation of beehives at the White House, drafted a proposal to establish hives on campus. The initiative is part of an effort to promote sustainable food and gardening spearheaded by GW student organization Food Justice Alliance.

"It's a great educational opportunity for GW," said Ms. Eddison, who plans a career in international sustainable agriculture.

GW alumna Amanda Jo Formica, B.A. '10, is former founder and past president of Food Justice Alliance and will serve as one of two beekeepers for the hives this summer. "The bees—and their ability to pollinate thousands of plants every day—will result in bigger and brighter plants and flowers on campus and in the surrounding neighborhood. We are extremely fortunate to be able to work with Sweet Virginia and have their volunteers serve as mentors for our new beekeepers."

Sweet Virginia is a nonprofit organization located in Manassas, Va., composed of volunteer beekeepers that harvest, process (drain the beeswax bits), bottle, package and donate Northern Virginia wildflower honey. Sweet Virginia co-founder Dan Price's desire to bring beehives into urban areas and to expose students to the practice of keeping bees prompted him to donate the hives to the university. GW plans to offer beekeeping workshops for the University community in the future.

Taking care of the bees on campus will typically require 10 to 15 minutes each day. Duties will include monitoring the bees, catching and hiving swarms, and looking for diseases or other problems. Each beehive measures about 2.5 feet wide, 3 feet high and houses approximately 30,000 bees.

"The hives are a wonderful way to honor the University's namesake," said Paula Lawley, GW assistant vice president for online strategy and experience, amateur beekeeper, and Sweet Virginia board member. "George Washington kept bees at his Mount Vernon Estate and noted that his favorite breakfast, even when traveling, was cornmeal cakes with honey." (Courtesy The George Washington University)

HARRY FULTON RETIRES

Mr. Harry Fulton, "Harry" as he was known in his almost 40 years of service to the Mississippi Department of Agriculture Bureau of Plant Industry has retired. Most significantly for the Apiculture Industry, Harry has been actively and progressively involved in State, National and International issues to the beekeeping industry all of this time. Harry is a beekeeper so he knows beekeeping and all levels of the industry from backyard beekeepers to commercial beekeepers with thousands of colonies.

Harry Fulton, Mississippi Dept. of Agriculture Bureau of Plant Industry, is retiring after 40 years of dedicated service to the state's beekeepers and beekeeping industry.

He has served on the National Honey Board as a member and on the National Honey Board nomination committee. He has been the Secretary/Treasurer of the Mississippi Beekeepers Association since 1975 and written and published a newletter "Bee News and Views" that has a readership well beyond Mississippi.

Harry served as president of the Apiary Inspectors of America twice, in 1978 and 2005. He developed a State Action Plan for dealing with future introductions of African Honey bees into Mississippi. This is only in his helping keep the beekeeping industry healthy, vital and active. His many other duties as state entomologist included plant pest programs, cooperative Agricultural Pest Surveys, pesticide usage and permitting, president of The Mississippi Entomological Society (1994), establishing the Mississippi Mosquito and Vector Control Association (1990), Southern Plant Board Positions and National Plant Board positions. Additional work included activities that helped farmers, commodity groups, advisory committees, various governing boards and stakholders throughout his years of service.

As you can see, Mr. Harry Fulton is going to be missed because he did so much. Replacing 40 years of experience, expertise and trust takes time. We will miss Harry as a leader, mentor and friend. *(Courtesy of Jerry Hayes)*

OBITUARY
WILLY BAUMGARTNER

The beekeeping industry has lost one of its greatest supporters. Willy Baumgartner, founder of Medivet Pharmaceuticals Ltd. and developer of the improved Fumagilin-

Medivet Pharmaceuticals, Willy Baumgartner, with his Oxalic Acid dispenser. Mr. Baumgartner died May 18, 2010.

B medicine for honey bees, died May 18 after a lengthy illness. Willy was 82 years old. Willy Baumgartner was a Swiss-educated chemist who immigrated into Canada when he was in his twenties. After a successful career in Ontario with a pharmaceutical company, Willy moved west to Calgary in 1980. He established Medivet - an enterprise making a variety of veterinary medicines mostly for cattle and horses. Soon his High River, Alberta, company began to specialize in pharmaceuticals for honey bees.

Until age 50, Willy didn't know about bees or beekeepers. But his veterinary supply business was getting requests for better medicines for honey bees. Like most people, back in 1980, Willy had no idea that honey bees could get sick and would need pharmaceuticals. While he was supplying medicine for horses, beekeepers started to ask for the same medicines for their bees. As a careful pharmacist, he knew that beekeepers shouldn't be dumping horse medicine into their bee hives. But, at that time, Willy didn't know the habits of beekeepers. As he found out, we can be pretty sloppy. So, Willy tested the materials, figured out the right dosage for a colony of bees and found a way to keep the medicines active at different temperatures and in different qualities of water. And Willy taught and encouraged beekeepers to treat bee medicines... like medicines. Willy said, "A small mistake with any drug can harm bees and the entire beekeeping industry. Too little or too much medicine can cause disease resistance, kill bees, or worse, contaminate honey. A lot of our work has involved getting dosage and delivery systems right for the beekeeper."

One of his first achievements was improving oxytetracyclines so they would maintain their efficacy in the rather alkali water common on the western prairies. He worked out dosages, reminding beekeepers that "a hivetool is not a measuring device." Willy Baumgartner's greatest pharmaceutical accomplishment was improving the delivery of fumagillin products for honey bees. Developed by Abbott Laboratories researchers in the early 1950s as a medicine for people, it was found to be more effective as a honey bee treatment against nosema. But the material clumped in water, wasn't stable for long, and was difficult to deliver to honey bees in the right dosage. Willy solved these issues, creating Fumagilin-B and making it available at an affordable price to beekeepers. The medicine is the only effective treatment against nosema, which has been widely implicated as a leading cause of colony collapse disorder. It can be said that Willy's work has saved the lives of hundreds of millions of honey bees around the world.

He and Ursula - his wife and business partner - enjoyed traveling to dozens of beekeeping gatherings: the local Calgary Beekeepers' Club, provincial meetings across Canada, international meetings in the USA and farther afield. They were regulars at Apimondia meetings and were major supporters of Vancouver's Apimondia 99. In 2007 he received an achievement award from the Alberta Beekeepers Association; and, in 2009 he became an honorary member of the Alberta Honey Producers Co-op.

Adony Melathopoulos, of the Beaverlodge Research Farm, says, "There was no better supporter of beekeeping research in Canada than Willy Baumgartner's Medivet Company." His business donated tens of thousands of dollars to research - all without any expectations or restrictions.

A tireless innovator, he developed machines and methods to safely distribute oxalic acid into hives to fight mites, regimes for safe tetracycline and fumagillin treatments, and procedures for proper pharmaceutical use in beehives. But he also strongly believed that beekeepers need more than antibiotics, acaricides, and fumagillin products to be successful. At every opportunity, he promoted integrated management approaches to beekeeping. Willy especially advised beekeepers to reduce stress in their beehives by keeping strong, well-provisioned colonies with young queens in well-situated apiaries. Willy said he would be happiest if his business could close because that would mean all bee diseases were cured.

Willy Baumgartner was a warm and generous person; a friend to all who knew him. He was a keen traveler, champion Jass player, skier, shooter, amateur actor, and great supporter of the Swiss cultural Society. He will be greatly missed by all who knew him. **(Courtesy of Ron Miksa, Calgary)**

OBITUARY
CHARLES PARKER

Charles "Charlie-Bee" died May 26, 2010. He was 64.

Charlie was founder, owner and operator of Charlie-Bee Honey, Parker Bee Apiaries Ltd. for 40 years. His dedication to his work began at the early age of 13, with one bee hive. This hobby later flourished with the help of his wife Ruth, family and devoted staff to what now is the largest beekeeping operation in Ontario.

Charlie Parker, an Ontario commercial beekeeper, died May 26, 2010.

FLORIDA BEEKEEPER CHARGED IN THEFTS

By Kristin Chambers
Reprinted courtesy of the Palatka Daily News

CRESCENT CITY, FL- The owner of a Crescent City honey farm was arrested in June after authorities say he stole bee hives, honey and honey-making equipment from businesses in St. Johns County.

Ruben Josey, owner of Josey's Honey Farm and vice president of the Beekeepers of Putnam County, was charged with two counts of dealing in stolen property after 48 beehives and related goods were located.

According to a report from the St. Johns County Sheriff's Office, the hives were reported stolen in December and January.

Other hives and stolen property from Putnam and neighboring counties may also be involved, said Lt. Johnny Greenwood, a spokesman for the Putnam County Sheriff's Office.

The state Department of Agriculture is heading the investigation.

Nancy Gentry, a Putnam County beekeeper, honey producer and member of the Beekeepers of Putnam County, said she and other local beekeepers, have been trying to gather information due to rising suspicions.

"We are pleased to see Mr. Josey has been arrested," she said. "The number of beekeepers that have been affected ... increase every day. There was a considerable amount of honey discovered still in the honey boxes and it looks as though those were stolen from beekeepers in Georgia, so this just keeps getting bigger and bigger."

Each hive contains registration numbers that are listed with the state.

Gentry said she and others had searched the back roads of the Crescent City area on Tuesday looking for evidence after they became suspicious of Josey.

"Beekeepers are tenacious when they find out there is a corrupt beekeeper," she said. "It is a hard business and you have to help each other."

Josey, 45, was elected the vice president of the Beekeepers of Putnam County when Gentry formed the organization in January 2008.

"He purported himself to be a beekeeper of longtime standing and he was elected," Gentry said.

"We came to find out most of it was lies," she said. "But as evidence began mounting against him I think he was beginning to find out people were on his trail."

Josey has been removed from the Putnam organization and a sister beekeeping organization he joined in Flagler County, Gentry said.

Josey is being held at the Putnam County Jail on a bond of $50,000.

Sgt. Chuck Mulligan, spokesman for the St. Johns County Sheriff's Office, said Josey could be transferred to St. Johns County for charges he faces there, but a decision will be made by the State Attorney's Office once an arraignment location is set.

STOREY'S GUIDE TO KEEPING HONEY BEES

Storey's Guide to Raising Series, with over 1.7 million copies in print, is recognized as the most trusted source of animal husbandry information. Now we are applying that same thorough approach to the world of the honey bee. And the timing couldn't be better. Bees are vital to our existence, as they pollinate the plants that provide our food. *Storey's Guide to Keeping Honey Bees* releases in August.

Because of the plight of bees, many cities are starting to allow beekeeping. A beehive is visible for the first time ever on the South Lawn at the White House, as well as in two parks, in the National Arboretum, and on the roof of the Fairmont Hotel, all in Washington D.C. There are honey co-ops and rooftop hives in Chicago, including on the green of City Hall! Urban blogs and websites abound, from Kirk's Urban Bees (kirksurbanbees.com) in Los Angeles to the Urban Apiary (urbanbees.blogspot.com) in Atlanta to City Bees (**citybees.blogspot.com**) in Washington, DC.

Storey's Guide to Keeping Honey Bees is an invaluable resource for beginners, detailing practices to ensure success of their first hives. The book outlines time, financial, and legal restrictions to consider before getting into beekeeping, and everything from safety and housing equipment, to honey collection techniques. The guide delves into specifics for the advanced beekeeper who needs to know all they can about diseases, optimizing crop pollination, requeening the colony, and more.

Author Dr. Malcolm Sanford is one of the most recognized writers on beekeeping in the United States. He has been published in *Bee Culture* and *American Bee Journal* and is Coordinator of the Apis Information Resource Center, author of *The Apis Newsletter,* and Professor Emeritus at the University of Florida. He has been a beekeeping management consultant in Egypt, Italy, France, Chile, Ecuador, Iraq, and Mexico, and he lives in Gainesville, Florida.

Author Richard Bonney, whose work is the keystone for *Storey's Guide to Keeping Honey Bees,* owned and operated Charlemont Apiaries in Charlemont, Massachusetts. He taught at the University of Massachusetts at Amherst, wrote regularly on beekeeping, and served as a state apiary inspector. He is the author of both *Beekeeping: A Practical Guide* and *Hive Management.*

Storey's Guide to Keeping Honey Bees Storey Publishing; August 2010 Photographs and illustrations throughout 240 pages; 6" x 9" $19.95 paper; ISBN 978-1-60342-550-6 $29.95 hardcover; ISBN 978-1-60342-581-0. **www.storey.com**

NEW YORK

Apprentice Level Fall Course 2010

The Cornell University Master Beekeeper Program will conduct its one-day Apprentice Level Fall Workshop twice this year. This is a comprehensive course that picks up where the spring class left off. It covers summer, fall and winter management; honey removal, extraction and processing; and IPM for honey bee pests, parasites, pathogens and predators. New beekeepers and experienced beekeepers looking for a refresher course are encouraged to attend. Class runs from 9am-6pm and includes 2 hrs of field work. Cost is $85.00. A workshop manual and refreshments are provided. For registration materials, go to **masterbeekeeper.org**. Classes limited to 24.

Offered at these times and places:

Saturday, August 14th

Dyce Lab, Cornell Univ. - Ithaca, NY

Saturday, August 21st

Betterbee - Greenwich, NY

NEW HAMPSHIRE

Charles Andros, former NH/VT Apiary Inspector, will hold a beekeeping workshop from 1-3:30 p.m. on Saturday, September 11, at 18 MacLean Rod, Alstead, NH 03602. Look for the "BEE" sign on the south side of Walpole Valley Road. Topics of discussion will include treatment of nosema and mites, winter preparations, winter protein and carbohydrate supplements, and making beeswax handcreams. Bring a veil, if you have one, as we shall be opening some colonies. We'll be inside if it is a rainy day. Water and chair may also come in handy. Registration required. email: **lindena@sover.net** or call 603-756-9056.

CONNECTICUT

Backyard Beekeepers Association

During the summer on most Sundays the BYBA's club queen rearing bee yard is open, please come visit. Each month we have timely inspection weekend hands-on workshops, mentor program and more. All events are free and open to the public. Please check our website for the dates and locations or more information at **www.backyardbeekeepers.com**

September 28: Stan Schneider "Caste Interactions and Their Role in Colony Reproductive Decisions in the Honey Bee"

October 26: Jennifer Berry "Sub-lethal effects of in-hive pesticides"

November 30: Allan Hayes on his unusual beekeeping tools & gadgets

WEST VIRGINIA HONEY FESTIVAL

August 28-29, 2010

Wood County, City Park, Parkersburg, WV

Honey Princess, Baking Contest, Honey & Wax Show, Honey Extracting, Beebeards by Steve Conlon & Family, American Honey Queen plus more! A family event at a family park.

http://www.wvhoneyfestival.org

Contact: Tom Riddle, President 304-481-6941, **teber1029@suddenlink.net**, or Wood County Visitors Bureau 1-800-752-4982, or (304) 424-1960 (WVU Ext. Service), WV Honey Festival, P.O. Box 2149, Parkersburg, WV 26102

Driving directions from major highway/interstate **3 miles West of 177 off US Rt 50 (7th St.) or 4 miles East of US 50 bridge to OHIO: follow signs**

Parking availability and fees: **NO fee for parking**.

Fee/Admission charges **$2.00 adults and $1.00 children**

Gospel, country and pop-live music, antique car show PLUS anything you want to know about honey, beeswax and bee products! Wonderful crafts and good food too!

FLORIDA

Honey Bee Awareness Day

National Honey Bee Awareness Day to be held at Dadant's in High Springs, Florida all day the 21st of August, 2010. Full day classes, demonstrations, door prizes, auction

with Laurence Cutts, open hive demonstration, plus much more. Great food and drinks. Special guest speakers include Dr. Jaime Ellis from the University of Florida, Entomology Dept., Jerry Hayes from the Department of Apiary Inspections, plus many more TBA. For more information contact **chappiesbee@windstream.net**

ALABAMA

The 2010 annual meeting of the Alabama Beekeepers Association will be held in Montgomery, AL at the Taylor Road Baptist Church on October 8th & 9th. Featured speakers include Dr. Keith Delaplane of the University of Georgia, Dr. James E. Tew of Ohio State University, Kent Williams, past president of EAS, and Sherry Ferrell, Bee Lab Coordinator, Ohio State University. Home grown talent includes David Kelton, Roslyn Horton, Elizabeth Whitaker, and others. There will be activities for spouses and children. Contact Phillip Garrison at 256-507-0262 or e-mail Bonnie Funderburg at **funder@otelco.net**. Details and registration form at **www.alabamabeekeepers.com**.

WISCONSIN

Beekeeping for Beginners

The pollination of our crops and gardens by honey bees is so important, and the honey they produce in the process is so delicious, that more and more people are getting involved in the fascinating endeavor of beekeeping. Now, the Dane Co. office of the UW-extension is hosting a class for people who are interested in becoming beekeepers. You will hear about everything you need to carry you through your first year. A registration packet will include hand-outs, guides, and a free magazine. The all-day class will be held on Saturday, Aug 21, from 9:30 am - 4:00 pm. The location is 1 Fen Oak Drive, Madison, WI 53718. For information about cost, and to register, contact Lisa Johnson at Johnson.lisa@co.dane.wi.us. Phone 608-224-3715 or 608-224-3701. Class size is limited to 50 people, so plan now to attend.

ILLINOIS SHORT COURSES

We will be offering two classes in August. Join us for our Advanced Beekeeping Course Friday August 13, 2010 9am-3pm here at Long Lane Honey Bee Farms in central Illinois. Some people have kept bees for years, but because they keep repeating the same mistakes, they are not gaining years of beekeeping experience. Instead they are stuck in being a first-year beekeeper. Take the next step, and leap into becoming a better beekeeper! Join Beekeeper David Burns for a day of Advanced Beekeeping on Saturday August 23, 2010 at Long Lane Honey Bee Farms located near Fairmount, Illinois. For more information, visit **www.honeybeesonline.com** or call 217-427-2678.

Join us for another Queen Rearing Class scheduled for Saturday, August 14, 2010 9am-3pm here at Long Lane Honey Bee Farms near Fairmount, Illinois. Our queen rearing courses fill up fast. Why? With constant struggles with queenlessness and the queen disappearing it's time to take the next step to stop buying queens and start raising your own! It will be worth the investment. Join beekeeper and queen producer David Burns for the whole day as he teaches you how to raise queens. For more information, visit **www.honeybeesonline.com** or call 217-427-2678.

IOWA

The Iowa Honey Producers will be holding their annual meeting November 5th and 6th at the Marshalltown Best Western Inn in Marshalltown, Iowa. Speakers will include Marla Spivak, University of Minnesota; Susan Cobey, Univerity of California; and Dee Lusby of Arizona. For more information contact Pat Randol 515-210-7445 or email **Pat@RandolHoney.com**.

NORTHWESTERN BEEKEEPERS CONFERENCE

The Washington State Beekeepers association will be hosting the Northwest Beekeepers Conference on October 28, 29 and 30th at the Best Western Hood River Inn (800) 828-7873 in Hood River, Oregon. The conference will begin with a Reception on Thursday evening the 28th at 7 PM and with conference sessions on Friday and Saturday beginning at 8 AM through 4:30 PM each day. A banquet and benefit auction will be held Friday evening the 29th starting at 7PM at the Hood River Inn. Registration information can be obtained from: Paul Hostica, 517 S Touchet Rd., Dayton, WA 99328 (**phosticka@gmail.com**) or Herb Brasington, 1881 NE Ashberry Dr., Hillsboro, OR 97124 (**treasurer@orsba.org**).

CALIFORNIA

The 121st annual convention of the California State Beekeepers will be held Nov. 16-18, 2010 at the Embassy Suites in San Luis Obispo, CA. Besides the informative speakers and the trade show, convention attendees will be able to visit such attractions as Hearst Castle, Cal Poly, Pismo Beach and the beautiful central Pacific coastline. Check our website **www.californiastatebeekeepers.com** for convention updates.

UNITED STATES

Honey crops are better in the United States this season, but as this was written a lot depended on July and August weather in the northern half of the country. Moisture was abundant, but these northern locations needed a lot of warm, sunny weather to spur flows from clover, alfalfa, soybeans, sunflowers and knapweed. On the other hand, a number of the principal southern honey flows were drawing to a close as the hot, dry season began. However, frequent rains showers, especially along the Gulf Coast due to hurricane Alex, may extend some flows for longer periods. Other remaining flows include cotton and soybeans in cultivated areas, as well as late flowering trees such as pepper, palm and melaleuca in Florida. Sourwood was also in progress in the Mideast and Southeast mountains. West Coast honey crops also look more encouraging this season. Rainy, cool weather slowed early flows, but promised to extend the flow period well past the point when hot, dry weather normally shuts down nectar production from wildflowers and bushes in the foothills.

The honey market and prices remain strong at both the wholesale and retail levels since honey, especially domestically produced honey, remains in very short supply. Beekeepers lucky enough to secure a honey crop have found ready buyers at $1.55 to $1.75 for white honey per pound with some small lots selling as high as $2.00 per pound. Amber prices are from 10 to 20 cents cheaper per pound.

Elsewhere in this issue, readers are urged to find out what is happening at the national level in an effort to prevent the entry of illegally transshipped Chinese honey into this country. It finally appears that the public, as well as government and elected officials, are taking note of China's illegal honey-shipping activities.

NORTHEAST—As this was written, a number of beekeepers had indicated fair to good spring honey crops, including flows from black locust, sumac, tulip-poplar, clover, vetch, birdsfoot trefoil, alfalfa, milkweed, blueberries, blackberries, honeysuckle, and numerous wildflowers and trees. Later flows from sources like alfalfa, sweet clover and white Dutch clover were still occurring. Ground moisture was sufficient for the present, but some correspondents were a little worried about later flows due to lack of rain in June. Colonies came through winter generally in better condition than last year, but some heavy losses were still occurring among commercial and hobbyist beekeepers. Fortunately, the nice early spring allowed established colonies, divides, nucs and packages to build up quickly.

Beekeepers in the Northeast are happy to finally start receiving some new crop honey. Many have been sold out since late 2009 and their customers have been clamoring for more local honey. Demand remains strong at both the wholesale and retail levels.

MIDEAST—Spring honey flows were generally normal to excellent for a number of beekeepers in the Mideast. The exception is where too much rain ruined flows by washing nectar from the flowers and not permitting normal foraging. Beekeepers had obtained honey from tulip-poplar, sumac, black locust, thistle, wildflowers, red bud, privet hedge, clover and alfalfa. In addition, where blackberries and persimmon were plentiful, additional flows were obtained from these sources. Beekeepers were still hoping for honey flows from sourwood and clover. Later this summer or early fall, beekeepers are also hoping for some late honey from goldenrod, aster and other fall flowers.

As we mentioned last month, flooding took a terrible toll on businesses and farms in several locations with the Nashville area being hit the hardest. Both hobbyists and commercial beekeepers lost colonies due to the flooding. In a few cases, beeyards owned by commercial beekeepers were completely wiped out.

Beekeepers are anxious to extract and bottle their new crop since their inventories are low or nonexistent and demand continues to be strong for locally produced honey. Both wholesale and retail prices are holding up well.

SOUTHEAST—Although cool, rainy weather delayed or curtailed some of the early flows, beekeepers have generally indicated better honey crops than last year. Florida reports are mixed with orange honey crops being better than normal, but later flows from gallberry and palmetto only ranging from about 1/3 to 1/2 of normal. Florida beekeepers were also hoping for flows from cabbage palm, pepper and melaleuca later this summer. In Alabama and Mississippi tallow produced fair to good honey crops along the Gulf Coast. In addition, fair to good flows came from clover, rattan, ti ti, blackberry, privet and assorted wildflowers. Beekeepers are also hoping for later flows from cotton, soybeans and fall flowers.

Colonies have been healthier with larger brood nests this season. In addition, not as many beekeepers have had problems with their queens. Rains have been adequate to carry through the main part of the season. In fact, at times the rainy weather has hampered flows. In addition, in early July hurricane Alex was churning up additional rain showers over parts of the Southeast, even though the brunt of the storm hit farther west and south in the Gulf

The honey market is still generally strong, but in some cases beekeepers said that they had not had as many calls for new crop honey as they had hoped. Prices remain generally good at the wholesale level with white and new crop orange honey selling in the $1.50 to $1.65 range and $1.20 to $1.50 for most amber grades. Retail sales and prices are also holding up well.

SOUTHWEST—Honey flows have been fair to good over much of this area due to plentiful and timely rain showers extending late into the spring and early summer in some portions of the Southwest. Eastern Texas and Louisiana were hit by stormy weather when hurricane Alex make landfall in northern Mexico in early July. Colonies have generally been in good condition this season and have not been hampered too much yet by varroa, viruses, nosema or small hive beetles.

In Texas, flows were listed as coming from brush, horsemint, rattan, clover, alfalfa, Chinese tallow, catsclaw, huajillo, mesquite, as well as numerous wildflowers and bushes. In Louisiana, flows had come from wildflowers, tallow, blackberries, clover and alfalfa. In Arkansas beekeepers had received honeyflows from vetch, holly, henbit, blackberries, clover and alfalfa. Due to the continuing good ground moisture, bees in Oklahoma were making honey from numerous wildflowers, clover, alfalfa and hairy vetch. In Arizona and New Mexico, drier conditions were bringing wildflower flows to a close, but bees were still working

U.S. HONEY, BEESWAX AND POLLEN PRICES FROM OUR REPORTERS

	North-east	Mid-east	South-east	South-west	East Central	West-Central	Inter-Mountain	West
Wholesale								
White lb. Blk.	$1.40-$2.20	$1.45-$2.00	$1.30-$1.70	$1.35-$1.70	$1.50-$2.00	$1.40-$1.75	$1.30-$1.60	$1.25-$1.60
Amber lb. Blk	$1.25-$1.60	$1.20-$1.75	$1.20-$1.50	$1.20-$1.60	$1.35-$1.75	$1.20-$1.60	$1.25-$1.50	$1.20-$1.50
1 lb. CS 24	$50.00-$80.00	$45.00-$82.00	$48.00-$90.00	$51.00-$85.00	$52.00-$75.00	$55.00-$81.00	$60.00-$95.00	$57.00-$92.00
2 lb. CS 12	$59.00-$80.00	$58.00-$72.00	$60.00-$68.00	$58.00-$73.00	$59.00-$79.00	$51.00-$78.00	$57.00-$76.00	$60.00-$77.00
5 lb. CS 6	$72.00-$88.00	$58.00-$87.00	$60.00-$76.00	$57.00-$75.00	$57.00-$86.00	$60.00-$84.00	$59.00-$85.00	$59.00-$88.00
Retail								
Jars 8 oz.	$1.50-$3.00	$1.40-$4.00	$1.25-$2.95	$1.20-$2.90	$1.50-$3.50	$1.40-$2.95	$1.30-$2.60	$1.25-$3.90
Squeeze Bear 12 oz.	$1.89-$3.50	$2.00-$4.00	$1.75-$3.75	$2.25-$4.00	$2.50-$3.95	$2.25-$4.10	$2.50-$3.85	$2.25-$4.25
Jars 1 lb.	$2.50-$5.50	$2.55-$5.25	$2.40-$4.75	$2.50-$5.00	$2.45-$5.25	$2.95-$5.25	$2.75-$5.25	$2.70-$5.95
Jars 2 lb.	$3.99-$6.75	$3.95-$7.00	$3.99-$5.49	$3.00-$6.25	$3.25-$8.00	$3.29-$6.50	$3.25-$6.25	$3.50-$6.50
Jars 1 1/2 lb. (Pint)	$4.50-$7.00	$4.25-$8.00	$3.50-$6.00	$3.58-$6.50	$3.25-$5.50	$3.50-$5.50	$3.75-$6.00	$4.75-$8.25
Jars 3 lb. (Quart)	$5.50-$9.75	$5.95-$14.00	$5.79-$10.00	$5.25-$9.25	$5.00-$11.50	$4.50-$10.00	$5.10-$9.75	$5.00-$12.50
Jars 4 lb.	$7.50-$12.00	$8.00-$15.00	$7.00-$10.75	$6.00-$12.70	$8.00-$14.00	$5.50-$13.50	$6.00-$14.50	$6.50-$16.00
Jars 5 lb.	$8.99-$19.00	$7.00-$19.50	$7.50-$17.50	$7.25-$18.00	$8.00-$21.00	$7.75-$18.00	$8.00-$19.25	$8.50-$22.00
Creamed 12 oz.	$2.50-$5.50	$2.50-$4.00	$2.49-$3.95	$2.25-$3.99	$2.50-$4.25	$1.99-$4.25	$1.75-$4.00	$2.25-$5.00
Comb 12 oz.	$3.00-$7.00	$3.50-$8.00	$2.25-$7.25	$2.50-$6.50	$2.50-$5.75	$2.50-$6.50	$2.50-$5.75	$2.75-$7.50
Round Plas. Comb	$4.00-$6.50	$3.25-$5.50	$3.50-$5.00	$3.00-$6.25	$3.25-$5.99	$3.00-$6.50	$3.25-$6.00	$3.50-$7.50
1 Gallon	$15.00-$25.00	$12.50-$26.50	$14.50-$25.00	$15.00-$25.00	$15.00-$30.00	$15.00-$27.00	$15.00-$30.00	$15.00-$30.00
60 lb.	$115.00-$145.00	$84.00-$125.00	$85.00-$120.00	$80.00-$130.00	$82.00-$140.00	$80.00-$135.00	$85.00-$130.00	$80.00-$130.00
Beeswax								
Light per lb.	$1.70-$3.50	$1.70 -$2.75	$1.70 -$3.00	$1.70 -$2.50	$1.70 -$2.50	$1.70 -$2.50	$1.70 -$2.50	$1.70 -$2.50
Dark per lb.	$1.60-$3.00	$1.60 -$2.35	$1.60 -$2.25	$1.60 -$2.25	$1.60 -$2.25	$1.60 -$2.25	$1.60 -$2.25	$1.60 -$2.25
Pollen								
Wholesale per lb.	$3.50-$6.50	$3.50-$8.00	$3.00-$6.00	$3.00 $5.00	$3.25-$6.00	$3.25-$6.00	$2.50-$6.00	$2.50-$5.50
Retail per lb.	$5.50-$15.00	$7.00-$15.00	$6.00-$15.00	$6.00-$10.00	$7.00-$15.00	$7.50 $15.50	$7.00-$12.00	$7.00-$15.00

The above prices are not meant to provide a realistic picture of prices in all states of the particular area. They are intended merely to show what a few beekeepers are receiving for their honey, beeswax and pollen and we realize prices may vary tremendously, even within individual states. The bulk prices for honey are stated per pound, delivered buyer's warehouse, containers exchanged or furnished by buyer, unless otherwise noted. Where prices are not shown, insufficient data were available.

irrigated crops such as alfalfa, as well as some of the desert plants and trees such as salt cedar that were still blooming. Later in the season, beekeepers still hoped to obtain flows from cotton, where grown, as well as soybeans and late summer plants such as rabbit brush.

Beekeepers also reported good income from renting their bees for pollination of crops such as melons and cantaloupes. Pollination fees were ranging from $45 to $55 in most beekeeper reports. Honey prices and demand remain excellent at both the wholesale and retail levels.

EAST CENTRAL—Above average rainfall in this area has brought mixed blessings to beekeepers. In some cases beekeepers were thankful for the added ground moisture, which has brought abundant honey plant growth among spring wildflowers and later clover and alfalfa. On the other hand, at times the unrelenting rain showers have washed nectar out of flowers and prevented normal bee foraging. In some cases, low-lying beeyards have been flooded or beekeepers were forced to relocate these colonies to higher ground.

Colonies have built up well in most cases, but many beekeepers are still trying to recoup their colony numbers and bee strength after the devastating winter. This has caused loss of early honey production in some cases. In contrast, those beekeepers with minimal winter losses could have colonies at full strength and were able to take advantage of early wildflower, black locust and clover flows. Later flows from clover, alfalfa and basswood have been fair to excellent, depending on the weather. Beekeepers in Michigan and Wisconsin were hoping for excellent honey flows since their main honey flows come a bit later, allowing more time for the weather to settle and colonies to build up strength. Due to the rain, soybeans were planted later and may also yield some honey in parts of Illinois and Indiana.

In summary, the honey flows look more promising than last year and beekeepers are cautiously optimistic. In addition, wholesale honey demand and prices remain strong, so beekeepers are hoping to receive top dollar for their 2010 surplus honey. Retail sales are also expected to remain strong through the end of this year.

WEST CENTRAL—This area is also hoping for improved honey crops in 2010. However, some beekeepers missed their canola, black locust and yellow sweet clover flows due to excessive rains. Farther north into Nebraska and the Dakotas this may not be a problem since clover and alfalfa flows come a bit later. However, beekeepers have been hoping for a nice long period of warm, sunny weather. Ground moisture is good over most of the area. Overwintered colonies have built up well, but beekeepers with heavy winter losses were forced to make divides or purchase packages and nucs to recoup their colony numbers. These bees will not be able to build up in time to take full advantage of better honey flows this season. In addition to white Dutch clover, yellow sweet clover and white sweet clover, some beekeepers mentioned flows from birdsfoot trefoil, assorted wildflowers and basswood. Later in the season, soybeans, sunflowers and knapweed may also provide some good honey surpluses.

Although Minnesota beekeepers were hopeful for a good crop this year, they have been busy trying to strengthen colonies and protect them from bears. Bear depredation remains a huge problem in the state and many beekeepers have to maintain bear fences, which adds to their operating expenses.

Honey demand and prices at both the wholesale and retails levels remain good. White honey prices are varying from $1.55 to $1.70 with some small lots selling for up to $2.00 per pound. Amber prices are about 10 to 15 cents below this. Consumers remain very enthusiastic about the benefits and quality of locally produced honey, so farmers markets and roadside stands are a popular way to retail new crop honey.

INTERMOUNTAIN—This area is normally behind much of the rest of country as far as colony build-up and honey flows are concerned due to a longer winter and late spring. However, this year has been worse than normal. Beekeepers said that their bees in California and the South often had to contend with rainy, cool and windy weather at a time when they are normally building their populations. Then, once beekeepers transported colonies back to their spring and summer Intermountain locations, the

weather continued to be rainy and cool when the bees are normally actively foraging on fruit trees, wildflowers and early clover. Many beekeepers were forced to feed their colonies at a time that they would normally be working wildflowers and early clover and alfalfa. Nevertheless, they were still hoping for later good summer flows from sweet clover, white Dutch clover and alfalfa. In addition, flows may also be obtained from sunflowers and knapweed later this summer. With the abundant ground moisture, honey plants should be plentiful; it's just a matter of the weather providing the needed foraging time for colonies.

