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American Bee Journal

VOLUME 150 NO. 10 OCTOBER 2010

In This Issue:

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Marla Spivak — Part 2 — **949**

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October Cover Picture

Honey bee foraging on Comfrey flowers (*Symphytum* spp.). Tibor I. Szabo, RR 1, Puslinch, Ontario, Canada N0B 2J0 took this excellent photo.

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Place the dosing tray or pad centrally on the top of the brood frames gel side up. Be sure to allow at least 1/4" of spacing between the top of the tray and the cover using spacer boards or empty supers as needed. Apply the second dose 14 days after the first. Screened bottom boards should be closed while Apiguard is being applied.

Foil tray shown on brood frames.

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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!

NEW QUEEN EMERGENCE

As my husband and I (brand new beekeepers this year!) were inspecting one of our colonies, a fascinating thing happened. We saw a new queen emerging, taking her first step on the frame. We had our camera and Ben took a beautiful picture of this unforgettable moment. It happened on June 29, 2010. We were in awe to witness such beauty.

Karine Pouliquen

Newly emerged queen (Photo by Ben Pouliquen)

REQUEENING LAYING WORKER COLONIES

It is generally accepted that a laying worker colony is virtually impossible to requeen. Most of the literature says shake the remaining bees out in front of other colonies and start over. I had good luck for a time of moving the hive off its stand and setting up an identical hive in its place – put a caged queen in the new hive on the old stand, and the returning foragers would accept her. A couple weeks later the original hive could be set back on top and everybody would get together and keep the new queen. I did that for a long time with complete success – then later it would fail sometimes.

With all of the need to make up winter losses, lots of new queens are coming into our apiaries each year. It seems that a percentage of these queens will become drone layers every year. After that happens, those queens will "run" and be hard to find. I found that having a well established nuc with a good queen in it available, and combining them was the easiest fix – but if the nuc was much smaller than the colony to be requeened, even if you used newspaper between, the bees would often keep the drone layer, perhaps because she was young and has lots of pheromone.

It was when I ran into a large colony (2 deeps and a shallow) filled with bees and eggs in all 3 supers from multiple laying workers, that I thought of a solution to all these messes. I pulled off the outer cover, took a small nuc (3 frames in a deep and well established), and set it over the inner cover of the laying worker colony, being careful to slide it back a bit for an entrance. Then, I put the outer cover on top and left for a couple weeks. I used a small nuc because I feared it would be lost. I left the inner cover hole open for a slow mixing, yet with both colonies able to keep a mass take over from happening. They could treat the hole as sort of a demilitarized zone.

I came back later and the bees from below had slowly abandoned the laying workers for a good first lady upstairs. They had filled the upper super with bees, brood and honey, and the queen had gone down through the hole to start laying below. By then the laying workers were gone and I pulled out the inner cover and traded brood frames to get it back to it's original size. I've done it since on many drone layers and it has worked every time so far. I'm not sure this method would work if the queen below was poor, but laying some worker brood. The bees might not abandon her so readily.

Someone may have used this before, but I've never read anything about it. Perhaps it can help others.

Dale Lesser

PESTICIDE BEE LOSSES

Mr. Randy Oliver's *SICK BEES* in the August 2010 issue of *American Bee Journal* joins a host of similar published articles and speeches that mostly avoid the use of the word "pesticide".

For most of the past four years these presentations with some research completed before David Hackenberg reported the November, 2006 losses of many colonies, have effectively helped promote the greatly expanded use of the new neonicotinoid pesticides. Rachael Carson surely must be revolving in her casket!

I am not challenging data these researchers have presented, but there are so many other issues that are consistently ignored. Except for those with their "heads in the sand" there are countless examples that have been documented that show a definite correlation between colony losses and the use of the new (as well as the old) pesticides. Too many of the researchers have failed to conclude that two plus two still equals four, but are happy to report "plausible" causes using George Orwell's *1984* arithmetic. Many examples can be given:

1) When 35,000 colonies were lost in Germany in 2008, Bayer did not deny that clothianidin had caused the problem, but blamed improper use of their pesticide. Cannot this happen again?

2) Three thousand organic beekeepers claim no CCD problem. One explanation of colonies being lost has been reported under questionalbe conditions. Most researchers would agree that one example out of three thousand does not prove a point!

3) Last year, the beekeepers in Paris, France where pesticides are not permitted, averaged over 100 pounds of honey per hive. Last year only Louisiana and Mississippi averaged over 100 pound.

4) Research has been reported that the pesticides (and other chemicals) weaken the bee's immune system and this makes the bee more susceptible to disease, viruses, pathogens, etc. In the United States, researchers are saying the diseases weaken the bee's resistance to pesticides.

5) With large numbers of chemicals being found in brood combs, is it any wonder bees are sick?

Lawrence A. DuBose PhD
Retired Civil Engineer
with almost 40 years beekeeping experience.
Carol Stream, IL

BEEKEEPING SAFETY

All through our life we hear the admonition,"Be Careful!" said by parents, grandparents, siblings and spouses. From our first steps, all the way into old age, we are encouraged to watch what we are doing.

As a young grandson, I worked with my grandfather in his shop, and he taught me many sayings of wisdom. First he would speak the saying in German, then translate it into English.

Some of these sayings stayed with me

and have become invaluable in later life, even in this account I will tell you here!

One of the adages he taught was, "You might get away with a mistake, but you can never break the laws of nature!"

Laws of nature, gravity, balance, friction, energy – all these have comforting standards when they are adhered to, and very strict consequences when they are disobeyed.

On July 2, 2010, I inadvertently broke some of the natural laws, and have paid a price.

Interestingly, the procedure I used had been done many times before, but how often has one taken a chance, and just because they made it through the circumstance one time, does not guarantee that they will again.

But back to my story; I was boiling water on an old camp-stove to run through my extractor to sterilize it, in order to process honey. I had done this numerous times before, and used due care each time. But this time, as I walked by the camp-stove, I brushed the three gallon pot with my hip, and the boiling pot spilled down my left leg and poured into my shoe, and soaked into my sock.

The result was second degree burns over 160 square inches of my left leg and foot. The longer term result has bee excruciating pain, and many, many trips to the wound clinic for debridement (scraping which means – MORE PAIN). All of this, along with the lost ability to do work, the inconvenience to self and family, and expense. All of this, when perhaps a little more care, and some additional precautions, such as a larger pathway next to the heating area, would have avoided calamity.

Beekeeping equipment is heavy, so we should always use proper lifting techniques.

Honey house equipment can contain HOT liquids, and knives and cappings scratchers are sharp.

BE CAREFUL - echo the words of mom and grandma. Oh if only we had!

So, from Me, "Be Careful".

Martin Gutzmer

HONEY FOR THE DOCTOR

My husband and I are beekeepers and honey producers and, when our children were little and had a pediatrician appointment, the doctor always asked me to bring her a 5# jar of honey.

So it was that, when visiting the pediatrician for a yearly check up, I seated our child on the examining table with a 5# jar of honey next to her. The nurse came in to take all the preliminary tests and, seeing the large jar of honey, said, "Ewwwww….did the doctor really want this much?"

Need I say anything else?

Karen Lorence
Illinois

BEEYARD USES FOR PLASTIC SIGN BOARDS

I have seen articles in the past on thrifty beekeepers and the use of second-hand materials in the beeyard. Besides the use of corrogated plastic signboard material for making small hive beetle traps, here are some other uses for this handy material, after it has served its initial purpose. This free material is particularly useful when an apiary is growing faster than are the resources needed to fully equip it! And in an election year the bees are apparently indifferent to whether the signs come from Republican, Democrat or independent candidates! These signs were acquired after the election had been held by contacting the candidates or their election committee chairpersons.

Joe Lewis
Harford Honey
Bel Air, MD

Beekeeping uses for recycled plastic sign boards.

SENATE TRADE LEADERS PROPOSE LEGISLATION TO COMBAT EVASION OF U.S. TRADE LAWS

GIVES THE U.S. DEPARTMENT OF COMMERCE NEW TOOLS TO ENFORCE TRADE REMEDY LAWS; PROVIDES MORE ACCOUNTABILITY FOR U.S. PRODUCERS

Washington, D.C. – In an effort to make it more difficult for foreign exporters to circumvent U.S. trade laws, U.S. Senators Ron Wyden (D-Ore.) and Olympia J. Snowe (R-Maine) introduced a major legislative initiative Aug. 5, 2010 that will give the U.S. Department of Commerce (DoC) both a mandate and additional tools to enforce U.S. trade remedy laws, specifically those related to anti-dumping and countervailing duties (AD/CVD).

Exporters from developing countries like China have been known to mislabel shipments and reroute goods through third-party countries in an effort to fool customs officials and circumvent U.S. laws designed to promote free and fair trade. The surging number of imports from these countries is making it harder and harder for customs officials to identify cheaters and enforce laws. The Enforcing Orders and Reducing Circumvention and Evasion (ENFORCE) Act will expand DoC's powers, and require a uniform, rapid-response to allegations of evasion of U.S. trade laws by the DoC and U.S. Customs and Border Protection (CBP).

"The ENFORCE Act would dramatically improve the enforcement of U.S. trade laws designed to create a level playing field for U.S. producers," said Wyden, who chairs the International Trade Subcommittee of the Senate Committee on Finance. He added, **"If the government is serious about helping American businesses grow and create jobs, it must ensure that U.S. trade laws are enforced and duties are paid. The ENFORCE Act is going to unleash the resources of the U.S. Department of Commerce to investigate evasion of U.S. trade laws and ensure that the correct trade remedy duties are applied at the border."**

"Most companies play by the rules, but when certain unscrupulous foreign exporters invent schemes to avoid paying duties it puts American workers at a disadvantage and bilks our government out of millions of dollars in uncollected fees," said Snowe, a senior Member of the Senate Committee on Finance. **"Our bill seeks to strengthen the process of investigation between Commerce and Customs to combat evasion and ensure we are enforcing the trade remedy statutes that are currently on the books."**

Currently, domestic producers may petition the U.S. Department of Commerce (DoC) to investigate imports that are believed to be sold at less than normal value (dumped) or unfairly benefit from government subsidies. If the U.S. government finds that these imports are dumped or subsidized to a degree that causes harm to U.S. producers, the DoC applies antidumping (AD) duties in the case of dumped imports, and countervailing duties (CVD) in the case of subsidized imports. AD/CVD "orders" are the primary means by which the U.S. combats unfair trade in merchandise. These trade "remedy" laws are only effective to the extent they are enforced, and importers are increasingly devising schemes to avoid paying AD/CV duties. Although the DoC initially imposes the AD/CV duties, it is currently unable to investigate whether importers are circumventing them.