As in rest of the country, beekeepers have exhausted their honey inventories from 2009 and desperately need a new crop of honey to restock packer inventories and retail store shelves. Producers would also like to be able to take advantage of the higher wholesale and retail prices while the strong honey market lasts. Wholesale buyers are offering $1.65 or more per pound for new crop white honey and some of our correspondents expected this price to increase.

WEST—Unusually wet, cool conditions persisted over much of the West Coast during the first half of spring at a time when warm, sunny weather would be normal. This caused some beekeeper adjustments, but overall, producers were hopeful for a better honey crop in 2010. Some beekeepers had to feed colonies longer than normal due to slow bee build up and a delay in flower bloom. However, the added moisture for this arid region should help extend flows for longer periods. Bees were working numerous wildflowers and cultivated plants in May, June and July. These included buckwheat, eucalyptus, sage, star thistle and clovers in the foothills. In the irrigated locations, colonies will be transported to seed alfalfa, safflower and cotton fields for flows. Earlier reports said the orange flow was average or better in southern California.

Farther north into northern California, Oregon and Washington, beekeepers have said that improved moisture conditions should help main flows there from sources like clover, alfalfa, mint, as well as the many wildflowers and berries. Beekeepers were also planning to move some colonies into the mountains for fireweed flows in July.

Beekeepers are thankful for better honey crops this year; especially since the wholesale honey market and prices remain strong. Packer honey inventories were also low, especially for specific floral honey varieties. Retail honey sales remain normal to strong.

Almond pollination prices will remain the same as this year or increase slightly in 2011. As always, stronger colonies will receive premium prices from growers—this normally means eight or more frames of brood and bees going into the almond pollination season. Prices we have seen in print are around $180 for strong colonies with eight or more frames of bees or $140 for six or fewer frames of bees going into the pollination season. Seasonal factors such as lower almond market prices on the one hand or a large winter bee kill on the other hand will also affect pricing for those beekeepers who are not already locked into a grower contract and price per colony.

ARGENTINA

As of the end of May 2010, cold weather had finally settled in most of Argentina. Timely rains came only during mid-autumn. Unlike previous weather forecasts, the severe effects of El Niño were significantly diminished during the fall season.

After the unexpected devaluation of the EURO against the U.S. dollar during May, most exporters are concerned about the fluctuations of currencies, and its impact on the course of honey exports during the remainder of the year. European importers will find it more expensive to get their traditional chunk of Argentina honey.

However, all evidence suggests that there is an eager market in the USA that will compensate for the shorter purchasing power of European buyers. American imports between January of April 2010 achieved a new record of 7,067 MT purchased for US$22.08 million (US$3,124 MT). This is substantially higher, than the 4,529 MT imported into the US during the same period of 2009. Germany, the other leading importer, has reduced its share of imports from 10,204 MT between Jan./Apr. 2009 to just 8,586 MT during Jan./Apr. 2010.

Nevertheless, the fate of Argentine honey exports during 2010 does not appear to be much different than in 2009. Total exports between January and April 2010 were 21,906 MT, versus 22,531 MT shipped during the same four months of 2009. The main difference has been the export price, which is now at world market levels of US$3,015 MT.

Scarcity of granulated sugar and HFCS are affecting the nutrition strategy of beekeepers. Woodenware manufacturers are also noticing severe shortages in their efforts to obtain supplies of pine and eucalyptus wood. The devastation caused by the Chilean earthquake of Feb. 27, 2010 has prompted huge exports of timber from Argentina into Chile, thus local supplies have been affected.

In spite of the high honey prices, most commercial beekeepers do not plan to either increase or to invest substantial amounts of money in their outfits. Lack of credit from banks is one reason. The honey crop was mediocre for most producers. And finally, the expansion of agricultural crops that do not provide as much nectar leaves little room for hive expansion. The last major commercial beekeeping exhibitions were failures in terms of both attendance and sales.

USDA Provides Emergency Assistance to Producers of Honeybees, Livestock and Farm-Raised Fish

WASHINGTON, June 30, 2010 - Agriculture Secretary Tom Vilsack announced that disaster assistance will be issued starting today to livestock, honeybee and farm-raised fish producers who suffered losses in 2008 because of disease, adverse weather or other conditions. The aid will come from the Emergency Assistance for Livestock, Honeybees and Farm-Raised Fish Program (ELAP).

"American farmers, ranchers and producers should have protection from market disruptions and disasters," Vilsack said. "The assistance announced today will be particularly helpful to beekeepers whose bees suffered from Colony Collapse Disorder (CCD) and will also assist other producers facing economic challenges."

More than $10 million in disaster assistance, including more than $6 million to compensate beekeepers for 2008 losses will be issued starting today, June 30. Under the program, producers are compensated for losses that are not covered under other Supplemental Agricultural Disaster Assistance Payment programs established by the Food, Conservation, and Energy Act of 2008, specifically Livestock Forage Disaster Program (LFP), Livestock Indemnity Program (LIP), and Supplemental Revenue Assistance Payments (SURE) Program. ELAP benefits related to 2009 losses are expected to be issued later this summer.

ELAP eligibility provisions have been amended for both honeybee and farm-raised fish producers. The modifications include allowing honeybee and farm-raised fish producers who did not replace their honeybees or fish that were lost due to a natural disaster to be eligible for ELAP payments based on the fair market value of the honeybees or fish that were lost. For more information about USDA Farm Service Agency disaster assistance programs, please visit your FSA county office or **http://www.fsa.usda.gov/elap** (USDA News Release)

International Honey Market

by RON PHIPPS
President, CPNA International Ltd.[1]
Co-Chairman,
Committee for the Promotion of Honey and Health

As summer proceeds there are three fundamental concerns overriding the American honey market. Those concerns are: 1) crop conditions, 2) changes in international currency rates and 3) circumvention and transshipment of Chinese honey through third countries. For each of these factors there remains considerable uncertainties as this report is written.

The fourth factor is how market participants—from beekeepers to exporters and importers to packers to manufacturers and retailers—understand the three factors.

Crop Conditions

It remains too early as this report is being written to assess crop conditions in the Northern Hemisphere. The fact that South America, in general, and Argentina, in particular had a poor honey crop contributed to both high prices for white honey and a depletion of honey stocks from previous crops in the USA and Canada. Prices remain firm for white honey as a consequence of these factors, even during a period of lower consumption and overall duress in western economies.

Thus far, the important factor of moisture levels is much improved in the USA in 2010 compared to 2009, which recorded the lowest crop in recent U.S. history. California overcame the drought that plagued it for several consecutive years. The orange honey crop looks good and California should have its best sage and buckwheat honey crops in the past 3-5 years. The Texas tallow crop is good. Most importantly the Dakotas have had abundant rains and clover bloom is plentiful. Beekeepers are more hopeful for a good clover honey crop.

At the same time, there has been loss of bees coming out of the almonds in California and stresses on bees in Florida remain serious concerns. The heavy rains in January led to fungus in the almond groves which in turn led to almond farmers using fungicides. As the bees came out of the almonds, there was a widespread loss of brood. The quality of the orange crop is excellent, but of the size of the crop is average. In some areas the sage crop is very white and excellent quality, but too much cold and rain eliminated the possibility of a bumper sage crop. For the first time in years some buckwheat is being produced.

In Florida, the widespread use of pesticides commercially and residentially has stressed bees. Some reports indicate 34% loss of bees due to CCD from February to April. Western Florida had a good crop, but eastern Florida did not. The orange crop is about 50-60% of normal, gallberry about 45-55% of normal. Texas' tallow crop was good, but not great as northern Texas was too cool.

The other concern is temperature. Like last year, there has been considerable cool, rainy weather in late spring and early summer. Thus, while white clover is blooming abundantly; bees were still being fed rather than working the blooming clover in South Dakota.

In Canada, the bees have wintered well, but concerns as summer began are with excessive rains. Field conditions are poor in southern Alberta, Saskatchewan and Manitoba. The Peace River area in northern Alberta looks good. These concerns with excessive moisture are not confined to the honey crop, but affect several crops. For example, the Canadian Wheat Board estimates that 11 million acres will not be seeded this year. The general requirement for a decent Canadian honey crop in 2010 can be expressed in one word; viz. heat.

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Report distributed June 21, 2010

Mr. Phipps is president and founder of CPNA International, Ltd. and is currently Secretary-Treasurer of the National Honey Packers & Dealers Association. He is an importer of honey, natural foods and tea from various international producers. Ron is also the former personal research assistant to the president of the American Philosophy Association. He is a recipient of the National Science Foundation fellowship for philosophy of theoretical physics. Mr. Phipps is a founding member of the Tea & Health Committee, which organized three major scientific symposiums on tea and health and the role of antioxidants in the prevention of disease. He has worked with FDA to develop a research protocol for the global diversity of honey.

Mexico's Crop

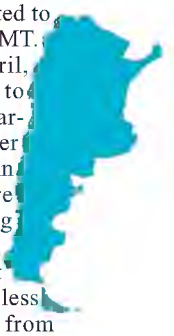
Mexico's honey production has already been reduced due to the drought and cold. Exports in May fell to 64% of previous levels. As summer approaches, the rainy season will commence, with current meteorological predictions indicating more frequent and severe hurricanes.

The northern mesquite crop exceeded expectations. California has bought over 1,000MT of this honey at favorable prices. The creamy yellow honey crop from the highlands will elicit large German purchasing beginning in September.

Mexico's honey industry has two acute new concerns. The European Commission is pressing Mexico to establish an effective and credible traceability system and to instill strict quality control measures to improve beekeeping practices and reduce the use of antibiotics needed to protect their bees. Sagarpa is instituting serious measures to establish traceability and improve quality. The second concern is a result of the weakening of the Euro. The overall financial crisis in Europe has led to the bankruptcies of two or three importers and a sharp reduction in European "pre-financing" of beekeepers and exporters. With high costs for fuel and sugar, wintering bees has become far more expensive in Mexico as the financial plight within Europe is felt in Mexico's honey industry.

Argentina

The total crop is estimated to be a disappointing 60,000MT. From January to April, 22,000MT were shipped to various international markets. In May, another 8,000MT were shipped. An additional 10,000MT were sold by late spring pending shipment.



These figures mean that there is only 20,000MT or less remaining to be shipped from July, 2010 through January 2011 for earliest arrivals February and March 2011. This means that there will be a protracted 8 to 9 months to absorb the remaining stocks of Argentinian honey. As the summer begins, western buyers have become passive and Argentine beekeepers have become extremely reluctant to sell. The market was frozen in this standoff between buyers and sellers. What honey is left in Argentina is mostly 50MM-80MM and prices remain fixed at historically high prices with Argentine beekeepers seeking prices that translate into a range of delivered U.S. prices of US$1.66/lb.-US$1.75/lb. The ambitions of Argentine beekeepers and the requirements of packers, especially European packers, have created a log jam of passivity and inertia in the marketplace.

India

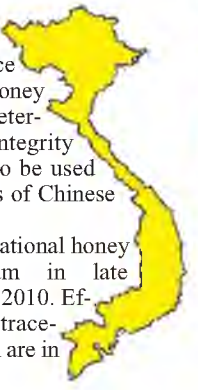
The European Commission has fiercely banned imports of Indian honey and (milk) as of June 12, 2010. The ban is imposed because of lack of adequate control of antibiotics in these food products.

There is a concurrent concern for lack of traceability of honey production within India. The Andrew Schneider articles of 2008 described elaborate and alleged circumvention schemes of Chinese honey being transshipped and/or blended via India. The European industry has reported the presence of heavy metals in Indian honey, including lead. It is worthy to note that a few years back there was talk of India launching an antidumping suit against China for flooding the Indian market with cheap Chinese honey, creating unfair competition for India's fledgling honey industry.

Where will this banned "Indian" honey now go? The ban in Europe may increase the demand for Chinese honey in the EU which may lessen the temptation of unscrupulous exporters to circumvent Chinese honey to the USA through transshipments.

Vietnam

A more extensive report will be in my next market update, but suffice it to say that Vietnam's honey industry appears to be determined to maintain its integrity and not allow Vietnam to be used for illegal transshipments of Chinese honey.



There will be an international honey conference in Vietnam in late October/early November 2010. Efforts for strengthening traceability and quality control are in progress.

Currencies

The confluence of severe national debts within the nations of the European Union, like the enormous national debt in our country, is disrupting and changing currency relations.

The U.S. and Canadian Dollars have achieved parity as summer 2010 begins. The Euro has declined in value 20%-26%. China's Yuan is under intense U.S. pressure to revaluate, which will make Chinese exports more expensive and China's imports cheaper. The Chinese are making limited concessions and point out that the Yuan had already appreciated about 16% relative to the Euro in recent months.

Currency issues are more important than ever. During the past several years, the tremendous appreciation of the Euro relative to the U.S. Dollar was the most decisive factor pushing U.S. Dollar prices higher and higher. The Europeans could pay much higher U.S. Dollar prices to Argentina, Uruguay, Chile, etc. without increasing the price in Euros within the European Union. That has changed as the Third Quarter, 2010 begins. Since the Europeans are not the only group of nations who have lived beyond their national means, currency relations remain inherently volatile and highly significant in determining where prices will settle during any given period.

Circumvention

The most significant "unknown known" is what will be done relative to the widespread circumvention of Chinese honey in order to avoid antidumping duties. The Chinese in the final analysis, may have as much to do about preventing this phenomena, which both harms their own national reputation and may delay China's treatment as a "market economy," whereby, the use of "surrogate country analysis" will end as promised in the bilateral agreement between the USA and the PRC made when China obtained membership in the World Trade Organization.

On June 9, 2010, there were hearings in the U.S. Senate regarding China's compliance or lack thereof, with the rules of the World Trade Organization. The hearings included talks by Senators Lindsey Graham, South Carolina, Senator Stabenow, Michigan and Senator Charles Schumer, New York. Senator Schumer's office issued a Press Released titled: **SCHUMER: NY'S HONEY INDUSTRY UNDER ASSAULT BY CHINESE 'HONEY LAUNDERING'—SENATOR SAYS CHINESE UNFAIR AND DECEPTIVE TRADE PRACTICES COULD DEVASTATE MULTIMILLION DOLLAR NY HONEY INDUSTRY, HURT FARMERS, AND PUT CONSUMERS AT RISK.**

Subheadings include:

"Schumer Demands Feds Take Immediate Steps to Crack Down on Shady Practices Allowing Illegal Chinese Honey into United States—Shipping Through Other Countries, Mislabeling Shipments, and Setting Up Shell Corporations

"In 2001 United States Levied Duties On Chinese Honey After Chinese Exporters

Found To Be Engaging In Predatory Trade Practices—Chinese Companies Now Illegally Avoiding Duties

"Honey Is Big Business In New York, Producing Millions of Dollars in Economic Activity Each Year—China Is undermining Industry and Sending Potentially Tainted Honey Into the Country; Schumer Calls for Immediate Crack Down

"Almost a decade ago, the United States started imposing duties on honey imported from China after it found that Chinese exporters were engaging in predatory trade practices. But in subsequent years, Chinese companies began to get around the duties by shipping the honey through other countries—such as Malaysia and Indonesia—and thereby circumventing payment of U.S. duties and food safety standards.

"….China mislabels honey as malt sweetener or blended syrup to avoid paying the antidumping duty.

"….China exports honey to the United States through other countries.

"….Shell companies are set up to import Chinese honey and then disappear when it comes time to pay the duty."

Senator Schumer also released a letter to the Director of the U.S. F.D.A. asking the F.D.A. to promptly establish a national Standard of Identity for honey. Numerous news articles followed across the nation and world including an article in *The Wall Street Journal* and in *Reuters*.

The Senate hearings were preceded by hearings in the House of Representatives at which time a formal statement was issued to the U.S. House of Representatives Committee on Ways and Means Subcommittee on Trade by the A.B.F, American Honey Packers and Dealers Association and the National Honey Packers and Dealers Association. That statement includes the lines:

"As beekeepers, honey packers and importers our challenges seem to grow faster than we can produce honey. The ever-evolving and complex schemes devised to enter honey into the United States without paying the U.S. antidumping duty on Chinese honey imports is mind-boggling, to say the least. Our comments are intended to shed additional light on these schemes, so the committee fully understands the gaps in our current laws and is better positioned to develop legislation that will provide the relevant federal agencies the enforcement tools necessary to fight this very real threat to our future in the honey industry.

"Honey laundering undermines the credibility of the entire honey sector, since the image and reputation of honey as a safe and wholesome product is put into question."

At no previous time has the problem of circumvention received such serious attention in the U.S. Congress as now. The reason is simple and straightforward. If cunning and shrewd schemes of collusion and circumvention are not stopped in a comprehensive and timely manner, honey companies will be driven into bankruptcy based upon the inability to successfully compete against illegal circumvented honey.

At the same time, the industry must recognize that the overall marketplace requires honest and legal imports of honey to make up for the deficiency between consumption and production which, in 2009, was approximately 450 million pounds consumed versus 144 million pounds produced. There needs to be the establishment of a comprehensive and authenticated international data base of honey types, quality control standards, improved beekeeping practices throughout the world and effective systems of traceability throughout the entire honey chain.

But circumvention must be stopped or its continuation will breed ill-gotten competitive advantages that will inevitably lead to domination and monopoly of both the industrial and the retail segments of the industry. Recent and on-going efforts will lead to the re-establishment of a level playing field.

Schumer: NY'S Honey Industry Under Assault by Chinese 'Honey Laundering'

– Senator Says Chinese Unfair and Deceptive Trade Practices Could Devastate Multimillion Dollar NY Honey Industry, Hurt Farmers, and Put Consumers at Risk

On June 9, 2010, U.S. Senator Charles E. Schumer called on the U.S. Immigration and Customs Enforcement (ICE), U.S. Customs and Border Protection (CBP) and the U.S. Food and Drug Administration (FDA) to crack down on "honey launderers" that are undermining New York's honey producers. Almost a decade ago, the United States started imposing duties on honey imported from China after it found that Chinese exporters were engaging in predatory trade practices. But in the subsequent years, Chinese companies began to get around the duties by shipping the honey through other countries –such as Malaysia and Indonesia – and thereby circumventing payment of U.S. duties and food safety standards. Chinese exporters also intentionally mislabel their honey shipments and set up shell corporations to avoid paying duties. The practice threatens to undermine New York's multimillion dollar honey market and deprives the United States of $100-200 million a year in duties. Additionally, because bees pollinate all sorts of crops, any threat to the domestic honey industry is a threat to many major agricultural industries.

"This is just one more example of China playing by its own rules to the detriment of everyone else," said Schumer. "Instead of simply selling their product in a fair and competitive way, the Chinese are using illegal, backdoor deliveries and mislabeling their product to accomplish their goal. Today I am calling on the federal government to issue a stinging rebuke to these practices, and once again level the playing field."

New York's honey industry is one of the nation's largest, ranking 12th in total production in 2009 and serving as the Northeast's largest beekeeping state. Just last year, New York's honey producers manufactured over 3 million pounds of honey and racked up $5.3 million in sales, all while employing thousands. Despite the fact that New York has a robust honey industry, it is has been severely strained over recent years as cheap honey from China has flooded the U.S. market. For example, the United States Department of Agriculture (USDA) keeps track of total sales from the honey industry and in the last year that final sales figures are available (2003-2007) show a 36.4% decline, which coincides with China's 'honey laundering' scheme to circumvent the duty.

Schumer Demands Feds Take Immediate Steps to Crack Down on Shady Practices Allowing Illegal Chinese Honey into United States – Shipping Through Other Countries, Mislabeling Shipments, and Setting Up Shell Corporations

Although USDA estimates indicate that New York's honey industry has ticked slightly upward since 2007, the overall trend is still downward—over 15% from 2003. If the federal government does not step in and blunt China's predatory trading practices, then the industry will continue to decline hurting New York's economy and endangering thousands of jobs. Also, since bees pollinate so many crops, a further deterioration in the honey industry is likely to have a cascading effect on the entire New York agriculture industry. Beyond the domino effect that China's continuing trade practice would have on agriculture across New York, the continued predatory trade practice would hurt small businesses that sell honey products. Throughout every region of New York, businesses that sell honey boost the local economy and create jobs, but would see a crucial part of their business put at risk if the status quo continues.

In 2001 United States Levied Duties On Chinese Honey After Chinese Exporters Found To Be Engaging In Predatory Trade Practices – Chinese Companies Now Illegally Avoiding Duties

In 2001, the United States began levying duties on Chinese honey to balance China's unfair trade practices. Since then China has developed a complicated scheme to circumvent international trade laws and sell cheap honey in the U.S. at the expense of domestic producers. China does this in several ways:

China mislabels honey as malt sweetener or blended syrup to avoid paying the antidumping duty.

Schumer said that such a method could be thwarted simply by the FDA instituting a "pure honey standard," essentially a definition of what honey is - something he today urged the FDA to implement. Schumer said the FDA and USDA's Food Safety and Inspection Services (FSIS) share responsibility for ensuring that food labels are truthful and not misleading. FSIS has the authority to regulate the labeling of meat and poultry products, and FDA has the authority to regulate the labeling of all other foods. Food standards are used to ensure that products sold under particular names have the characteristics expected by consumers.

While the FDA is not responsible for enforcing trade law, the agency is responsible for ensuring the safety of much of the U.S. food supply. Standards of identity are referenced throughout FDA regulations and the existence of a standard of identity can trigger application of laws not otherwise applicable to non-standardized foods. Establishing a honey standard would provide FDA and other federal agency enforcement officials with a tool to ensure the purity of imported honey and to detect the existence of potentially hazardous additives. In addition to safeguarding the food supply, this tool would make it easier for U.S. officials to prosecute those who seek to exploit loopholes in our food safety system.

China exports honey to the United States through other countries.

The United States produces less than half

the honey that it consumes, which means the U.S. relies on imports to make up the difference. The U.S. imports from major honey producers like Canada, Argentina and Brazil. However, customs data also reveals that the U.S. imports a significant percentage of honey – perhaps as much as a third of total imports – from countries with no significant commercial honey exporting business. Four of the top eight countries – India, Malaysia, Taiwan, and Indonesia – export far more honey than their domestic bees produce.

Official imports from China, which as recently as 2006 provided over ¼ of U.S. honey imports, are now virtually nonexistent – unofficial, illegal imports are another matter. Since the United States imposed stiff antidumping duties on imports of Chinese honey in 2001, attempts to avoid such duties – by sending Chinese honey into the U.S. from a second or even a third country—have proliferated. This transshipping or "honey laundering" – ie, the intentional mislabeling of the country of origin – is costing the U.S. millions of dollars in unpaid duties and putting consumers at risk from honey contaminated with antibiotics, a problem common with Chinese honey.

Shell companies are set up to import Chinese honey and then disappear when it comes time to pay the duty.

Efforts to stem the flow of Chinese honey imports are being severely weakened by intentional circumvention of U.S. trade and food safety laws. These circumvention schemes often depend upon fly-by-night importing companies that are thinly-capitalized and specialize in importing questionable food products. When CBP tries to collect antidumping duties or ICE tries to take enforcement actions, these companies shut down operations and become insolvent; the owners simply disappear. The companies are then replaced with new, undercapitalized shell companies, often run by the same owners of the previously-shuttered entities. Legislation is needed to fix the loopholes and gaps in U.S. trade laws that allow these problems to persist.

Schumer said that the first problem that needed to be addressed was the establishment of "pure honey" standard of identify. It would give federal agents much greater authority to crack down on adulteration, misbranding, and fraudulent mislabeling. Schumer also said that he would be working with the honey industry in New York to prepare legislation that would give Customs greater authority to crack down on "honey laundering" through other countries. His legislation would make it harder to set up shell corporations and provide more resources to Customs and the FDA to crack down on these scammers.

The text of Schumer's letter to FDA is below:

June 8, 2010

The Honorable Margaret A. Hamburg, M.D.
Commissioner of Food and Drugs
U.S. Food and Drug Administration
10903 New Hampshire Avenue
Silver Spring, Maryland 20993

Dear Commissioner Hamburg,

I am writing to express my concern that the Food and Drug Administration has yet to issue a national standard of identity for pure honey. Such a standard would be a critical tool in promoting truth in labeling, and provide a basis for enforcement actions by State and Federal agencies against those responsible for imports of mislabeled or adulterated honey.

The request for establishment of a federal pure honey standard – filed by a broad coalition of American beekeepers, honey producers, packers and dealers – has been pending before the FDA for over four years, since March 2006. And, in response to a QFR from the June 3, 2009, hearing on food safety legislation before the Subcommittee on Health, House Energy and Commerce Committee, you promised to respond to that request within the year. It is my understanding that the FDA has yet to do so. I urge you to take immediate action in response to the 2006 request.

Honey Is Big Business In New York, Producing Millions of Dollars in Economic Activity Each Year – China Is Undermining Industry and Sending Potentially Tainted Honey Into the Country; Schumer Calls for Immediate Crack Down.

Even though honey is produced in the United States, traded internationally, and consumed both as a packaged food and as a food ingredient, there currently is no federal standard of identity for honey in U.S. law. A number of states, however, have decided they can no longer wait for federal action on this important issue. Florida and Wisconsin both recently established their own honey identity standards, and other states are considering doing so. The FDA has previously expressed concerns that differing state standards for honey may cause unnecessary burden on interstate commerce if producers are required to make honey to different specifications. The increasing state activities regarding standards of identity for honey would seem to be yet another reason to move forward expeditiously with establishment of a federal standard.

I also have serious concerns about the quality and labeling of Chinese-origin honey brought into the United States. Official imports from China, which as recently as 2006 provided over ¼ of U.S. honey imports, are now virtually nonexistent – unofficial, illegal imports are another matter. Since the United States imposed stiff antidumping duties on imports of Chinese honey in 2001, attempts to avoid such duties – by sending Chinese honey into the U.S. from a second or even a third country – have proliferated. This transshipping or "honey laundering" – that is, the intentional mislabeling of the country of origin – is costing the U.S. millions of dollars in unpaid duties and putting consumers at risk from honey contaminated with antibiotics, a problem common with Chinese honey.

The FDA has established over 280 food standards of identity, including standards of identity for everything from parmesan cheese and grape jelly, to milk chocolate and maple syrup. Such standards establish a common language for trade while providing consumers more assurance about the quality of the food that they purchase. Given the importance of protecting the health of consumers and ensuring fair trade practices, establishment of a federal standard of identity for honey would seem to be a reasonable and appropriate response. Moreover, a standard of identity for pure honey would serve notice to unscrupulous importers that the United States will no longer be a haven for mislabeled or adulterated honey.

I respectfully urge you to act expeditiously on the 2006 petition for establishment of a national standard of identity for pure honey. I also ask that you please keep me apprised of developments on this issue. If you have any questions, please contact Stacy Ettinger, on my staff, at 202-224-7945.

Sincerely,

Maxwell C. Young
Press Secretary
US Senator Charles E. Schumer
W: 202 224 7433

American Bee Journal Editor

Frank C. Pellett

by M.G. DADANT and ROY A. GROUT*

In the March 1916 issue of the *American Bee Journal*, C. P. Dadant made this announcement:[1] "We are glad to inform our readers that our editorial staff is now increased with the addition of Frank C. Pellett, who will act in the capacity of staff correspondent.

"He will need no introduction to the readers of the *American Bee Journal* of the past few years, for he has been a regular contributor and his articles are appreciated. Mr. Pellett, who is now State Inspector of Apiaries in Iowa, a born naturalist and author of the new book, *Productive Beekeeping*, has been furnishing us with a series of articles on *Honey-Producing Flora in the United States*. In his new capacity, he will not only continue the series, but will also supply additional writings and ideas on bees, both popular and technical. He will also act on the Advisory Board of the *Bee Journal*."

With only a normal school education, Pellett gained for himself, by industrious study, the right to practice law in Missouri and he practiced there for a few years.[2] But his interest was not in legal work, and he decided to dedicate his life to the things he loved so much—nature, wildlife, the birds, the plants, and the bees. So, the family moved to a small farm near Atlantic, Iowa, and here he set aside a 10-acre plot for a wildlife preserve. This was to be followed later by the Honey Plant Test Garden, which he developed in conjunction with the *American Bee Journal*.

Frank Pellett became State Apiary Inspector of Iowa in 1912 and in the same year first contributed to the *American Bee Journal*.[3] The following year he began a series entitled "Bee-Keepers I have Known" and contributed six articles to the *Journal*. This was continued in 1914 with seven articles and, in 1915, he began a series of articles entitled *The Honey-Producing Plants*, contributing 17 articles in all.

Pellett's writings for the *Journal* became so extensive that he decided it would be desireable to move to Hamilton and, in the October 1918 issue, C. P. Dadant made this announcement, also stating that Pellett would be an associate editor.[4] Although the family lived in Hamilton most of each year, the summer months were spent in the gardens and with the bees at Atlantic, Iowa. Visitors came from far and wide to enjoy a day with Frank and to observe the results of his work and studies.

In the May 1932 issue, Frank C. Pellett's status was changed to field editor. With the February 1937 issue, when C. P.'s health was waning, both Pellett and G. H. Cale were listed as editors, along with C. P. Dadant.

However, long before being named field editor, Pellett had become a "roving" field editor for the *Journal* and as such visited many different parts of the United States, Canada, and Mexico. This provided him the opportunity to write about conditions in various parts of the country, as well as about prominent personalities in beekeeping, and he was always observing the honey plants wherever he traveled. He promoted field meetings; helped established the Department of Apiculture at Ames, Iowa; and visited bee laboratories in the various states and in Washington, D. C.

Frank Pellett was an *American Bee Journal* editor from 1938 to 1949. However, as early as 1918 editor M. G. Dadant had given him the title of associate editor and later field editor. This photo was taken in 1934.

In the October 1930 issue of the *Journal* appeared his first "Postscript" page[5] and this was continued almost every month until his death in April 28, 1951. Thus, "Postscripts" was a department in the *Journal* for more than 20 years. Including this monthly department, Frank Pellett contributed more than 600 articles to the *Journal*, and he also wrote for other publications.

When the question of resistance of honey bees to American foulbrood first came up, Pellett vigorously pursued the possibilities. In cooperation with Iowa State College, the Iowa Agricultural Experiment Station, and the *American Bee Journal*, an apiary of 45 colonies was established from many sections of the country, to determine the degree of disease resistance of their progeny and whether such characteristics might be tranmitted from one generation to another. This they did prove and the first report of this research appeared in the January 1936 issue of the *Journal*.[6] Later the work was turned over to other hands, including the Division of Bee Culture, and Pellett returned to his long-loved nature studies.

In the course of his life, Pellett wrote 13 books and co-authored several others, including his chapters in the 1946 and 1949 editions of *The Hive and the Honey Bee*. His books include *Our Backdoor Neighbors*, *Birds of the Wild*, *How to Attract Birds*, *Success with Wild Flowers*, *History of American Beekeeping*, *Beginner's Bee Book*, *The Romance of the Hive*, *Productive Beekeeping*, *Practical Queen Rearing*, and with his son, Melvin, *Practical Tomato Culture*.

The great monument which he created and which was his most outstanding work was his book, *American Honey Plants*. First published in 1920 by the *American Bee Journal*, it was revised and enlarged in 1923 and again in 1930, the 4th and last revision being

***Former *American Bee Journal* editors**

From the very beginning Frank loved nature and was a keen observer of all things natural. Photo taken in 1915.

published in 1947 by the Orange Judge Publishing Co., Inc., of New York. It was reprinted in 1976 by Dadant & Sons, Inc., due to its continued popularity, despite having been out of print for a number of years. In it are listed some 475 plants whose flowers either produce nectar or pollen, together with information on their blooming time, distribution, soil requirements, and their nectar and pollen attraction for bees.

Another of his important works was his searching for and testing of plants which might have possibilities for the beekeeper and also fit into our North American agriculture. To do this, Pellett established a Honey Plant Test Garden on his farm at Atlantic in cooperation with the *American Bee Journal*. With the January 1939 issue of the *Journal*, Pellett began a series of articles entitled, *From Our Honey Plant Garden*, that appeared frequently until shortly before his death.[7]

Hundreds of plants coming from all over the world were tried by him. Out of this prolonged work, came *Trifolium ambiguum*, later named Pellett clover—a legume having a deep and spreading root system. Likewise, he investigated the native mints that might have commercial value for their menthol or other chemical constituents. He was among the first to recognize the value of bird's foot trefoil and ladino clover as highly desirable legumes. The following was on a sign prominent in the garden:

"The kiss of the sun for pardon,
The song of the birds for mirth.
One is nearer God's heart in a garden
Than anywhere else on earth."

Pellett's recognition of the importance of honey-bee pollination to our agricultural economy was far ahead of his time. It was his enthusiasm that sparked the first pollination conference that did much to bring proper recognition by agriculture to the importance of honey bees. On his 67th birthday, he was given special recognition at the pollination conference held at the garden at Atlantic.[8] At the Fifth Annual Pollination Conference, a banquet was given in his honor. He will long be remembered for the keynote statement he made at this meeting: "The beekeeper holds the key to national prosperity."[9]

After an illness lasting more than a year, Frank Chapman Pellett passed away at Atlantic, Iowa, on April 28, 1951. Had he lived unitl July 12, he would have reached his 72nd birthday.

G. H. Cale[2] ended his tribute as follows: "We at the *American Bee Journal* office, in 35 years of association with Mr. Pellett, have known of his many fine works, but above all we admire him as a man. He always had a kind work for everyone; all people were his friends. He was never too busy to help the other fellow and never resented, but rather applauded, the work done by someone else, whether or not it was at his instigation. We will always remember his enthusiasm, his philosophy of life, and his fullness of purpose which made him a great man."

F. C. Simpson, editor of the Atlantic, Iowa, *News Telegraph*, ended a splendid tribute to him in this way: "So the quiet little man we knew attracted to himself men high in the scientific world, as he built for himself a life which might well become a pattern for young men who search for the deeper satisfaction of life which comes with accomplishment. But this was not done without a plan. It was no hit or miss way of life. Early, Frank Pellett adopted a creed by which he lived. He wrote this creed down in later life, so that we are able to pass it along. By this creed Frank

Pellett posted this sign in his Atlantic, Iowa Honey Plant Test Garden.

Pellett became a truly great man. We recommend it to young men everywhere. It is a legacy which Frank Pellett has left for all who will use it.

"The universe is mine with all eternity to explore it.

"My limitations are only such as I myself shall make.

"No one can injure me but myself.

"The greatest calamity that can befall me is but temporary and in the light of the future will seem but a trifle.

"I will therefore be serene, unruffled and content, knowing that if the thing which I desire is beyond me today, it will come to me tomorrow."

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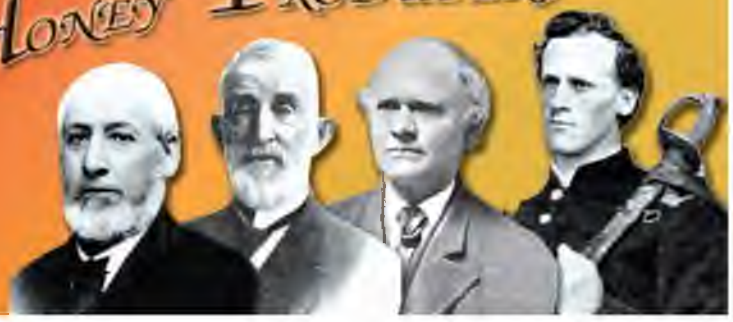
Pioneer Honey Producers

From the "History of American Beekeeping"

by FRANK C. PELLETT*



Moses Quinby perhaps is entitled to recognition as the first commercial honey producer of distinction. He began beekeeping in 1828, when the bees were hived in a box or hollow log and smothered for their honey. Long before the invention of the bee space and movable frame hive, Quinby undertook to make honey production profitable. There was no such thing as a smoker, an extractor, or comb foundation. The modern beekeeper would be helpless under such conditions, as were most of Quinby's contemporaries.

Although Quinby made some contribution to the development of such implements as the smoker and extractor, his greatest achievement was that of becoming a successful honey producer with primitive equipment. When the discovery was made that the honey could be obtained without the destruction of the bees, the first great advance in beekeeping was made. True, the beginning was very crude and the amount of honey obtained was small, but it was so revolutionary as to mark the start of the present day methods.

Moses Quinby of New York is entitled to recognition as the first commercial honey producer of distinction.

When a cap was placed on top of the box hive to provide a separate chamber for the storage of surplus honey, the way was open for the appearance of the super. When, in 1856, Moses Quinby and a few of his neighbors, who followed his leadership, produced for market a crop of 10 tons of box honey, something of a sensation was created. The newspapers commented extensively and much curiosity was aroused as a result. Quinby was deluged by correspondence because of this publicity, by men who wanted to know what system of management would bring such an amazing result.

To one reading Quinby's book in the light of the later developments, with his description of the removal of a board from the side of the hive and the cutting out of frames of honey, it is hard to believe that such crops could have been harvested by such methods. Following such instruction, he tells how to "strain" the honey. Here we must remember that he was making use of the equipment common to his time, and that his methods were in advance of his fellows.

Quinby became a very large-scale beekeeper for that day, and it is recorded that he owned by himself and in partnership with others from 600 to 1,200 colonies of bees during the height of his beekeeping career. It was during the Civil War that Quinby reaped a rich harvest. With the supply of sugar cut off from the South, sweets were scarce and high in price. During the last year of the war he harvested 11 tons, which brought a snug sum in that period of high prices.

Quinby appears to have been slow in recognizing the value of Langstroth's invention. He tried the new hive, but had difficulty in getting the bees to build straight combs in the frames. He declared that movable combs would not suit the average beekeeper, since he would not have the patience to take the trouble needed to get straight ones. Although we speak of him as a practical man, he continued to use his standing frame hive until his death. This certainly was a less practical hive than the one which replaced it in the favor of American beemen.

It is a significant fact that New York, where his influence was most in evidence, became the first region where honey production assumed commercial proportions. Several of Quinby's followers became well-known as large-scale producers of honey.

Born April 16, 1810, Quinby lived until May 27, 1875, when he suddenly passed away. During the later years of his life he was prominent in all that pertained to the industry, and in his influence we must recognize the beginning of commercial honey production. It was he who gave confidence that bees could be made to provide a livelihood and support a family in the comfort which they were entitled to expect.

J. S. Harbison was best known among California pioneer beekeepers.

*Former editor of the *American Bee Journal* and author of the book *History of American Beekeeping*.

JOHN S. HARBISON

John S. Harbison was a contemporary of Quinby and his influence in California was similar to that of Quinby in New York. It was a difficult and expensive task to take bees from Pennsylvania to the new land of California, but once he had done it, he proceeded to expand his apiaries as rapidly as possible. In partnership with R. G. Clark he established apiaries in San Diego County in 1869. The spot chosen was in the mountains about 20 miles east of San Diego, in what was then sheep ranching country. The nearby mountain has since been named "Harbison Mountain," at the suggestion of visiting beekeepers who made the request at the time of a meeting held in San Diego in 1918.

In 1873 Harbison bought his partner's interest and in a few years probably owned more bees than any other man of that day. It is never safe to say that a man was the most extensive beekeeper, for always there is another elsewhere to contend for the honor. His big shipments of honey to eastern markets attracted even more attention than Quinby's shipments had done at an earlier date. His book, *Beekeepers' Directory,* provided information for the novice dealing with California conditions, and he paved the way for a successful career for many beginners following his leadership.

Harbison enjoyed doing big things in a big way, even though the expenses consumed most of the profits. He frequently exhibited California honey at eastern fairs and, in 1876, was awarded a medal for his exhibit at the Philadelphia Centennial. In like manner he received the highest awards at St. Louis and New Orleans, and made his name familiar to the general public over a great expanse of territory.

Shipping 23 carloads of honey of his own production in one year would be something of an achievement even today, but in that early time it was sensational. He became the recognized leader among beekeepers of the far West, and so continued until old age slowed him down.

When California fruit-growing was in its infancy some friction developed, and Harbison sustained serious losses because of the distrust of ill-informed fruit growers who thought honey bees could damage fruit. Whole apiaries were burned to drive him from the neighborhood.

At one time Harbison owned 3,500 hives of bees. John H. Martin, "Rambler," recorded that he harvested 60,000 pounds of honey from 300 colonies of bees. That he was of an ingenious turn of mind is evidenced from his invention of the honey section, his hive which was so widely used in the West, and his stove smoker which was discarded when the bellows smoker came into use. He is remembered as a pioneer who introduced commercial honey production into California. All of his inventions except the section have long ago gone out of use, but that alone is sufficient to entitle him to a place in the beemen's hall of fame.

ADAM GRIMM

Adam Grimm was another pioneer beekeeper who is remembered for his influence as a honey producer rather than as a discoverer. Born in Germany in 1824, Grimm came to America in 1849 and settled in Wisconsin where he bought 20 acres of unimproved timber land with the meager savings which he brought to this country. He had been interested in bees in Germany, and made his start here by means of wild swarms which he caught in the woods. The bees, together with a small nursery, helped him toward independence. It was the bees, however, on which he later came to depend principally for his income, He was a pioneer in a new land with new problems and was making a beginning with a new industry.

In 1864 he had 60 colonies of bees in all kinds of boxes and straw hives. In the closing year of the war, honey brought high prices, which served as an inducement to look for more efficient methods of caring for the bees. That year he adopted the Langstroth hive and secured Italian bees. From that time on his progress was rapid. Only 10 years later he sold his crop for 10 thousand dollars and with the money thus obtained founded the Farmers and Merchants Bank of Jefferson, Wisconsin.

That a man could secure the capital from bees to start a bank was sufficient to arouse great public interest, and the fact was published far and wide. For half a century the story continued to be repeated by the public press, and this publicity had no little effect upon the development of the beekeeping industry.

Of interest here is a detailed report of Grimm's operation for the year 1870, reported to the Commissioner of Agriculture.* That year he had wintered 600 colonies out of 670 from the fall before. These he reports as in poor condition. After selling some, he started the season with 575 colonies and increased by natural swarms to 903. As this was more bees than he cared for at that time, he united some colonies and prepared to winter 730 for the next season.

Adam Grimm of Wisconsin started a bank with money received from the sale of honey.

With this large number of bees he reported a total crop of only 22,725 pounds. The returns for the season, however, totaled $5,742.80, of which $3,930 is reported for honey. Two hundred forty colonies of bees were sold for shipment to Utah for $2,450, but not counted in the above return since they were sold so late as to be counted in the business of the following year. Among his expenses, he reported the cost and board of a hired man for the year at $350, and about $500 for hives, honey boxes, postage on queens sold, and the expense of caring for his horse and wagon. His greatest number of colonies in one yard was 393, although he stated that 100 colonies is as many as can be kept in one location without reducing the per colony yield.

Although he continued his interest in the bank, he did not lose contact with his bees and gave them his personal attention during the active season. Unfortunately, he did not live long after launching his banking enterprise, for he died in 1876 at the age of 52. At that time he is reported to have had in the neighborhood of 1,400 hives of bees in seven or eight apiaries in the vicinity of Jefferson.

Although he imported Italian queens and wrote for the bee papers of his time, he contributed little that was new or original. However, his financial success did inspire confidence and was, undoubtedly, responsible for starting others in the same direction.

CAPTAIN HETHERINGTON

Capt. J. E. Hetherington, of Cherry Valley, New York, was a disciple of Quinby. Born in 1840, he started beekeeping at the age of 12 years, and by the time he was 17 he was selling honey by the ton. When the Civil War opened in 1861, he was regarded as the most extensive beekeeper in the country. In the excitement of the time he enlisted in the army to serve until 1864, after having attained the rank of captain. His discharge came because of disability from wounds and for a time his life appears to have hung in the balance.

With returning health he took up honey production with his old time enthusiasm and was soon again producing honey on a large-scale. At one time he made extensive shipments of comb honey to England, forwarding larger quantities than had been moved to that market previously. Hetherington received much publicity as the most extensive beekeeper in the world. At that time he had about 3,000 colonies of bees. It is doubtful whether he was entitled to such recognition, although, of course, there is no certainty as to what particular individual owned the largest number of hives at one particular time.

In any case, Hetherington was an exten-

*American Bee Journal, June, 1871.

Captain J. E. Hetherington during his life was said to be the world's most extensive honey producer.

sive and successful beekeeper who made material contributions to the advancement of the industry. He conducted many experiments with foundation and the use of wire in the support of combs. He probably originated the use of wire for this purpose. He did not write much for publication, and, but for the fact that his operations were so extensive at a time when small apiaries were the rule, he would have been all but forgotten now. He appears to have been among the first to discover the technique of management which would enable him to care for large apiaries without the bother of much swarming. It is said that he was able to carry whole apiaries through an entire season without a single swarm.

MAKING HONEY PRODUCTION A BUSINESS

Although there were many others at that time who kept enough bees to entitle them to be called commercial honey producers, it was these four who did it on such a big scale as to attract nationwide notice. Each was responsible for some contribution making for the progress of the industry, but, aside from Harbison's invention of the comb honey section and Hetherington's use of wire in the support of combs, Quinby's improvement of the smoker was the only outstanding thing to be left behind. Were it not for the fact that they kept so many more bees than others of their time, they hardly would be remembered.

As Hetherington was inspired by Quinby's success, so many others have followed him, as they also have followed Grimm and Harbison—because of the assurance that bees could be made to provide a livelihood. We owe something to many men of the pioneer period, but it is to these four especially that we owe credit for a striking demonstration of the possibility of commercial honey production.

Langstroth's Cincinnati Connection

by GENE KRITSKY
Department of Biology
College of Mount St. Joseph
Cincinnati, OH 45233

In 1858, Lorenzo L. Langstroth moved into a small brick house on eight acres of land in Oxford, Ohio. The property was a gift from his brother-in-law, Aurelius B. Hull. There, Langstroth set up a small apiary where he continued to conduct his apicultural research (Naile 1976). Oxford was (and remains) a small college town just to the northwest of Cincinnati, which was then the largest city in the western United States, a major center of commerce, and a transportation hub to the West. This provided an economic lure for people with an entrepreneurial spirit, and two of these individuals would go on to play a role in Langstroth's life and the history of American beekeeping.

In 1848, Edward Townley (1802-1882) moved to Mount Auburn, a small village that is now a neighborhood of the "Queen City," leaving an allegedly successful beekeeping business in New York. He was the author of *A Practical Treatise on Humanity to Honey Bees; or Practical Directions for the Management of Honeybees*, in which he described his various experiments on honey bees and claimed to have patented a hive for sale. His "Townley's Patent Premium Self Protecting Hive" was a "parlor hive" with glass doors that permitted easy observation of the bees. The hive hung from a frame system, as did many box hives commonly used during the late 1840s (Kritsky 2010).

Figure 1. An 1863 Civil War token issued by Edward Townley. Photograph by G. Kritsky.

By all accounts, Townley's relocation to Cincinnati was successful. Charles Cist's *Sketches and Statistics of Cincinnati in 1859* included a complimentary section on Townley's operations. It reads:

> Bee-Hives.–Edward Townley, Mount Auburn, has been for years a successful raiser of bees and producer of honey. He is the patentee of a bee-hive, which, after all the various attempts to introduce others into this vicinity, appears to be the best adapted to bees, and their honey product. Ten hives, last spring, have thus increased to thirty, in his hands. Has sold six hundred dollars worth of honey, of this year's produce. Hives with bees, are sold by him at from ten to thirty dollars per hive, according to quality and condition of the bees. He has repeatedly made two hundred dollars from four hives, in a season.

Townley's business was such that in 1863, during the Civil War, he issued tokens that were used as local currency in addition to advertising his business (Fig. 1). A year later, King and King (1864) included testimony from Townley documenting his success in just one year. Townley claimed that he purchased 10 colonies in "old fashioned boxhive [sic]" that were so full he had to make splits before he could move them. Thirteen days later, he split them again, resulting in 30 additional hives. In the end, he sold $547 worth of honey and the hives were valued at $500. He does not describe the hives he used, but he did claim that he took 12 frames of honey from some of them within 14 days.

Charles F. Muth (1834-1898) (Fig. 2) was another major figure in Cincinnati's apicultural industry. Muth was born in Hesse Cassel in Germany and immigrated to the United States when he was 19 years of age. He remained in New York and then in Baltimore for just a few weeks before moving to Cincinnati. Unlike Townley, Muth did not claim beekeeping experience; instead, he was experienced in sales. He worked in a grocery for three years before moving to Kansas in 1856, but then returned to Cincinnati in 1858, joining a wholesale grocery. This business experience gave Muth the confidence to start his own grocery, which he eventually sold. With the proceeds, he started another business selling beekeeping supplies, seeds, and baking powder, which he manufactured (Saxby 1888) (Fig. 3). He also bought and sold honey to such an extent that Root wrote, "Perhaps no man in the world has bought and sold more honey than he has" (Root and Root 1888). Muth sold his honey in square glass jars stopped with a cork, now called "Muth jars" (Fig. 4) and still available today.

Muth considered beekeeping a hobby, and he had a large city apiary consisting of between 26 and 40 Langstroth hives, which he kept on the roof of his store (Fig. 5). He was a rather successful beekeeper, and in 1876 he averaged 181 pounds of honey per hive (Muth 1877). He was a regular contributor to the *American Bee Journal* and active

Figure 2. Charles F. Muth of Cincinnati. From Root and Root 1888.

Figure 3. A close-up view of Charles Muth's store in Cincinnati with smokers and bottles of honey in the center window. With permission of the Cincinnati Historical Society Library, Cincinnati Museum Center.

Figure 4. Muth honey jars. From Root and Root 1888.

Figure 5. A woodcut of Charles Muth's store showing his rooftop apiary. From Muth 1877.

in regional beekeeping conventions, and he also published a small pamphlet on beekeeping in 1881. He was a friend of Langstroth and the Dadants, and it was Muth who advised Langstroth to have Charles Dadant revise Langstroth's book (Naile 1976), which appeared under the new title of *Langstroth on the Hive and the Honey Bee* (Dadant 1889).

Muth and Townley did know each other, but it is not known how cordial this acquaintance was. The two men competed at the Fourth Annual Cincinnati Industrial Exposition in 1873: Townley entered a basic box hive with glass sides, and Muth entered a Langstroth hive occupied by "Egyptian bees." The glass sides of Townley's hive showed that the comb was attached to the glass on all sides, demonstrating that the hive was not based on a frame system. Muth, on the other hand, opened his hive and removed the frames to show the queen to the judges. In the end, Muth was awarded "Best Bee Hive" (Anderson and Stephenson 1873).

The relationship between Townley and Langstroth was likely contentious at best, as Townley claimed that he was using a frame hive in 1848, three years before Langstroth invented his hive. Indeed, Townley's claim was investigated in 1866 by the United States Patent Office. In the inquiry, Townley presented his "Townley Patent Premium Hive" as the hive that he argued negated Langstroth's patent. The report found that the Townley hive itself, which was a simple box hive, was the proof that Townley had not invented a moveable frame hive. Moreover, Townley marked his hive as patented, but in reality, he never legally patented his hive. The findings of the Patent Office establishing Langstroth as the inventor of the moveable frame hive were published in the *American Bee Journal* in 1870 (Gallup 1870), the same year that H. A. King terminated his agreement with Langstroth to license the Langstroth hive for sale (Kritsky 2010). Moreover, 12 years after the Patent Office's report, A. J. King cited the Townley hive as a predecessor to the Langstroth hive in his address on the history of the hive, which he presented to the North American Beekeepers Association National Convention in 1878 (King 1878). This claim, in spite of the Patent Office findings, continued the Kings' challenge to Langstroth's priority.

After scrutinizing Townley's book (Townley 1848), it will not be surprising that Townley claimed he had invented a frame hive before Langstroth. The title, *A Practical Treatise on Humanity to Honey Bees; or Practical Directions for the Management of Honeybees*, is the same as the title of a book first published in 1832 by Thomas Nutt. It is unlikely that many beekeepers in the mid-nineteenth century would have the library and time to do a critical comparison of beekeeping books, but in the age of the Internet, such a comparison is relatively easy. It turns out that Townley wrote very little of his book. Indeed, if the first few words of the various chapters are typed into a search engine, identical matches can be found in other books. Several chapters were lifted from Dunbar's *The Natural History of Bees* (1840). In Chapter XVII of his book, Townley published the details of an experiment that he allegedly performed. However, the actual experiment was published by Dunbar eight years earlier. Townley did make minor changes, such as replacing Dunbar's "our experiments" with "my experiments." Townley did not exclusively use Dunbar as a source for his plagiarism; the introduction to Townley's book and Chapter XXIV were lifted from Nutt's (1832) book. Townley's detractors were unaware of these examples of plagiarism. Langstroth owned copies of both Townley's and Nutt's book, but there is no evidence that he recognized the similarity.

Townley died in 1882, and the *American Bee Journal* published a front-page obituary of his passing (Anon 1882). However, the 1888 edition of *The ABC of Bee Culture* does not include Townley as one of the great beekeepers of America, suggesting that the passage of six years had diminished his reputation.

Muth died by his own hand in 1898. A. I. Root penned an obituary for his friend, writing that "Mr. Muth was one of the cleverest, most whole-souled and generous men I ever knew." Muth apparently had financial difficulties towards the end of his life (Anon 1898), which Root speculated contributed to Muth's suicide (Root 1898). Unlike Townley, Muth is included in the 1888 *ABC of Bee Culture*, where he is described as a noted beekeeper and honey wholesaler.

Both Townley and Muth, beekeepers and competitors in life, are buried approximately 750 yards from each other in Cincinnati's Spring Grove Cemetery. Perhaps both men would appreciate being only 600 yards away from the cemetery's apiary.

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The Classroom
by Jerry Hayes

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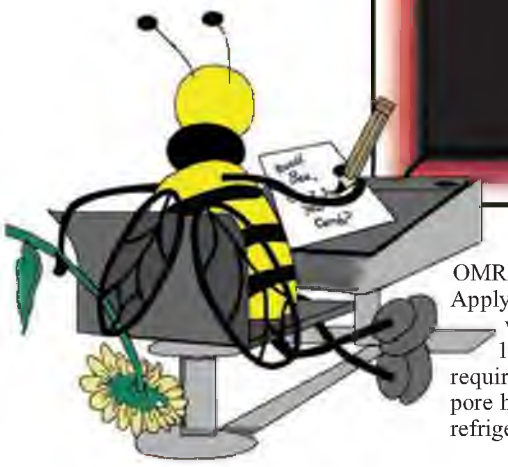


Q GRASSHOPPER PLAGUE?

Hello Jerry—I recently learned of the possibility of a "Biblical proportion" of grasshoppers this summer. In response I ordered a 1 lb. bag of Semaspore Bait. (See the information below that I copied from the website). After researching various sources and the company, I purchased the product from them. The evidence indicates that this product WILL NOT harm my bees. Because I trust your judgment, I am emailing you to confirm my decision to use the product...so, what can you tell me? (We have a large orchard and several gardens...grasshoppers have been a problem in the past, so I just want to make sure before I use this product in a proactive response). Thanks for your time Jerry!

From the mountains of North Idaho
Linda Maureen

"Semaspore Bait contains *Nosema locustae*, a naturally occurring grasshopper control. After eating Semaspore grasshoppers become sick, eat less, and begin to die. The disease spreads to healthy grasshoppers through cannibalism. In 2-4 weeks, 50% of the population will die, and most survivors will be infected to continue spreading the disease. Infected survivors eat 75% less than healthy grasshoppers and lay fewer eggs. Safe for people, pets and the environment. OMRI Listed for use in organic production. Apply 1 pound Semaspore Bait per acre, when grasshoppers are young (1/4 to 1/2-inch long). Heavy infestations may require repeat applications. Note: Semaspore has an 8 week shelf life - 5 months if refrigerated."

Active Ingredient:
Nosema locustae 0.05%
Contains 1.0 x 109 viable Nosema spores per pound)
Other Ingredients 99.95%

A

Linda, that sounds scary. The Gulf of Mexico is full of oil, undocumented aliens are flooding into the U.S., the deficit is out of control, volcanoes and earthquakes are everywhere and now GRASSHOPPERS!

There are probably 30+ different kinds of Nosema that are specific to different kinds of insects, from beetles, to wasps, to honey bees and **Grasshoppers**. *Nosema locustae* is specific to Grasshoppers and shouldn't affect honey bees. *Nosema locustae* is the microsporidian that is combined with bran that young nymph stage grasshoppers eat. It destroys their gut over a period of time. Other grasshoppers eat the dead ones and it spreads. It is pretty slow acting though and generally only affects about 50% of the population of grasshoppers.

LINDA WRITES BACK
Good morning Jerry,

Thanks for your response! I can always count on your expert advice and rich humor. Thank God for the simple pleasures in life, like our honey bees!

Linda Maureen

Q "Potentiated" Pollen

Jerry, I hope you remember me. I live in Tennessee and have a brother in Florida who called me the other day asking questions about "potentiated" bee pollen. I know there is some evidence out there that implies that regular bee pollen is difficult to digest. I have taken bee pollen off and on for several years, and I know it is helpful to me. However, my brother found this on the Internet or somewhere, and I felt like you could shed some light on this subject. What he found comes from New Zealand and they claim a lot of things like their potentiated pollen provides 80 times the nutritional value that regular pollen provides. Thanks for your time.

Honey bee collecting pollen. (Photo courtesy of www.pdphoto.org)

Jim Garrison
President
Tennessee Beekeepers Association

A

Hi Jim, How could I forget you! Pollen, the male genetic element of the plant's reproductive process, is crucial to the plant species survival. It must be protected, and preserved in the process of having an insect, in our case pick-up, transport and re-deposit the pollen grain on the appropriate flower part (stigma) in order for the fertilization process to begin. This must happen even though the pollen grain is exposed to heat, humidity, sunlight, getting bumped around, etc. Tough trip. The plant protects pollen grains by enclosing them in a tough resilient shell. Our digestive systems have an almost impossible task in trying to get digestive juices in and nutrition out. In order to obtain any benefit from the pollen grain, it must be broken open somehow by crushing, grinding, or sonication to get to the contents. The marketing claim by the product's producers that it has about 80 times the nutritional value is probably because the pollen grain is broken open to expose the goodies. It is "potentiated" because it is broken open:)

Pure Sugar

Dave and I are trying to produce the "purest honey on Earth". To achieve this goal of "zero pesticides and man-made residues" we need your advice on the source of "pure sugar" to feed the bees that will not concentrate pesticides and other man-made residues in the "bee food".

The FDA has become very concerned over the sources of foreign honey that are heavily contaminated with pollutants that are coming from China, Russia and India. We would like to be the source of "blank (no manmade component) honey" and be scientifically certified as the source of this "blank" honey. So, we need "pure" sugar.

Do you know of a source?

A

I have been asked this question several times in the last year or so. I am not aware of any "organic" production from sugar beets or sugar cane that is at a price that one could easily justify as a food supplement for honey bees. In many cases having enough "carbohydrate" resources available is a management decision. In a perfect world the bees would collect/produce enough honey that the beekeeper manager could leave on an appropriate amount for the bees' use or be able to feed extracted honey back to the colony from a secure known source.

Feeding sugar solutions to honey bees should be minimal and for a reason i.e. survival or the production of beeswax to build comb quick and then move on to natural sources.

Problems in Pakistan

I am asking you this question on behalf of my fellow beekeeper who lives in a remote place and cannot communicate with you. He is keeping 80 beehives in D.G. Khan, a city of Pakistan. It's a hot place reaching a temperature of up to 50°C in summers. He keeps hives there throughout year with small distance migrations within 50 kms thrice a year. He has observed strange behavior in few of the colonies. The flying bees, when leaving the hive, do not fly but instead crawl out of the hive, go to a distance of one yard and start to rub their hind legs and then take their flight. From inside, the colonies seem healthy so I wonder what causes them to exhibit this behavior? Could this be the precursor to some big problem?

Naveed Ahmad
Pakistan

A

Generally speaking, when one sees honey bees crawling and rubbing their legs or grooming themselves in this manner, it is a sign of some type of toxin issue (whether from varroa chemical treatments, as applied by the beekeeper, or from toxins picked up in the environment such as in production agriculture settings). This type of crawling in more temperate regions of Europe or North America can also be sign of tracheal mite or Nosema infestations, but in Pakistan with 50°C temperatures, I do not think this is the challenge. So, the question is: If the problem is "chemicals" of one type or another, what are they doing to the general health of the colony and the developing brood? If the bees' lives are shortened by even a few days, then the whole colony's balance/ecology is thrown off.

Icky Combs and Queenless Hives

Hello Jerry. I believe this topic has been addressed in a previous column, but I've been unable to locate the past *ABJ* issue. Is it all right to put honey supers on a hive that have a small amount of black mold on the frames? If not, can you recommend a safe and effective cleaning procedure? Or, are these frames bound for the solar wax melter?

On a second issue: One month ago a thorough check of my six hives revealed one hive that was not queen-right and the other five seemingly all right with a satisfactory amount of brood in various stages of development, but with an abundance of drones and drone cells. I gave the queenless hive a frame of uncapped brood from another hive in the hopes that they would produce a new queen. My hives have, in the past, produced successful and productive supersedure queens and with this season's abundance of drones, I counted on their ability to mate a virgin queen.

One month later I was back to add honey supers to these hives and to check on my attempt to re-queen and found all six hives were queenless. The hives had pretty close to 50% drones and no honey or brood. Each hive had tried to requeen, as evidenced by six or more queen cells in each (some looked as though they had successfully produced a queen - others were only partial cells). But apparently, none of the queens had mated, despite the high drone population.

I'm in the process of ordering new queens for installation this week. Do you recommend any other tactics to get these hives back on track? Should I try to kill some/most of the drones so the workers can produce some excess honey? Is there a recommended way to reduce the drone population? Thanks for your help and always-valuable advice.

Susan R. Morgan
Texas

A

A weak household bleach or vinegar solution are both good cleaning agents for icky, moldy combs.

Your unfortunate news about all six of your hives going queenless at the same time is certainly unusual. One possibility is that your queen problems could be due to African Honey Bee (AHB) genetic introgression from "open mating" of supersedure/replacement queens. AHB loves to reproduce by swarming up to 15-20 times per year in Texas. This spreads AHB genetics around quickly. Drone congregation areas can be dominated by AHB drones and voila you have colonies that do AHB-like things more.

Ordering *marked* queens from a producer participating in BMP's (Best Management Practices) as a tool to keep AHB genetics out and keeping manageable European honey bee genetics viable will help. If you look into your colonies and then see a queen not marked, then you know things have changed and you need to change them back.

Safer Treatments

We've been hearing a little about the use of essential oils such as spearmint, lemongrass and thyme to treat bees for disease/parasites. We are a small commercial apiary and are concerned about the amount of chemicals we are exposing our bees to. Do you think this is a viable treatment for commercial use? Where can we get research information on this type of treatment? As always thank you for your help.

Scott VanDerwalker
VeeBee Honey and Pollination
Buhl, Idaho

A

Scott, I think that you are thinking about the right things and the right direction to go in. You are asking the questions that more people should be asking. There are products on the market right now that meet your var-

roa control needs more sanely. Apiguard and ApiLife-Var are two products using essential oils that have excellent efficacy and not the level of toxic residue concerns as some of the "strip" varroa products. These products certainly are not benign in a colony, but the documented short- and long-term side effects or collateral damage is not as comprehensive as other products. Nothing is perfect. Remember, in regards to varroa control, broadly speaking, you are trying to kill a little bug on a bigger bug. This is tough to do without negatively affecting the big bug (honey bee) in small subtle ways.

In my mind diet, nutrition, environmental toxins, the sequestering (storing) of chemicals in beeswax, genetics and honey bee stress (whatever that is) are all of the other variables that are impacting honey bees. But not all honey bees are dying. The parallel is human health. When a new novel human disease makes its appearance in a population, it never affects everyone. The question is: What variables make someone get a full blown fatal case of H1N1, Ebola or Hanta virus and someone in the same exposure setting not?

In honey bees, my opinion is that 80% of the problem is varroa. Controlling them safely for the bees and the beekeeper are the goals without causing more long-term problems.

Q Share and Share Alike

Will sharing bee club extracting equipment work for your association?

Our bee club is considering buying extracting equipment that can be used by club members. We have considered storing it with one member and renting it out. We have also thought about having it stored permanently in a location where members could come to use the equipment. Both approaches raise questions regarding cleaning up after use, liability if users or observers get stung, tracking who has it now, and what would be required if used in a permanent/stationary location such as water, power, tables, etc.

Do you know of any clubs that have attempted something similar? I appreciate the role you play in getting information out to hobby beekeepers.

Regards,
Doug Morris,
North Carolina

A

Doug, bee clubs have been doing this or considering doing this since Adam or at least Cain and Abel. It all comes down to the ethics, morals and level of trust you have in the rank and file membership. All of the concerns you note are real. In the days when local clubs had maybe only 15 members, this was all a bit easier because everybody knew each other and there was some fraternal social pressure that kept extractors clean, facilities washed, not sticky and care and respect for equipment was at a high level. Now with local or regional clubs having 50-75-100+ members, things are not as "simple" as they used to be. Many clubs have now chosen to have a central permanent location, sometimes at a larger beekeeper's "honey house" that has the dedicated facilities to allow safe, clean extraction and collection of honey. Many times this is better than somebody's garage or basement when you are trying to harvest a pure food product. The club may have several "extraction days" and everyone gets together to share the work, beekeeping stories, and any blame that goes around. I have heard that if the larger beekeeper's equipment is used, there is a per pound charge for the use of facilities.

Having the club bring an extractor, trying to keep up with where it is, dealing with cleanliness, dings/dents and broken parts can be done, but you need a dedicated person to do all this stuff. (See Howard Scott's article on this subject on page 751 of the August 2009 *ABJ*.)

Q Chalkbrood

What causes chalkbrood? At this point I have three hives which have chalkbrood that didn't have it before. I know there is no government-registered medication for it, but was wondering if there is anything that can be done to fix this?

John McQuown

A

John, the fungus *Ascosphaera apis* causes chalkbrood. Fungal spores attack honey-bee larvae. The larvae become moldy with the white fungus hyphae, the vegetative part of the fungi. Because of all of the fungus hyphae, the larvae turns into a white chalky-looking pellet. When the fungus is ready to reproduce, it sporulates. These "fruiting" bodies are black and the chalky "mummy" takes on a black appearance. These hard pellets of fungus can rattle in the comb when shaken and sometimes, as the bees try to clean the cells out, they appear on the bottom board and the entrance landing.

Some honey bees are genetically predisposed to be infected by chalkbrood. Some Australian bees that have been imported into the U.S. have shown a high incidence of

Variations in color among chalkbrood mummies reflect the presence or absence of fungal fruiting bodies—one of the reproductive states of the fungus. (Photo by Jeff Pettis, USDA-ARS Beltsville Bee Lab)

chalkbrood. Sometimes in the spring of the year, when temperatures are cool and damp and the brood is expanding faster than the colony can keep them warm and fed, chalkbrood appears, but then disappears as the weather stabilizes. The rule of thumb has been that if springtime chalkbrood doesn't self regulate and go away, then requeening with a different queen from a different supplier than the susceptible stock is a good remedy. This generally takes care of the problem. The new bees clean up the hive and all is good.

Q American Foulbrood

Thank you very much for the awesome column you continue to write for ABJ. I love reading it every month. I have been keeping bees for nearly 10 years now, and I still am having occasional problems with AFB. I have destroyed nearly all of my old frames by fire and scorched my brood boxes with propane flame, but I hate to discard my good frames containing considerable amounts of stored honey.