The Enforcing Orders and Reducing Circumvention and Evasion (ENFORCE) Act of 2010 is designed to combat the evasion of AD/CVD orders and enforce the trade remedy statutes that are currently on the books. The ENFORCE Act would do the following:

- **Empower the DoC to investigate evasion of trade remedy laws.** Currently, U.S. Customs and Border Protection (Customs) is empowered to investigate allegations of evasion and enforce AD/CVD orders. The broad scope of Customs' mission leads many to believe that is too slow in identifying and responding to AD/CVD evasion in a way that is helpful to domestic producers. Empowering the DoC to investigate the evasion of an AD/CVD order, which the DoC imposed in the first place, is a common-sense strategy to combat unfair trade practices. The ENFORCE Act would not diminish Customs' role; rather, it would bolster greater cooperation and information sharing between the two agencies to combat unfair trade practices that hurt U.S. manufacturing and employment.
- **Establish a rapid-response timeline by which the DoC and Customs would respond to allegations of evasion.** The ENFORCE Act would give the U.S. government 60 days, after an allegation of evasion is put forward, to determine whether there is a reasonable basis to believe an importer is evading an AD/CVD order. If an affirmative preliminary determination is made, the ENFORCE Act would require that AD/CV duties be collected *in cash* until the investigation is concluded.
- **Improve the safety of imports.** Many of the same schemes that importers employ to evade an AD/CVD order, like mislabeling, often shirk regimes the U.S. has in place to ensure that products are safe for consumption. The ENFORCE Act would authorize information sharing among the appropriate agencies when the government determines that an importer may be attempting to evade an AD/CVD order.

The ENFORCE Act enjoys the support of various trade and industry groups including the American Honey Producers Association, the Coalition for Enforcement of Anti-dumping and Countervailing Duty Orders, and the Committee to Support U.S. Trade Law.

ACCUSED ILLEGAL HONEY LAUNDERER PLEADS GUILTY IN LIEU OF PLEA AGREEMENT

The United States District Court Northern District of Illinois Eastern Division U.S. Attorney Patrick J. Fitzgerald announced Aug. 4, 2010 a plea agreement with defendant Huang Ta Fan and his attorney, James I. Marcus. "The information in this case charges defendant with conspiracy to defraud the United States and to commit offenses against the United States, to wit: Entry of Goods into the United States by Means of False Statements, in violation of Title 18, United States Code, Section 545, all in violation of Title 18, United States Code, Sections 371 and 2."

CHARGE TO WHICH DEFENDANT IS PLEADING GUILTY

"By the Plea Agreement, defendant agrees to enter a voluntary plea of guilty to the information, which charges defendant with conspiring to enter and cause to be entered by means of false and fraudulent statements and documents, goods into the United States, in violation of Title 18, United States Code, Sections 542 and 545, that is, 48 entries compromised of Chinese-origin honey falsely declared as Korean, Taiwanese, and Thai-origin honey having a total declared value upon entry into the United States of at least $1,681,163, thereby avoiding antidumping duties otherwise applicable to Chinese-origin honey of approximately $3,089,977; and 50 containers of Chinese-origin honey falsely declared as Indian-origin honey having a total declared value upon entry into the United States of at least $1,155,200, thereby avoiding antidumping duties otherwise applicable to Chinese-origin honey of approximately $2,288,393; together resulting in a total loss to the United States of approximately $5,378,370, all in violation of Title 18, United States Code, Sections 371 and 2."

As this was written, the court had not set a sentencing date for the defendant, Huang Ta Fan.

ARTIFICIAL BEE EYE GIVES INSIGHT INTO INSECTS' VISUAL WORLD

Despite their tiny brains, bees have remarkable navigation capabilities based on their vision. Now scientists have recreated a light-weight imaging system mimicking a honey bee's field of view, which could change the way we build mobile robots and small flying vehicles.

New research published in August, in IOP Publishing's *Bioinspiration & Biomimetics*, describes how the researchers from the Center of Excellence 'Cognitive Interaction Technology' at Bielefeld University, Germany, have built an artificial bee eye, complete with fully functional camera, to shed light on the insects' complex sensing, processing and navigational skills.

Consisting of a light-weight mirror-lens combination attached to a USB video camera, the artificial eye manages to achieve a field of vision comparable to that of a bee. In combining a curved reflective surface that is built into acrylic glass with lenses covering the frontal field, the bee eye camera has allowed the researchers to take unique images showing the world from an insect's viewpoint.

In the future, the researchers hope to include UV to fully reflect a bee's color vision, which is important to honey bees for flower recognition and discrimination and also polarization vision, which bees use for orientation. They also hope to incorporate models of the subsequent neural processing stages.

As the researchers write, "Despite the discussed limitations of our model of the spatial resolution of the honey bees compound eyes, we are confident that it is useful for many purposes, e.g. for the simulation of bee-like agents in virtual environments and, in combination with presented imaging system, for testing bee-inspired visual navigation strategies on mobile robots." *(Courtesy Bioinspiration & Biomimetrics)*

BELTSVILLE BEE LAB BUILDING TO BE RENOVATED

A construction contract for $12.4 million, funded by the American Recovery and Reinvestment Act, has been signed to provide critical deferred maintenance to equip an historic laboratory building to do cutting-edge research at the U.S. Department of Agriculture's Henry A. Wallace Beltsville Agricultural Research Center (BARC) in Beltsville, Md.

BARC is operated by the Agricultural Research Service (ARS), which is USDA's chief intramural scientific research agency, and is one of the largest agricultural science centers in the world.

The repairs will be done at BARC's Building 306, which was built in the 1930s to house research projects formerly conducted at USDA's Arlington Farm and subsequently moved to Beltsville to make way for the Pentagon. The building is a historic example of Georgian Revival architecture. About 55 people, including 12 scientists, will move into Building 306 when the repairs are compete. This will include most of ARS' Environmental Management and Byproducts Utilization Laboratory as well as the Bee Research Laboratory, which is leading USDA's efforts to find the cause of Colony Collapse Disorder, the condition causing the mysterious disappearance of honey bees.

"With these repairs, Building 306 will be more environmentally efficient, and our research programs will be more effective in their renewed facilities," said BARC Director Joseph Spence.

COMMERCIAL TRAP FOR WASPS, HORNETS AND YELLOWJACKETS "BAITED" WITH USDA TECHNOLOGY

Safe for Use Around Honey Bees

Forget the ants marching one by one--yellowjackets are the real party-crashers when it comes to spoiling picnics, outdoor barbeques and other summer fun where cold beverages and meat are present.

Fortunately, a new trap is available that lures these stinging, sugar-sipping pests to their doom, thanks to attractants developed by U.S. Department of Agriculture (USDA) scientists and commercialized by Sterling International, Inc., of Spokane, Wash. The scientists work for USDA's chief intramural scientific research agency, the Agricultural Research Service (ARS).

Sold commercially as the RESCUE! W-H-Y Trap (Wasps, Hornets and Yellowjackets), the technology is the successful outcome of a cooperative research and development agreement involving Sterling and the ARS Yakima Agricultural Research Laboratory in Wapato, Wash.

In studies there, research leader Peter Landolt isolated two key compounds from fermented molasses to produce an attractant blend that lures not only yellowjackets, but also paper wasps and hornets. ARS holds patents on the attractant and has licensed it to Sterling.

Yellowjackets and paper wasps become especially irksome during the spring and summer, when their foraging intersects with the outdoor activities of winter-weary humans. However, the insects are also considered agricultural pests. In orchards and vineyards, for example, their feeding damages cherries and grapes. They're also a danger to field workers, especially around harvest time.

The blend Landolt developed and tested in collaboration with Sterling President Rod Schneidmiller and R&D Director Qing-He Zhang attracts 12 yellowjacket species, multiple paper wasp species (including *Polistes dominulus* from Europe) and two kinds of hornets, making it the most comprehensive lure yet.

Sterling's W-H-Y trap is unique in its design, with two compartments. The bottom is baited with an attractant that primarily lures western and southern yellowjackets. The top uses a different attractant blend to lure other yellowjacket species, bald-faced hornets, European hornets and paper wasps.

Once inside, the pests die by drowning or dehydration, depending on the compartment. Beneficial insects including honey bees are not attracted to the traps. W-H-Y traps are available to consumers at retail chains nationwide. (Courtesy ARS News Service)

OBITUARY
FRANK A. ROBINSON

Frank Robinson, 89, died Aug. 18, 2010.

Frank Albert Robinson, 89, died Aug. 18, 2010 at his home in Tallahassee, FL. A memorial service was held Aug 28th at Grace Presbyterian Church in Gainesville.

Frank was born in Columbus, Ohio the middle son of Kate G and Edgar W Robinson. The family moved to Mountain Brook, Alabama in 1923 where his father worked as an engineer for Alabama Power Company, retiring as Vice President of Operations.

Frank served in the U.S. Army Air Corp from 1942 till 1945 and was awarded the Presidential Commendation Medal.

Prior to moving to Tallahassee 2 years ago, Mr. Robinson lived in Baton Rouge, La., and since 1950, in Gainesville.

A graduate of Auburn University, Frank was retired from the University of Florida after 35 years of service as a Research Professor in IFAS specializing in Apiculture.

Frank was a member of Grace Presbyterian Church in Gainesville, where he served as Deacon, Elder and Treasurer. Since moving to Tallahassee he had been a member of Faith Presbyterian Church.

He was a member of the International Bee

Research Association, Executive Secretary of The American Beekeeping Federation, Florida Entomological Society, Entomological Society of America, Southern Association of the Food and Drug Administration, and the Florida Beekeeping Association.

Frank also served as a Volunteer with Hospice of North Central Florida and the North Central Florida Long Term Care Ombudsman Council where he was honored as RSVP Volunteer of the Year for 2007.

He is survived by his wife of 68 years Sarah S. Robinson of Tallahassee, daughter Sarah Katherine Sparkman of Tallahassee, son Richard E. Robinson (Janet) of Birmingham, Alabama, grandson Brent D. Sparkman (Danielle), granddaughter Melissa K. Bakas (Ben), great grandchildren Blake and Logan Sparkman, Bryson and Sarah Katherine Bakas all of Tallahassee, sister-in-law Carolyn C. Robinson of Ashland, Virginia and many wonderful and loving nieces and nephews. *(Courtesy The Gainesville Sun)*

NORTH AMERICAN BEEKEEPING CONFERENCE AND TRADE SHOW SCHEDULED

Together for a Sweet Future

Beekeeping Industry to Gather in Galveston in January

Plans are well underway for the "Together for a Sweet Future" 2011 North American Beekeeping Conference & Tradeshow, Jan. 4-8, in Galveston, Texas. This joint conference of the American Beekeeping Federation (ABF), the American Honey Producers Association (AHPA) and the Canadian Honey Council (CHC) promises to be the largest beekeeping event in the United States. And with anticipated attendance of more than 1,200, this is sure to be the conference you won't want to miss – beekeepers at all levels and from all over North America and beyond will gather to share ideas and develop new contacts.

The joint conference promises to offer something for everyone. From the new hobbyist to the seasoned professional, conference organizers have planned a schedule to incorporate educational sessions at all levels. The tradeshow has also been expanded to offer even more great deals and new product ideas. And, other industry-related organizations have been invited to participate in this groundbreaking event, including the American Association of Professional Apiculturists (AAPA), the American Bee Research Conference (ABRC), the Apiary Inspectors of America (AIA) and the National Honey Packers and Dealers Association (NHPDA).

The conference will be held at the San Luis Resort, which consists of four properties: The Galveston Convention Center (where all meetings will be held); The Hilton; The San Luis Resort; and The Holiday Inn. We have secured rooms at all three hotels with rates ranging from $89.00 to $99.00 per night (plus tax).

The conference will begin on Tuesday evening with a complimentary welcome reception for all registered attendees. Wednesday morning will kick-off with the Opening General Session followed by Shared Interest Group meetings, and then finish in the evening with the traditional Honey Queen Reception. The 2011 American Honey Show will also take place on Wednesday.

The expanded tradeshow will open on Wednesday afternoon and remain open during conference hours until noon on Saturday. Thursday and Friday will be dedicated to general sessions, as well as the always-popular and well-attended Serious Sideliner Symposium facilitated by Dr. Larry Connor of Wicwas Press and the ABRC conference. Interactive workshops will take place on Saturday morning. In addition, both the ABF and AHPA will host their annual banquets during the conference.

The conference will include many great opportunities for networking and socializing, including two optional activities. "Murder by Honey" will take place on Thursday evening and includes dinner and entertainment, provided by YOU. That's right, join us for a murder mystery dinner, where you and your fellow beekeepers will put on your acting caps and show just how talented you truly are. This is sure to be a great time for all who participate.

The second optional activity will follow the conference on Sunday and is just the place to unwind and socialize with your new friends. We've reserved the conference lounge at the San Luis Resort for lunch, networking and fun. So before you go home, stop by for a little last-minute mingling.

Registration rates, online registration and hotel reservation information are now available on the conference Web site at **www.nabeekeepingconference.com**. Be sure to check the Web site often as additional conference details will be posted as soon as they are made available.

NEW YORK

The Western New York Honey Producer's
November Potluck Dinner

Date and time: Wednesday, November 17, 2010 6:00 p.m.
Place: First Presbyterian Church
9 Paine Street, East Aurora, New York
Speaker: Dr. Larry Connor- Biology Driven Management
Note: Bring dish to pass, your own utensils, plates, and cups. Beverages provided.
Any questions: Call Fred Thompson at (716) 773-4945
Website: **www.wnyhpa.org**

NEW JERSEY

The New Jersey Beekeepers Association will be holding their fall all-day meeting on Oct. 2, 2010 at the Rutgers EcoComplex, Bordentown, NJ. The featured speaker will be Kim Flottum, editor of *Bee Culture* magazine, who will speak about Producing and Marketing Artisanal Honey and the State of Beekeeping in America. For information and to register contact Curtis Crowell at 609-651-4585 or email him at **curtis.crowell@att.net**.

CONNECTICUT

Fifth Southern New England Beekeepers Assembly November 20 features Medhat Nasr, Dave Miksa and Larry Connor

With a theme of PROACTIVE BEEKEEPING, the fifth SNEBA meeting will run from 8 am to 5 pm at the Unitarian Society of New Haven, located on Turnpike Road in Hamden, CT.

Speakers and topics are:

Medhat Nasr Ph.D., Alberta Provincial Apiarist, Alberta Canada. He will speak on: 1. Practical Integrated Pest Management for Honey Bee Varroa Mites. 2. Alberta Honey Bee Surveillance Program: Is it Colony Collapse Disorder? and 3. Use of Organic Acids in Mite Control: Principles and How to make them work.

David Miksa, Commercial Queen Producer, Groveland, Florida. He will speak on three aspects of queen rearing, selection and queen use: 1. "Why it Happens", 2) "Tools Needed" and 3) "How we do it". Miksa produces tens of thousands of queen cells for use throughout the United States.

Larry Connor, Ph.D. Owner, Wicwas Press and Author for *Bee Culture* and *American Bee Journal*. He will discuss: 1. Virgins and 48-hr cells, My experience in 2010, 2. Insanity Confirmed: Setting up a very small queen rearing and breeding program, and 3. Teaching beekeeping teachers.

Registration is $49 per person with a reduced fee of $39 for those registering by October 31. A box lunch will be an option at $10 per person. You may bring your own lunch.

Registration forms are available at the **SNEBA.COM** website—please check that site for updates. PayPal registrations are being accepted at the **WICWAS.COM** bookstore website.

CONNECTICUT

BackYard Beekeepers Association

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

Ms. Berry, apicultural research coordinator and lab manager at the University of Georgia, will discuss her recent publication from the Proceedings of American Bee Research Conference.

Meetings are at 7:30 p.m. in the Norfield Congregational Church in the Community Room on Norfield Road in Weston, Connecticut. At 6:30 p.m. there is a NewBees meeting for beginning beekeepers and WannaBees youth group meeting.

Each month we have timely weekend hands-on inspection workshops, bee school, mentor program and more. All events are free and open to the public.

Please check our web site for the dates and locations or more information at

www.backyardbeekeepers.com.

2010 BYBA General Meetings Program
November 30: Allan Hayes on his unusual beekeeping tools & gadgets

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, University of California; and Dee Lusby of Arizona. For more information contact Pat Randol 515-210-7445 or email Pat@RandolHoney.com.

ILLINOIS

Queen Initiative Fall Meeting

The Fall Meeting of the Illinois Queen Initiative (IQI) will be Saturday, October 16 at Grand Bear Lodge in Oglesby, IL. Dr. Jeff Harris of the Baton Rouge Honey Bee Lab will be the featured speaker. He has considerable experience with both the Varroa Sensitive Hygiene and Russian honey bee projects. Dr. Harris will give one talk on breeding basics and one on those projects and how beekeepers can utilize their genetics in breeding locally-adapted, mite and disease-resistant bees. Oglesby is located near the intersection of US Highways 39 and 80. There are numerous hotels/motels 15-30 minutes from the Lodge, which is near starved Rock State Park with its beautiful fall foliage and unique vistas.

The meeting will be from 9 a.m. to 4 p.m. In addition to Dr. Harris, there will be a panel discussion with several Illinois queen producers and a presentation by IQI coordinator Dr. Stu Jacobson. There will be plenty of time for questions and sharing ideas. The priority audience for the meeting is those who are currently raising queens for sale to other beekeepers, as well as those who took the IQI queen raising classes in 2009 or 2010.

Registration: The cost is $15.00, which includes lunch and refreshments. Space is limited. If you currently produce queens for sale or seriously plan to do so and wish to attend, please send an e-mail to sjacobson@warpnet.net describing your queen raising interests.

MISSISSIPPI

October 28-30, 2010
Jones Junior College Advanced Technology Center
Ellisville, Mississippi

Motel Accommodations – Please make your own reservation:

Call Hampton Inn & Suites – (601) 399-0659. Call before October 8 to insure that you get a room and you must tell them that you are with Mississippi Beekeepers Association, Code MBA. Only a limited number of rooms at $93.00 + tax per night have been reserved.

The $25.00 pre-registration fee must be received no later than Oct. 15, 2010. Mail to Harry Fulton, PO Box 5207, Mississippi State, MS 39762. Please call (662) 325-7765 if you need additional information.

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

The WHPA's Fall Convention will be held Nov. 4-7, 2010 at the Holiday Inn, 4601 Calumet Ave., Manitowoc, WI. Early registration fees paid before 9/30/10 will be $40.00 for members and $15.00 for their spouses and children (12-18 years at home). Late registration fees for members will be $55.00 and $15.00 for their spouses and children (12-18 years at home). Rates are higher for non-members. Friday luncheon is $15.00 and Saturday banquet is $25.00

LOUISIANA

Fourteenth Annual Field Day at the Baton Rouge Honey Bee Lab

The Honey Bee Breeding, Genetics & Physiology Laboratory in Baton Rouge, Louisiana will hold its annual Field Day on Saturday, Oct. 23, 2010. The one-day event will be held at the laboratory building and grounds at 1157 Ben Hur Rd. Gates will open at 9:30 a.m.; activities are scheduled from 10:15 a.m. to 3:30 p.m. A registration fee ($12.00 for adults and $5.00 for children) includes refreshments and a catered lunch.

The field day will include activities for both beginners and experienced beekeepers. A highlight this year will be a queen-rearing workshop in addition to other interactive demonstrations. Beekeepers will have access to a number of activities including a beginning beekeeping course, artificial insemination, grafting, and more.