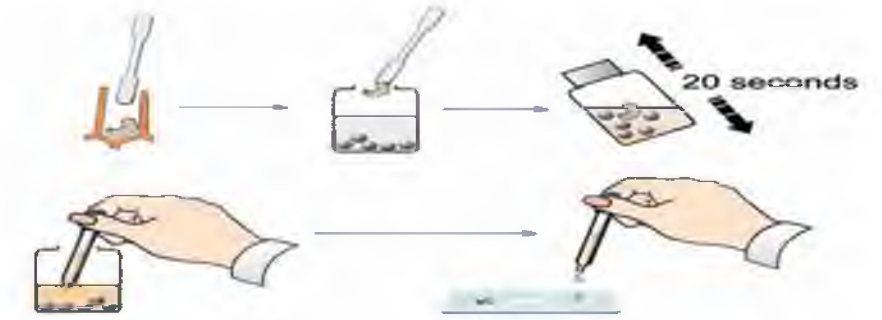
My questions for you are:

1. Is there a simple way for the hobby beekeeper to test for American Foulbrood (AFB)?
2. Is there any practical way to disinfect my AFB-tainted frames by radiation, etc? Thanks in advance for your savvy assistance. I hope to hear from you soon.

Yours truly,
Douglas Stream
Belgrade, Montana

A

Thank you for the Classroom compliment Douglas. As you know, American foulbrood (AFB) is primarily identified visually. Everything that is in or on a colony of honey bees is first and foremost visual. Diseases, either bacterial or viral, mites, chalkbrood, chilled brood, etc., all have symptoms that are most easily "seen". However, there are AFB "test kits" available commercially **www.vita-**



Using the Vita American Foulbrood (AFB) Diagnostic Kit (www.vita-Europe.com)

europe.com to confirm if your diagnosis from visual cues is actually AFB or not.

We have radiation facilities in Florida that are used to treat some fruits and vegetables to kill pathogens that cause rot and extend shelf life. We have gone through the exercise to have the dosage calculated to treat pallet loads (minimum) and neutralize AFB and most other harmful organisms in hive bodies, frames and comb. The cost, per pallet load, is approximately $7.00 per hive body with 10 frames/comb. This is actually a pretty cost effective route. However, these facilities cannot guarantee that they can disinfect full uncapped frames of honey. These are just too thick for the radiation to penetrate with completely reliable results. Extract this honey first before processing these frames through a radiation facility. This honey is perfectly safe for human consumption, just not for honey bee consumption.

Where commercial radiation facilities are not feasible or available, culling and destroying all combs with active AFB or dried scale is necessary. Burning is the most effective method of eradicating AFB spores. Some honey bees are genetically pre-disposed to becoming infected with AFB. So, replacing existing queen stock with other queens bred for hygienic behavior is in order. Scorching woodenware and empty wood frames is not really necessary as the infective AFB spores are in the cells in the beeswax comb, not on the surface of woodenware.

Sometimes the big unknown is whether or not you have neighboring beekeepers around you who have AFB and think that antibiotics will cure AFB? They are delusional. When things get tough for active, vegetative AFB when antibiotics are applied, they simply form long-lived (decades) spores and are a reservoir for future AFB infections. If your neighboring beekeepers are not doing the same sanitary, hygienic things you are doing, then you will continue to get AFB occasionally over time. Hang in there. You can do it.

Q Specific Nectar Plants Information

Jerry, could you point me to a web site that has the plants with the most nectar for bees, starting from the most to the least. I am looking to plant some crops for my bees and would like to know.

Thanks,
Tom O'Neil
Powhatan, Virginia

A Tom, I am not sure there is a web site that covers all honey plants to the degree that you want. Certainly there are some tree, shrub and small flowering plants that you can generalize on, but a tried and true list is difficult. Try searching the Internet for honey plants and you will probably find some reasonably good web sites and information. Then, try localizing your computer search to honey plants that are good for the Mideastern U.S. or Virginia. Certainly, tulip-poplar, sumac, black locust, clover, thistle, persimmon and sourwood would have to rank high for the Mideastern U.S.

Nectar secretion is variable, based on climate, soil moisture, soil ph, sunlight, average temp, temperature swing from night until day and other factors. Now with (global warming) climate change, plants which did or didn't grow in a particular area or region now can or can't. I would contact the oldest person in your local beekeeping club and ask him or her the same question. You will probably get a more accurate answer. Plus, the information that he/she provides will be localized for your area, so you will know that it is more accurate.

American Honey Plants by Frank Pellett was probably the last really comprehensive book on the subject. However, it was last reprinted in 1976, and even then it was starting to sound dated since most of the research was done in the early to mid 20th Century. Dr. George Ayers, our ABJ monthly honey plants columnist, is probably the foremost expert on American honey plants right now. He authored an excellent chapter (100 pages) on honey plants in *The Hive and the Honey Bee* that is available from Dadant & Sons, Inc. www.dadant.com. It is currently the most up-to-date information on American honey plants that I know about.

Varroa Shaker

Two 500 ml transparent plastic jars glued together. The centers of the lids have been cut out and an 8 mesh screen has been sandwiched between the two lids with glue to hold the lids together.

The Medhat Nasr and A. J. Williamson Varroa Shaker

In my mind varroa is the most significant health challenge of honey bees. If we could eliminate varroa, in my opinion we would get rid of 80% of our problems. Well, we are not going to eliminate varroa entirely, but we can treat sanely, rationally and safely.

But, how do you know when to treat? Well, when you have identified varroa at the "economic threshold level" (Lots of previous ABJ articles on this), then you treat or modify your Integrated Pest Management (IPM) strategy. How many of you are treat-

A 300 to 400 bee sample is taken from the brood nest and added to one jar, along with 250 ml of 70% alcohol. Varroa are washed through the screen and appear in the second jar.

ing because somebody told you to do it at a certain time, season, or month? How many of you are treating only when it is needed based on monitoring of varroa mite infestation? Is monitoring, surveying, sampling more of a pain than it needs to be and is that why you are or are not doing it?

Here is a modification of the standard screened top jar method that has been used for alcohol or powdered sugar from Dr. Medhat Nasr and A.J. Williamson from Alberta (Canada) Agriculture and Rural Development. This method was briefly explained in the May issue of ABJ in Abstract 20 (page 504) of the *Proceedings of the American Bee Research Conference*. However, some readers may have missed it or not fully understood its improved efficiency for monitoring varroa infestations. It is a great extension on the original design; it is effective and reliable. Win-win.

Take two 500 ml transparent plastic jars, cut the centers out of both lids and put in 8 mesh screen sandwiched between the two lids back to back and glue them together. This makes a strainer-closure that can keep the two jars connected mouth to mouth (see photo). Collect 3-400 bees from the brood nest area in one of the jars holding alcohol. Then, the second jar is screwed back on. The varroa hand shaker is vigorously shaken for 1 min. Then, see how many varroa you have. The varroa hand shaker is flipped upside down to keep the bees on the top of the screen and allow the mites and alcohol to pass through the screen into the empty jar. Now count the mites. Pretty slick. Make one and use it!

Legal Honey Bees

New York City Bees and Beekeepers Come Out of Hiding

by REINOUT VAN WAGTENDONK

Walk across the Brooklyn Bridge these days and you might spot the beehives on the roof of Bridge Cafe, "the oldest drinking establishment in New York". The restaurant on Manhattan's Water Street dates from 1794, but the hives are a recent addition. Until March of this year, beekeeping was banned in the Big Apple. But beekeepers in the boroughs have to hide no longer. As soon as the ban was lifted, urban hives were moved out into the open. Old hands came in from the cold. And would-be apiarists got the opportunity they were waiting for.

Bridge Cafe owner Adam Weprin had wanted to host city bees for years, but did not want to break the law. "There was guerilla beekeeping going on, people were doing it illegally and I was very tempted to do it," Weprin acknowledged. "But the number one pitfall was liability. And also there was no glory in it. Even if I got to make the most delicious honey in the world, I couldn't tell you where I got it from."

Just days after the repeal of the city's health code ordinance against beekeeping, Weprin contacted Andrew Cote, an apiary veteran and the president of the New York City Beekeepers Association. Cote quickly arranged for a delivery from Wilbanks Apiaries in Claxton, Georgia, to Weprin's lower Manhattan eatery. Now, the transplanted colonies nesting in six hives on the restaurant's hot, tar papered roof sustain themselves through foraging in city gardens around City Hall and parks across the East River in Brooklyn.

Adam Weprin proudly calls himself "the uncle" of the Italian honey bees on his roof. "Andrew is the papa to the bees," he said.

Andrew Cote tends to some 40 hives in New York, mostly in Manhattan and Brooklyn, but also on top of a few industrial buildings in Queens. Like other beekeepers in the City, the ban and the possible fines of up to $2000 for violations did not stop him from keeping bees. But it did make him more circumspect. "If the ban were still in existence, I would not have had the hives this close to the edge of the roof, to make sure they weren't visible from the street," Cote pointed out on top of Bridge Cafe. "And I would have put up a large board or some other structure to block the view from the Brooklyn Bridge."

Since New York City lifted its ban on beekeeping, the newly installed beehives on the roof of the lower Manhattan restaurant Bridge Café are easily visible from the Brooklyn Bridge and in sight of City Hall (center).

According to Cote, his New York City Beekeepers Association has about 250 members. He and several friends founded the group a couple of years ago, in a diner on Avenue A in Manhattan's East Village where he owns an apartment. The organized beekeepers kept up pressure on city government to end the prohibition.

Former New York City mayor Rudolph Giuliani instituted the ban about a dozen years ago, as part of his campaign to improve the general quality of city life by showing "zero tolerance" for even minor nuisances. The perceived threat of stinging bees to city dwellers – "an uninformed but not uncommon perception," said Cote – was deemed such a nuisance.

After studies and hearings and perhaps the alarming publicity about Colony Collapse Disorder, New York's current government, under mayor Michael Bloomberg, reversed the ban. The City's health department found bees no real threat to public safety, and officials proved open to arguments about the importance of healthy bee populations to sustainable agriculture.

"Most people don't make the connection between urban farming and New York," said Cote. "But we do have a tremendous number of community gardens. People are raising chickens here, and keeping honey bees has become quite popular amongst residents of all five boroughs. The Big Apple needs to be pollinated, just like any other apple."

Because the sight of beehives with world famous New York City landmarks as backdrop is a new and unexpected one, the end of the ban on bees has drawn international attention. On a hot spring afternoon, Bridge Cafe's rooftop not only held its six hives, restaurant owner Adam Weprin and Andrew Cote in beesuit with smoker, but also a CNN

Urban beekeeper Andrew Coté tends to a hive on the roof of the lower Manhattan restaurant Bridge Café, within sight of New York's City Hall. After a prohibition of a dozen years, New York recently allowed keeping honey bees within city limits again.

Andrew Coté is president of the New York City Beekeepers Association. He has about 40 hives in Manhattan, Brooklyn and Queens, six of them on a restaurant roof next to the Brooklyn Bridge. Efforts by the organized, yet illegal beekeepers in New York helped convince city government earlier this year to make it once again legal to keep honey bees in the Big Apple.

camera crew and reporters and photographers from Japan, Australia, Great Britain and the Netherlands. Quite a few of their questions dealt with the die-offs of honey bees. Would city bees perhaps prove more resistant to the disorders that are taking such a toll?

Cote cited a study by French beekeepers that suggested that honey bees in Paris did do better than their rural relatives, especially rural bees used to pollinate monoculture crops. He warned against reading too much into the French study, because the Paris colonies studied were not large enough a control group. "But I can tell you this," he said, "there are fewer pesticides and invasive agricultural methods used in an urban setting then there are in the countryside. I believe that in that sense urban beekeeping can definitely be a help."

Coté, 39, also tends to some 200 hives in the suburban environs of Fairfield County, Connecticut, and Westchester County, New York. Three years ago, he started Bees Without Borders, a non-profit charity that promotes beekeeping as a means to alleviate poverty all over the world. This year, the son of the well-known Connecticut beekeeper Norman Cote traveled to Haiti, Fiji and Ecuador to help people set up to make honey into a cash crop.

His international connections extend to the Netherlands. Dutch beekeeper Willem Schelberg, editor-in-chief of the beekeeping website **imkerplatform.nl** sent the NYCBA a letter of congratulations when the New York ban on bees was lifted.

"We look at New York as a shining example now," Schelberg said in a telephone interview from his hometown Heerlen in the Netherlands. "Urban beekeeping is not technically illegal in Holland, but the language in local ordinances does prohibit it in practice."

Schelberg hopes to use the New York example to get the restrictions on urban beehives in his own country loosened. "I will keep following their experiences," he said. "I am especially curious to see what public opinion will do when hives swarm out and the swarms scare people."

"Practicing safe and reliable swarm prevention techniques is even more essential in urban beekeeping," agrees Andrew Cote. "We don't want to upset the civilian population. Many people are not well versed in the truth about swarms being docile."

His widely dispersed hives in different neighborhoods of New York City add an extra challenge. Cote sounded like a Manhattan delivery driver for FedEx or UPS when he discussed his rounds. "This is a terribly frustrating part of urban beekeeping," he said. "Traffic and parking make getting around in a truck loaded with extra honey supers and equipment much different than the suburban brand of beekeeping."

Honey Bee Biology

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Bait Hives: Swarm, Hive Thyself

As part of my routine seasonal bee management, I put out bait hives. A bait hive is an unoccupied hive that is made attractive to swarms when their scout bees are out searching for nest sites. This past spring, I put out 27 bait hives and caught 14 swarms (52% occupancy).

The two main goals for the bait hives are first to catch swarms from my apiaries. I also, whenever possible, try to locate them in places with bee activity, but without nearby managed hives, that is, no beekeepers. These are most likely feral colonies that might be genetic stock surviving on their own with varroa mites. When these colonies swarm, I want to catch them. If it is a prime swarm, which has the mother queen, she carries the genetic attributes of the colony.

When the colony is reestablished, its varroa population can be monitored. This strategy for bait hive use can take months of advance planning to find these locations. While these survivor colonies can be quite valuable, for example to help maintain genetic diversity in a varroa-controlling stock line with unrelated queens, in other situations a swarm caught in a bait hive may not be wanted.

If a beekeeper lives in an area with Africanized Honey Bees or locations near their invasion front, or in the vicinity of ports where these bees could enter on ships, then getting swarms from bait hives may not be appropriate (because of the defensive behavior of these bees). When an errant swarm enters a bait hive, unless the queen was marked, its genetic origin is unknown, even though it could have been from another beekeeper's hive with a gentle stock. If in doubt as to your location, contact your state bee inspector, extension personnel, or county agent to determine whether using bait hives is appropriate. What follows is my bait hive method, which other beekeepers can customize to their operations.

In standard equipment, a bait hive can consist of a single deep super (brood chamber). This hive has a volume large enough to be accepted by the scout bees who measure it as part of their evaluation of a potential nest site. From a survival perspective the cavity must be large enough to hold a set of combs with a winter supply of honey. Otherwise, if the cavity is too small, the bees are destined to perish. Since I use top-bar hives, I use them for bait hives too, but usually as a two-foot long hive. They have plenty of volume, but are easier to handle as bait hives compared to the longer and heavier three-foot hives (or longer) that top-bar hive beekeepers typically use.

To make a bait hive super attractive to scout bees, so it will be chosen over other possible nest sites they could find (see Figure 1), I put in empty combs. When a new swarm leaves the parent colony, in the beginning their only food supply is within. From that meager starting point, the bees race the clock for the very life of their colony. Before the end of the season, when cold weather kills off their nectar and pollen sources, they must find a nest site, construct a set of combs, and fill them with enough honey to survive the winter. At the same time, the colony must build up and maintain a brood nest. Finding a nest site with combs greatly increases a swarm's chances of survival. Not only do they require time to build, but considered as an energy cost, combs are expensive to construct.

In standard equipment, three frames with empty drawn comb would be reasonable with foundation in the rest of the frames. A frame of foundation could go between the ones with comb (and to fill in around them). I follow a similar pattern in my hives. My bait hives have three top-bar combs. Other top bars with foundation strips, from which the bees build comb, fill in for the remaining space (see Figure 2). Either way, placing foundation between the combs forces the swarm to build comb right when it moves in.

The hive body, including the top and bottom, should be used, or perhaps older equipment near the end of its service. The (former) bees will have sealed the interior in propolis (bee glue). That scent adds to the attractive hive odor. Even after airing out equipment following comb fumigation from the previous season, my preference is not to have even a hint of paradichlororobenzene (PDB) odor on any equipment used for bait hives, including the woodenware.

The combs in these hives are subject to

Figure 1. Bees have nested in hollow trees of North America since escaping from colonists in the 1600's. This hollow tree near one of my large apiaries has probably been rejected by the scouts bees numerous times. I'm guessing its too small, and the entrance might be too big. Just right for the wood-pecker family. A parent has just brought a meal. One of the youngsters, not ready to leave, pops up at the hole.

Figure 2. Putting in three combs per bait hive, or perhaps two if drawn comb is in short supply. I use the tailgate as a workbench and stack the finished hives in the truck, so they are ready to move to the out-apiaries and other places.

Figure 3. A close-up of one of my bait hives on a shed roof. Note the features, relevant for frame hives too: mouse guards, weights on top (a cinder block and log) to secure the hive, picking a shady place under the branch, and giving the hive height with the entrance end at the roof edge. For top-bar hives, there's one more, the cut stick under the front to level the hive, a requirement.

wax moth damage since they are mostly unoccupied by bees. In my operation the damage is minimal for a few reasons. The hives are only out during swarm season, early April to at the latest early June for my area. By late May the bulk of the swarming is over. If I need some extra drawn comb when working in out-apiaries, where more swarming is doubtful, I just get it from the bait hives. It's an expedient management way of dismantling them as swarm season draws to a close.

Part of the comb's protection is that they are completely *empty*, including pollen, so they do not feed wax moth larvae. Using only empty combs keeps them from attracting ants into the bait hive, another important consideration. In my Virginia and North Carolina apiaries the cooler spring temperatures also help protect the bait hive combs. Further south, where wax moths are more of a problem, this schedule may need modification.

Here are other points to consider. I always use mouse guards to protect the combs in the bait hives (see Figure 3). Even though the combs are empty, mice will occasionally damage them. Ideally, the only thing I want going in my bait hive are bees – no mice, ants or moths. While rarely a problem, consider potential vandalism or inadvertently attracting bees, though temporarily, to places of human activity or to their pets or livestock. For example, I would not even consider putting a bait hive by (or near) an active horse barn. Painting bait hives to blend in helps them to be less noticeable. The scout bees can still find them mainly by odor.

With a standard bottom board, I would consider reducing the entrance size to about one quarter. Attach the bottom board to the hive body with hive staples to make the bait hive easier to handle. Think ahead to how spring winds can upset the hive or blow off the cover. If not in a wind-sheltered place, which would be better, put a weight on the hive. Hoping to call in the scout bees with scent, I leave pieces of old comb pinched under the roof weights, right on the metal cover, to warm up in the sunlight, and spread the smell of old comb in the air. Some sunlight is acceptable, but a place that gets hot should be avoided. Early in the spring before my big rush, mainly in swarm season, I sort out the combs and put out the bait hives. Getting them out early is much better than a little too late when big prime swarms could be missed (see Figure 4).

In other apiaries, I have seen where beekeepers build small platforms in trees about ten feet high for the bait hives. A height like this is best reached from the tailgate of a pick-up truck, which is more stable than a ladder. When handling a bait hive, it can be easy going up the ladder (empty), but heavy coming down, since the swarms forage vigorously. If the bait hive is in an awkward place to take down, do not delay in removing the hive before it gets too heavy to handle. My hives are on stands three-feet high. Swarms routinely come to my bait hives at this height, mainly because of the comb, though higher sites would be better. With so many bait hives and contemplating having up to fifty, I do not build tree platforms. Instead I just find sites with some height where bait hives can be set off and picked up from the tailgate of the truck like a ladder on wheels (see Figures 5 and 6). Swarms even enter bait hives just sitting on the tailgate of my bee truck, a behavior that could spoil me.

Swarms do have a preference for moving away from the parent colony roughly a few hundred yards or so. I have bait hives stationed near each apiary (which are all in rural sites). For locating these hives (usually still on the owner's property), I try to put them beside buildings like abandoned farmhouses or storage sheds, large landmarks that might attract scout bees. In these rural places, like abandoned farms, watch out for old wells. Near one of my apiaries, I have a good swarm-catching place in the back doorway of an abandoned building way out in the woods. Less than ten feet to the left though, hidden under rotten boards, vines, and a layer of leaves is a big vertical pipe going deep into the ground, an ancient well.

My other goal for bait hives is to use them to capture swarms that could be stock surviving with varroa. I locate these bait hives far from my apiaries or any others that are known. Here it is not the quantity of swarms captured, but if they really are able to resist varroa, it's that genetic quality, which is desired. One must accept though that most of these bait hives will be empty at the end of swarm season.

This strategic bait hive use takes advance planning, starting with the old adage from scientific research, "chance favors a prepared mind." For example, I take my trash to our rural county dumpster. The operator knows I'm the "bee man" and tells me about some bees that came around the dumpster for a few days before he hosed down the cement. He and the other employees, all local country folk who grew up in that area, do not know of any beekeepers around there. He even shows me the bees' flight bearing, a direction into a swampy area with large trees, which could have hollow cavities for nest sites. Here is a good situation for a bait hive. The hard part is finding acceptable and secure places for the bait hives in such a rural place, beginning with who owns land to secure the necessary permissions.

Figure 4. A wider shot of Figure 2. Now all the hive equipment that I am sorting through to make up the bait hives become visible. The branches to the left are from our big cherry tree. It's so early in the spring, the white cherry flowers have not begun blooming. Swarm season is far off, but always seems to sneak up and pounce on me.

Figure 5. Bait hives on an abandoned trailer. This site is near an outapiary and has saved numerous swarms from going to the woods.

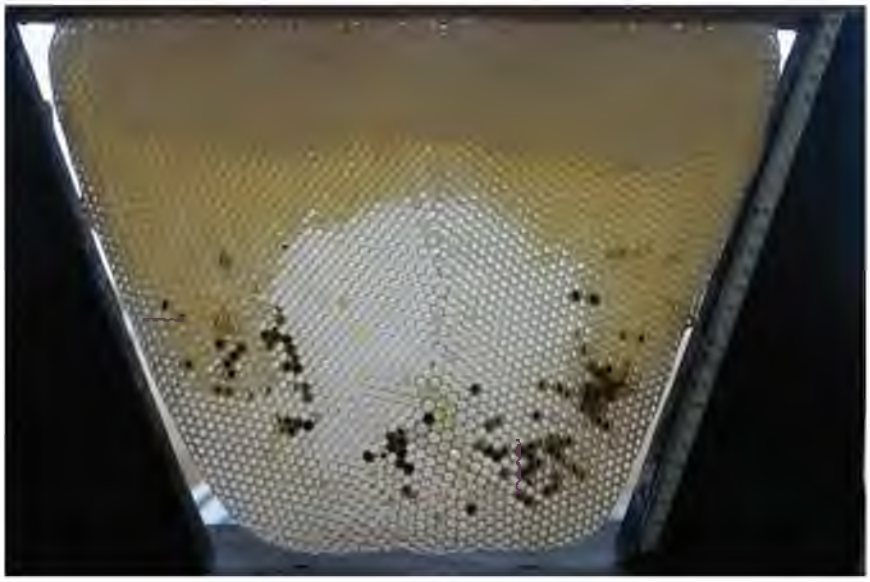


Figure 7. Newly built natural comb from a bait hive swarm, viewed with light emanating *through* the thin translucent cells. The empty-looking cells in the middle contain tiny eggs. Unripe honey is stored directly above with no pollen band in between. The dark spots are pollen cells, which are beginning to clump together. Apparently there was no room for a pollen band in it normal position. Here we see the swarm's initial solution, beginning to form the pollen band towards the lower comb edge.

Figure 6. A bait hive behind an abandoned building. By the road to my out-apiaries (but far from them), it's convenient to check. So I can work from the truck, the landowner lets me back up to this wall, which I use to elevate the hive. Swarms consistently come to this site; their origins remain a mystery. I set out the longer three-foot hive here, which I might regret. It could get rock-pile heavy and hard to retrieve if I delay bringing it down with a swarm.

It's always a pleasure to win the bait-hive lottery, an endeavor fueled by anticipation and hope. Upon arriving at a bait hive, my eyes instinctively scan around the entrances for even a flittering of bee flight. Just sunlight glittering off their wings will do. Seeing that always gives me a jolt. Now are they scouts checking out the hive? Or has a swarm already moved in? Without opening the hive and disturbing the bees – just watch them. Their behavior tells all to the trained eye. Scouting bees spend much time around the entrances, flying in nervous jagged patterns looking over the front of the hive. There is no deliberate and directed flight as with numerous foragers coming and going to the fields, working vigorously in the manner of a new swarm. While watching the bees, if any come in with pollen, or are heavily loaded with nectar, or if there is any drone flight, then bingo, those are dead giveaways – the swarm is in the hive (see Figure 7).

Now what was been won? A big monster power-house swarm, building sheets of combs like a factory, or a little flighty teacup-size swarm, which couldn't fight off an old wax moth. Put out bait hives long enough, and you will see them all.

Acknowledgments

The author thanks Suzanne Sumner for her comments on the manuscript.

Bee

Up Very Close:

A Book of Electron Microscope Photos and How It Was Created

by M.E.A. McNeil

When artist-photographer Rose-Lynn Fisher stepped across the threshold into science, her art came, too.

Looking deeply into the eyes of another can change the course of a life. So it was for artist Rose-Lynn Fisher: the eye she gazed into was that of a honey bee – magnified some 200 times. She was drawn into a 17 year quest into the anatomy of the bee, its beauty, its function and beyond. The prize is *Bee,*[1] a stunning book of electron microscope photographs.

It opens with a luminous full page photo of fresh comb and then divides into six sections: antenna, body, eye, leg, proboscis, wing. Each part begins with a photograph at low, more recognizable magnification, and increases to as much as 3000x, enticing the viewer into a forested landscape of sensilla and undulating forms.

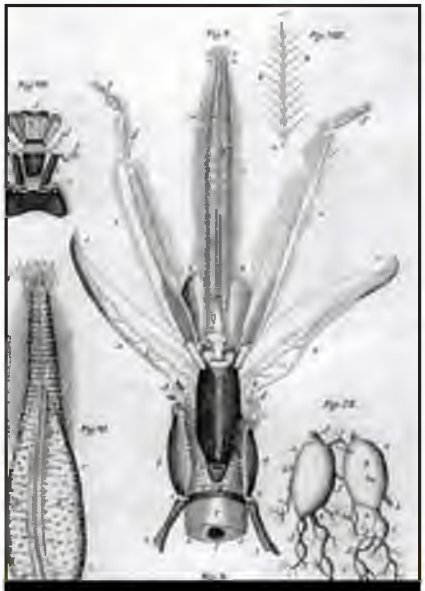
Simple curiosity had first led Fisher to peer into a scanning electron microscope (SEM) at the lab of a friend. Her random subject was a dead bee picked up from her windowsill. Remembering the moment when the microscope came into focus that day still resonates for her with amazement.

"It was the first time I'd looked closely at a bee at all. I knew nothing. I saw the compound eye. It was a field of hexagons. I was so excited; it looked just like honeycomb. There was congruity, some kind of connection inherent in life, a metaphor between seeing and action. I wondered, is this a coincidence or a clue?"

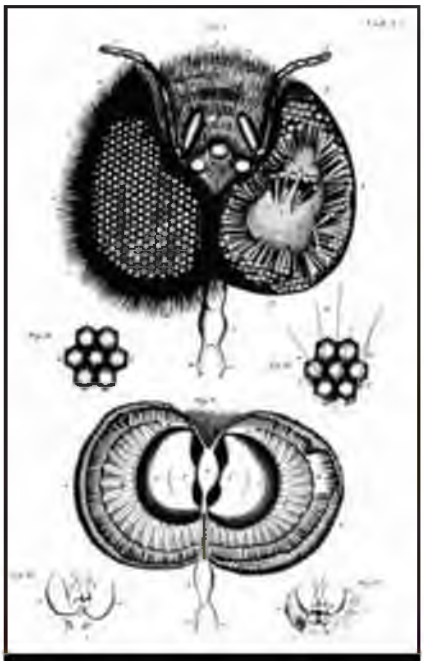
For Fisher, a painter and photographer, this kind of question is at the heart of her work: she creates images of transitions, thresholds — where one thing becomes another or comes into perception. (To further understand this concept, see her other photography.[2]) Fisher favors the word limen, which neatly holds all of these nuances. The story of the creation of this book is a story of many such passages: the limits of natural vision from the macro to the micro, the threshold between art and science, the transformation of the artist's understanding of the bee.

In 1992, when she discovered the SEM, Fisher was exploring geometric patterns in her paintings at an artists' residency on the desert. She began to see congruity between what she saw in her occasional visits to the microscope and the shapes in the dunes. That enticed her back to the lab to shoot more images. "It felt like 'Fantastic Voyage'", the old science fiction movie where people travel through a body. "Hey, I'm driving through this fantastic landscape of the bee. It was possible to zoom out, rotate,

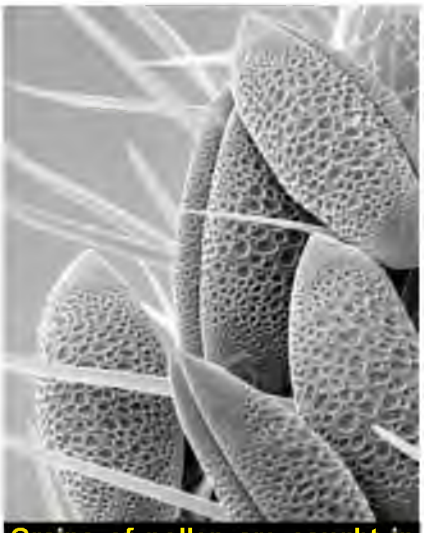
Rose-Lynn Fisher speaking at the Brooklyn Botanic Garden Bee Day last June before a projected image from her book *Bees*. *(Stephen Hoffman photo)*



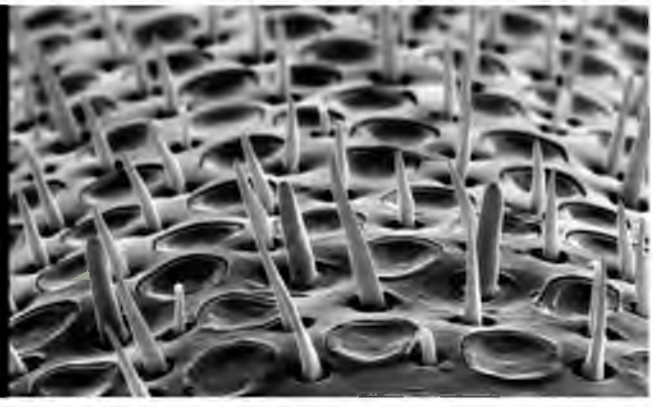
The bee proboscis a seventeenth century illustration of a view through the microscope by Jan Swammerdam.



Drone eyes, a seventeenth century illustration made from the image in a microscope by Jan Swammerdam.



Grains of pollen are caught in the sensors on a bee's antenna, magnified 1100x by a scanning electron microscope. *(Rose-Lynn Fisher photo)*



Protruding and concave sensilla on the bee's antenna, magnified 1700x, create a sensory landscape. *(Rose-Lynn Fisher photo)*

tilt up and down, in and out, move in closer.

"Oh, here's the reality of this creature. It became more and more an adventure of discovery. I was filled with wonder and awe. It became less of a metaphor but simply the experience of bee as bee."

In 2004 she brought six of her photos to "The Great Pollinator Partnership" at the United States Botanic Garden in Washington, D.C., an event of the North American Pollinator Protection Campaign. There she made another passage – to understanding the bee in a larger context. "I learned about pollination, pollination issues. They served food with placards explaining the connection of each dish to bees. That really hit home for me. And within the exhibit itself, people were explaining to me that the structures I found beauty in had functional relevance. It was not just art."

Early European magnifying lenses were called "flea lenses" from fascination with the view they provided into the insect world. The first scientific best-seller was *Micrographia,* a book of drawings of images from a microscope, published in 1665 by the Englishman Robert Hooke. Samuel Pepys stayed up till 2 am one night looking at it, and called it "the most ingenious book that I ever read in my life."

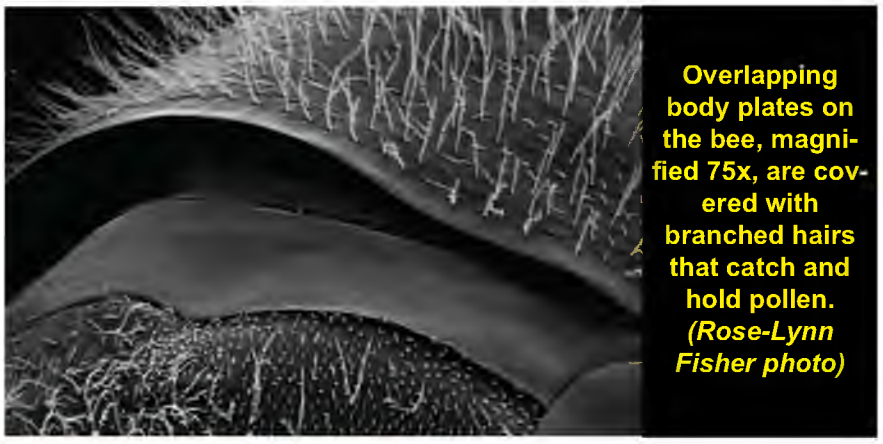
Hooke's Dutch contemporary, Jan Swammerdam,[3] made beautiful, detailed drawings of his dissections of bees as seen through his early microscope. He made the first precise depictions of the proboscis, sting and ovaries – proving that the "king" bee was in fact a queen. Fisher reproduces his copper-plate engraving of a drone's magnified eyes – as magnificent and surprising to him, no doubt as it was to her.

Three hundred years later, a much closer look at bee anatomy was published in Eric Erickson's wondrous *A Scanning Electron Microscope Atlas of the Honey Bee* (1986).[4] The large format book contains hundreds of SEM photos, magnified from 30x to 23,800x. The technology of 25 years ago limited the clarity of the photos, but not their fascination. The book is divided by caste, pointing out differences between the queen, worker and drone. It was important to illustrate and identify the various sensory receptors covering the bee, as many of them had previously been unknown or unseen. The complexity of the captions requires regular use of the extensive glossary, which, for the lay reader, requires yet a further reference to decode. (Harry Laidlaw at U.C. Davis supplied hairless bees for the project, no doubt a story in itself.)