Those planning to attend must register by October 1 so that refreshments and the catered lunch can be arranged. Please mail your registration check (payable to the Louisiana Beekeepers Assn.) to, Honey Bee Lab, 1157 Ben Hur Road, Baton Rouge, LA. 70820. For more information contact Dr. Lanie Bourgeois (225/767-9299), Alva Stuard (225/261-2032), or the websites for the Louisiana Beekeepers Association www.labeekeepers.org and the Honey Bee Lab http://ars.usda.gov/msa/br/hbbgpru

LOUISIANA

Louisiana Beekeepers Association (LBA) Annual Convention December 3 – 4, 2010

The Louisiana Beekeepers Association will hold their 49th annual convention on Friday, December 3rd and Saturday, December 4th at the Embassy Suites in Baton Rouge, Louisiana. Please join us for the latest research information from the USDA/ARS Honey Bee Breeding, Genetics & Physiology Lab. Beekeeping basics, pest management and many more topics will be discussed. A block of rooms will be held for the LBA at a special rate of $89.00 plus tax. Please call the hotel at 800.362.2779 to make your reservation. **Remember to mention the Louisiana Beekeepers Association to get the special rate. Please, make your reservations early, since the cut off date is November 25th.** A registration fee of $10.00 is required. There will be something for everyone from beginner to lifetime beekeeper, so please join us in Baton Rouge. For more information contact Alva Stuard at 225.261.2032, Sharon Hebert at 337.937.6722 or Jimmy Dunkley at 225.610.2628 or visit the web site at www.labeekeepers.org.

NEBRASKA

Nebraska Beekeepers will host guest speaker Kirk Webster on November 20. Additional speakers include Reed Johnson and UNL graduate students. For more information, visit nebraskabeekeepers.org or contact Todd Fiala at 402-783-0324 or tf92300@windstream.net.

OKLAHOMA

Oklahoma State Beekeepers fall conference to be held Friday, Oct. 29 at 7-9 p.m., Saturday, Oct. 30 at 8:30 a.m. to 4:30 p.m. at OSU Extension, 900 N. Portland, Oklahoma City, OK. Contact: Teresa Bell (405) 537-8326

TEXAS

Chemical-Free Beekeeping Is On The Rise

Dennis Brown, former commercial beekeeper and founder of "Lone Star Honey Farms", shares his wealth of knowledge and experience with the world. Dennis does not use hard or soft chemicals in his hives and they are strong and prosperous. He has started a club that is open to anyone who keeps their hives chemical free. It doesn't matter where in the world you live in order to join. There are members from as far away as "Northern Ireland". There is a wealth of information on his web site and to become

a member is free. Dennis writes a monthly article in an East Texas newspaper and teaches monthly classes. He initiated the first contact with the "Boy Scouts of America" to re-instate the beekeeping merit badge last November. "Lone Star Farms" is on the move with helping beekeepers to become chemical-free and would like to take any beekeeper along with them who wants to support chemical-free beekeeping. The Lone Star Farms motto is "Saving The Bees One Hive At A Time". If you want to help or for more information, please visit **www.lonestarfarms.net**

MONTANA
State Convention

Kalispell, MT
October 14 – 15, 2010

Hotel: Hilton Garden Inn, Kalispell
1840 US Highway 93, Kalispell, MT 59901
406.756.4500
Refer to this conference to receive discounted room rate.

Registration info: To be mailed to all MSBA members or contact **Nicole@Morrishoney.com**

Vendors: Vendors are welcome to participate! Tables available for vendors and vendor donations are appreciated. Please mail donations and/or door prizes directly to the hotel identifying our conference. Please contact Nicole with any questions at **Nicole@morrishoney.com**

OREGON
Northwest Beekeepers Conference

The Washington State Beekeepers association will be hosting the Northwest Beekeepers Conference on Oct. 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 p.m. and with conference sessions on Friday and Saturday beginning at 8 a.m. through 4:30 p.m. each day. A banquet and benefit auction will be held Friday evening the 29th starting at 7 p.m. at the Hood River Inn. Registration information can be obtained from: Paul Hosticka, 517 S Touchet Rd., Dayton, WA 99328 (**pshosticka@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.

FLORIDA
Florida State Beekeepers Association
90th Annual Convention

Estero Community Park, Estero, Florida
October 28, 29, & 30, 2010

The Beekeepers Association of Southwest Florida is pleased to announce the 2010 Florida State Beekeepers Association Annual Convention will be held in Southwest Florida on October 28, 29 & 30, 2010. For more details, see **http://swfbees.com/**

MICHIGAN

The Michigan Beekeepers' Association (MBA) will be holding their 2010 Fall Meeting at the Hilton Grand Rapids Airport Hotel on October 22 – 23. Guest speakers include Doug McRory, retired commercial beekeeper and retired Provincial Apiculturist of Ontario, Canada, and Dr. Malcolm T. Sanford, retired Extension Apiculturist, University of Florida, Gainesville. In addition, there will be breakout sessions on Friday morning and afternoon, and Saturday morning.

On Friday evening, the MBA will host a "Beekeeper's Banquet", and on Saturday afternoon, a very important business meeting will be held to elect new MBA officers and to vote on the new MBA Constitution. All members are urged to attend.

Online registration is available for the fall meeting at **www.michiganbees.org**. Special room rates are available at the Hilton, and room reservations can also be made online.

Fees for both days are $20 for MBA members, and $10 for spouses. Non-members are $40, and spouses are $10. Single day fees are $10 for MBA members and $20 for non-members. Additional information is available at **www.michiganbees.org**.

TOGETHER for a SWEET FUTURE

NORTH AMERICAN BEEKEEPING CONFERENCE & TRADESHOW

January 4-8, 2011 • The San Luis Resort • Galveston, Texas



Come "Together for a Sweet Future" and join 1,200 of your closest beekeeping friends at the 2011 North American Beekeeping Conference and Tradeshow. The conference will be held January 4-8, 2011, on Galveston Island in Texas and promises to be one you won't want to miss.

Features of the conference include:

- Joint participation from the American Beekeeping Federation, the American Honey Producers Association and the Canadian Honey Council
- The American Bee Research Conference
- The Serious Sideliner Symposium
- The largest beekeeping tradeshow, full of the latest beekeeping innovations
- The 2011 American Honey Show
- Optional activities perfect for networking and socializing with fellow beekeepers and industry experts
- Something for everyone, from the new hobbyist to the seasoned professional

Conference Location:

The San Luis Resort
5222 Seawall Boulevard
Galveston Island, TX 77551
www.sanluisresort.com

The San Luis Resort consists of the Galveston Island Convention Center (where the tradeshow and all meetings will be held), the Hilton, the San Luis Resort and the Holiday Inn. Room rates range from $89 – $99 depending on which hotel you select.

2010 Registration Rates

Category	Advanced	On-Site
Single Person (Member)	$275.00	$325.00
Single Person (Non-Member)	$325.00	$375.00
Family (Member)	$375.00	$425.00
Family (Non-Member)	$425.00	$475.00
One-Day/One Person (Member)	$175.00	$225.00
One-Day/One Person (Non-Member)	$225.00	$275.00
One-Day/Family (Member)	$275.00	$325.00
One-Day/Family (Non-Member)	$325.00	$375.00

Non-member rates include a one-year membership to either ABF or AHPA.

Tentative Schedule: (subject to change)

Tuesday, January 4:

Morning/Afternoon:	Board and Committee Meetings
Evening:	Welcome Reception
	(complimentary to all registered attendees)

Wednesday, January 5:

Morning:	Opening General Session
Noon:	Tradeshow Opens
Afternoon:	Shared Interest Group Meetings
	Honey Show Judging
Evening:	Honey Queen Reception & Quiz Bowl

Thursday, January 6:

Morning:	Ladies Auxiliary Breakfast/Meeting
All Day:	General Session
	Serious Sideliner Symposium
	American Bee Research Conference
	Tradeshow
Evening:	"Murder by Honey" Dinner Show (optional)

Friday, January 7:

All Day:	General Session
	Serious Sideliner Symposium
	American Bee Research Conference
	Tradeshow
	Business Seminar
Evening:	AHPA Annual Banquet

Saturday, January 8:

Morning:	Interactive Workshops
	Tradeshow
Afternoon:	Business Meetings
Evening:	ABF/CHC Annual Banquet

Sunday, January 9:

Mid-Morning:	"The Hive" Beekeepers Social (optional)

For additional information and to register for the conference, please visit www.nabeekeepingconference.com

Donna Bilick with her bee sculpture, "Miss Bee Haven," at the Haagen-Dazs Honey Bee Haven, a half-acre bee friendly garden at the Harry H. Laidlaw Jr. Honey Bee Research Facility (Photo by Kathy Keatley Garvey)

"Miss Bee Haven" A Bee-utiful Work of Art in the UC Davis Honey Bee Garden

by KATHY KEATLEY GARVEY
Communications Specialist
Dept. of Entomology
University of California
Davis, CA

DAVIS, CA--Its title is a play on words, but the sculpture is a work of art.

"I like to play with words," said noted artist Donna Billick who created "Miss Bee Haven," a six-foot-long honey bee sculpture for the Häagen-Dazs Honey Bee Haven at the University of California, Davis.

The sculpture, funded by Wells Fargo, graces the half-acre bee friendly garden, located on the Department of Entomology grounds of the Harry H. Laidlaw Jr. Honey Bee Research Facility on Bee Biology Road.

"The bee sculpture is beautiful and provides the perfect focal point for the garden," said entomologist Lynn Kimsey, director of the Bohart Museum of Entomology and professor and former chair of the UC Davis Department of Entomology who oversees the garden. "On top of that it accurately represents a worker bee and provides an educational component as well as an aesthetic one."

"The Wells-Fargo honey bee sculpture is a wonderful educational tool in the garden," said Melissa "Missy" Borel, program manager of the California Center for Urban Horticulture who has helped develop the garden since its inception. "Visitors can get up close and personal with the bee, even touch the pollen baskets on her legs. We're fortunate to have such a beautiful model as a showcase to the public."

Kimsey, who is master-planning the grand opening celebration of the garden, set from 10 a.m. to 2 p.m. on Saturday, Sept. 11, said the Häagen-Dazs Honey Bee Haven "is sure to become a campus destination."

The key goals of the haven, Kimsey said, are to provide a year-around food source for the Laidlaw bees and other pollinators, to raise public awareness about the plight of honey bees, and to encourage visitors to plant bee-friendly gardens of their own.

The bee, shaded by an almond tree, stands on a pedestal/bench decorated with ceramic art tiles, the work of the UC Davis Art/Science Fusion Program. Billick, who worked on the bee from her Davis studio, Billick Rock Art, is the co-founder and co-director of the UC Davis Art/Science Fusion Program. Billick founded the program in 2006 with entomologist-artist Diane Ullman, professor and former chair of the UC Davis Department of Entomology and now associate dean for Undergraduate Academic Programs, College of Agricultural and Environmental Sciences.