Even larger in format and scope is the magnum opus *Form and Function in the Honey Bee,*[5] a study of honey bee anatomy published in 2003 by the International Bee Research Association. It is divided into the major structures and activities of the bee such as sense organs, vision, feeding, flight, glands, response to gravity. Its many SEM photos, with the advantage of later technology, are sharper than in *Atlas*. Not intended as art, they are liberally marked with arrows and numbers for detailed identification. The book, the posthumously completed work of Lesley Goodman, also includes transmission electron microscope images of cross sections. It is an invaluable reference work and still available.

Bee is another kind of book altogether — a work of art celebrating science, or science celebrated in art. It is beyond the modern vogue for combining art and science, manifested in gimmicks such as dissected animals and CT scans of Big Macs. A respectful, even awed tone is set in a foreword by the deft nature writer Verlyn Klinkenborg, who confesses "species envy" when it comes to bees.

Consider first the tool for this work. With, say, a brush, there is a place at which the mind directs the bristles, which, in turn, define the brush stroke and that creative



Overlapping body plates on the bee, magnified 75x, are covered with branched hairs that catch and hold pollen. *(Rose-Lynn Fisher photo)*

This section through the flight muscle of a worker illustrates how a bee breathes, with oxygen absorbed directly. The image, from *Form and Function in the Honey Bee* is from a transverse transmission electron microscope (TEM). It shows the breathing tubes (tracheoles:*tr*) indenting the muscle cells with the mitochondria (*mi*: where nutrients are broken down to make them available) and the myofibrils (*mfr*: the threadlike contracting part of the muscle fiber). The arrow points out the thickened folds of the breathing tubes that keep them from collapsing. *(Courtesy International Bee Research Association, www.ibrastore.org.uk)*

moment where the two are one. Fisher would call it a limenal point. So it is even with the scanning electron microscope (SEM) in the hands of the artist.

The device Fisher used, the JEOL 6100 SEM, dating from the 1980s, is the level of technology that a grad student might access. Still, she was able to produce images magnified from 10x to 3300x.

The bee is mounted in a vacuum chamber and an electron beam scans across it, like a flashlight on an object in a dark room. The beam maps the surface topography of the object. Since the signals result from interactions of the beam with atoms at the surface of the object, the bee was coated with a fine layer of gold to create conductivity. The gold layer required is so fine it is measured in atoms. An interface between the microscope and the computer generates a digital image.

Fisher's first SEM photos were on Polaroid film. The digital connection, which came some years into the project, dramatically enhanced the clarity of the photographs. Fisher could adjust light and contrast at the microscope, but she could further enhance the digital images in Photoshop. "Looking as an artist, I pushed the exposures to make the images as beautiful as possible."

Her interest in biomimicry, where science and technology look to nature for patterns, led her to approach the editor of Princeton Architectural Press with her SEM bee photos saying, "Just think of this as the architecture of the bee." The concept in architecture was ahead of the suggestion, with design, biology and function considered all of a piece and an international conference on insects and architecture taking place in Italy. It was a fit, and Fisher went back to work to make a book for the publisher.

She shot the photos of honeycomb with natural light at the apiary of Los Angeles beekeeper Ramon Martinez. "It was just a lucky day at his hives. I held a frame of fresh comb up to the light in late summer. It was just right." But with a portfolio of hundreds of SEM bee photos, Fisher started all over to create new images, and it was not like that lucky sunny day.

"It was a slow, meticulous process. Sometimes the challenge was simply excluding a piece of dirt. Or it could be random, impulsive, in the moment — like taking any picture, finding the most dynamic image. My biggest challenge came when I shot first and then had to identify the images. What is *this*? To have anchor points I would pan out to create a key.

"The proboscis drove me crazy. It was weeks into it before I suddenly said 'Ah! That's how it works' — starting to understand the biology. They are wonderful words that describe parts of the bee: clypeus, galea, propodeum."[6]

"I thought it would be more of an art book, but then it became more science. I didn't have the same luxury of esoteric thinking that I had at the start. I want my ideas to have a place in the real world. First it was bee as metaphor and symbol. Then it was bee as bee. Then it was bee in the world, how our sustenance depends on it. The work started to find relevance.

"As to the connection between the hexagonal pattern of the bee's eye and the pattern of honeycomb, entomologists told me that it is nature's way of packing circles. What intrigues me is what might be behind that? I did a whole body of work based on the inspiration of that question. It kept unfolding and unfolding. I felt like in some way I was looking at a correlation between my inner structure and my outer expression." She hopes all who view it will see it as a threshold, too, to look both outward and inward, seeing themselves in the natural world.

"If people start to see that this is what the bee is — with such inherent beauty in its very being – and then realize that the bees are struggling, they may want to care for them."

Note: For exhibitions of photos from *Bee* and talks by the artist, see ***www.Rose-LynnFisher.com***. Some scheduled are:

Provo, Utah; Brigham Young University, Bean Life Science Museum, October 15 – January 15, 2011
Santa Monica, CA; Craig Krull Gallery, November 24 - January 8, 2011
Tucson, AZ; Arizona-Sonora Desert Museum, September 8 - October 21, 2012

Thanks to Eric Mussen for sharing his ready knowledge of bee biology.

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Footnotes

1 *Bee,* photographs by Rose-Lynn Fisher, foreword by Verlyn Klinkenborg, Princeton Architectural Press, New York, 2010.
2 See other work by the artist as well as photos from *Bee* at: ***www.Rose-Lynn Fisher.com***. Compare, for example, the eighth Water Study on the website and the

photo of the bee's wing on page 116 of *Bee;* they could have been switched at birth.

[3] Jan Swammerdam (1637 – 1680) was a Dutch biologist among whose contributions to science was showing that larvae, pupa and adult are the same animal.

[4] *A Scanning Electron Microscope Atlas of the Honey Bee* by Eric H. Erickson Jr, Stanley D. Carlson, and Martin B. Garment, 1986, 292 pp, 9 by12 inch format. Although it is out of print, the entire book can be seen at: **www.ars.usda.gov/SPZUserFiles/Place/53420300/AtlasoftheHoneybee.pdf** Allow the book to download completely before scrolling down through it. Erickson is retired from a career at the USDA-ARS Tucson lab.

[5] Goodman, Lesley, *Form and Function in the Honey Bee,* International Bee Research Association, Cardiff, 2003. ISBN 0-86098-243-2. Available from *www.ibrastore.org.uk*

[6] The clypeus is a plate on the front of the bee's head; it evolved from earlier mouth parts. The galea is part of the proboscis. The propodeum is the first abdominal segment, which appears to be part of the thorax.

THE SECRET LANGUAGE OF FLOWERS

by PETER LORING BORST

In previous articles I wrote about the ways that honey bees communicate within the darkness of the hive using subtle blends of odors. Intriguingly, many of these odors are very similar in composition to the floral odors that bees and other pollinating insects typically encounter and respond to in their environment. In a very real sense, plants and insects are communicating. In fact, when viewed over the larger scale, they have had an ongoing conversation for a very long time. What have they been talking about? Basically, there has been a back and forth exchange of information about their needs and how they can supply these to each other. Their story and the further tale of how we learned to listen to it will bring in a variety of players, chief among whom is Charles Darwin.

Darwin and Flowers

While many people tend to associate the name Darwin with apes and men, he spent a great deal of time studying insects and flowers. In fact, one of his early books, published in 1862, had the snappy title of "On the various contrivances by which British and foreign orchids are fertilised by insects, and on the good effects of intercrossing". In this influential work, Darwin laid the groundwork for what was to become the study of co-evolution. Life forms change in relationship to their environment, but this environment includes not only factors such as resources and climate, but other organisms which are changing as well. So, evolution can be seen as the complex web of interaction, not only with winners and losers, but also one that favors cooperation and mutually beneficial adaptations.

Millions of years ago, according to the fossil records, life reproduced asexually. That is, there were not male and female creatures, but life spread and divided like many organisms still do today. In fact, there are whole forests that consist of clones that sprouted from spreading roots of an original tree. There is a 106 acre Aspen grove in Utah nicknamed Pando. Scientists believe that the grove may have been established over ten thousand years ago, before the last ice age, since aspens no longer reseed in the arid west.

One of the amazing innovations that evolution has produced is the recombination of genetic material by the pairing of the opposite sexes, in plants and animals. And yet, even more surprising is the fact that plants and animals participate in this intriguing dance together.

The first seed-bearing plants and the first insects are thought to have appeared during the Devonian Era, around 400 million years ago. Apparently, winged insects began to proliferate 100 million years later. During the Permian Era, the first of seed-bearing plants or gymnosperms arose. In the Jurassic Era, gymnosperms were common and included conifers, cycads, and ginkos, which can still be seen today.

However, the period that interests us is the Cretaceous, about 100 million years ago. It was during this epoc that flowering plants (angiosperms) and many new types of insects became widespread. One such family of flowers is the *Magnolids*, which are familiar to us because they include trees such as magnolia, tulip poplar, avocado, sassafras, and nutmeg. The important point is that flowers seem to have arisen together with insects and these would serve to distribute pollen, enhancing genetic recombination, reproductive success, and evolution itself.

The Abominable Mystery

The sudden appearance of flowering plants so vexed Darwin that he called it "an abominable mystery." He wrote:

> Saporta believes that there was an astonishingly rapid development of the high plants, as soon as flower-frequenting insects were developed and favoured intercrossing. I should like to see this whole

Attracted by the deep fragrance, the hawkmoth visits the night-blooming moonflower (Datura) (Photo by Robert Raguso)

Orchids have developed bizarre and intricate shapes and vivid colors to attract insect pollinators. (Photo at the Raguso Lab, by Peter Loring Borst)

problem solved.

In fact, it was Gaston de Saporta's idea that a co-evolutionary set of interactions between angiosperms and insects may have been central to the rapid diversification of flowering plants in the mid-Cretaceous. For Darwin, the problem was not so much that co-evolution could have happened, but that it appeared to have happened so suddenly. The very slow progression of hundreds of millions of years had suddenly shifted gears and the world was filled with a wondrous profusion of flowers and insects, with their strange shapes, brilliant colors and seductive fragrances.

Many times we hear Darwin's ideas boiled down to the phrase "survival of the fittest". This, of course, is a great oversimplification and leads to the notion that "only the strong survive" and "nice guys finish last". This is not how the natural world works at all. While it is true that natural selection subjects all of life's creatures to the ultimate test of survivability, just how the many creatures accomplish survival is surprisingly varied. Central to all this variety is, of course, sexual reproduction and the recombination that is involved, but there may be another force at work. One simply has to factor into the equation the role of innovation. Has evolution produced and favored creatures that produce new and novel forms? The many millions of species certainly would attest to this idea. But nowhere is it more obvious than in flowers and their interplay with insects.

Something Old, Something New

Many years ago, as an aspiring songwriter, I stumbled upon a library book that told the secret of successful song writing. A good song has to be different enough that it will be heard as something new, but familiar enough that we will recognize and enjoy it. There is something of a universal truth in this little platitude. If something, say a flower, is too different, it may fail to be attractive at all. But if you are just unique enough, they may beat a path to your door, like they did with the Beatles.

But how do living creatures come up with new strategies? The random recombination of genes? This is a very hard point for some people to accept. Perhaps you have played the simple card game "War." You just keep turning cards over, and whoever has the highest wins that round. Everyone knows that it doesn't really go anywhere; it is a game that never ends. If evolution was simply like that it would seem unlikely we would get past the amoeba stage. Obviously, there is something more that causes evolution to move along a path that isn't simply more of the same. How about attraction?

Even the lowliest amoeba is attracted to things. It seeks warmth, food, and so on, in order to survive. By the time life was complicated to the point where creatures became interested in each other except as food, the senses were already pretty well developed. A good hunter has acute talent for smelling, seeing, hearing to locate its prey. But plants can't see or hear, can they?

Maybe not, but here's what they do. They put on a gorgeous display of colors and fragrance, in order to attract the opposite sex. Obviously, it is not the male flower that is attracted by the female flower, though. This is where bees come in. Flowers are filling the air with enticing fragrances, showy colors, and even offering food in the form of sweet nectar. In fact, some produce so much pollen that there is enough for the visiting bees to load up, so long as they do a little pollinating while they visit. The flower of the plant is actually a sophisticated form of advertising to grab an insect's attention as it goes about its busy world hunting for food and a mate of its own.

Smells Bad

Nobody knows how this whole process began. In fact, it is quite possible that plants first evolved chemicals to repel anything that would try to eat them. For example, consider the tobacco plant with its bitter, poisonous leaves. Most creatures that bite into this plant, will find it unpalatable. If they don't take the hint, the nicotine kills them and that bug won't be back. He won't have children either, so in the course of evolution, creatures that avoid eating poisonous plants will be favored.

But meanwhile, the plant needs to get pollinated to reproduce. As we saw previously, it is the recombination of genes that created novelty in the first place, the reshuffling of the deck to produce a better hand of cards. But once it started down that path, life became infinitely more complicated. While the plant wants to repel or kill the predator,

it wants to attract and even feed the pollinator. So, plants evolved that produced chemicals that were enticing to the right guests and repugnant to pests.

The *Datura* plant is a close cousin of tobacco. Its leaves are rank smelling and poisonous. So while it is growing, most creatures leave it well alone. Then, it produces a wondrous white trumpet flower that fills the air with a heavenly smell and holds deep within it a pool of nectar. In this clever way, it gets the work of swapping genes done, and then the flower wilts dead away, returning the plant to being a stinking bush. Later, when the seeds begin to form, it encloses them in a spiky fruit, better known as a "thorn apple". This is even more poisonous than the leaves, which protects it from being eaten. Any creature that survives a bite of this apple, remembers how sick it got and doesn't come back for another.

Shop Talk

So here is the heart of the matter, plants are communicating with insects on two levels. The first is the basic level: come hither, *I have what you want*. This is the immediate message, and the reward is immediate as well. However, more intriguing is the conversation that has been going on for millions of years. You could compare it to the relationship that musicians have with their audience. In the beginning, talented log beating kept them rapt for hours. But sooner or later, somebody hit upon a new sound, maybe hitting two rocks together. Simple and satisfying no longer was enough, and a few millennia later, you had the symphony orchestra.

In the same way, plants went from self pollination by producing light pollen which would generally fall where it was supposed to go, to cross pollination aided by the wind. But when insects got into the act, things really took off in another direction. This was the beginning of Darwin's "abominable mystery," which is discussed eagerly to this very day. Recently, Pamela and Douglas Soltis discussed the mechanisms that lead to the extreme novelty of so many flowers. Underlying the obvious (to us) features, are interesting genetic patterns. They state:

Gene duplications represent the ultimate source for the origin of genetic novelty and it is reasonable to predict that duplications in genes controlling aspects of floral morphology may be responsible for morphological novelty.

One Man's Meat?

What this means is that random copying errors may create the wondrous forms we see and the infinite variations of fragrances ranging from the scent of ripe fruit to the stench of rotten meat. Be forewarned, not all flowers smell sweet! Flowers of *Rafflesia* plants emit a repulsive odor that attracts flies which pollinate the plant. The rare *Rafflesia arnoldii* is found in the jungles of Sumatra and Borneo. This stinking flower can be 3 feet across and weigh 15 pounds. Odors of carrion flowers are produced by chemicals with descriptive names like putrescine and cadaverine, and are so potent that concentrations of only 5 to 10 parts per billion are enough to produce the horrible odors.

But here is a very clear example of the plant tailoring its presentation to its targeted audience, carrion-loving flies. No doubt these flies get very little from their visits, but the flower manages to get pollinated and reproduce by means of what can fairly be termed deceptive advertising. Some of these types of plants even trap the unwitting visitors and force them to pollinate, before allowing them to go back to hunting for dead animals.

What We Missed

So, if odor is so important in this communication system, why do we know so little about it? There are several key reasons. First, much work has been done on the visual communication of honey bees. By this, I mean, honey bees are able to discover and identify patches of nectar-producing flowers, and memorize their location using a visual map. They translate this map into an easily communicated code, sort of like GPS coordinates. Their message tells which way to fly, how far, and how good the spot is. The discovery of this secret code earned Karl von Frisch the Nobel Prize.

Meanwhile, some younger bee researchers made the discovery that bees can locate floral sources directly without the dance messages, using only odor cues, which they receive from returning foragers. Adrian Wenner and Patrick Wells spent several decades in a pitched battle with the "dance language proponents," in a effort to dismiss the bees' ability to understand and utilize the curious dances which clearly contain the information that was claimed by von Frisch. This episode had at least two unfortunate consequences. One was the wasted energy that was expended on arguing over who was right about what bees do or do not understand. The other: Wenner and Wells pretty much polarized the field and probably a lot of interesting research that could have been done on odor communication didn't get done or was ignored as propaganda of the "odor only" faction.

Years later, the issue has been essentially resolved by the efforts of level headed researchers with no bias to enforce. I'll mention only briefly work done by Kirchner and Andreas Grasser, who ingeniously disoriented the bee dance by turning the honey combs on their side and filming the ensuing chaos with infrared light. They showed conclusively that foraging was hampered by the loss of this information when it referred to food sources far from the hive. For nearby sources, there was no effect, presumably because the odor cues were sufficient to guide the bees the shorter distances. They wrote:

Odor cues are significant. It might therefore well be that, under certain experimental conditions, odor cues are even more important for the recruit bees. It is possible that small differences in the experimental design led to the controversial conclusions in the literature about recruitment in honey bees.

This agrees with what the great bee researchers Martin Lindauer and Warwick Kerr had said, many years earlier. "Flower odours clinging to a bee's body can serve as a source of information about the food's quality, and help the searching bees to find it in the field."

Carnivorous plants like the sundew attract insects and make a meal out of them. (Photo by Peter Loring Borst)

The New Florists

Nevertheless, the study of floral scent is being rekindled by people like Robert Raguso, of Cornell University. Just the title of his papers gives you a sense of the situation. He recently penned "Start making scents" and "Wake Up and Smell the Roses" which cover the topics of pollination ecology and the evolution of floral scents. He suggests that plant-insect communication is exceedingly common in plants ranging from annual weeds like *Arabidopsis* to venerable trees, many of which are known to beekeepers as significant sources of honey. Tree sources of honey include eucalyptus, black locust (acacia), orange blossom, and basswood (linden) as well as avocado, tulip poplar, and others already mentioned in this article.

Dr. Raguso clearly underscores the evidence that since floral sights and scents aim to attract desirable pollinators, their surrogate mates, the features of flowers are subject to "the same selective pressures and modes of signal evolution as animals display, including signal honesty, sensory drive, and sensory exploitation."

And, there are things even stranger to be told. The subtle play of flowers and bees becomes a bit rowdier in some quarters. In an effort to attract insects, some flowers have even gone a bit too far. Many different orchids, such as *Ophrys*, mimic virgin female bees both in appearance and odor. The male is fooled into copulating with the flower, thereby getting some of its pollen on his body. Evidently, he quickly loses interest in the flower he has sullied and goes looking for a fresh mate. In this manner he transfers pollen from flower to flower, and effects cross pollination.

Teaching How to See Smells

One of the chief difficulties in teaching about the role of odor communication between insects and flowers is the fact that it is relatively difficult for us to "visualize" the messages as they are blindly sent and received. As human beings, we are more accustomed to communicating via sight and sound. However, it is easy to demonstrate that *hearing* is an extremely effective way of transmitting visual information.

For thousands of years, all knowledge was handed down by the spoken word. Whole histories with descriptions of people and places could be conjured up by story tellers reciting to attentive audiences in camps or caves in the night by the fire. Tales of hunts, of faraway pastures, of battles and heroes, were heard and then seen in the mind's eye. This great art of story telling was somewhat replaced by books and then plays, during the second millennium. But the blind voice resurged again with the advent of the telephone and the radio.

Although we use facial cues and body language to assist in face to face communication, there is no doubt that enough information is contained in the sound of the human voice to communicate such things as the person's identity and their emotional state. Can such complexity be encoded into a scent? Most definitely. For insects which are acutely attuned to fragrance, there is a great deal that can be perceived in an odor. Flowers can carefully tune the various chemical compounds, balancing and playing one off another.

All in the Nose

Dr. Raguso describes four different ways a particular multi-component scent can be varied: (a) original or ancestral blend; (b) same compounds, same ratios, greater abundance; (c) same compounds, different ratios, same abundance; (d) addition of novel compound (α-pinene); (e) same compounds, ratios, abundance, but a different context (flower color).

But perhaps the most interesting feature of these chemical compounds is their presence in so many different places. It is almost as if there is a universal language that is understood by plants, insects and animals. Perhaps you have chuckled when you heard someone describe a particular wine:

A Bordeaux blend based on Cabernet Sauvignon, this is a beautifully structured, opulent deep purple wine. Aromas of sweet black cherry, warm licorice, cedar, oak and toasted espresso. Intense, full-bodied and well concentrated balance. O'Brien *Seduction* 2005 California

Maybe you wondered what on earth they were talking about. It turns out these scents are coming from a complex mix of chemicals including alcohols, aldehydes, ketones, ethers, and esters. These same chemicals are what give flowers their scents, and fruit their taste. And, perhaps most amazing, these are components of insect pheromones: the scents they use to communicate. The Nasanov gland of the honey bee emits a blend of geraniol, nerol, and farnesol and citral, which bees use for orientation. These compounds are also present in wine. You will recognize them when I connect them with aromas you know. The following list is from Tom Cannavan's **wine-pages.com**

> Geraniol: found in nutmeg, ginger, basil, rosemary, sage, cardamom and grapefruit. A chief constituent in essential oils including geranium oil, lemongrass oil, orange flower oil, hops oil, and lavender oil.
>
> Nerol: present in orange blossom, ginger, basil, cardamom, mint and mandarin.
>
> Farnesol: in Linden Oil and is a constituent of garden rose aroma.
>
> Citronellol: garden rose, geranium, ginger, black pepper, basil, peppermint and cardamom, Lemon Eucalyptus.
>
> Linaloöl: found in lavender, bergamot, jasmine, basil, rosemary, sage, star-anise, cinnamon, clove, nutmeg, coriander, cardamom, ginger, black pepper and mandarin.

This last is quite interesting. Over 200 species of plants produce linalool, especially the families *Lamiaceae* (mints, scented herbs), *Lauraceae* (laurels, cinnamon, rosewood) and *Rutaceae* (citrus fruits). It is crucial to our enjoyment of strawberries, tomatoes, carnations and petunias. And – it is used by certain bees in their courtship rituals!

Linalool was the main constituent in the extracts of the cephalic secretions of virgin females, mated females, freshly emerged males, and patrolling males of the solitary bee *Colletes cunicularius*. Linalool may act both as a sex attractant and a food attractant. A number of spring flowering plants emit one or both of the linalool enantiomers. In *Salix* (willow) which is a main nectar and pollen source for the bees, linalool is also present, especially in the male flowers, which might strengthen the attraction of bees to the flowers (Borg-Karlson).

The Bees' Map of the World

If my bees have found a vast swath of basswood flowers, I may get in the car and go "look" for it. I have done this, spent hours looking for the source of the honey in the hive. I knew that the bees had found the flowers by the smell and taste of the honey, but given my limited ability to smell the way they do, I simply couldn't know what else they knew. To smell the world as they do, I would have to be able to fly above the tree tops, sniffing the air until I caught wind of the huge invisible odor plumes that would necessarily mark these fragrant flower patches. If we could *see* them, they would appear like colorful smoke clearly rising above the little pots of honey waiting below in the branches of the trees, or low to the ground.

In summer, the air is literally filled with floral scents, all clamoring for insects' attention. If I were a young bee, whose job it was to go get the honey, I might simply ignore all the complicated dancing and try to fly straight to the source. Of course, excellent forage spots may not exist nearby or those that do may quickly be depleted, making it imperative for the bees to have an alternate form of communication that can describe other sites that are out of range of their little sniffers. Even so, each dancer returns to the hive fairly reeking of nectar and pollen, and her head filled with a map of her world.

Extensive research has been done on bees' ability to form long-term memories, which are referred to as mental maps. But map doesn't really do justice to their recollections, because just as our memories are not just road maps, so the bees retain a range of associative information including time of day and quite probably specific visual and odor memories. All of this information is of great use in increasing the skill and efficiency of honey bee colonies in their daily work of hunting and gather-

**In Eastern lands they talk in flowers,
And they tell in a garland their loves and cares;
Each blossom that blooms in their garden bowers,
On its leaves a mystic language bears.
Percival**

**And ye talk together still
In the language wherewith spring
Letters cowslips on the hill.
Tennyson**

ing the food supply for thousands of hungry mouths back at home.

And yet, who hasn't had a flood of memories brought back by the merest whiff of a fragrance? A fleeting scent transports us to long forgotten (or so we thought) place and time and reminds us that memories, though sometimes difficult to recall, are not really ever forgotten. But beyond that, there is something about fragrance that if it is held soft and not too cloying, we will not tire of it, and the urge to love is reborn just like spring.

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Most any long-time beekeeper has noticed that bees are simply not as healthy as they used to be, and that we have been plagued with a spate of unusual colony collapses in recent years. As luck would have it, I've been an intimate witness to the experimentally-induced collapse of colonies in a field trial this winter and spring. My observations have helped me to better understand how such collapses play out.

Sick Bees

We generally assume that our bees are healthy, as long as they are building normally and producing honey. The reality is that there is a constant battle going on in the hive between the bees and the parasites that seek to exploit them (note that to a biologist, the word "parasite" includes all the pathogenic mites, fungi, bacteria, and viruses). I'd like to quote excerpts from an address given in 1977 by the great bee pathologist, Dr. Leslie Bailey:

"Bees flourish in spite of the beekeeper, and this is because they are not domesticated....Indeed, they must have their freedom to survive [no one has yet figured out how to keep bees alive without access to natural forage].

Anyone who relies on the old accounts of bee diseases, and even on the most up-to-date books on beekeeping, will conclude that when bees are not obviously sick, they must be free of pathogens; conversely, when a visibly sick colony is found to be infected with a pathogen, this will be blamed for causing the disease...When I began work on bee diseases, this was the general idea, and I fully expected to cause sickness easily for my experiments. However, my bees usually continued to look well. It was not that the agents for these alleged diseases were not in my bees; I could find them quite easily, but usually they didn't produce any striking symptoms. The fact soon became clear that most, probably all of the wide variety of bee pathogens can occur in colonies that nevertheless can continue to appear healthy....

A good beekeeper understands how certain activities in beekeeping can aggravate and spread infections of all kinds. These practices include disturbing colonies unduly, hindering their normal development, keeping too many close together, keeping them in districts of poor nectar-flows, ...dispersing brood in them, distributing contaminated combs to other colonies, and feeding unsuitable sugar preparations" (Fig. 1).

Figure 1. Colonies being "stimulated" in California prior to almond bloom. (Practical tip:) The feeding of syrup will induce these bees to break cluster and shift from the long-lived "winter bee" state to "forager" status. It will also encourage them to wear themselves out by engaging in fruitless foraging in an unfriendly environment. Such stimulation prior to natural pollen flows is very stressful to the colony. Due to drift and robbing in the crowded yard, pathogens can quickly spread and flourish. (Photos by the author.)

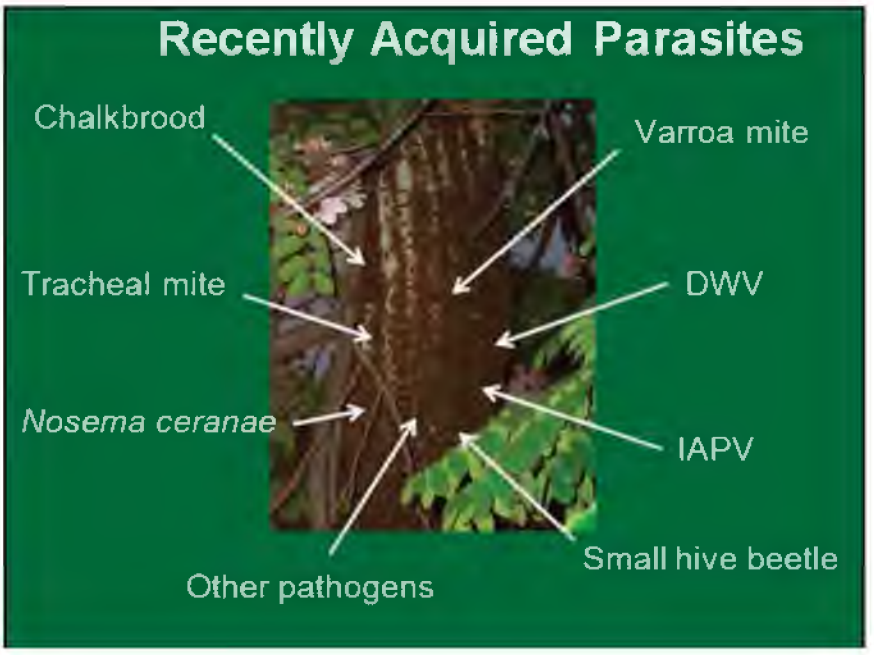

Figure 2. Bee parasites introduced into the U.S. since the 1960's. It is amazing that the honey bee is resilient enough to deal with at least eight new pathogens in so short a time! We older beekeepers reminisce about the "good old days" when all we worried about was AFB (not yet antibiotic resistant).

Figure 3. Sick brood suffering from what is termed "EFB-like" symptoms. Note the "corn yellow" larvae, the slumping white propupae, the sunken capping, and the partially removed sick larvae. Colonies in my operation with these symptoms flounder.

And that was back in the "good old days" of beekeeping, before I had ever heard of tracheal mite, chalkbrood, varroa, or bee viruses! Since I first started keeping bees, all the new pathogens in Figure 2 have arrived, one by one. Such an onslaught of parasites is a tremendous evolutionary challenge to any species, since each new pathogen changes the equilibrium of existing host/parasite relationships, and the dynamics and efficacy of the bee immune response.

Likely as a result of bees trying to come to terms with the new parasites, nowadays I'm seeing bee diseases that I've never seen before (or at least haven't seen since bees suffered from Parasitic Mite Syndrome shortly after varroa arrived) (Figures 3 and 4). Plus, I suffered the unfortunate experience a few years ago of watching my colonies go through a period of dwindling and die offs that fit the symptoms of what was later named "colony collapse disorder" (CCD).

This is not just the grousing of an aging beekeeper—I feel that the fact that our bees are having to come to terms with a slew of new parasites has a great deal to do with the case of the…

"Disappearing" Bees

I started writing this article some time ago, thinking that I would first introduce the reader to the aspects of honey bee biology that lead to colony collapses. Unfortunately, I got caught up in my obsessive thoroughness (as I am want to do), and in simply trying to introduce you to the critical function of ethyl oleate in colony collapse, I wound up writing the previous four-part series on the primer pheromones! This led me to realize that if I kept it up at that rate, it would be a year before I finally got to the actual mechanism of collapse. So, I'm jumping ahead now, and going to describe collapses, and *then* follow with more detailed analyses of the components involved.

Beekeepers are used to colonies perishing from starvation, queenlessness, AFB, nosema, or varroa. In these cases, each sort of deadout exhibits a signature of distinct symptoms. What has caught our attention about CCD is that it seems "different." The first reports were of a sudden "disappearance" of the adult workforce, leaving behind plenty of stores and *large areas of brood* (vanEnglesdorp 2006). A later description (Debnam 2009) describes the slow (often two-year) progression of the symptoms. In the experimental yard mentioned above, I was able to observe both the rapid and slow collapse of colonies.

There is nothing new about the phenomenon of sudden colony collapses (Underwood & vanEnglesdorp 2007). ***The historical descriptions of the symptoms of such collapse events were often strikingly similar to those that have occurred in the past few years***. Note that they occurred prior to either parasitic mite or *Nosema ceranae* arriving in this country, and before the invention of cell phones or neonicotinoid insecticides!

Therefore, I have a hard time swallowing that CCD is necessarily caused by an ***entirely*** novel factor, but *am guessing* that the recent collapses are likely a variation on an old theme. In fact, the speculation about the cause of CCD reminds me of the blind men with the elephant—many have allowed their research specialty, personal biases, or favorite pet peeves to cause them to focus on a single culprit.

So let's play Sherlock Holmes, and briefly sift through the evidence for or against the various suspects that have made the news. What I'd like to do is to apply Koch's Postulates (the accepted scientific method for identifying the causal agent of a disease).

Koch's Postulates (simplified)
1. Is the suspect factor *always* associated with the disease?
2. Will the suspect factor *always* create the same symptoms?

Let me make a quick list of suspects that do not meet both of the above postulates, since they either do not ***always*** show up in analyses of collapsed colonies, and/or do not ***always*** create CCD-like collapses when applied to colonies: cell phones or electromagnetic radiation, varroa or tracheal mites, genetically modified crops, or any particular pesticides.

That is not to say that at least some of the above could not be ***contributing factors***. And this may be a key point—the current level of colony ***losses*** (not just CCD-like collapses) indeed appears to be higher than the "norm." So it would be wise to see what novel contributing factors might be increasing the degree of losses.

What's Changed?

I've been running bees in roughly the same manner for 30 years: I pollinate almonds in February, then to prunes, then home to make splits which build up on the foothill honeyflow, then to Nevada for irrigated alfalfa for the late summer, fatten them up on Rabbitbrush in fall, and then winter them back in the foothills. Worked like a charm, year after year.

The introduction of tracheal mite hit me hard, but I quickly recovered with resistant stock. Varroa brought me to my knees; recovery was much harder, but I was still eventually able to greatly expand my operation.

However, things were no longer the same. Queens would fail, and colonies would go queenless. Winter losses were higher. Beekeeping was just tougher. Dave Mendes notes that "bees are simply more 'fragile' than they used to be."

Then in 2004 and 2005 my bees weren't right. At first they just didn't build up normally, and often exhibited the odd symptoms as seen in Fig. 3 and 4. Then, they suffered serious fall and winter collapses (a fellow beekeeper in the same area lost thousands of colonies, but oddly, not so another buddy with yards alongside ours!). We erroneously blamed it on the mosquito spraying due to the West Nile Virus scare—further investigation did not support that link. And when I asked the growers, they hadn't changed seed type nor pesticide use (most didn't use any) for years. I couldn't keep my numbers up, and was puzzled and distraught.

Then, Dave Hackenberg made the news when he suffered unusual colony collapses in 2006. The point that he made was not that he suffered losses, but rather that the degree of the losses and way in which colonies collapsed, was unlike anything he had ever seen before. Something had changed!

What bugs commercial beekeepers is when folk blame long-time practices for this new problem: we've been trucking bees, using plastic foundation, feeding syrup, and had varroa mites for some time, and our bees generally thrived (as long as we kept mite levels down). ***So I'd discount any purported cause that hadn't changed shortly prior to the appearance of CCD.***

Figure 4. Sudden death of adult bees. Common in my yards in both California and Nevada, on various crops and at different times of the year. Generally, there will suddenly be a pound or two of dead bees in front of one or a few hives in a yard. Then, the "disease" disappears just as quickly, and the colony recovers. I typically do not find nosema spores in the dead bees. In the one instance where I was able to put samples of dying bees onto dry ice, there were no detectable pesticide residues, and viral testing was inconclusive.

Some changes that ***did*** occur in that time frame were:

1. **Additional colony stress due to the resurgence of the varroa mite and buildup of miticides.** When mite levels increase, colonies die. At the time when colony collapses were increasing, some miticides had begun to fail, which then led to higher mite levels, the use of stronger miticide doses, and the use of multiple miticides. This resulted in increasingly high levels of comb contamination from those beekeeper-applied miticides (BAM's)—the most common pesticides now found in hives (Mullin 2010; imidacloprid, by the way, was detected in only 1% of U.S. samples). Indeed several blue-ribbon studies from throughout the world have linked colony deaths with high levels of (often illegally applied) BAM's. *(However, this wasn't the case with me, since I had eschewed synthetic miticides since the year 2000).*

2. **Large-scale unfavorable weather events** preceded many reported collapses—mainly droughts in the Midwest, South, Texas, and California, very wet summer weather in the Midwest and East last year, and unusual frosts in the southern states. Poor weather during expected bloom periods causes major nutritional stress for the bees. Perhaps more importantly, drought and wet summers create two serious prob-

Figure 5. These stacks of empty pallets indicate the degree of losses suffered by one beekeeper this winter in California—the deadout boxes were shipped home separately to save space. He attributes the losses largely to "natural events"—poor weather that left the colonies in a stressed condition. He has subsequently restocked the equipment. The ability of beekeepers to recover from such misfortune, although at staggering financial expense and lost income, tends to mask the serious costs of maintaining a bee operation these days. (Photo by Dr. Jerry Bromenshenk.)

lems related to Deformed Wing Virus (DWV): colonies don't build large enough to outbreed varroa, *and* beekeepers may be tempted to put off mite treatment in order to get that last super of honey. If mites are not controlled by the end of August, the colony may enter winter with eventually fatal DWV levels (Martin 2010). *(I don't feel that abnormal weather was a factor in my losses).*

3. **More expansive monoculture and herbicide use**, which results in incomplete bee nutrition, due to the elimination of the weeds that previously provided good forage to honey bees. There is also a shift in the types of pesticides applied—many environmentally more benign, but at the cost of being systemic in the pollen and nectar. Also of particular concern is the effect of the new classes of fungicides upon colony health—note that boscalid (Pristine, first registered for use in 2004) causes major problems to beekeepers in almonds, and is also widely sprayed during bloom on apples, sunflower, canola, and a host of other crops. *(Again, other than in almonds, I had always avoided crops with any pesticides).*

4. **The shift of beekeeping to larger-scale operations** (at least in the U.S.), and especially the industry shift to almond pollination midwinter. The homogenization of bee pathogens from throughout the country occurs each year in the California almond orchards. The changes in management necessary to fill contracts for strong colonies in February, especially following a poor season, may be challenging, and not all beekeepers manage to stay on top of colony health and nutrition. (*Being a California beekeeper, I'd always managed my bees for almond pollination.)*

5. **The introduction of *Nosema ceranae.*** What can I say? Being infected by nosema all through the year just can't be good for bees, and Dr. Mariano Higes' work strongly suggests that it was associated in the unusual losses of colonies in Mediterranean Europe about that time. However, archived samples from Dave Hackenberg's operation in 1985 tested positive *N. ceranae*, but Dave didn't notice CCD problems until 2006! But apparently *N. ceranae* did not become widespread in the U.S. until about 2004 (Evans 2010)—which certainly puts it on the short list of suspects. *(When I tested my colonies for* N. ceranae *in 2006, only some had it, but not at high levels—it was too late by that time to test the deadouts from the previous years).*

5. **New or more virulent strains of bee viruses.** Varroa changed everything about virus presence, transmission, and virulence in bees. Note that widespread colony losses have only been reported from countries is which varroa is a problem (Neumann 2010). Colonies without mites may be virus free (Highfield 2009), but up to 100% of colonies *with* varroa may be infected by one or more viruses, *even if there are no apparent symptoms* (Tentcheva 2004). ***The scary thing about viruses is that they can suppress certain aspects of the immune system, and interact with each other, and with nosema!***

So could new virus strains, such as Israeli Acute Paralysis Virus (IAPV) be the problem? And where would they come from? Some have pointed the finger at Australian imports, but there are two flaws that I see in that logic—collapses started prior to the first imports in 2005, and Canadian beekeepers imported plenty of Aussie bees, but did not suffer concurrent massive losses. However, I don't want to let imports off scot-free. Dr. Elke Genersch (2010) points out that "Repeating previously observed scenarios, the dramatic increase in emerging virus diseases in the honey bee may still be worsened by the continuing development of international exchanges and the potential dissemination of still undiscovered viruses or other agents that may favor their active multiplication."

New virus strains may have come from elsewhere, but can also arise spontaneously through their rapid evolution (like human flu viruses), or by passing through an alternate host (such as bumblebees or yellowjackets or perhaps varroa). In fact, the bee viruses actually exist as "virus clouds" of slightly differing, constantly changing strains, generally becoming more virulent each generation until they reach an equilibrium (which changes again each time the bees gain a new parasite)(Agudelo-Romero 2008).

I've been noticing such changes in my own bees. I saw more sacbrood (some of it odd looking) in those two years than I had ever seen before, more unusual larval deaths, and also more symptoms of Chronic Bee Paralysis Virus (hairless black trembling bees). There were sudden losses of adult bees as illustrated in Figure 4, suggesting rapid-acting viruses. ***But most notable was that the epidemiology of deformed wing virus (DWV) appeared to have changed—it no longer required high mite levels to show evidence of symptoms.***

The case for fingering viruses as a prime suspect involved in colony collapse is strong. It's been well established that it is one or more viruses that finally take down a varroa-infested colony (in which the adult bees also "disappear" suddenly—but, in the case of DWV, leave clear symptoms in the brood).

There are a number of other pieces of evidence that implicate viruses:

1. Most emerging infectious diseases on Earth are caused by viruses.
2. The disorder appears to be transmissible from one colony to the next (vanEngelsdorp 2009), and can spread from yard to yard (Debnam 2009). Only a disease caused by an infectious, transmissible pathogen would be expected to behave in such a manner. By process of elimination, the causal parasite would likely be a virus, since parasites other than viruses would be fairly readily detected (OK, could be a viroid or even a prion if you want to get picky.)
3. The sterilization or "resting" of combs from failed hives decreased the incidence of collapse following reintroduction of fresh bees. Bee viruses tend to become noninfective when dried (Bailey 1967; and from personal experience with DWV deadouts).

4. Analysis of the bee immune response in CCD colonies indicated that the main infection was likely viral (Johnson 2009). The same study found that DWV and a number of similar viruses were more abundant in CCD bees, and that the bees exhibited "all the signs of death by massive virus replication." On the other hand, Bromenshenk (2010) found that DWV was negatively correlated with collapses in the operations that he sampled (another virus appeared to be involved)!
5. Titers of some viruses are strongly correlated with colony losses in Europe and the U.S. (Highfield 2009, Berthoud 2010, Evans 2010) (but different viruses appear to be associated with losses in different areas, and at different times of the year). vanEngelsdorp (2009) found that "colonies co-infected with 4 or more viruses were 3.7 times more frequent in CCD colonies than in control colonies."

It sure appears to me that viruses look pretty guilty, and the results of our field trial strongly support this hypothesis. But viruses ***generally*** don't take down a colony on their own, or there wouldn't be any colonies left alive today! Colonies appear to normally be able to "purge" a within-hive virus epidemic (Bailey 1983), ***unless it passes a certain threshold of numbers of bees infected*** (Sumpter 2004). Or, perhaps we should more clearly define what a viral "epidemic" is. Sumpter states: "An epidemic can have a range of severities, an epidemic may mean the virus persists at a low level with only a small proportion of bees being infected,… or it may mean the virus has spread through the whole colony."

So the question to me is, what factors or circumstances will kick the low-level viral epidemics that our colonies normally experience, into the sort of raging epidemic that results in rapid colony collapse?

Some clues come from beekeeper observations. In a recent self-reported survey, U.S. beekeepers ranked the following factors as contributing to colony losses (top to bottom): starvation, queens, weather, mites, weak in fall, *Nosema*, management, CCD, and pesticides (vanEngelsdorp 2010). Please note that colonies fail for many reasons, and that ***most deadouts are not the result of CCD***. This can make the investigation of the cause(s) of CCD difficult, especially when the Government is offering financial compensation to beekeepers who claim that their losses were caused by CCD! The above survey results indicate that most beekeepers will honestly report the true causes of their losses, to the best of their knowledge. And of the causes, four factors clearly stand out, both historically and associated with recent collapses.

The "Four Horsemen of Bee Apocalypse"

Poor nutrition, due to drought, extended rain, lack of bloom, or crop monoculture. Also includes starvation from lack of nectar or honey. I've written at length about bee nutrition—any fool can keep bees alive during a good nectar and pollen flow! It's generally when bees become nutritionally stressed that they get sick.

Figure 6. Honey bees have needed to deal with environmental toxins long before humans started using pesticides. This forager may be unwittingly poisoning its colony by working California Buckeye. Generally, my bees take the nectar, but do not collect the toxic pollen (the literature is unclear as to whether the nectar is also toxic). In years when the Buckeye products are not diluted by other nectars and pollens, this natural toxin can devastate colonies.

Cold snaps in spring or fall, ***when the colony is not in winter cluster.*** When I look at the historical accounts of collapse events, a cold snap often jumps out. ***Honey bees are tropical animals***, and the European honey bee has adapted to life in temperate climates by living in insulated cavities, and by forming a heated winter cluster consisting of long-lived, stress-resistant "winter bees." A cold snap when a colony is not prepared for it can chill the brood and stress the workers (especially by depressing their suppression of viruses, nosema, and chalkbrood).

Toxic chemical stress—This can be from natural plant toxins (Fig. 6), heavy metals, environmental pollutants (such as PCB's), any sort of pesticide, or beekeeper-applied miticides. Bees have evolved the ability to detoxify many chemicals (including pesticides), but that ability is depressed when they are nutritionally stressed or cold.

Parasite stress, especially infection with multiple parasites (remember, this includes viruses). There are several pieces of evidence linking parasites to CCD, notably that excessive numbers and variety of parasites often exist in the sick colonies (Cox-Foster 2007).

The first three "Horsemen" (nutrition, chill, and toxins) don't normally directly take down a colony (except in the case of severe starvation or pesticide poisoning)—***it generally takes a combination of more than one factor to do the job***, as long as the bee stock is robust and genetically diverse.

That leaves parasites to apply the *coup de grâce*. So which parasites can cause symptoms similar to CCD? There are four that stand out:

1. Viruses—covered above, perhaps a new strain.
2. Tracheal mite, but it simply isn't found to any extent in CCD colonies.
3. *Nosema apis*—the "old" nosema. This long-time scourge of the honey bee may cause colony collapse: "In a typical case of a colony being depleted because of a *Nosema* infection [normally in winter or spring], the queen can be observed surrounded by a few bees, confusedly attending to brood that is already sealed" (Anon 2004). However, there is generally distinct dysentery, and dwindling of the colony, and it normally doesn't kill strong, healthy colonies with adequate nutrition.
4. *Nosema ceranae*—A great body of research by Dr. Mariano Higes (2010) supports the hypothesis that *N. ceranae* causes colony collapses. However, the progression of disease as he describes it is not universally observed by either other researchers or beekeepers (nor in my own test yards), so there are likely other factors at play (let me be clear that I greatly respect the work of the Higes team, and that I correspond regularly with Dr. Higes and find him to be most helpful in trying to resolve this quandary). A number of researchers have suggested that poor bee nutrition and/or weather play a major role in the pathogenicity of *N. ceranae* (Pajuelo 2008).

So could one or both of the nosema "cousins" be involved in CCD? Cox-Foster (2007) found ***both*** species of nosema in all CCD colonies, **with *N. apis* at surprisingly high levels**. vanEngelsdorp (2009) found that "Co-infection with both *Nosema* species was 2.6 times greater in CCD colonies when compared to control colonies."

Then at the American Beekeeping Federation conference early this year, Dr. Jerry Bromenshenk stated that his extensive data from CCD sampling supported a dual-pathogen (virus + nosema) hypothesis, which was later echoed by a presentation this May by Dr. Jay Evans (2010).

One clue may be that nosema and viruses often go hand in hand—some viruses are only found in association with nosema, perhaps because a nosema infection breaches the integrity of the normal effectiveness of the gut wall as a virus barrier. However, clinching the virus/nosema link is difficult—the detection of viruses depends largely upon experienced technique and having the proper primers at hand, so it is

easy for some viruses to go undetected. There is also another critical point to keep in mind—***that both bee viruses and N. ceranae are constantly changing by recombination of their genes*** (de Miranda 2009; Sagastume 2010), ***so the virulence of the parasites could vary from month to month, area to area, and colony to colony!***

So, can researchers induce CCD by inoculation with viruses (and fulfill Koch's second postulate)? Dr. Diana Cox-Foster (2008) inoculated nucs in a greenhouse, and found that "rapidly increased death of bees was observed within a week after feeding the colony sugar-water containing the IAPV….Although these symptoms were consistent with reported symptoms of CCD, effects on the brood were not like that observed in CCD colonies. In CCD colonies, brood appears to remain healthy and strong, with the primary death being observed in adult bees." I will return to this observation later, as I do not feel that it precludes IAPV from causing CCD-like symptoms, however, in later surveys in other areas, IAPV was not found in the majority of collapsing colonies, so is unlikely that IAPV alone is the major cause of CCD.

In my own trials with caged bees in an incubator, inoculation with a purified cocktail of mixed viruses, originally extracted from collapsing colonies, caused rapid and near complete mortality of the bees in some cages at about nine days. Dr. Wayne Hunter confirmed that this is normal. In my field trial, feeding the same cocktail in syrup also initiated collapse of colonies within ten days, some failing rapidly, some suffering an agonizingly slow death over the course of months! ***This is a very important point—that oral ingestion of viruses by adult bees can cause rapid illness and death.*** I will expound upon this point later in this series.

OK, so we've got some likely suspects. In the next installment, I will explain two critical aspects of the honey bee immune response that can lead to colony collapse, detail how the "Four Horsemen" fit in, and present a model of the process.

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Honey Bee Nutrition

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Honey bees, like any other animal, require essential ingredients for survival and reproduction. What we know about honey bee nutrition now was learned mostly during the 1950s-70s, and recent studies specifically on honey bee nutrition are very few. Honey bees require carbohydrates (sugars in nectar or honey), amino acids (protein from pollen), lipids (fatty acids, sterols), vitamins, minerals (salts), and water. Additionally, these nutrients must be present in the right ratio for honey bees to survive and thrive.

1. Carbohydrates

Like other animals, honey bees need carbohydrates as an energy source. All carbohydrates are first converted to glucose, which enters the Krebs cycle and produces ATP, the fuel in nearly all cells, and carbon dioxide and water as by-products. Aside from being used as an energy source, glucose can also be converted to body fats and stored. A worker bee needs 11 mg of dry sugar each day (Huang et al., 1998). This translates to about 22 ul of 50% sugar syrup per worker per day. A colony with 50,000 bees therefore needs 1.1 liter (about 2 pounds) of 50% sugar syrup per day (about half a gallon of nectar at 25% sugar concentration), which does not include brood rearing and other activities. A colony of this size therefore will consume almost 700 pounds of nectar per year, assuming the nectars have a 50% sugar concentration! Of course, consumption is lower during winter when temperature is not regulated at 35C, but perhaps that cancels out the brood rearing and flight activities.

1.1. Collection of Nectar

Nectar is the main source of carbohydrates in the natural diet of honey bees. Sugar concentration in nectar can vary widely, from 5% to 75%, although most nectars are in the range of 25% to 40%. A honey bee uses her proboscis to suck up nectar from flowers and stores the liquid in her honey crop. The crop is a specialized part of the digestive system, and has a structure between it and the midgut, where digestion takes place. This structure, the proventriculus, can let some nectar in when the forager needs energy on its way home, remove pollen inside the nectar, and serve as a one-way valve to prevent backflow from the midgut. This ensures that no contamination of nectar or honey can take place. For this reason I tell people that honey is definitely not "bee vomit." The honey crop is also the site of synthesis of ethyl oleate, a pheromone from foragers that tells young bees that they do not need to develop into foragers. The average weight of the nectar inside the crop is 25.5±15 mg (Calderone and Page, 1992), quite a feat considering that an average worker bee weighs 120 mg.

1.2. Conversion of Nectar into Honey

Foragers add enzymes (invertase, glucose oxidase) to nectar during foraging, so some digestion is already occurring before nectar is brought back to the hive. Invertase converts sucrose into two six-carbon sugars, glucose and fructose. A small amount of the glucose is attacked by the second enzyme, glucose oxidase, and gets converted into gluconic acid and hydrogen peroxide. Gluconic acid makes honey acidic, and hydrogen peroxide has germ-killing properties, both contributing to honey's unfriendly disposition to bacteria, mold, and fungi. Foragers then pass the nectar to special "receiver" bees, which are middle-aged bees that have finished nursing, but have not started foraging yet. Receiver bees deposit nectar into cells and dry the nectar either on their mouthparts, by forming a large drop between the proboscis and the mandibles, or

Dr. Zachary Huang

by fanning over the cells. The moisture has to be reduced to 17%-18% before bees consider the honey "ripe" and then seal the cells. Honey with high glucose levels (such as canola honey), will crystallize very quickly and should be extracted as soon as possible.

1.3. Toxic Substances in Nectar and Sugar Supplement

Adult bees can utilize glucose, fructose, sucrose, trehalose, maltose, and melezitose, but bees are unable to digest rhaminose, xylose, arabinose, galactose, mannose, lactose, raffinose, melibiose or stachyose. Most of these sugars are also toxic to honey bees. About 40% of sugars found in soybeans are toxic to bees, and therefore care should be taken when using soybeans as a pollen substitute.

Other plants are toxic to bees due to the presence of alkanoids in nectar. These include: azalea *(Rhododendron molle),* azure *(Aconitum carmichaeli),* black hellebore (*Veratrum nigrum*), California buckeye *(Aesculus californica),* Chinese alangium *(Alangium chinense),* Chinese bittersweet (*Celastrus angulatus*), jimson weed *(Datura stramonium),* plume poppy (*Macleaya cordata*), happy tree (*Camptotheca acuminate*), Summer Titi (*Cyrilla racemiflora*), tea (*Camella sinensis*) and oil-tea (*C. olelfera*). Nectar from these plants is usually toxic to both adult bees and brood, and the majority of them are also toxic to humans.

Honey dews are sugary secretions produced by homopteran insects (aphids, leafhoppers, and woolly aphids). Honey dews are produced because the low protein diet (plant sap) that these insects rely on force them to drink excess fluids to obtain enough amino acids, and thus need to secrete the excess sugary water. Honey bees will collect honey dews to make honey dew honey. This type of honey is praised by some people due to its strong and unique flavor, but can cause dysentery in overwintering bees due to indigestible sugars or high levels of minerals. Adult bee paralysis in bees in Germany was also attributed to high Potassium and/or Phosphorus and low Sodium concentrations.

HMF (hydroxymethylfurfural) is formed in honey and high fructose corn syrup (HFCS) at high temperatures due to acid-catalyzed dehydration of hexose sugars, with fructose more prone to its formation. HMF above 30 ppm (parts per million) is considered toxic to honey bees. HFCS with such levels of HMF has been found to cause high mortality in cage studies (LeBlanc et al., 2010), as well as higher mortality than bees infected with *Nosema ceranae* (Z.Y. Huang, unpublished data). Beekeepers using HFCS for bee feeding should pay special attention to storage conditions, although many times, the batch from the supplier might have already become "bad" due to high temperatures either during transportation or storage.

Some honeys are not toxic to bees, but to humans. A good example is honey from tutu *(Coriaria arborea*), which has caused fatalities in New Zealand.

2. Protein

2.1. Importance of Pollen

Pollen provides bees with protein, minerals, lipids, and vitamins (Herbert and Shimanuki, 1978). All animals need essential amino acids, which must be obtained externally and cannot be synthesized by animals. Honey bees also need the same 10 amino acids (see section 2.5) as other animals (e.g., humans). These amino acids are obtained from pollen only, because honey bees do not have any other sources of protein. Pollen collection by a colony ranges from 10-26 kg per year (Wille et al., 1985). When honey bees are provided with insufficient pollen, or pollen with low nutritional value, brood rearing decreases (Turner et al., 1973; Kleinschmidt and Kondos, 1976, 1977) and workers live shorter lives (Knox et al., 1971). These effects ultimately affect colony productivity (reviewed by Keller et al., 2005). Shortages of pollen during rainy seasons can cause colony decline or collapse (Neupane and Thapa, 2005). Recent studies have shown that spring pollen supplement can work as insurance (when spring weather is bad) for faster spring buildup and higher honey yield (Mattila and Otis, 2006a), and can reduce the effects of varroa parasitism (Janmaat and Winston, 2000) and nosema infection (Mattila and Otis, 2006b).

2.2. Collection of Pollen

Pollen is collected either by pollen foragers, which specialize in pollen collection, or nectar-foragers, which happen to be dusted with pollen. Pollen is brushed off the worker's body by the front and middle legs, and transferred to a special structure in the hind leg called the cubicula, or pollen basket. Pollen foragers unload their pollen by "kicking" the pollen pellets off their legs into a cell, which often already has pollen in it, and then the pollen pellets are "hammered" into a paste-like consistency by other workers. Due to the secretions added by bees, the pollens in each cell go through a lactic fermentation. The main effects of fermentation seem to be the reduction of starch (from 2% to 0%), increases in both reducing sugars and fiber, and reduction of ash and pH (Herbert and Shimanuki, 1978). Three bacteria that might contribute to lactic acid fermentation are found in bee bread: Pseudomonas, Lactobacillus, and Saccharomyces. Recently, it was shown that pollen collected by bees can easily be inoculated and fermented, and bees consumed it in the same way they consume unfermented pollen (Ellis and Hayes, 2009).

The weight of two pollen pellets from a pollen forager ranges from 7.7-8.6 mg (Rose et al., 2007). A colony will collect more pollen if it has more brood pheromone, more queen pheromone, or is genetically disposed to collect more pollen. Robert Page (currently at Arizona State University) has selected high and low pollen hoarding lines, whereby the high pollen line will collect so much pollen that there is no room to rear brood, and the low pollen line will perish without supplementing pollen artificially.

2.3. Processing Pollen into Proteins

Pollen is mixed with glandular secretions to produce "bee bread," which is consumed by young bees, considered the "social stomach" for protein digestion (because foragers cannot digest pollen directly, but still need protein (Moritz and Creilsheim, 1987). Rearing one larva requires 25-37.5 mg protein, equivalent to 125-187.5 mg pollen (Hrassnigg and Crailsheim, 2005).

Newly emerged bees have undeveloped hypopharyngeal and mandibular glands. Hypopharyngeal glands are paired glands inside worker's head, consisting of a long central duct with many "grapes" (acini) attached. The glands will only develop after consuming a lot of pollen for the first 7-10 days. The glands first secrete the protein-rich component of royal jelly in young bees, but then secrete invertase, which is used to convert sucrose to simple sugars (fructose and glucose), in foragers. Mandibular glands are simple, sac-like structures attached to the base of each mandible. The glands secrete lipid-rich components of the royal jelly in young bees, but produce an alarm pheromone (2-heptanone) in foragers.

2.4 Royal Jelly Composition

Royal jelly (RJ) is 67% water and 32% dry matter. The dry matter is composed of 12.1% carbohydrates, 4.0% lipids, 12.9% proteins, and 1.1% ash (Wangchai and Ratanavalacai, 2002). These percentages vary slightly in different seasons. RJ also contains many trace minerals, some enzymes, antibacterial and antibiotic components, and trace amounts of vitamin C. The fat-soluble vitamins, A, D, E and K, are absent from royal jelly. The 13% of total proteins consists of 52 different proteins (Yu et al., 2009). The majority of the identified proteins (47 out of 52) are major royal jelly proteins (MRJPs), named as MRJP1 through 6, each of which has many variations. Three enzymes were also detected in the RJ: glucose oxidase, peroxiredoxin, and glutathione *S*-transferase. It is no doubt that RJ is highly nutritious for bee larvae. Bee larvae grow exponentially during their first 4.5 days of life, from 0.36 + 0.008 mg (12 hr larvae) to 131.44±18.7 mg (4.5 days), reaching a weight of 159.66±12.91 mg after being capped (Petz et al., 2004). The weight gain is nearly 1000 times when compared to the weight of the eggs (0.17 mg, Taber et al., 1963). Furthermore, bee larvae do not defecate at all during the first 5 days of life, which is necessary because otherwise larvae would be feeding on their own waste. The midgut and hindgut are not connected until the last molt into the mature larvae, therefore preventing the possibility of defecation. After defecation, the larva stops feeding, starts spinning a cocoon, and straightens itself along the cell axis, and becomes a prepupae. Three days later it will pupate and eventually, (after one week) emerge as an

adult.

It is not yet clear what role(s) the major royal jelly proteins play in honey bee larvae nutrition. Larvae can survive on an artificial medium without RJ or proteins for 3-4 days, but they all die 1-2 days before defecation (Z.Y. Huang, unpublished results). Until a chemically defined media is available for honey bee larvae, we will not know the roles various components of RJ play in larval growth and development.

2.5. Measurements of Pollen Quality

Pollen quality can be measured by two methods: crude protein levels or the composition of amino acids. Ten amino acids have been found to be "essential" for honey bees (deGroot, 1953), meaning that bees cannot synthesize or even convert other amino acids to acquire them, and therefore must obtain them directly from food, either as free amino acids or digested from protein. These 10 amino acids are listed in Fig. 1. The crude protein level tells us how much protein a particular plant pollen has, and higher crude protein levels are better than lower ones. However, if the 10 amino acids are not balanced, bees cannot fully use what is available in the pollen. For example, Fig. 1 shows that honey bees need 4% isoleucine from the total available amino acids, if one type of pollen has only 2% isoleucine, then bees can only use 50% of the total protein because isoleucine will be the limiting factor (Stace, 1996), forcing bees to ingest twice the amount of total pollen to obtain the needed isoleucine, essentially wasting half of the total protein.

2.6. Not All Pollens Are Created Equal

Different pollens have different nutritional value to honey bees. Schmidt et al. (1987) studied the nutritional value of 25 pure pollens by feeding caged bees the different pollens, using sugar as a negative control, and mixed pollen as a positive control. Consumption of test pollen diets varied dramatically among test pollens, with a mean consumption of 16.5 mg pollen per bee for the first 10 days and a range of 1.9-29.0 mg per bee. Both pollen consumption rates and crude protein levels are correlated with the ability to improve longevity. Pollens that decreased worker longevity include ragweed (*Ambrosia),* a rust spore (*Uromyces)*, cattail (*Typha)*, and Mexican poppy (*Kallstroemia)*. Those that slightly improved worker longevity include terpentine bush (*Haplopappus),* desert broom *(Baccharis)*, and dandelion (*Taraxacum).* The best pollens are those from Mormon tea *(Ephedra),* mesquite *(Prosopis),* blackberry *(Rubus),* and cottonwood *(Populus)*. Mixed pollen consistently performed very well. In another study, Schmidt et al. (1995) concluded that bees foraging in sesame and sunflower fields should be supplemented with other pollen, but rapeseed (canola) pollen is highly nutritious to bees and does not need supplementing. Through these studies, Schmidt concluded that factors contributing to increased bee longevity include presence of attractants and phagostimulants, so that bees will readily consume large amounts of pollen; lack of toxic compounds; and a good nutrient balance or level. No studies have tried to correlate the amino acid profile of a pollen and its ability to improve worker longevity.

A few pollens are toxic to honey bees, with some killing the adults (e.g., *Zigadenus*), others killing the brood (e.g., *Heliconia*). Other plants with toxic pollen are balsa (*Ochroma lagopus)*, California buckeye (*Aesculus californica*), and Flame of the Forest (*Spathodea campanulata)*.

2.7. Pollen Substitute for Bees

A good pollen substitute for honey bees should have the same features as a good pollen: 1). palatability (bees will readily consume it), 2). Digestibility (it is easily digested by bees), and 3). Balance (it has the correct the amino acid balance and enough crude proteins). Currently, there are five commercial pollen substitutes for honey bees in the U.S.: Brood Builder®, Bee-Pol®, Bee-Pro®, Feed-Bee®, and MegaBee®. It appears that Brood Builder® and Bee-Pro® are soy-based, and Feed-Bee® and MegaBee are non-soy-based. I have insufficient information for Bee-Pol.

Cremonez et al. (1998) fed caged bees various diets and used hemolymph protein titer to assess their quality, with higher protein titer suggesting higher quality. Six-day-old bees had protein concentration of 27.6, 24.1, 11.4, 3.98, and 2.2 ug/ul, for bee bread, soybean/yeast, pollen, corn meal and sucrose, respectively. De Jong et al. (2009) used the same assay to assess the quality of commercial pollen substitutes. They found that bees feeding on Feed-Bee®, Bee-Pro®, pollen, acacia pod flour diets and sucrose had hemolymph titers of 9.42, 8.95, 6.26, 6.0 and 3.56 ug/ul, respectively. It would be informative to see if the high protein in blood translates to longer life in either cages or small colonies.

Gregory (2006) reported that for longevity inside small colonies of bees fed different diets, ranked by superiority: fresh pollen > Feed-Bee® > Bee-Pro® > old pollen. In cage studies, Feed-Bee® had similar hemolymph protein to fresh pollen. She also reported that Feed-Bee® contained 34.9 mg sucrose and 2.03 mg stachyose, while Bee-Pro® contained 8.85 mg sucrose and 4.55 mg stachyose. Stachyose is toxic to honey bees unless it is diluted to below 4% with 50% sucrose.

Degrandi-Hoffman et al. (2008) evaluated three diets, Bee-Pro®, Feed-Bee®, and MegaBee®, in two separate trials. In both trials, Bee-Pro® and MegaBee® patties were consumed at rates similar to pollen cake, but Feed-Bee® was consumed significantly less. Higher food consumption was significantly correlated with increase in brood area and adult population size. According to this study, MegaBee appeared to be superior to both Bee-Pro® and Feed-Bee® in terms of brood production or adult population.

Honey bee collected pollen is the only usable diet for rearing bumble bee colonies in commercial settings. None of the current honey bee pollen substitutes can replace real honey bee collected pollen in rearing bumble bee colonies. No colonies can be produced from a single queen using these substitutes (H. Burroughs, personal communication).

2.8. Pollen Nutrition May Play a Role in CCD

Recently, a new threat, Colony Collapse Disorder (CCD), has emerged to attack the honey bees in the U.S. and has caused 30%-40% loss of bee colonies each year since the fall of 2006 (CCD working group, 2007). CCD-affected colonies have greatly reduced adult bee populations, with only a few hundred workers and the queen left, but with many frames of brood, which suggests rapid depopulation of adults. The cause of CCD remains unknown, but many scientists believe that it may be caused by a combination of factors, such as pesticides, parasites, nutritional stress, and stress from long distance transportation. There is a growing body of evidence showing that poor nutrition can be a major player in affecting honey bee health. Eischen and Graham (2008) demonstrated that well-nourished honey bees are less susceptible to *Nosema ceranae* than poorly nourished bees. Honey bees that were treated with imidacloprid and fed *Nosema* spp. spores suffered reduced longevity and reduced glucose oxidase activity, indicating an interaction between the two factors (Alaux et al., 2010a). Naug (2009) tested the hypothesis that nutritional stress due to habi-

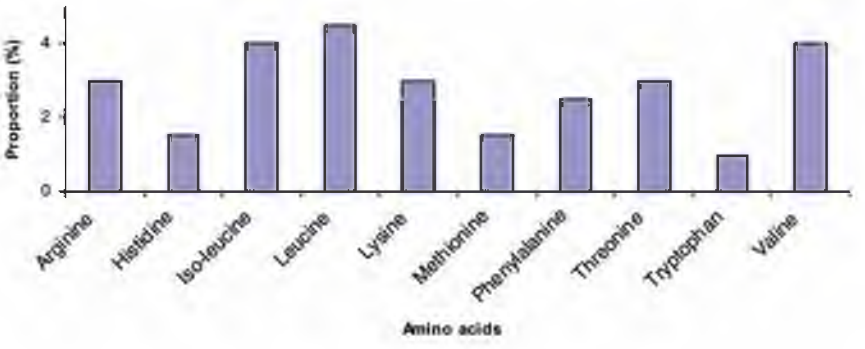

Fig. 1. Proportion (%) of the 10 essential amino acids needed by honey bees (deGroot, 1953).

tat loss has played a major role in causing CCD by analyzing the land use data in U.S. He showed a significant correlation between the number of colony losses due to CCD from each state and the state's ratio of open land relative to its developed land area. Furthermore, Naug showed that these states with the largest areas of open land have significantly higher honey production. It therefore appears that honey plants (especially those in natural, undeveloped areas) might play a major role in honey bee health.