The Art/Science Fusion Program includes design faculty, science faculty, museum educators, professional artists and UC Davis

(l) Artist Donna Billick (center) receives assistance from two members of the UC Davis Department of Entomology faculty in affixing donor plaques below the bee sculpture she created. (In front is native pollinator specialist Neal Williams, assistant professor, and Cooperative Extension apiculturist Eric Mussen. (r) The translucent wings of the bee sculpture are made with fiberglass. (Photos by Kathy Keatley Garvey, UC Davis Department of Entomology)

The bee sculpture, "Miss Bee Haven," towers over the bee garden at the Harry H. Laidlaw Jr. Honey Bee Research Facility at the University of California, Davis. The bee, created by Donna Billick, is morphologically correct, said Cooperative Extension apiculturist Eric Mussen of the UC Davis Department of Entomology faculty. (Photo by Kathy Keatley Garvey)

students. "Participants see and feel art and science, hold it in their hands, hearts and memories—in ceramics, painting, photographs, music, and textiles," Ullman said.

Billick, a self-described "rock artist," designed, fabricated and constructed "Miss Bee Haven" using rebar, chicken wire, sand, cement, tile, bronze, steel, grout, fiberglass and handmade ceramic pieces. The project took her four months to complete.

Millions of yellow porcelain tiles resembling hair cover the structure. "It's pretty hairy," the artist quipped.

Miss Bee Haven, placed in the garden in June, is no lightweight. Anchored with 200 pounds of cement and with six bronze legs drilled into the pedestal, this worker bee is destined to stay put—unlike the six million bees that forage from the 110 hives at the nearby Laidlaw facility.

Billick's sculpture is morphologically correct, said Cooperative Extension apiculturist Eric Mussen, member of the UC Davis Department of Entomology faculty. He praised the intricate detail of the head, thorax and abdomen.

"This is a surprisingly accurate rendition for a highly attractive work of art," Mussen said. "I can gather a group around it and point out the special anatomical features that make the honey bee such an invaluable pollinator of our food crops. This bee and all the other magnificent ceramic works of art around our building, on-campus structures, and planned-for future structures demonstrate the enormous, highly visible value of the Art/Science Fusion Program."

Billick used lost wax bronze casting to craft the six legs, which extend from the thorax to rest on a ceramic "purple dome" aster, fabricated by Davis artist Sarah Rizzo. The purple dome aster is among the flowers in the garden.

Billick created the double set of translucent wings with three sheets of fiberglass. The result: wings that are fragile-looking and true to life, but strong.

"During this entire process, I developed a real in-depth relationship with honey bees," Billick said. For inspiration and detail, she visited the apiary in back of the Laidlaw facility, read about the functions of bees, and held the thoughts close. "It was not about expressing anything other than the beeness. I have a lot of respect for bees."

"It was fun and satisfying to do," the rock artist added. "I learned a ton."

Billick is now creating a bee sculpture called "Swarmed," which she calls a "wild-card idea" gleaned from the making of Miss Bee Haven. The piece, being finished for an art show in San Francisco, features 30 suspended bees.

A 35-year artist and an alumna of UC Davis, Billick toyed with a scientific career before opting for a career that fuses art with science. She received her bachelor of science degree in genetics in 1973 and her master's degree in fine arts in 1977, studying art with such masters as Bob Arneson, Roy De Forest, Wayne Thiebaud and Manuel Neri.

Billick traces her interest in an art career to the mid-1970s when then Gov. Jerry Brown supported the arts and offered the necessary resources to encourage the growth of art. He reorganized the California Arts Council, boosting its funding by 1300 percent.

The mid-1990s is when Billick and Ullman began teaching classes that fused art with science; those classes led to the formation of the UC Davis Art/Science Fusion Program.

Billick's work is displayed in numerous public and private collections, including the Oakland Museum, Crocker Art Museum in Sacramento, Carborundum Museum in New York, Richmond Art Center; Richard Nelson Gallery at UC Davis, William Sawyer Gallery in San Francisco and Mills College in Oakland.

Her work on the UC Davis campus includes the colorful Harry H. Laidlaw Jr. Honey Bee Research Facility's ceramic sign that features DNA symbols and almond blossoms. A hole drilled in the sign leads to a bee hive.

Also in Davis, Billick created the whimsical Dancing Pigs sculpture and the Cow Fountain, both in the Marketplace Shopping Center on Russell Boulevard; the Meditation sculpture at Central Park Gardens; and the Frawns for Life near the West Area Pond.

She maintains a compound in Baja, where she teaches three workshops a year called "Heaven on Earth."

Miss Bee Haven also promises to provide heaven on earth--as a draw to admire the honey bee and as a sculpture to study the art form. "Bees are very engaging," Billick said. "I have a strong love for the work they do and how they go about doing it."

UNITED STATES

Honey crop estimates continue to look better than last season's record poor crop. Many beekeepers in the Northeast and Mideast harvested considerably more honey than they had received in the last few seasons. Favorable weather and rainfall at the right times are credited for the better crops. Parts of the Southeast and Southwest were hampered by unfavorable spring conditions followed by hot, dry weather that hurt honey flows, although some beekeepers were still able to secure average or better honey crops. Honey crops were definitely better in the East Central and West Central areas, but excessive rainfall or at times dry weather hampered flows and caused a rather spotty crop. Rainy, cool weather also hurt honey crops for some beekeepers in the Intermountain and West areas, but overall crops were still considerably better than last year's disappointing honey crop. Some beekeepers commented that the difference between receiving a good or poor crop was often determined by how strong overwintered colonies were and how much winter loss had to be recouped by making splits or buying nucs or packaged bees.

Beekeepers are happy to have some honey to sell this season, especially since both the wholesale and retail honey markets remain strong. Many buyers were disappointed last season that they could not buy their local honey variety favorites due to poor crops over most of the country. With continued strong demand and a general shortage of honey at the wholesale level, most of our reporters felt that prices should remain strong through the remainder of the year. According to some of our reporters, local packers are buying new crop honey quickly to restock their poor inventories. On the other hand, other packers are taking a "wait-and-see" attitude until they know how big the total U.S. honey crop will be before they commit themselves to a certain price.

Many area reporters felt that their bees were in reasonably good shape coming out of summer honey flows. In the case of commercial almond pollinators, these colonies will begin receiving build-up syrup and pollen supplements to prime them for early 2011 California almond pollination season. Almond pollination prices are expected to hold up well for the coming season and many beekeepers have already locked in prices and brood strength requirements for the 2011 season.

NORTHEAST—Honey crops have been good for the most part this year, finally breaking a series of poor seasons for many Northeastern beekeepers. Unfortunately, as is always the case, some locations missed the good flows due to either dry, hot weather or too much rain at the wrong time. Weather turned hot and humid during much of July and early August before cooler nighttime temperatures and mild summer days returned. A number of beekeepers were reporting flows from goldenrod, aster, purple loosestrife, and Japanese knotwood. Reporters said that beekeepers hoped to produce perhaps one more super of honey before removing all supers and starting their late summer or fall medications and feeding.

Bees are generally in good condition at this point, so beekeepers are optimistic. With better honey crops, beekeepers are also happy about being able to restock customers who have not been able to obtain local honey for quite some time. Demand is strong and prices have climbed at roadside markets, fairs and festivals.

MIDEAST—Beekeepers reported average to excellent honey crops before the hot weather began in July. While some beekeepers missed their main flows from clover due to rainy weather, many others have told us that they have produced good honey crops from clover, as well as many wildflowers. Beekeepers were busy extracting honey in July and August. They were also beginning their mite treatments

in mid to late August as the temperatures returned to more seasonal norms. Some told us that they were simply afraid to begin chemical mite treatments when temperatures were in the 90's or triple digits.

In the mountains sourwood flows were rated as below normal, although some beekeepers still received a super or more of sourwood honey. Some goldenrod and aster was blooming as this was written and beekeepers hoped that their colonies would be able to make some winter stores from these sources. Beekeepers were also busy with bottling and selling their honey. They are finding a very receptive customer base, especially for local favorites like sourwood, sumac, black locust and clover honey.

SOUTHEAST—Florida honey crops were down anywhere from 25 to 50% from normal due to cool, rainy early spring weather followed by dry, hot weather later in the season. Although some of the orange honey crops were excellent, later important flows from tupelo, gallberry and palmetto were down significantly. Georgia honey crops were also down some, but some beekeepers did produce good crops. In the northern mountains, for example, sourwood flows were good. Mississippi honey flows were down about 10%, while reporters from Alabama believe their crop was near average or above average. Beekeepers anticipate having little trouble selling their honey production this season since both bottle-grade and industrial honey remain in short supply. Some beekeepers were already selling out of varietal honeys such as tupelo and orange.

Fall flows are expected from goldenrod, aster and Spanish needles. In Florida, beekeepers mentioned flows from Brazilian pepper, melaleuca and black mangrove. The extremely hot, humid July was hard on bees. Many beekeepers waited on mite treatments until the weather cooled some. Varroa mite problems have not been severe, but in some parts of the Southeast, small hive beetles were again a major problem for beekeepers.

SOUTHWEST—As major flows drew to a close in July, beekeepers were finishing their extracting and starting their late summer/early fall mite and disease treatments. Regional flows mentioned included soybeans, cotton, sunflowers, pumpkins, melons and wildflowers. Early flow reports were mixed, but many beekeepers were able to harvest fair to good crops before the extremely hot, dry weather began in July. Despite the difficult weather conditions, colonies were generally in fair to good condition. Beekeepers were finishing their honey extracting and bottling. Honey demand was listed as good for both wholesale and retail sales. As cooler weather returns this fall, sales are expected to pick up even more, especially as fall fairs and festivals get underway.

EAST CENTRAL—Honey crops are definitely better than last season's poor

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. Bik.	$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	$1.35-$1.60
Amber lb. Bik	$1.35-$1.60	$1.30-$1.75	$1.30-$1.50	$1.30-$1.60	$1.35-$1.75	$1.30-$1.60	$1.30-$1.50	$1.30-$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 1/2lb. (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.	$2.10-$3.50	$2.10 -$2.75	$2.10 -$3.00	$2.10 -$2.50	$2.10 -$2.50	$2.10 -$2.50	$2.10 -$2.50	$2.10 -$2.50
Dark per lb.	$1.95-$3.00	$1.95 -$2.35	$1.95 -$2.25	$1.95 -$2.25	$1.95 -$2.25	$1.95 -$2.25	$1.95 -$2.25	$1.95 -$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.

HONEY MARKET FOR THE MONTH OF JULY 2010

In volumes of 10,000 pounds or greater unless otherwise stated

(From AUGUST 2010 USDA National Honey Report)

Prices paid to beekeepers for extracted, unprocessed honey in major producing states by packers, handlers & other large users, cents per pound, f.o.b. or delivered nearby, containers exchanged or returned, prompt delivery & payment unless otherwise stated.

-Report includes both new and old crop honey-

(# Some in Small Lot — +Some delayed payments or previous commitment)

Arkansas - Soybean light amber $1.35
California - Alfalfa light amber $1.29
Orange white $1.59
Dakotas - Clover white $1.60 - $1.65
Florida - Galberry white $1.60
Galberry extra light amber $1.55
Orange white $1.60 - $1.65
Orange extra light amber $1.60
Palmetto extra light amber $1.55
Wildflower white $1.58
Wildflower extra light amber $1.55
Wildflower light amber $1.30 - $1.40
Louisiana - Wildflower extra light amber $1.55
Tallow extra light amber $1.25
Maine - Blueberry extra light amber $1.65
Mississippi - Galberry extra light amber $1.55
Montana - Clover white $1.60
Texas - Tallow light amber $1.25 - $1.30

Prices paid to Canadian Beekeepers for unprocessed, bulk honey by packers and importers in U. S. currency, f.o.b. shipping point, containers included unless otherwise stated. Duty and crossing charges extra. Cents per pound.

Mixed Flowers white $1.50 - $1.62

Prices paid to importers for bulk honey, duty paid, containers included, cents per pound, ex-dock or point of entry unless otherwise stated.

Argentina - Mixed Flowers white $1.48 - $1.59
Mixed Flowers extra light amber $1.45 - $1.59
Brazil - ORGANIC light amber $1.50 - $1.51
India - Mixed light amber $1.17
Mustard extra light amber $1.40 - $1.47
Mustard light amber $1.29 - $1.40
Mexico - Orange white $1.60 - $1.64
Vietnam - Mixed light amber $1.17 - $1.23
Uruguay - Mixed white $1.54 - $1.56

yields, but due to excessive rains during main honey flows, some beekeepers were disappointed in their crops. The honey crop has been spotty, and some beekeepers have noticed great yield variations from one outyard to the next. The main crop came from clover, alfalfa and basswood. The thistle flow was disappointing for some beekeepers, however. Later honey flows were being received from purple loosestrife, goldenrod, aster, sunflowers and Japanese knotwood.

Beekeepers were beginning their fall mite and disease control programs. Other beekeepers were busy extracting and bottling their crops. Honey remains in short supply, so both the wholesale and retail honey markets are still strong.

Both Illinois and Michigan beekeepers were happy to hear that their state legislatures have passed laws to exempt small producers from expensive licensing and honey house inspections. This will allow many small producers to continue to sell their honey locally at farmers markets, fairs and festivals.

WEST CENTRAL—Excessive rain also hurt honey crops in this area, but many locations were spared from the unrelenting summer showers and in these locations beekeepers have done quite well. In fact, some beekeepers are crediting the extra rain with helping their summer clover and alfalfa flows, as well as extending late alfalfa, smartweed, sunflower and goldenrod flows. Soybeans also produced some honey in July and August.

South Dakota honey crops were hurt in the south and eastern parts of state by too much rain and then grasshoppers ate up some western locations. North Dakota sources were saying that many of this state's beekeepers received excellent clover and alfalfa flows. Nebraska beekeepers also mentioned heavy rains, but in many cases sources felt that the added moisture actually helped honey flows rather than hurting them. Frequent summer rain showers also inundated parts of Iowa and Missouri, but a surprising number of beekeepers still believe that their bees will make an average or better honey crop. Early flows came from clover, bass-

wood and alfalfa, but later in the season, after the rain showers let up, beekeepers also made some honey from soybeans, sunflowers, second-cutting alfalfa, goldenrod, aster, and smartweed.

As this was written, beekeepers were extracting and bottling honey. Mite treatments were also starting as beekeepers began thinking about preparing their colonies for overwintering. High temperatures extending through August caused some beekeepers to delay mite treatments until milder seasonal temperatures returned.

The honey market at both the wholesale and retail levels is good, although some producers said that a few packers were taking a wait-and-see attitude until more is known about the extent of the 2010 honey crop. Wholesale honey prices offered are ranging from $1.55 to $1.65 for white honey and between $1.50 and $1.60 for amber grades. Some small lots of honey are selling at considerably better than this, however. Retail sales at local roadside markets, fairs and festivals have been fair to good. Sales were expected to increase once cooler weather returns.

INTERMOUNTAIN—Honey flows came a bit later, some delayed by rainy, cool weather, while others suffered from windy, dry conditions. Honey crops are generally better than last year, but some beekeepers were still disappointed with their total crops. Honey flows came from canola, yellow and white sweet clover, alfalfa, sunflowers and numerous wildflowers. Beekeepers are also hoping for some late winter stores from wildflowers such as goldenrod and rabbit brush.

Extracting started a bit later than usual, but was well underway by the end of August. Prices being offered for larger lots of honey are mostly varying from $1.50 to $1.65 for white honey and 10 to 20 cents lower for amber grades. Some small lots were selling at higher prices. Retail sales of new crop honey were just beginning at roadside stands, fairs and festivals, but were expected to be brisk.

Colonies were generally in good condition going into the fall months. Beekeepers were adding their mite and disease treatments as they removed their last supers for the season. Many of these colonies will be taken to California for build up and almond pollination later this year.

WEST—Cool, rainy weather at times hampered late summer honey production from wildflowers and some cultivated crops along the California coast. Bees continued to work many wildflowers, but had been removed from the cotton and seed alfalfa fields for the season. Honey production from these later sources has only been fair to poor. Among the flower sources still being worked, beekeepers mentioned star thistle, lavender and mint. In Washington and Oregon, colonies had finished most of their clover and alfalfa flows, but were still working flowers such as buckwheat, knapweed and thistle. Some late mint fields were also still producing nectar. Rabbit brush was also expected to produce some late honey for overwintering colonies.

As the last supers are removed, many beekeepers are beginning to prepare for the 2011 almond season. These preparations include medications and mite treatments, as well as pollen supplements and syrup. Bees were generally in good shape coming out of honey flows.

American Bee Journal Editor

G.H. Cale, Sr.

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

The need for someone with experience to operate the Dadant apiaries arose in 1921, and the following modest announcement appeared in the March issue of the *American Bee Journal*:[1] "G.H. Cale, formerly of the Maryland College of Agriculture, and more recently on the staff of Dr. E.F. Phillips in the U.S. Department of Agriculture, joined the forces of Dadant & Sons on February 1. Mr. Cale will have charge of all work in the Dadant apiaries, now numbering about 800 colonies, and will be on the *American Bee Journal* staff as Experimental Apiarist."

G.H. tells his own story of how he became interested in beekeeping in "Burr Combs" in the June 1924 issue of the *Journal*.[2] Realizing the need for education, he put himself through high school and started in college determined to be a chemist. Zoology and entomology were courses related to chemistry and bees and beekeeping were a part of entomology. He found work there caring for the apiary and buildings, and here is how G.H. continued the story:

"The beekeeping work carried me back to my younger days. My stepfather kept bees and his brother, F.H. Dewey, of Great Barrington, MA was the inventor of the Dewey foundation fastener, the forerunner of the Byard, Daisy and Woodman. I drew the patent drawings for the Dewey fastener and helped with the bees among the Berkshire hills.

"Dr. Burton Gates, my teacher at college, was also inspector of apiaries for Massachusetts. He is a likeable chap and we mixed well. By his very enthusiasm he switched me completely from chemistry to bees. For 2 years I was his deputy inspector and thence drifted to beekeeping and zoology in Maryland.

"Between times, I had a longing for adventure, and went out to the Catskills in New York State where that good beekeeper, J.B. Merwin, of Prattsville, put in a whole season rubbing off my 'green' and replacing it with real experience. With Merwin's 300 colonies, I received my first real enthusiasm for beekeeping as a large-scale operation. There was so much enjoyment in that first season's work that I decided I would be a beekeeper thence-forth."

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

After graduating from the University of Massachusetts, he taught science and beekeeping for a year and a half at Essex Agricultural College. In February on 1917, he left to take a position at the University of Maryland as associate professor of entomology under Dr. Cory. Later in 1918 when the war was on, Dr. E.F. Phillips, head of the Division of Bee Culture of the U.S. Department of Agriculture, needed help. So G.H. joined the staff and, for the next 4 years, he received a liberal education in beekeeping, both in a practical way and in fundamentals. George S. Demuth also was in the office with Dr. Phillips and G.H. gained much from his association with these two giants in beekeeping.

G.H. Cale, Sr., was listed an *American Bee Journal* editor from 1928 until 1965.

On one of his numerous trips around the country, C.P. Dadant, editor of the *American Bee Journal*, met G.H. and was impressed with his abilities and his knowledge of beekeeping. So, G.H. was invited to come to Hamilton to take charge of the bees and to help with the *Journal*.

His first article appeared in the May 1921 issue of the *Journal*[3] and they continued down through 1965 – more than 300 articles over a period of 44 years. Although he helped with the *American Bee Journal* from the time he came to Hamilton, his name does not appear on the staff until the October 1928 issue which lists C.P. Dadant as editor, F.C. Pellett and G.H. Cale as associate editors, and M.G. Dadant as business manager.

As C.P. Dadant was growing older, G.H. Cale and F.C. Pellett were given full status as editors beginning with the February 1937 issue. G.H. continued as editor until the March 1945 issue when the masthead lists him as managing editor and the rest of the staff as associate editors. This continued until the January 1949 issue when his status was changed to editor. Upon his retirement he was given the status of consulting editor[4] which he retained until his death on Dec. 27, 1965.