2.9. Polyfloral Diets Healthier for Honey Bees

Schmidt conducted a series of studies and convincingly showed that in general, mixed pollen given to caged bees let bees live longer than those on a single species of pollen (Schmidt, 1984; Schmidt et al., 1987, 1995). In a very recent study, Alaux et al. (2010b) showed that polyfloral diets from mixed pollen enhanced some immune functions compared with monofloral diets, in particular glucose oxidase activity, suggesting that the diversity in floral resources provided bees with better in-hive antiseptic protection. These studies suggest that bees feeding on a single type of pollen are not as healthy as those on a variety of pollens. With the modern way of agriculture— increasingly larger areas of mono-cultured crops— honey bee health might be adversely affected.

3. Other Nutrition

3.1. Sterols and Lipids

A sterol, 24-methylene cholesterol, is common in pollen and is the major sterol source for honey bees. Nearly all insects need to obtain sterol from their diet because of their inability to synthesize it directly. Sterol is the precursor for important hormones such as molting hormone, which regulates growth because it is required at the time of each molt. It is not clear what other lipids are required by honey bees, but most likely normal consumption of pollen provides for all the lipid requirements. Pollen with low fat content is less likely to be consumed by honey bees, but can be made more attractive to bees with the addition of lipids. The total lipid concentration within a pollen supplement is recommended to be 5%–8%.

3.2. Vitamins

Nurse bees are thought to need the following vitamin B complex for brood rearing: thiamine, riboflavin, nicotinamide, pyridoxine, pantothenic acid, folic acid, and biotin. Ascorbic acid (vitamin C) also seems essential for brood rearing. Like sterol and lipids, the vitamin needs of a honey bee colony are satisfied if pollen stores are abundant in the hive or fresh pollen is being brought into the colony. It is not known whether micro-organisms naturally present in the alimentary canal of bees may play a role in providing vitamins and other essential substances.

3.3. Minerals

The mineral requirements of honey bees are poorly understood. High amounts of potassium, phosphate, and magnesium are required by all other insects, and so presumably are by honey bees as well. Excessive levels of sodium, sodium chloride, and calcium have been shown to be toxic to honey bees. Again, all the required minerals can be obtained from pollen, although nectar also contains minerals. Dark honey contains higher levels of minerals. The optimal ash concentration for maximum brood rearing seems to be at 0.5%–1%. Pollen with more than 2% ash inhibits brood production.

3.4. Water

Honey bees forage for water for two purposes. One is to use it to dilute honey so that honey can be added to brood food. The second is to use water to cause evaporative cooling by fanning over a thin layer of water when the ambient temperature is over 35° C. During winter time, bees have enough water from condensation over the inner cover, so the issue is usually too much water, which can drip on the cluster and kill bees if there is not adequate ventilation. When bees have a choice, they usually prefer water with some salts (e.g. a swimming pool over a lake). Other species of honey bees (e.g. *Apis dorsata, A. cerana*) have been observed to forage on urinals or open restrooms in Asia. This is probably because bees are not obtaining adequate sodium from their nectar or pollen.

CONCLUSIONS

Honey bees can obtain all of their nutrients naturally if bees are in a natural setting. Unfortunately, modern agriculture has necessitated large scale mono-cropping which can be harmful to honey bees. This is mainly because each plant species has a specific nectar or pollen characteristic. Much like humans, a lack of variety in foods can cause problems. Many studies have shown poly-floral pollen diets are superior to a single species of pollen, with perhaps one exception (rape seed pollen alone can be excellent). We urgently need to understand the implication of each mono-culture crop on honey bees. For example, how much stress do bees experience when feeding exclusively on almond nectar and pollen for 3-4 weeks? How long do they need to (or can they?) recover after the stressful period? Are there "supplemental" crops available to reduce or eliminate such a stress? By understanding these questions and providing solutions to them, we will be able to make bees as healthy as possible.

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LOCALLY ADAPTED, VARROA RESISTANT HONEY BEES: IDEAS FROM SEVERAL KEY STUDIES

By STU JACOBSON*

On this warm spring morning my home beeyard looks very peaceful. However, as in beeyards almost everywhere, there is an ongoing struggle between the forces on our side, honey bees, and those on the other side, parasitic *Varroa destructor*. In most beeyards our side can't survive without our using chemicals to control the varroa; at least some of these are chemicals believed to stress our bees, negatively affect their immune systems and possibly make them more susceptible to viruses and other microorganisms (Mullen et al, 2010; Ostiguy, 2010). This past winter was especially stressful on colonies. In my area of central Illinois losses averaged at least 50%; in other regions they have been worse. An increasing number of beekeepers realize that we are not on a sustainable path; that we cannot continue to depend on chemicals alone without suffering major losses. Many recognize that varroa resistant honey bees that are adapted to local environmental conditions are critical to reducing chemical usage and to implementing an Integrated Pest Management approach to mites and diseases.

My interest in locally adapted, mite resistant stock increased greatly over this past year after I learned about four different apiaries in Illinois where colonies had survived 5-11 years without treatment. This made me want to search for studies of survivor or mite-resistant stock from a scientific perspective. In my pursuit I came across several thought-provoking articles. Many of you may have already read one or more of them. However, perhaps like me, at the time you may have overlooked their importance. I have chosen two specific articles, as well as several related ones from an ongoing breeding/research project to summarize briefly here. It is my hope that after reading the present article, readers will have a better understanding of some of the challenges and resources available to those who wish to breed or acquire varroa resistant, locally adapted honey bees.

Local Stocks as Sources of Varroa Resistant/Tolerant Honey Bees

In 2000 Erickson et al published *Producing Varroa-tolerant Honey Bees from Locally Adapted Stock: a Recipe*. This is an important article that should be read – and reread — by anyone concerned about breeding varroa resistant honey bees. I didn't appreciate its significance when I first read it because the project was conducted in Arizona and I had assumed that the bees being selected were Africanized. Because that subspecies is rightly regarded as highly defensive, as well as resistant to varroa, I dismissed the study's relevance. However, in an earlier article the authors point out that they started the project with non-Africanized bees and that any colonies in the program that had Africanized traits were eliminated (Erickson et al 1998). They also stated that Africanized bees in another, distant apiary were no less susceptible to varroa than the study colonies of European stock. I now believe that the plan described in the 2000 article is very useful, regardless of the degree of Africanization of the stock they worked with.

The Italicized words below are taken di-

Figure 1. Conducting a hygienic test: pouring liquid nitrogen from Styrofoam cup into a cylinder "screwed" down into capped brood. Eye protection and tongs are important; welder's gloves aren't necessary.

*Dr. Jacobson is retired from the University of Illinois at Springfield and coordinates the Illinois Queen Initiative.

rectly from the 2000 article without altering any wording, although I did not include the authors' additional explanations regarding each point. These are the article's major points:

1. *Identify Varroa-tolerant colonies in your apiaries.*
2. *Move all colonies identified as Varroa tolerant to a single isolated test apiary. This apiary should be at least 3-4 miles from managed colonies treated for mite control.*
3. *Monitor Varroa levels in the selected colonies every three months.*
4. *Graft only from those colonies with the lowest mite loads…Never use colonies with known problems such as disease, poor productivity or unacceptable defensive behavior, no matter how Varroa-tolerant they may appear*
5. *Mate all queens in the isolation test apiary.*
6. *Requeen colonies in your other apiaries as queens become available. Once requeened, these colonies become candidates for future selections of improved Varroa-tolerance, hence, the need for good record keeping.*

Figure 2. Results of hygienic test at an Illinois Queen Initiative training: better than 95% removal of freeze killed brood in 24 hours.

Figure 3. These results indicate that the workers were not hygienic.

Note the use of the term *tolerance* where most articles on the same topic use the term *resistance*; I will use the latter term in the rest of this article. Resistant bees, to me, are ones that manage to prevent varroa populations from increasing to the point that they cause severe economic damage or colonies to collapse, although not necessarily eliminating the mites.

This plan emphasizes starting with locally-adapted stock rather than specific hygienic, disease resistant (e.g., the Minnesota Hygienic) or varroa sensitive hygiene lines. According to the authors, varroa resistant stock may be found in 3-10% of colonies in a given apiary (Erickson et al 2000). The article also provides information on a number of methods of identifying varroa resistant colonies. The authors recommend the alcohol wash test for monitoring varroa levels; sugar roll tests would also work. They advise eliminating all colonies from the breeding program and isolation yard with more than 15 mites per 100 bees; later on lowering the cutoff to 10 or fewer mites per 100 bees. However, as mentioned later in their article, requeening with queens from colonies with the lowest mite loads is less drastic, but a less immediate alternative to physically moving undesirable colonies. The authors also recommend making sure that survivor colonies have plenty of drones and suggest requeening entire yards rather than doing this piecemeal. The authors did not mention the use of management approaches such as screened bottom boards, dusting with powdered sugar or widely spacing hives so as to reduce movement of varroa between colonies. When Erickson et al published their "recipe" in 2000, their program colonies had gone six years without treatment. Earlier, in their 1998 article, the same authors state that overall the colonies averaged 6-7 mites per 100 bees and that four cooperating beekeepers, including one each in Georgia and New Mexico who used broadly similar approaches, had similar levels of varroa in their colonies.

Erickson and colleagues tested the "recipe" in a 600 colony commercial operation in Arizona (2000). Unlike the rather wasteful Bond "Live and let die" approach, it does not advocate stopping all treatments and letting weakened colonies die; rather it advocates *continuing treatment and requeening* colonies with varroa levels above 15 mites per 100 bees. Breeding progress under these conditions should be faster than with the Bond plan. The authors point out that their plan may not work equally well in all regions. In addition, their guidelines on mite loads may not apply equally to other areas of the country. Further, while the 2000 article states that one can achieve a "varroa-tolerant population" within 2 years, it's important to note that some of the stock they began the breeding program with came from four colonies out of 36 that had survived 3

years without varroa treatments (Erickson et al 1998).

Clearly, the amount of time it will take until you have resistant colonies will depend on the stock you begin with. If you have access to bees that have gone two or more years without treatment for varroa, it will take less time to reach your goal of varroa-resistant bees. I would think that stocks within a radius of 100-200 miles from an environment similar to your own would be a good starting place, if they already possess at least some resistance to varroa. Another point regarding local stock is that while possessing resistance to varroa, it may lack other desirable characteristics. For example, in my area many of the feral colonies are quite defensive. It's also advisable to start with stocks that are hygienic, testing your colonies with the liquid Nitrogen test, as shown in Figures 1-3.

Take Home Lesson No. 1: Colonies from your area are potential sources for breeding varroa resistant/tolerant honey bees that are adapted to local environmental conditions. Eliminating colonies with undesirable traits such as defensive behavior or disease susceptibility, as well as keeping good records, are critical to success.

Feral Colonies Coexist with Varroa Mites in the Northeastern U.S.

In 2007 Tom Seeley published an article entitled *Honey Bees of the Arnot Forest: a Population of Feral Colonies Persisting with Varroa Destructor in the Northeastern United States.* Seeley studied feral bees isolated from managed apiaries in upstate New York. He found that this population remained quite stable; most of the colonies survived over a three-year period from 2002 to 2005. Swarms from these feral colonies that took up residence in single, deep bait hives placed in trees later proved to be infested with varroa mites. However, their mite populations did not surge to high levels in late summer as occurs in most managed colonies.

Seeley then compared varroa levels in colonies derived from Arnot Forest bees with colonies of New World Carniolan (NWC) bees in an established apiary. At the end of the 4-month study, there were no differences in the growth patterns of the mite populations between the two colony types; the feral stock appeared to be no more resistant to varroa than the NWC stock. However, unlike the mites in the apiary, the Arnot Forest varroa populations were less harmful to their feral honey bee hosts because they did not increase to high levels in late summer as did the varroa in the apiary. The lower rate of reproduction means that the Arnot mites would transmit fewer viruses and would be less likely to kill their host colonies. Seeley concluded that there is a "stable bee-mite relationship" in the Arnot Forest characterized by varroa mite avirulence, not honey bee host resistance (See Sidebar A).

As Seeley (2007) noted, feral colonies distant from managed colonies are more likely to develop a "balanced host-parasite relationship," in which the parasite is much less harmful to its host. In part this is because when beekeepers treat colonies for varroa, they help to perpetuate genes susceptible to the mites. Further, beekeeping practices such as prevention of swarming, crowding colonies and transferring combs of bees and brood between colonies may reduce the chances of development of mite resistant bees (Sidebar A).

It is hard to disagree with Seeley's conclusion that the Arnot mites have evolved to be less harmful to their bee hosts. However, it's also quite possible that the Arnot bees and their mites have coevolved in a way that the bees possess one or more means of resistance that may have "nudged" their mites toward a lower reproductive rate and avirulence. Seeley's comparison between the Arnot and New World Carniolan colonies lasted only 4 months (July-October), which presumably would not have been sufficient time for such co-evolution to occur between the "domestic" varroa and their feral hosts (Seeley 2007).

SIDEBAR A: Parasite Avirulence and Vertical and Horizontal Transmission

According to theory, avirulence — a less damaging form of parasitism — is favored under conditions where parasitic organisms are spread between related individuals, a process known as vertical transmission (Seeley, 2007). Horizontal transmission — or the transfer of parasites between unrelated hosts—is thought to favor evolution of virulent parasites that maximize their reproduction and often kill their hosts before infecting other host individuals (Seeley, 2007). Vertical transmission in honey bees would typically occur from a honey bee colony to daughter swarms cast from it; or alternatively from splits from a colony using queen cells from that colony. Horizontal transmission would occur typically from robbing, drift between unrelated colonies and through beekeepers transferring combs of bees and brood between unrelated colonies. Feral colonies are generally widely spaced and thus should have much less horizontal transmission. Locating colonies close to each other is typical in most bee yards and should increase horizontal transmission and, theoretically, virulence of varroa. However, Erickson et al (2000) achieved major reductions in varroa populations without apparently altering management practices such as spacing of colonies to reduce horizontal transmission.

The Arnot Forest article points out the role that varroa genetics appear to play in reduction of mite populations. There is a need to think more holistically and recognize that there is an ongoing evolutionary interaction between the bees and varroa. Breeding "better" varroa may not be practical; alternatively, it may be advantageous to acquire varroa from survivor yards along with the survivor colonies from those yards in order to achieve good survival in the face of varroa mites.

Take Home Lesson No. 2: In addition to acquiring and/or breeding varroa resistant stocks, beekeepers may make more rapid progress in achieving reduced varroa levels if we treat for populations of more harmful mites and replace them with less harmful, "good" varroa from survivor yards.

Varroa Sensitive Hygiene: A Resistance Trait Present in US Honey Bee Stocks

In 1997 John Harbo and Roger Hoopingarner reported on European honey bees in the US that had partial resistance to varroa mites. However, it wasn't until 2006 that it was discovered that the resistance to varroa is due to the varroa sensitive hygienic trait (VSH, formerly suppressed mite reproduction or SMR) (Ibrahim and Spivak 2006). It's important to note that the VSH trait is targeted toward removal of varroa-infested pupae; whereas "regular" hygienic behavior (such as found in the Minnesota Hygienic line) focuses on removal of pupae infected with American foulbrood or chalkbrood (REFS). Since Harbo and Hoopingarner published their article, there have been a series of publications that provide additional information on the varroa sensitive hygiene trait and the line with the same name. The major means of resistance is that the nurse bees that have this trait detect the presence of varroa in the cells of worker pupae, uncap the affected cells and remove the pupae. As a result, any immature mites present die, although not necessarily the mother varroa. There is also evidence that the mites do not reproduce as readily in VSH brood (Ibrahim and Spivak 2006).

Interestingly, previous research had suggested that bees with the VSH trait selectively remove pupae on which varroa are reproducing. The most recent data suggest, however, that they do not target reproductive mites, but rather that their uncapping behavior probably disrupts mite reproduction and results in eventual declines in varroa numbers. This latest research also suggests that the VSH bees are not detecting the mites directly, but instead changes in the pupae due to the mites (Harris et al 2010); perhaps due to feeding on the pupae.

Honey bee breeders can incorporate genetic resistance to varroa into existing commercial lines to provide significant reduction of this destructive pest. Crosses with other lines that are about 50% VSH give good control of varroa populations. In a study in Alabama, colonies with workers that were 50% VSH x 50% unselected Italian crosses had levels of mites comparable

to colonies of pure Russian bees; these two groups had substantially fewer varroa than the pure Italians. There were no differences in honey production.

A second study in the upper Midwest compared an Italian control line with the Minnesota Hygienic line, as well as crosses with the latter, that averaged either 37% or 18% VSH (Ibrahim et al 2007). Even colonies with workers averaging 18% VSH had significantly fewer mites on adult bees than control Italian colonies or MN Hygienic colonies; a 50-75% reduction compared to the Italians. The MN Hygienic colonies had levels of varroa intermediate between the VSH crosses and the control line. The 37% VSH crosses had comparable honey production to the MN HYG colonies and less than the Italian control line in one operation, but not the other. Crossing the VSH line with hygienic lines of bees may well give superior results to crossing with non-resistant lines, as was done in the Alabama study mentioned above.

In my experience VSH queens crossed with local stock perform admirably. The crossbred workers are gentle. More importantly, when introduced into non-VSH colonies they start to clean mites out of capped brood rapidly. Under these circumstances the brood patterns in these colonies are often quite spotty, which initially can raise concerns (Figure 4). However, within one-three months the patterns look normal, as a result of the hygienic behavior reducing varroa levels. Last year was a terrible one for honey; and the VSH queens were introduced late in the season, so I was not able to evaluate honey production.

Take-Home Lesson No. 3: The Varroa Sensitive Hygiene line of bees has genetic resistance to varroa that can be incorporated successfully into existing commercial lines as well as locally-adapted stocks.

How Can We Use the Information in These Articles?

My intent in summarizing the above-mentioned articles is to provide those interested in breeding locally-adapted, varroa resistant, bees with information that can assist them in designing or modifying their breeding projects. The article by Erickson et al (2000) demonstrates that one can start with local stocks and select successfully for varroa resistant colonies while continuing to treat for these pests. In the process you do not have to let your colonies collapse. A *key step in their approach, which is also applicable to other breeding programs, is to replace queens from colonies with high varroa populations on a reasonably frequent basis.* While the authors' recommendations of monitoring every three months may be less practical in northern climates, it's advisable to replace poorly performing queens at least in spring and in late summer/fall as needed.

Seeley's article (2007) appears less immediately practical than the studies by Erickson and his colleagues. However, it does help us to understand that in many cases it's not just honey bee genetics that we must try to change. I am not aware of a workable approach to breeding "better," or less harmful varroa. However, as discussed in Sidebar B, if we select for resistant bees, we also may be selecting for less virulent varroa.

At least two studies, previously cited, have shown that the VSH trait can be successfully introduced into commercial lines of honey bees. Given the central role that varroa mites are thought to play in Colony Collapse Disorder, in the weakening of the honey bee immune systems and the transmission of viruses, there is a clear need to increase our utilization of varroa sensitive hygiene genetics in almost all beekeeping operations. Breeder queens of the VSH line (Figure 5) can be purchased from Glenn Apiaries (**http://www.glenn-apiaries.com/**). There also are a growing number of queen producers who sell naturally mated VSH queens, as well as queens originating from crosses between VSH and other resistant lines. A list of these producers can be found on the same website. Glenn Apiaries also sells breeder queens of both a Carniolan and a hygienic Italian line that incorporate VSH genetics. *However, it's critically important that the pure Varroa Sensitive Hygiene line be maintained so that those beekeepers concerned about locally adapted stock can continue to introduce this valuable trait into bees acclimatized to different environments.*

For those interested in breeding varroa resistant bees, there are several options that can help you reach your goals. Although I am an advocate of systematic breeding programs, less planned approaches frequently are successful. Five years ago Phil Raines,

Sidebar B: A Link between Varroa Sensitive Hygiene and Parasite Avirulence?

By definition, avirulent parasites have lower rates of reproduction and thus are not sufficiently harmful to kill their hosts, although they may weaken them and reduce their reproductive success (Gandon et al, 2002). According to theory, avirulence will evolve under conditions of vertical transmission of parasites, for example from parent colony to swarm. However, honey bees are known to possess several means of varroa resistance that reduce reproduction in varroa and may result in mite avirulence. The most obvious candidate is varroa sensitive hygiene, which in European honey bees is best developed in the VSH line. This trait was observed previously in the Asian honey bee *Apis cerana*, the original host of the varroa mite, *Varroa destructor* (Rath and Drescher, 1990). The varroa mite appears to be in a state of avirulence or a balanced host-parasite relationship with *A. cerana,* in contrast to its relationship with the European honey bee, *A. mellifera.*

Whether or not Seeley's Arnot Forest bees have the VSH trait is not yet clear. They may have other mechanisms that, together with vertical transmission and other environmental factors, result in varroa that are avirulent. Grooming behavior is another means by which honey bees resist varroa. Another is the lower mite reproduction observed on VSH pupae compared to Italian pupae seen even in the absence of VSH workers, in an incubator.

Figure 4. Spotty brood on frame from colony with naturally mated VSH queen and crossbred workers in mid-March. The VSH queen was not introduced into this formerly non-VSH colony until the previous October.

Figure 5. Light colored VSH queen (courtesy of Jeff Harris, USDA).

a commercial beekeeper on the Illinois-Wisconsin line, set aside a beeyard that he chose not to treat at all. He had purchased the yard from a beekeeper who had stocked it with Minnesota Hygienic, New World Carniolan and Russian queens. Now and then Phil took frames of bees and brood from this apiary to restock other beeyards. This past winter, when colony losses in the area were 50% or more, this survivor yard had no losses, although they were neither wrapped nor fed as were most of his other colonies. Phil's approach did not involve active selection for varroa resistance. However, this year he is breeding from the most productive and hygienic queens from this survivor yard.

If you have access to a number of colonies that have survived without varroa treatments for several years, I suggest adapting the selection program described by Erickson et al (2000) to your circumstances. Should you have only a few colonies that appear resistant, you might consider crossing lines with VSH genetics with your stock in order to increase genetic diversity and maintain resistance. Following the initial cross using VSH queens, in succeeding generations you can then raise queens from the most varroa resistant colonies that have other desirable characteristics such as hygienic behavior, gentle temperament, productivity, etc; adapting the general approach advocated by Erickson and colleagues (2000).

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The Traveling Beekeeper

An Interview with Dr. Medhat Nasr About Beekeeping in Alberta, Canada

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As the Provincial Apiculturist in Alberta, Dr. Medhat Nasr brings to the province a wide range of professional beekeeping experiences. Born and educated in Cairo, Egypt, Nasr did his graduate work at the University of California at Davis under Dr. Christine Peng, but also worked closely with Drs. Harry Laidlaw Jr., Robert 'Rob' Page, Jr. and Robin Thorp. Prior to moving to Alberta eight years ago, he worked in Ontario with the bee breeding program (searching for resistance to both tracheal and varroa mites) and at Rutgers University, New Jersey, USA.

Describe beekeeping situation in Alberta

The Canadian Province of Alberta ranks second in the size of the beekeeping industry behind California. For the past 10 to 12 years, the number of colonies has increased 5-10% each year; in the past twenty years the colony count has gone from 135,000 to 255,000 in 2006.

During the past three years there has been harsh winter weather, with about 30% of honey bee colonies dying, which coincided with CCD in USA. However, in Alberta the losses were due to three factors—the general failure of chemical controls against varroa mites, the problems of Nosema and very harsh winters. This caused a reduction in colony numbers to 225,000 in 2007, but with various proactive programs, the colony numbers are expected to reach 265,000 in 2010.

There are 700 beekeepers registered in the province, of which 113 are rated as commercial – having 500 hives or more. This makes up 225,000 hives or an average of 2,000 colonies per commercial beekeeper. The remaining beekeepers are rated as sideliners and hobbyists. Hobbyists usually have less than 100 hives. There are fewer than 50 beekeepers operating between 100 to 500 colonies and they are considered sideliners. This distribution gives a bimodal distribution with one peak around 10 colonies, and the other around 2,000. The smaller beekeeping operations are concentrated around the two large cities in the Province, Calgary and Edmonton.

What is the economic value of the industry?

During the past five years the total income from beekeeping has been 50 million Canadian dollars per year. There were and additional 10-15 million Canadian dollars per year paid for pollination services to the beekeeper for rental for hybrid canola certified seed production. Between 65,000 to 75,000 hives are rented for this pollination, and the beekeepers are paid based on colony strength, between $110 to $165 per colony. For the top payment, a beekeeper has to provide a colony with 16 frames of bees and a minimum of 10 frames of brood. The pollination season for canola is from the third week of June to the end of July. It is possible for individual beekeepers to make over a million dollars a year from canola seed pollination.

Certified hybrid canola is a specialty crop developed by several high tech companies, including Bayer, Pioneer Hi-Bred, Monsanto and Hytech. The crop has been genetically modified for both herbicide, disease resistance and high yield. The seeds are treated with imidacloprid for crop protection during development. In other parts of the world this compound has been linked with Colony Collapse Syndrome, but in Alberta, the winter kill on bees moved to canola pollination has been less than 15% per year, compared to 30% for colonies not placed onto pollination. Some of this difference is undoubtedly due to the better beekeeping practices, stronger and healthier colonies used for this seed production, plus the milder climate found in central Alberta. The winterkill increases as you head north to the Peace River, where there is 45%. We have evidence that stronger hives are able to deal with stressful field conditions better than weak hives..

Colonies used for hybrid canola production only average 40 lbs of honey per colony where there may be a colony density of two to three colonies per acre. This is compared to the average honey production of 140 lbs

Dr. Medhat Nasr was recognized by the Canadian Beekeeping Industry with the Fred Rathje Memorial Award.

Shaker jar with bees in the upper jar and alcohol or other fluid in the lower part, where mites collect.

per colony in all of Alberta. The highest production is experienced in the Peace River region of northern Alberta with a 220 lb colony average.

Hybrid canola pollination is a four-way hybrid plan utilizing two 2- line crosses—AB and CD. AB can be a male donor and CD can be a female recipient of pollen. They are planted in rows in a ratio 1:3 or 1:4 male to female plants, depending on the company crop systems. This system acts like a dioecious plant, and becomes dependent on insects for pollination. There are some leafcutter bees, some flies and the rest honey bees. Nasr observed a 90% increase yield when comparing open pollination with bees vs. closed screened cages. Many consider canola grown in fields as a crop to be wind pollinated.

Honey production in the northern part of Alberta is high is due to having strong, healthy hives; that will match the two peaks of nectar flow from canola and alfalfa/sweet clover (hay crops). Consider 17 hrs. daylight in Edmonton at Summer solstice and 18 hrs. in Peace River.

Where do you think Alberta beekeepers are going with queen rearing (I was invited to teach basic queen rearing)?

I think beekeepers in Alberta have learned the value of locally adapted queens/stock that are suitable for their management system. Beekeepers actually ask for the teaching—they wanted classes on queen production at all levels. Understand that there is a demand for queens in Alberta of between 100,000 to 150,000 queens in the next five years, even to 250,000 queens as the rate of growth increases 5-10% per year. Currently we rely on Hawaii, the continental USA, Australia, New Zealand and Chile to supply 120K queens per year. Hawaii is the largest supplier, providing more than half of our needs. Beekeepers are looking for ways to diversify their production (honey, pollination) and they understand the restrictive short season for queen production.

We are looking at stocks developed in USA, Canada and Europe with potential disease and mite resistance, high honey production, with a baseline of good wintering—these must form the basis of a new locally adapted stock. Since the Canadian border was closed in 1987 to United States packages, Alberta producers have relied on wintering their own bees and making splits. They also import some packages from Australia and New Zealand at the rate of 40,000 to 50,000 per year. There are a few thousand packages imported from Chile. They usually come in April and May. After that it is too late for the Southern Hemisphere producers.

In general, our objective is not to replace currently available queen supplies, but to develop a diversified queen supplier market and help meet the need for queens in our growing honey production and pollination industries. Demand will continue for early and quality queens supplied in spring. We have 20-25,000 queens produced in Alberta every year. Those beekeepers have never used imported queens.

Tell me about your program since you arrived in Alberta.

When I started in 2002 as Provincial Apiculturist, the employment mandate was to take on three areas of responsibility —regulatory, research and extension program. This basically meant that I was doing three jobs with only one Medhat. The focus was on updating regulation programs that would help provide growth of the industry. Research focused on applied research, helping solve day-to-day problems in a long-term sustainable fashion. Extension duties were focused to help the industry to understand the fast pace of changes in bee health, food safety, consumer expectations, and honey markets.

Which have required the greatest effort?

There was a huge need for new research and extension. Beekeepers have had limited resources for mite control, although we have been promoting Integrated Pest Management. Unfortunately, beekeepers were allowed to use one single miticide at a time with no other options for alternation of molecules.

The second challenge came with the fast rate varroa developed resistance to these molecules. With the challenges of honey-bee nutrition and the discovery of *Nosema ceranae* we experienced these overlapping problems as shown in 3 yrs of harsh winter conditions, long winter, less than - 45 ºC for long periods of time. Extensive surveys were done to define management practices for what works and does not work in the field. This was combined with sampling of thousands of hives for varroa and nosema levels to explain possible causes of winter kill. We needed to deliver recommendations to stop bee losses. Beekeepers suffered big losses. It is not easy to go home; sleep and ignore it.

Have you seen CCD in Alberta?

We have had losses. We have not seen anything that fits the criteria being defined by USDA.

Where have your efforts been focused?

We learned from the surveys that we need to move the program into a proactive surveillance program. That means that we ask beekeepers for an answer to one simple question: ***Are your bees healthy to survive the winter?*** That is the bottom line.

To do this we worked to develop a program in partnership between the Alberta Beekeepers Commission (the provincial beekeepers association), the pollination companies (such as the big firms mentioned earlier), Alberta Agriculture and the Alberta Crop Industry Fund (funding agency and corporation from government and foundation funds).

The program has three objectives:

1. To develop honey bee pest surveillance /monitoring system for both varroa and nosema including immediate delivery of results to beekeepers so they can take action to insure healthy bees going into the winter.
2. Screen and evaluate new molecules for varroa control and other management practices for varroa control.
3. Conduct outreach educational program to facilitate implementation of a developed management system for IPM pest control.

The program was highly accepted by beekeepers in the first year, with 75% participation (voluntary). During the first year (2009) 15 operations out of 75 had high mite levels that could cause more than 50% winterkill. These beekeepers already treated their hives with what was available and thought they had been providing control. The emphasis here is on monitoring.

Nosema samples – no beekeeper monitored for nosema before 2008 due to the requirement of the microscopes, etc. But our

The shaker jar Nasr helped develop collects the mites in the alcohol or other fluid in the jar after the mites are dislodged from the body of the bees.

Dr. Nasr and the polystyrene nucs being used in Alberta to overwinter five-frame colonies with success in the very cold Canadian winters.

survey was an eye opener for them, with some operations with more than 6 million to 15 million spores PER BEE!

As a result, recommendations were delivered to the beekeepers and we followed up with further inspections. In the 2007 and 2008 surveys, we found 10% of tested operations had healthy bees entering winter (i.e. less than 1% varroa mites and less than 1 million nosema spores). In 2009, 78% of the beekeeping operations entered the winter healthy. Preliminary 2010 surveys show winter kill in Alberta is about 17% (vs. 30% in 2008). The long-term winter kill over 20 years is 15%. Our monitoring system was successful in predicting winter kill and beekeepers have become aware of the value of monitoring. ***The bottom line for this program is monitoring, monitoring and more monitoring.*** Then, take action on a timely basis to insure healthy bees going into the winter. Monitor in spring and in mid/late August to allow enough time for treatment. Monitoring does not mean one snap shot of sampling. It is required to monitor more than once each season. Monitoring also is not only to identify the problem, but also to insure the treatment to control the pests and protect the bees, and on time.

What have been your other research projects?

1. Provide alternatives for pest control, and add more tools for mite and nosema control. This area is still being worked on. The program is basically going back to basics and remembering to protect your bees at the right time and applying our knowledge first—such as with varroa and nosema.
2. We do not underestimate the role of viruses, but our model is developed after malaria control—you go after the vector to protect the host.

What was the last book you read?

A book on host/parasite relationships. It was pretty intense.

Who had the greatest influence on your career and why?

Harry Laidlaw and Rob Page. Their vision of looking at science dealing with numbers to support their conclusions. Their development of the closed population bee breeding program was a simple idea that changed the bee breeding system of honey bees.

You used this in Ontario when you ran the bee breeding program there?

Yes. And I used it in developing a device used in monitoring mite populations, a simple system that may be used by beekeepers in the field that became the backbone of mite control and IPM implementation.

You are talking about your shaker?

Yes, for 20 some years people developed good means of mite control, but beekeepers did not adapt them because they are too expensive, time consuming or required modification of the hive (like screened bottom board).

Where do you see yourself and the Alberta beekeepers in five years?

The industry in Alberta is progressive and demanding and looking for substantial increase in colony numbers and honey exports, providing high quality honey for the world market, such as Japan. Beekeeping in Alberta is the only industry increasing 5 to10% per year. We saw yesterday (on a tour outside Edmonton) how the honey houses, equipment and management are state of the art, which gives us the fundamentals of growing in the future.

The industry is demanding. They are always looking to improve practices and take care of bee health; though it costs them money. They are not afraid to provide financial support for good research that will meet their objectives through the Alberta Beekeepers Commission.

For myself, it was challenging when I came to Alberta. There is a fundamental change in the philosophy of running this program from previous years. That challenge did not stop me from working to navigate the program to achieve what we currently have. Since coming to Alberta, over one million dollars have been raised to support these programs.

Last year the industry gave me an achievement award, the Fred Rathje Memorial Award for service to Alberta and betterment of the Canadian bee Industry. Usually, this award goes to someone who is about to retire. Alberta does not have mandatory retirement.

June 22, 2010 Interview with Medhat Nasr by Larry Connor. For the latest information from Dr. Connor, check www.wicwas.com.

BIDAYUH BEEKEEPING

How Two Local Villages in Borneo Keep Bees and Harvest Honey

By STEPHEN PETERSEN
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I'm frequently asked about my travels - "What does an apicultural consultant do?" The following article is a good example – long sweaty treks to the back of beyond, eating local food, sleeping on the floor of bamboo huts and seeing beyond the tourist route. I try to turn projects into something that will generate a bit of income for locals and myself alike, but frequently it is apiphilia (love of bees) that is my only reward. The biggest lesson I've learned about bees and development is "thinking outside the Langstroth box."