Mastheads alone do not tell the full story of the part that G.H. Cale played in editing and publishing the *American Bee Journal*. By the time G.H. came to Hamilton, C.P. Dadant had retired from business and, as a means of occupying himself, was directing the editing of the *Journal*, but was anxious to be relieved of routine tasks. So, it appears that, as early as 1928 when his name first appeared on the *Journal's* masthead, G.H. was actually managing editor carrying most of the load of editing and producing the publication. Frank Pellett's interests were more in things pertaining to nature, especially honey plants, and he spent his summers at his farm near Atlantic, Iowa, where he later established the Honey Plant Test Garden.

In the course of managing the Dadant api-

G.H. Cale, or "Glory Hallelejah" as he was affectionately known by his many friends, remained active in beekeeping and contributed a huge body of practical wisdom to the *American Bee Journal* for many years.

aries and also keeping his own bees, G.H. had the opportunity to test out many new ideas, and to herald them to the beekeeping industry throughout the world by writing about them in the *American Bee Journal*.

One important undertaking in which G.H. played a prominent part was the development of disease-resistant bees, an effort that later led to the development of hybrid bees. (G.H.'s son, Dr. G.H. Cale, Jr., also worked for Dadants and is remembered for developing the first two commercial hybrid queen lines, the Starline and Midnite queens.) As early as 1923 and 1924, H.C. Dadant and G.H. were marking cells and looking for strains of bees resistant to American foulbrood. In the December 1925 issue,[5] G.H. wrote an article that told of the work of Dr. Bruce Lineburg and John M. Bixler and raised the possibility of breeding resistant strains of bees.

At a Tri-state Beekeepers' Meeting held at Hamilton in 1927, Dr. Lloyd R. Watson demonstrated his technique for artificial insemination of queen bees.[6] Later that year, G.H. went to Watson's home in Alfred, NY, to learn the method. Due to lack of refinements in the technique, these men were unable to maintain stock by this method. By 1932, however, H.C. Dadant and G.H. had gathered in one yard at Hamilton colonies from widely separated sources that had survived wholesale infection of disease. This resulted in the disease resistant project at Atlantic, IA (told in a previous issue in the story about Frank C. Pellett as an *ABJ* editor.)

We have strayed a bit from our story of G.H. Cale as *ABJ* editor, but we would be remiss were we not to point out that G.H. was a promoter of ideas that led to extensive research efforts, the development of instrumental insemination, and finally to commercial hybrid bees, via his son, Dr. G.H. Cale, Jr.

Raising a family of four children through the Depression years was no easy matter and, as honey dropped in price to 5 and 6 cents a pound, we find G.H.'s writings sometimes on the depressed side. Later he wrote that now that honey was selling for 12 cents a pound, everything else costs 2-1/2 times as much. All this gave him a keen sense of the economics of beekeeping and he wrote many articles on the subject.

The use of carbolic acid for repelling bees from supers of honey was first mentioned about 1933. After using it in a practical way for two years, he wrote his long-remembered article entitled, "Whisking Off the Honey."[7] Swarm control likewise interested him and he wrote his famous article entitled, "Relocation as a Means of Swarm Control."[8]

In 1945, G.H. published articles by L.F. Childers[9] on the use of pollen supplements and feeding sulfathiazole as a cure for American foulbrood, and a review of a bulletin on sulfa treatment by Dr. Leonard Haseman and Childers. G.H. was quick to take up the use of sulfa and during the following two years wrote a number of articles in support of its use. In 1948, G.H. wrote a story of Childers' sulfa experiments in an article entitled, "His Hunch Saved an Industry."[10]

But G.H. will be remembered most for his folksy advice and comments in his page entitled, "All Around the Bee Yard," that started in the January 1933 issue of the *Journal*.[11] In that first year, it appeared in every issue but, as G.H. became busier, it appeared intermittently through 1945. By popular demand, the page was resumed in 1949 and continued with fair regularity through 1954, and appeared twice in each of the years 1958, 1962, and 1965.

G.H. also contributed to beekeeping literature, writing three chapters in the 1946 and 1949 editions of *The Hive and the Honey Bee*. These were "First Steps in Beekeeping," "Management for Honey Production," and "Removing the Extracted Honey Crop." In the 1963 edition, he wrote two chapters entitled, "First Considerations in Keeping Bees" and "Management for Honey Production". In addition, he gave valuable help and advice to Roy A. Grout, editor of the book.

Gladstone Hume Cale died Dec. 27, 1965, at the age of 75,[12] just a few months after his retirement was announced in the October 1965 issue of the *Journal*. The following was stated in the final paragraph of his obituary: "Gladstone Hume Cale, Sr., dubbed 'Glory Hallelujah' by the late Frank Pellett with whom he was associated for many years, has left his mark on the sands of time of the beekeeping industry. No man has done more to carry out the desires of C.P. Dadant who wrote, 'I want the *American Bee Journal* to be the finest publication about bees and beekeeping in the world.' The beekeeping industry truly has lost an outstanding leader, teacher, and friend."

References Cited

1. **Dadant, C.P. 1921**. G.H. Cale to Hamilton. *Amer Bee Jour*. 61(3):95.
2. **Cale, G.H. 1924**. Burr Combs. *Amer. Bee Jour*. 64(6):310.
3. **1921**. Stores as Crop Insurance. *Amer. Bee Jour*. 61(5): 173-175.
4. **1965**. See masthead. *Amer. Bee Jour*. 105(10): 365.
5. **Cale, G.H. 1925**. Bees show resistance to American Foulbrood. *Amer. Bee Jour*. 65(12): 563-564.
6. **Anonymous. 1927**. The Hamilton Meeting. *Amer Bee Jour*. 67(9): 480-481.
7. **Cale, G.H. 1935**. Whisking Off the Honey, *Amer Bee Jour*. 75(7): 313-315.
8. **1943**. Relocation as a Means of Swarm Control. *Amer Bee Jour*. 83(5): 190-191.
9. **Childers, L.F. 1945**. Pollen Supplements – With a Sidelight on Sulfathiazole. *Amer Bee Jour*. 85(3): 83-84. Also see: How to Feed Sulfathiazole to Bees. *Amer Bee Jour*. 85(4): 118.
10. **Cale, G.H. 1948**. His Hunch Saved an Industry. *Amer Bee Jour*. 88(11): 534-536.
11. **1933**. All Around the Bee Yard. *Amer. Bee Jour*. 73(1): 24.
12. **Grout, Roy A. and M.G. Dadant. 1966**. Obituary. Gladstone Hume Cale, Sr. *Amer. Bee Jour*. 106(2): 46. Also see: G.H. Cale, Sr. *Amer Bee Jour*. 105(10): 366-368.

ADULTERATION OF HONEY AND PURE FOOD LEGISLATION

From the "History of American Beekeeping"

by FRANK C. PELLETT*

In view of present day protection, it is difficult for the beekeeper to appreciate the importance of the pure food law. Without it, it is doubtful whether the honey-producing industry could have survived. When glucose, then known as grape sugar, came into use, it offered a cheap and easy form of adulteration of honey. Although adulteration was general in many foods, it was the honey producers who first felt the competition keenly enough to begin agitation for legal protection.

It was about 1870 that Charles Dadant had shipped several barrels of honey to a dealer named Perrine, in Chicago, getting 17 cents per pound. A little later he found on the shelves of a local grocer in his own town of Hamilton, honey put up in small glass jars by this same dealer at 16 cents per pound. Dadant saw at once that there was something wrong when a packer could sell honey in small containers for less than he paid in barrels. This seems to have been the first case of honey adulteration to be called to public attention. Dadant at once wrote to the bee magazines, calling attention to the facts and suggesting that every beekeeper publish a statement on his label that granulation was the best proof of purity of honey.

In 1878 Dadant went to St. Louis to sell his honey, and was shown glass jars of glucose put up in New York and sold as honey at a price below what he expected to receive for his honey in bulk. He bought a jar of this glucose and learned that it was substituted in like manner for maple syrup, molasses and other sweets. He learned that the presence of glucose could be detected by putting a few drops in a cup of tea. The sulphate of iron then present in glucose turned the tea black. A little investigation disclosed that the sweets then on the market were very generally adulterated in this manner.

The Western Illinois and Eastern Iowa Beekeepers' Society met at Burlington, Iowa, on May 8, 1878, and to this convention Dadant went with his sample and his information. Although he had difficulty at times in making himself understood because of his uncertain accent and his tendency to revert to his native French, he did arouse the beemen in attendance to a feverish excitement, for they realized that the industry was at stake. When Dadant stated that it should be as much the business of the government to stop a counterfeit food product as to stop a counterfeit of money, it was decided to petition Congress to enact a law against the adulteration of honey.

A committee was appointed to draw up a petition and to submit it to the beekeepers. Dadant was made chairman of the committee, with Thomas G. Newman and the Rev. Clute the other members. A resolution was also adopted asking that copies of the petition be printed in all the bee papers, with a request that the readers copy it and present it to the public for signature.

The petition, as drawn, contained five sections. The first recited that sweets were very generally adulterated with glucose, and that, in many cases, glucose was entirely substituted for the product it was supposed to be. The second section described the manufacture of glucose and mentioned the chemicals which were at that time retained in the product. Section three described the analysis of 17 samples of table sweets and the poisons found in them, while section four gave the reasons for legal protection, and section five outlined the right and duty of Congress to guard against fraud in food as well as in money.

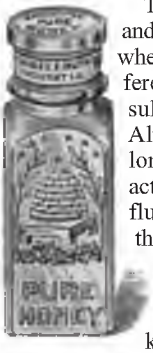
The *American Bee Journal* and the *Beekeeper's Magazine* at once launched the movement with enthusiasm, but Editor Root of *Gleanings* was more cautious and hesitated. This resulted in a heated argument between Dadant and Root and some rather caustic correspondence in the bee magazines regarding the merits of the controversy. The argument became somewhat personal and drifted into matters entirely apart from the question at issue. Later, how-

Charles Dadant pioneered the fight for Pure Food Laws in the United States

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

ever, Root became an ardent supporter of the pure food movement, and his sons recognized leaders.

Charles F. Muth, a dealer in honey at Cincinnati, Ohio, became an ardent champion of the proposed law and stated that glucose was the worst obstacle in the honey trade.