Introduction

The Bidayuh (a local indigenous group) farmers of Sarawak, Borneo have been keeping bees in traditional log hives or "gelodogs" for many generations. They are kept for their honey production - honey is usually consumed within the *kampung* (village) or, if there is an excess, brought to town for sale generating a small but much needed cash income.

I made the arduous trek to two *kampungs* (Kg. Bojong and Kg. Semban) with local guide Edward C.K. Yong for three days and two nights to observe the techniques and bee species employed by these farmers.

Traditional life in the longhouse community is changing; a hydroelectric project (one of several) in the area is forcing the relocation of some villages and bringing a lake to their front door – but they are farmers not "*orang ulu* – upriver people". They hunt game and gather wild foods in the forest and raise some subsistence crops (predominately rice). The sale of honey adds a few *ringgit* (Malaysian currency) to their meager income. There is potential to market honey to niche markets touting it as "Red Bee Honey only from Borneo" or capitalizing on the purported medicinal value of stingless bee honey.

Flowers of the *Acacia mangium* trees, grown for the paper industry, are attractive to honey bees and produce flowers all year around.

The coral vine (*Antigonon leptopus*) is highly attractive to honey bees and produces nectar all year. A beautiful climbing vine, it is recommended for planting as bee forage.

The Bees

There are several (5) *Apis* species indigenous to the area and all recognized by the locals. There are several species of *Trigona* (stingless bees) which are also kept but not differentiated. Table 1 below lists the bee species present in the area and local names.

Respondents in the two villages indicated that they sometimes hunt for *A. dorsata* on the tall tualang or tapang trees (*Koompassia sp.*) by constructing a herring-bone style ladder to access the nests frequently located more than 100 feet from the forest floor. However, this activity has substantially decreased in recent years as "*the bees don't come anymore*". Part of the problem may be the harvest methods; the bees are often killed by fire and the complete nest taken or in some extreme cases the whole tree is cut down. Neither of these methods lends itself to a sustainable bee population.

Table 1

Latin name	English	Malay (common names)	Bidayuh (Bengoh dialect)
Apis dorsata	Giant Asian Honeybee	Lebah tualang Lebah tapang Lebah rimba	Banyeh
Apis cerana	Asian Hive Bee	Lebah hitam Lebah neron Lebah keran	Nyahwan
Apis koschevnikovi	Borneo Red Bee	Lebah merah	Nyahwan beday
* *Apis florea* & *Apis andreniformis*	Small and/or Dwarf Honeybee	Lebah daun Lebah lalat	Titih
Trigona sp.	Stingless bees (34+ Asian species)	Kelulut	Nyelek

*** Note - The small Asian honey bees (*A. florea* & *A. andreniformis*) are both present in the area and both are recognized, but they share a common name.**



There are more than 34 species of the stingless bee (*Trigona sp*) in SE Asia; frequently the species may be determined by the unique entrance tube architecture.

In durian season piles of the spiky fruit fill market stalls – like many gourmet foods, there are many varieties both wild and cultivated.

Wes pulls a piece of "long-ago-dead-pig" from the ceramic crock where it has been fermenting…yummy?

***Cerana* bees in a fixed-comb gelodog – they will later be transferred to a movable comb colony. Why not start off with top-bars to make it even easier?**

Villagers stated that they rarely harvest the nests of *florea* and *andreniformis* as they are not common. They are "opportunistically harvested"; that is, if the nests are discovered while gathering durian, firewood, or on the way to garden plots, they are taken.

The two species of multi-comb, cavity nesting bees (*A. cerana* & *A. koschevnikovi*) are kept in fixed-comb boxes made from planks or in fixed comb log hives called "gelodogs". Typically the empty boxes are placed in the forest in anticipation of being occupied by a swarm. After occupation the container may be returned to the village for convenience sake or left in the forest with better access to forage. All of the containers observed were in the vertical position; none were seen to have the long dimension of the hive in the horizontal position.

Stingless bees (*Trigona sp*) appeared to be a popular choice for beekeeping probably because they require little or no management, but yield only small amounts of honey. They are kept in the same style box or gelodoks as the *Apis* species.

Bee Management and Beekeepers

As stated above the *Apis* species of cavity-nesting bees are kept in purpose-made boxes or log hives. They are harvested once or twice a year usually by killing all the bees or by driving them out and taking all of the resources. Harvest readiness is judged by "how heavy" the container is. Honey (ripe and unripe) is squeezed from the comb undoubtedly with some contamination by pollen and brood; the brood is eaten and the wax is discarded. If there is extra honey, it may be bottled up in recycled bottles, brought to market and sold for about 10 RM (≈ $3 USD) for a 635 ml. beer bottle (about 900 grams). Moisture content is high (probably 23% +) so the shelf life of the honey is limited before it ferments. Upon harvesting most of the bee colonies abscond and the hives are left to be occupied by future swarms.

In the village of Bojong there are 32 families; 6-7 of these families have 2-3 *Trigona* hives and 1 or 2 *cerana/koschevnikovi* hives suspended from the eaves or floor beams of the house. Other families have hives in the forest near their gardens or near a family-owned fruit tree. Private property is well respected; e.g. specific durian trees are "owned" by a family who hold exclusive harvest rights; hives placed in the forest are seen as personal property and respected. If a wild colony is found, marks or some indicator is made on the tree designating ownership. Often the trunk of a tree containing a nest of *Apis* or *Trigona* will be cut off above and below the cavity and brought back to the village. It was not determined if bees in the wild were ever transferred to purpose-made boxes nor was the occupancy rate of swarm boxes determined.

The village of Semban is a grueling hot, uphill walk for about six hours from the trail head near the Bengoh Dam project and it is one of the most attractive villages I've encountered anywhere in Asia. There are 62 houses, 330+ residents and about 70% of the households keep bees. About 10% of the *Apis* colonies kept are *A. koschevnikovi* (Red bee) probably reflecting the wild population dynamics. The *koschevnikovi* bees, as reported by respondents, are less aggressive than *cerana*, but produce less honey than their cousins (1-2 bottles vs. 2-3 bottles per year). April (end of the rainy season) seems to be the harvest month.

Villagers in Bojong stated that the Department of Agriculture gave a top-bar hive workshop "about 10 years ago" employing nylon fishing line hanging from the top bars to act as comb bracing. Respondents claimed that no bees occupied the hives and there was no follow up.

Life in the village

I arrived in the village in mid-November when life appeared to revolve around wild pig and durian (*Durio sp.* – there are 30 some species 9 of which produce edible fruit), which Alfred Wallace best described in his 1869 classic "The Malay Archipelago" as "*the durian is the king of fruits…. In fact to eat durians is a new sensation, worth a voyage to the East to experience it*" (Wallace 1869). Remember that this was written in the days when it took several *months* to make a "*voyage to the East*". There are those who shun durian because of its distinctive odor; all I can say is they would not be crazy about fermented wild pig. We nicknamed it "long-ago-dead-pig"- the odor was, shall we say "pervasive", as our host, Wes, brought several chunks from

a ceramic vessel where it had been bubbling away for several months. A diet of "long-ago-dead-pig" along with durian three to four times a day and topped off with "arrack", the potent locally brewed rice wine, made us happy the houses were well ventilated.

Villagers rise early in the morning and are off to their "garden" plots which may be several miles away. They always carry a large basket on their back using a tumpline across their forehead as support — it comes back filled with jungle produce. The kids and elders are left in the *kampong* entertaining themselves as children do while the elders tell stories or play music. One elderly lady, complete with brass wire wrapped around her wrists, struck notes on a percussion instrument made from a very large piece of bamboo.

The arrival of "*orang puteh* (white man)" soaked in sweat and panting like a dog was cause for the kids to come and stare – few visitors make it this far. Toward evening the villagers began returning, one with a barking deer (*Muntiacus sp.*) destined for the cooking pot (much better than fermented wild pig). After dinner we had an impromptu bee session discussing the problems and potential of the area.

One farmer insisted on opening his stingless bee colony for me which I thought would be interesting - until I saw him banging on it with a hammer to pry the lid off! They may be stingless, but they sure can bite.

Beekeeping potential of the area

There is potential for small-scale honey bee production in the area using indigenous bees. They are "free" for the taking from the wild, appear to be numerous, and there appears to be adequate bee forage as some colonies are year-round residents provided they don't abscond after harvesting. There are several factors that must be addressed in developing a project;

1. Transition to moveable combs – in order to be *managed,* colonies must have moveable comb or frames. Top-bar beekeeping using village-built rustic containers offers the best method of *Apis cerana* or *A. koschevnikovi* management.
2. If *Apis dorsata* are selected, an intensive program of education and sustainable harvest techniques must be implemented.
3. Training in bee biology and management – after bees have been established in moveable comb hives—lessons in bee biology and simple management techniques (e.g. splits, supering, population control, diseases and pests) are necessary.
5. Training in honey handling and quality control – Asian honey is characterized by high moisture (allowing spoilage) and the public perception that it has probably been adulterated with sugar syrup. To address this problem, quality control procedures must be established and adhered to.
5. Market penetration – the quality product must have brand recognition and something that sets it apart from the competition. The fact that the Red Bee (*Apis koschevnikovi*) exists only on Borneo would be a "hook" for marketing. Other aspects, e.g. "a portion of the proceeds from the sale of this honey go to support sustainable community livelihoods in the rainforest" or an organic label (with certification) will allow branded honey to sell for a premium price.
6. Access to markets – there are several villages that are being displaced due to the Bengoh Hydro Project. Currently it is a long day's walk to and from the *kampungs* to the market. In order to be worthwhile respondents stated they must return with 80-100 RM (Malaysian ringgit) cash or goods equivalent to justify the effort to travel to markets. This is a substantial amount of honey (8-10 bottles) at the current price. Kg. Semban (with the highest proportion of beekeepers) is above the projected flood area and will remain difficult to access. Some sort of beekeeping association or cooperative would be necessary to market larger amounts of honey.

Planting for bees

There is a successful interaction between beekeepers and silviculturists (tree plantation operators) throughout Malaysia, especially with *Acacia mangium*, a fast growing leguminous tree grown for the pulp industry and an excellent honey plant. Additionally, plantations of rubber (*Hevea brasiliensis*), coconut (*Cocos nucifera*), and a variety of fruit trees offer opportunities for both *cerana* and *mellifera* beekeeping. On the main North-South highway in Peninsular Malaysia one may note billboards advocating the close relationship between beekeeping and *Acacia mangium* plantations.

In Sarawak (on the island of Borneo), near Bintulu, a Chinese pulp company imported *cerana* bees from China instead of using the local *cerana* bees to produce honey on their *Acacia mangium* plantation… go figure!

As population and development activities put more and more pressure on the remaining rainforest, the reality of "plantation bees" must be accepted. *Apis koschevnikovi* does not do well in disturbed landscapes and needs the diversity of the intact rainforest to thrive. There will probably always be a conflict between "development" and maintaining a balance with the natural world.

Recommendations

In order to develop a beekeeping program several steps must be taken. First and foremost would be a community meeting in the area villages with the existing beekeepers to determine the level of interest in a project. At this time a more complete beekeeping calendar demonstrating activities such as swarming times, migration, floral blooms, rainy season, and human activities can be developed.

Workshops held in the village on top-bar construction should take place prior to the time determined as the swarming season – this will increase the chances of occupation.

View down into a recently opened (with a hammer!) stingless bee colony. *Trigona* bees produce cerumen - a mixture of propolis and wax. From this they make cells to raise brood and store honey, but there is no uniform hexagonal pattern as with *Apis* – it appears to be very random construction.

***Apis koschevnikovi* gathers moisture from a plank- note the reddish hue of the body hairs, hence the common name "red bee of Borneo".**

The author photographs some colonies of *Trigona* (stingless bees) suspended under the floor of a house. Note the large areas of cerumen around the entrance to deter ants.

For fun with the foreigner open a colony of bees after sunset with a hammer — they may not sting but they can bite!

The true test of bamboo construction — have a 200+ pound "orang puteh" cross last; then there is no way home! This bridge and several like it were wiped out in floods a few months later isolating the village for several months until repairs could be made.

***Apis koschevnikovi* peer from the entrance to their fixed-comb log hive. Gentler than *cerana,* they produce less honey under the same conditions.**

Coconut log gelodogs under coconuts which, along with bananas, provide a nectar and pollen flow almost all year around in plantations.

A simple, well-illustrated, 10-15 page text on hive construction, bee biology and management should be produced in Malay.

Follow-up workshops, when sufficient hives are occupied, on bee biology and management should take place. This could also be accomplished by prearranged trips to existing apiaries.

As an initial income-generating method, the idea of selling whole bee colonies (transferring top-bars to another hive) to farmers in *Acacia mangium* plantations or others who may need bees should be examined.

Long-term goals and objectives would include;

- Establishment of quality control systems, internal control systems, and small holder management criteria.
- Establishment of association/cooperative for marketing products.
- Branding of products and creation of loyal consumer base with quality products.
- Seeking certification of "organic" or "fair trade" status to enhance return to producers.
- Seek and supply niche markets via direct sales or Internet.

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The Other Side of BEEKEEPING

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More Members of the Ericaceae

salal, shallon

Scientific name: *Gaultheria shallon*

Origin: *Gaultheria shallon* is native to the Pacific Coastal Area of North America from California to Alaska.

Plant description: Salal is a low-spreading shrub often with erect stems that can grow to heights of about 6 ft. The leaves are 2 to 4 inches long. They are quite variable in shape and range from being kidney-shaped and strongly indented at their base (reniform) to being nearly squared off at the base, then often being 3 to 4 times longer than wide with more or less parallel sides (oblong), to being widest in the attached half (ovate), in which case they can end in a sharp point, or be more rounded (orbicular)[1]. The leaf edges are frequently finely toothed (serrate). The individual flowers are borne on glandular hairy racemes[2]. The urn-shaped flowers range in color from white to pinkish and are about 0.375 inches long and are also frequently also glandular-hairy. The more or less spherical fruit generally has a diameter of 0.28 to 0.3 inches and is dark purple, later becoming black.[5, 13, 16, 25]

***Gaultheria shallon*. Photo from potted plants grown in greenhouse specifically for the photo. Date and locality information of no value. Plant obtained from ForestFarm, Williams OR (www.forest-farm.com).**

Distribution: In California the species generally inhabits moist forest margins under about 2600 ft and prefers acidic soils[25] (pH 5.5-7.0[24]). Goltz[8] states "Salal is the most abundant shrub in open timbered areas and thickly covers the forest floor in western Oregon. It yields some honey on the west side of the Cascade Mountains in Oregon where its growth is less rank."

Blooming period: According to Hortus Third[10], salal blooms spring to early summer. In California it blooms during April to July[16]. In Oregon it blooms from May into July[5]. Ramsay[20] provides a blooming date range of June to mid July for Canada. D. M. McCutcheon in his response to the Ayers and Harman questionnaires[3] indicates that it blooms during June and July in British Columbia. Sheppard et al.[22] indicate that it blooms during May and June in British Columbia.

Importance as a honey plant: Ramsay[20] provides the information that salal is "regarded as one of the best native nectar plants in western Canada, especially coastal British Columbia." McCutcheon in his reply to the Ayers and Harman questionnaire[3] considered the species to be a major source of nectar in the mountainous area of British Columbia. Sheppard et al.[23] lists the species as being among the "Principal nectar-bearing native flora of British Columbia'.

Honey potential: Burgett et al.[5] state that the "Flowers produce an abundant supply of nectar" and also that it "yields some honey on

[1] **I am indebted to the Michigan State University Herbarium for the photos showing some of the variability found in the leaves of *Gaultheria shallon*.**

[2] **Raceme: an inflorescence where the individual florets arise from a central stem and generally bloom from the base toward the tip. Glandular hairy: has hairs that exude a sticky substance.**

the west side of the cascades where salal is thick and abundant." Harvey Lovell [14] provides the information that "Bees collect considerable nectar from the bell-shaped flowers."

Honey: Burgett et al.[5] state that "the honey is light amber in color and good flavored."

Pollen: Both Burgett et al.[5] and Ramsay[20] indicate that salal produces no pollen for our bees.

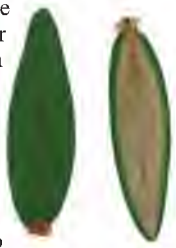
Bog Labrador tea, Labrador tea, rusty Labrador tea

Scientific name: *Ledum groenlandicum*

Synonyms: *Ledum palustre* ssp. *groenlandicum, Ledum palustre* var. *latifolium*, *Rhododendron groenlandicum*

Origin: Northern lower US and Canada, Alaska, Greenland, Saint Pierre and Miquelon.[3]

Plant description: *Ledum groenlandicum* is generally a freely branching shrub that is usually in the height range of 2 to 4 feet. There is also a form that lies more or less on the ground, but does not root at the stem tips or nodes. The twigs are densely covered with long, soft, shaggy hairs (villous). The evergreen leaves are arranged alternately on the branches with short (0.25 inch) leaf stems (sessile or subsessile) and range in shape from a narrow oval with the greatest width at the midpoint (elliptic) to the widest point closer to the stem end (ovate) to long and narrow with nearly parallel sides (oblong). They range in length from 0.75 to 2 inches and from 0.25 to 0.5 inches in width. They are dark green above, and covered beneath with whitish or rust colored short wooly matted hairs (tomentulose) and are fragrant when crushed.



The 0.5 to 0.75 inch across flowers have both male and female parts (perfect) and are borne in approximately 2 inch across crowded corymbs[4]. It has an elongate style, five separate, spreading white petals, and 5 to 10 stamens whose relatively short filaments are attached to the back of the anthers.

The fruits are slender elongated egg-shaped structures about 0.28 in long made up of five platelets (valves) that split apart starting from the attached point. The unattached end is tipped with the remains of the style. [7 &13]

***Ledum groenlandicum*. Photo taken at The Morton Arboretum in Lisle IL on 5/11/04.**

[3] **A French Island holding, consisting mainly of two islands (Saint Pierre and Miquelon) a little off the southern coast of Newfoundland.**

[4] **Corymb: a flat or rounded topped inflorescence with the lower flower stems longer than the upper ones.**

Distribution: Within its native range the plant grows in bogs, on wet shores or sometimes on rocky alpine slopes[7]. Dirr[6] considers the plant to be a zone 2 to 5 species.

Blooming period: Gleason and Cronquist[7] covering the northeastern US and contiguous parts of Canada, give a blooming date range of June to July. Pellett[19] states that it is May and June. Ramsay[20], writing about the bee forage of Canada and the northern, US provides a range of May and early June. Sheppard et al.[22] give a blooming date range of May and June for British Columbia. Dirr[6], who considers the plant as a potential ornamental for cool moist to swampy locations, provides a blooming date range of May through June in the central Illinois to Boston area.

Importance as a honey plant: Ayers and Harman[3] from their questionnaires, found the species to be of at least some importance in BC. Sheppard et al.[22] include the species in their list of 'Principal nectar-bearing native flora of British Columbia'. Ramsay[20] credits the species with being an important source of honey in some provinces, "especially Manitoba, northern Ontario and British Columbia". She references this statement with Pellett[19], but I do not find the province of Manitoba mentioned in the Pellett writing. Both the Harvey Lovell and Goltz manuals[8 & 14] mention the plant and state, "bees visit the flowers for nectar".

Honey potential: Pellett, referring to a Sladen report, states the species is a source of nectar in northern Ontario, but the species is not mentioned in Larsson and Shuel's 'Nectar Trees, Shrubs and Herbs of Ontario'[12].

Honey: Ramsay[20] states that the honey has a minty flavor, but gives no reference.

Pollen: Robertson and Oertel[21] credit the species with only producing nectar.

Additional Information: Pellett[19] states that the species was used as a substitute for tea during the Revolutionary war, hence the name Labrador tea. While this is apparently so, *you should be very careful when trying to make Labrador tea from material you collect. There are other species that grow in the same environments that are said to look much like Ledum groenlandicum that are thought to be toxic.*

Black huckleberry

Scientific name: *Gaylussacia baccata*

Synonyms: *Decachaena baccata*

Origin: The species is native to Eastern US and Canada.

Plant description: *Gaylussacia baccata* displays considerable variation in its leaves, flowers and fruit[4]. In general, it is a much-branched deciduous bush that grows to a height of about 3.3 ft. The leaves are simple (not compound), alternately placed on the stems, without teeth (entire) and resinous on both surfaces. They range in shape from being broadest in the middle and rounded at both ends (elliptic), to long and narrow with nearly parallel sides (oblong), to more or less pointy at both ends and attached at the narrow end (oblanceolate). They range

***Gaylussacia baccata*. Photo taken in the W. J. Beal Botanical Garden in the Systematic Collection on the Michigan State University Campus on 5/5/02.**

in length from 0.78 to about 2 inches.

The individual tubular flowers range in length from 0.16 to 0.24 inches and are about half that in width. The floral assemblages (racemes) are short, rarely longer than the leaves, with the individual floral stems generally shorter than the flowers. The corolla (all the petals) and the calyx are usually covered with dense short hairs (pubescence). There are usually ten stamens that do not extend beyond the end of the corolla. The edible fruit is generally black and glossy and ranges from 0.24 to 0.32 inches in diameter.[4, 7 & 13]

Distribution: Black huckleberry is frequently found in dry sandy or rocky soils of woods and thickets[7] but sometimes also in swamps and bogs[4].

Blooming period: Gleason and Cronquist[7] supply a blooming date of late spring for Northeastern US and contiguous parts of Canada. Billington[4] states that it blooms in May and June in Michigan and that the fruit is ripe in July. Wyman[27] provides a blooming date of late May for the Boston Area and also supplies a method to estimate blooming dates in other parts of North America.

Importance as a honey plant: While the genus *Gaylussacia* appears fairly frequently in the American beekeeping literature, often the exact species is not indicated. Oertel[17] from his questionnaires, found the genus to be of at least some importance in DE, GA, MD, NJ, OR, RI, TN, and WV. With the exception of OR, (see distribution map), *G. baccata* could have been represented, at least in part, from any of these states. Nothing in the genus *Gaylussacia*, however is listed from Oregon by the USDA website[usda] Ayers and Harman[3], from their questionnaires, reported the genus to be of at least some importance in OK, GA, VA, LA, SC, NC, MD, DE, and NJ. With the possible exception of OK and LA (see distribution map), these reports may in part have represented *G. baccata*. On the other hand, information from the USDA website[24] suggests that even the *Genus* is not found in Oklahoma. Pellett[19] states that the species is "the common huckleberry of the markets" and references W. J. Sheppard that it is a honey plant in British Columbia. Ramsay also states that the species is recognized as a honey plant in BC, but she cites Pellett and a 1938 British Columbia Department of Agriculture Bulletin [22][5].

[5] **I suspect that the Pellett reference is the British Columbia Department of Agriculture Bulletin No. 92[22] which has been reissued several times. Ramsay references a 1938 version of this publication.**

From the distribution provided by Gleason and Cronquist[7] , and the USDA Website's distribution for the Genus as a whole, where the western boundary of the genus is a line that runs approximately from Ontario and Minnesota south to Louisiana, *I judge* this probably represents a mistaken identification.

The 1923 version British Columbia document describes *Gaylussacia resinosa* as being important in British Columbia, but the 1945 document[22] substitutes the name *Vaccinium parvifolium* in its place. This species does in fact, according to the USDA website[24], grow in British Columbia. As far back, however, as 1926, John Lovell[15] appears to have had some insight into this situation when he comments that some members of the Genus *Vaccinium* in western North America are referred to as huckleberries. The report by Burgett et al. for Oregon [5] also seems to substantiate this explanation. Lovell goes on to state, "On Cape Cod Massachusetts, without *Gaylussacia baccata* a crop of honey would not be certain oftener than every other year."

Harvey Lovell[14] treats blueberries and huckleberries (two different genera) in the same paragraph and provides no species names. The edition edited by Goltz[8] says little more. Pammel and King[18] say little more than the species occurs in southeastern Iowa.

Additional information: While huckleberry fruits are edible, they are not generally considered to be of high quality, but I clearly remember as a boy growing up amongst the mountains of Pennsylvania and braving chance encounters with a poisonous copperhead, how wonderful I thought the berries were!

Mountain laurel

Scientific name: *Kalmia latifolia*

Origin: The Appalachian Mountain region of Eastern United States.

Plant description: Mountain laurel is either a deciduous shrub or a small tree, usually in the range of 7 to 15 ft in height, but occasionally reaches heights of 32-36 ft. It often forms dense thickets. Dirr[6] describes "walking through thickets of mountain laurel in the southern Appalachians that barely allowed light to penetrate". The young

***Kalmia latifolia*. Notice the ten little purple areas in each flower into which the anthers are tucked before being dislodged by an insect pollinator. Also notice in the enlarged insert photo how the filaments of the stamens are bent in a 'tense knee' position, which propels the anthers upward and toward the insect pollinator that triggered the device (best seen in the lower left hand area of the insert). Photo taken at the Arnold Arboretum of Harvard University on 6/16/02.**

leaves at first are a light yellowish green to bronzish color, later turning a rich green. Generally they are placed alternately on the stem, but occasionally are placed oppositely or are whorled around the stem. They can range in shape from being more or less oval (elliptic) to being broadest near the middle and tapering to points on each end (elliptic lanceolate). "Generally they range in length from 2 to 5 inches and in width from 0.75 to 1.5 inches. The flowers are borne in 4-6 inch, more or less flat-topped assemblages, where the outer flowers open first and have longer individual flower stems than the more inner flowers (corymbs). In the wild the individual 0.75 to 1 inch diameter flowers range in color from white to rose and have purple markings. This is a very attractive flower and many cultivars have been developed, in which case the petals can range into color patterns not common in the wild. There are 10 stamens that originally have their anthers tucked into the little purple pockets of the five lobes of the flower. Initially the filaments are under pressure, taking up a 'tense knee' position that spring the anthers out of their original position when disturbed by an insect[7 &18].

Distribution: Mountain laurel is most commonly found in wooded areas, mainly in acidic, sandy or rocky soils. Dirr[6] describes the species as a zone 4 to 9 plant.

Blooming period: Wyman provides a blooming date for the Boston area as mid June. This reference also provides a way of estimating blooming dates in other parts of the U.S. and can be interacted with on the web[27]. In its Appalachian homeland, the local blooming date can vary considerably with altitude. Dirr[6] describes a trip from Athens, GA going north on highway 441 on May 16, 1996, where starting at Athens, GA at an elevation of 700 ft the plant had finished blooming, but along the relatively short trip was in full flower at 1500-2000 ft, and was at tight bud at 2500-4100 ft. On July 12, 1997, he found the plant at full bloom along the Blue Ridge Parkway.

Importance as a honey plant: While mountain laurel is sometimes quite attractive to honey bees[9 & 10], its bigger claim to fame in the apicultural world concerns the toxic risks that it poses for humans and perhaps for bees as well. Plants produce many products for their protection against herbivores and pathogens, as well to reduce competition from other plants. Many of these chemicals are effective as a result of their toxicity to the "intended" target organisms. It is not surprising that at times some of these compounds find their way into nectar and pollen and therefore into the hive. Fortunately, by a very large margin, most nectars and pollens are not toxic to honey bees or humans. *Some* members of Ericaceae, however, are exceptions to this and make nectars that can produce toxic honeys. I use the word *some* because there are members of the family that produce exceptional nontoxic honeys. Sourwood and heather spring to mind, both producing honeys that are highly prized. The rhododendrons and mountain laurels as well as some other members of the family fall into the group which at least sometimes produce toxic honey. These toxins belong to a group of about 18 very closely related compounds known as grayanotoxins. The terms acetylandromedol, andromedotoxin and rhodotoxin are sometimes used almost synonymously with grayanotoxin, but technically seem to be the same compound, which The Merck Index[23] refers to as grayanotoxin I. *At least one* of the modes of action of these compounds appears to be through the nervous system where they affect the sodium channels, which are essential to normal functioning of the nervous system.

Much of the literature dealing with the topic honey from the ericaceous plants deals with the rhododendrons, the toxic effects which have been known for many years. Howes[10] describes the effects rhododendron honey had on soldiers during the famous disastrous "Retreat of the Ten Thousand" in 400 B. C. The retreat was led by and recorded in considerable detail by Xenophon, a Greek historian and military commander. The soldiers who had eaten only small amounts of the honey appeared *merely intoxicated* while those who had eaten more were described as being like mad men and were affected with vomiting and purging. The offending plant in this incident is thought to have been *Rhododendron ponticum* growing on the shores of the Black Sea.

There is an interesting short piece in the February 1875 issue of 'Gleanings in Bee Culture' written by Dr. J. Grammer[9], an M.D. and surgeon in the Confederate army, that describes his observations on the adverse effects of mountain laurel honey on the Confederate soldiers as well as on himself. Just as the incident described by Xenophon, the following statement by Dr. Grammer seems to suggest that the ill effects that he was ascribing to mountain laurel honey were dose-dependent: "I ate a small quantity of it, and was prevented by the disagreeable taste of it from eating more. My comrades equally ignorant, and not quite so fastidious, indulged more freely and consequently suffered in proportion." He describes the symptoms he personally suffered with the following words: "… ..some time after eating, a queerish sensation of tingling all over, indistinct vision, caused by dilation of the pupils with an empty dizzy feeling about the head and a horrible nausea that would not relieve itself by vomiting. In my case this lasted perhaps an hour". Those who were worse off complained of the symptoms for two or three hours. He provides a description of the symptoms of the soldiers as, "the first case or two that I saw were entirely over powered by it and their appearance was exactly as they were dead drunk and I should certainly have pronounced them so had not their messmates assured me to the contrary, ….".

One needs to be careful when evaluating reports like these. During wartime, where armies essentially live off the land as they most likely did in the case of the retreat under Xenophon, as well as during the Civil War, there are many things soldiers might encounter that would lead to health problems. On the other hand, Dr. Grammer would have, for his day, been reasonably well-trained, and the described dose-dependent aspect of both the poisonings suggests that there was reasonable evidence that the illnesses were caused by the honey. Notice also that the symptoms in both the Xenophon and Grammer accounts seem to imitate drunkenness, which also suggests to me that in both cases the afflicted were quite possibly affected by the same toxic substance. One final argument, mountain laurel and rhododendron are known to be toxic to grazing animals due to one or more of the grayanotoxins[11] and it seems reasonable that these substances might at times find their way into the nectar of these plants.

There seems to be a feeling among beekeepers who live in mountain laurel areas that fully ripened honey from sealed comb is not toxic. Howes[10] seems to agree with this and Atkins[2] mentions it without providing a definitive personal opinion. I personally am more suspect of this opinion, which, while it may be true, may also be little more than denial on the part of the beekeeper, and I come down on the side that it is better to be safe than sorry.

According to Robinson and Oertel[21] as well as Atkins[1 & 2] mountain laurel nectar seems to also have toxic effects on the bees.

Honey: Harvey Lovell states that the honey is light amber in color and so thin that it might ferment. White[26] provides the analysis of a single sample of mountain laurel honey produced at an elevation of 2600 ft in Cocke Co., TN, which the beekeeper providing the sample indicated was toxic (see table 1).

Table 1. Characteristics of a single mountain laurel sample[white].

Color	Granulation	Moisture	Age	Fuctose	Glucose	Sucrose	Maltose	Higher sugars
Dark half of water white Pfund =8 to 12mm	a few scattered crystals	15.60%	15 months	35.30%	24.21%	0.52%	17.64%	2.48%

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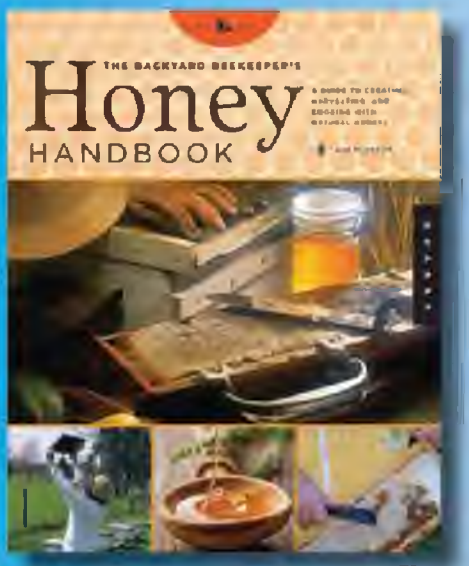

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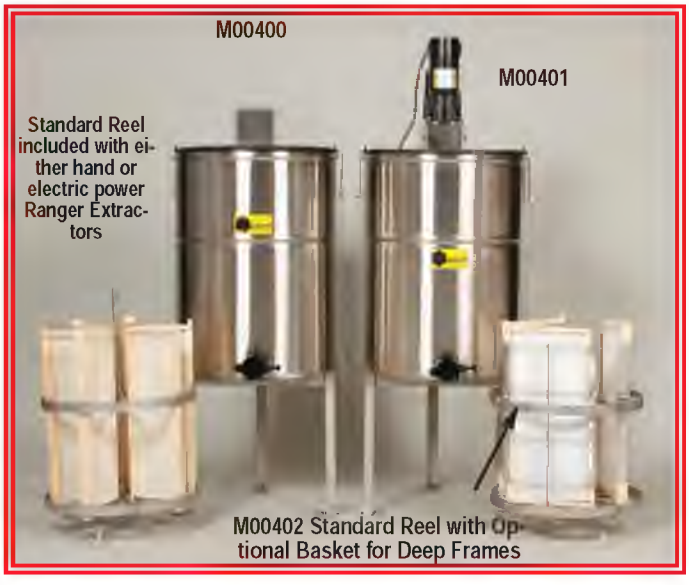

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1 pound	12	1 (58 mm)	M001962	8	$8.49
1 pound	24	1 (58 mm)	M001972	14	$16.30
2 pound	12	1 (63 mm)	M001982	12	$12.18
4 pound	6	(G70)	M001992	10	$11.49

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* 8 oz. and 2 lb. bears are also available.

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Carton of 12 with white plastic lids

M001932

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1½ pound	24	M01152	4	16.70
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Please specify red or yellow snap caps. If none specified yellow will be sent.

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