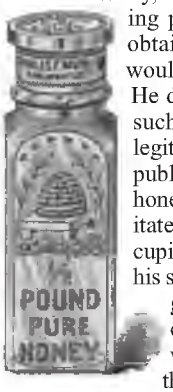


In May, *1879,* the society met at Hamilton, and Dadant, as chairman of the committee, made a report of progress. The committee had several thousand copies of the petition printed and distributed. A large number of papers supported the movement by printing the petition. It went to Congress with signatures from every state, more than 30,000 in all, was referred to the Committee on Ways and Means, but was never reported for action.

A movement of this kind, which proposed a radical departure in the matter of an important government policy, hardly could be expected to obtain favorable action immediately. Several sugar refiners joined with the beekeepers in the attempt to obtain legislation against the adulteration of sweets. The net result was far better than would be expected under such circumstances. A vast amount of publicity resulted, which called public attention to the general condition. This was not without its objectionable features, however, since it served to arouse suspicion of all liquid honey.

Four states, Michigan, Minnesota, Kentucky and New Jersey, did, in fact, pass laws against the adulteration of honey and that was an accomplishment of no mean importance.

The same committee was reappointed and continued the agitation. It is doubtful whether any group of beekeepers ever offered any other action which finally resulted in such far reaching results. Although it was destined to be many long years before Congress finally acted, the time came when enough influence was brought to bear to obtain the enactment of a measure covering the whole field of foods and drugs. In the meantime, one group after another had joined with the beekeepers, until the originators of the movement were nearly lost sight of and their numbers seemed insignicant in comparison to other groups seeking the same outcome.



"THE WILEY LIE"

Just when the movement was gaining public support, a most unfortunate incident occurred. The man who was later to become the recognized leader of the pure food forces and to concentrate the combined efforts in such a manner as to procure the enactment of the desired legislation, gave out some ill-advised publicity. Dr. Harvey W. Wiley, who, as chemist of the United States Department of Agriculture, was to arouse the entire country to the dangers of food adulteration, wrote as follows in the *Popular Science Monthly,* June, *1881:*

In commercial honey, which is entirely free from bee mediation, the comb is made of paraffin, and filled with pure glucose by appropriate machinery.

This at once destroyed public confidence in comb honey, as well as extracted, since the statement was very generally circulated in the press of the entire country for a period of several years. There was a storm of protest on the part of the beekeepers and a demand for proof that such manufacture had ever been done successfully.

Wiley, of course, was interested in arousing public sentiment to the point of obtaining legal restrictions which would make adulteration impossible. He did not realize the influence that such a statement would have on the legitimate honey dealer by destroying public confidence in the one form of honey which it was impossible to imitate. The high position which he occupied as a chemist gave authority to his statement, and since it was known generally that liquid honey was commonly adulterated, the public was very willing to believe that the same was true of honey in the comb.

The bee magazines were filled with stinging denouncements of Wiley, who was accused of deliberate and malicious falsehood, and no doubt he felt very keenly the criticism of the group who had started the movement which he was trying so hard to foster. Later he attempted to justify his position by explanations, which served only to prove that he had been careless in his statements.

In the *Canadian Bee Journal,* July 18, 1888, he wrote that his original statement had been made on authority of Dr. E. J. Hallock, editor of the *Boston Journal of Chemistry;* that in Boston where he resided a full outfit of machinery had been made to manufacture comb from paraffin and fill it with glucose. He said that neither he nor the doctor believed that such could be made a commercial success, and in another letter that his statement had been made as a scientific pleasantry.

This statement did not help the doctor's position with the beekeepers, and it was followed by even more bitter comment in the magazines. At this distance, it looks as though Wiley made the statement in the heat of passion while making an attack on the general practice of adulteration, with little thought of the ultimate consequence. The incident mentioned by Hallock served to provide additional ammunition for the fight, and he proceeded to make use of it.

As already stated, it was extremely unfortunate, since it alienated the friendship of a large number of beekeepers, including Charles Dadant, who had started the movement to bring about federal legislation against adulteration. These men distrusted Wiley and refused to work with him and thus hampered the movement and, quite possibly, delayed the final favorable out-

Ironically, Dr. Harvey W. Wiley, often called "the father of Pure Food Laws" elicited disdain among beekeepers for a number of years due to his false statement in the June 1881 *Popular Science Monthly* stating that imitation comb honey could be created with paraffin and glucose. This statement further eroded public confidence in being able to purchase pure honey. The "Wiley Lie", as it was named by the bee press, was repeated over and over in the general press, further exasperating beekeepers. A. I. Root even offered a $1000 reward to anyone who could prove that comb honey had ever been successfully imitated. The reward was never claimed.

come. Beekeepers could only think of what they called "the Wiley lie" when any attempt was made to combine forces with the famous chemist.

The attention of the beekeepers was centered on an effort to remove suspicion from comb honey. A. I. Root offered $1,000 to anyone who could prove that comb honey had ever been successfully imitated, and the leaders of the industry were largely occupied in writing to editors of papers and magazines, who had published Wiley's statement, to obtain retraction.

These attempts were not very successful and usually resulted in making a bad matter worse. In 1888 G. M. Doolittle, then vice-president of the Bee-Keeper's Union, wrote to the *Rural Home* commenting on the statement and calling attention to Root's offer of $1,000 for proof of manufactured comb honey. A Virginian named W. M. Evans answered the article, stating that no responsible man had made such an offer and daring anyone to make it. The reply was called to Root's attention, and he at once wrote Evans and demanded that he retract his statement or claim the reward. Evans then appealed to Wiley for assistance and, in reply, Wiley wrote him along the same lines as published in the *Canadian Bee Journal*. All this correspondence was published in the *American Bee Journal* of June 13, 1888.

Due to the agitation for legislation against adulteration, one paper or another published the original Wiley statement at frequent intervals for many years, and the beekeepers were kept in a state of feverish excitement trying to overcome the effects of such publicity.

In the *Chicago Record-Herald,* March 15, 1908, Marion Harland, a widely-known writer, spoke of honeycomb "made by the bees themselves instead of the artificial combs of paraffin now manufactured." That she was misled by the quotations from Wiley so widely published, is indicated by the fact that when a protest reached her, she very courteously offered a correction in the March 22 issue.

In *Gleanings* for May 1, 1913, appeared a quotation from Ida M. Tarbel, whose syndicated article stated, "they even manufacture honeycomb and fill it with glucose." This probably brought a very general protest from beekeepers. In her reply, instead of admitting her mistake, she criticized beekeepers for objecting to an expose of a guilty practice. So sure was she that such practice existed that she indicated her intention to claim the reward, when it was called to her attention. Thus, after 30 years, an ill-advised statement continued to be accepted and passed on by writers with wide opportunity for reaching the public.

The $1,000 reward, which had been standing unclaimed for so many years, by that time had been increased to $2,000, since the national beekeepers' organization also had offered an amount equal to that offered by Root.

Only a beekeeper who had tried to sell his honey direct to the customer could have an idea of the extent of prejudice which was built up by this unfortunate publicity. In *Gleanings* for March 1, 1902, is a letter from a California honey producer telling of his troubles in selling honey at Bartlett Springs, a fashionable resort where the elite of San Francisco had their summer homes. Fancy comb honey was offered, but none sold. They were too wise to be fooled by a manufactured product, they assured him. "Wise in his day and generation," he cut the honey from the sections, mixed in bits of leaves and rotten wood, and "mixed it all up in a mess," put it in rusty cans and, with a change of clothes, went back to offer wild honey for sale. It went like hot cakes, to the tune of numerous comments about the absence of paraffin and glucose, and the lament that such honey could not be had in the markets. It is significant that all the honey thus offered was sold promptly when the fancy product was avoided. The public wanted honey, but had been led to distrust anything offered in a neat package.

C. P. Dadant, in an article in *Gleanings* about the same time, called the beekeepers' attention to the fact that no two sections of comb honey were alike, while any machine-made product would exactly duplicate every other such article. This, he said, was the best argument to use in selling comb honey, but it was a slow and painful process to rebuild public confidence. A powerful and dangerous weapon is publicity, and it must be handled with care.

It was in 1897 that the organization known as the United States Beekeepers' Union was formed for the purpose of combatting the adulteration of honey, the defense of beekeepers' legal rights, and the prosecution of dishonest commission men. Eugene Secor was selected as general manager. He at once became active in pursuit of newspapers which published the Wiley statement, but little more success attended the organized effort than had been possible to individual beekeepers. Somewhat better success attended the efforts to prosecute adulteration. The first case, in the city of Chicago, resulted in the discharge of the defendant, but the attendant publicity was helpful in showing that an effort was being made to stop the practice. Another case in Michigan resulted in involving a man widely known in the beekeeping trade as a honey producer and supply dealer, who was accused of selling honey which was adulterated. The grocer who bought the honey for resale was convicted and fined.

After the passage of the pure food law in 1906, the government took over the pursuit of violators and there was no longer the same need for individual activity. Under the protection of the law, public confidence gradually returned.

With the passage of the law, Wiley became the recognized leader of forces demanding pure foods, and so he continued until his death at an advanced age. After he had been forced from his position in the Department of Agriculture, he remained a powerful influence through his department in *Good Housekeeping* magazine. When an attempt was made to amend the pure food laws to permit the use of corn sugar in sweetening canned goods, and in confectionery goods, without showing the fact on the label, Wiley sounded the battle cry which was once again to bring the beekeepers into common action. They did not fully understand just what was at stake, but they remembered all that they had suffered from glucose in adulterating honey, and they were fearful of any opening which would make it easy to include that or any of its products in any food. They feared that the amendment was to be an entering wedge which would lead to all kinds of modifications of the law which had served them so well.

Although a few of the old-timers still harbored resentment against Wiley for his indiscretion of a half century ago, the rank and file were ready to follow where he led with little question as to his authority. This time Congress listened to the beekeepers. Letters and telegrams were poured into Washington in such numbers as to make any congressman hesitate. Several times the bill was up for consideration under the appeal that it would increase the outlets for corn, which was becoming a burden in the markets, but always it fell short of passage. The matter was finally settled by an executive order of the Secretary of Agriculture, permitting the use of corn sugar as a sweetening agent.

Pure food laws are now a part of the established policy of the government, and there is little danger that adulteration again will be a common practice. The beekeepers who started the agitation, and who paid such a price, have benefitted greatly from the general enforcement. Any suggestion of modification of the law at once arouses them to action. The general public, however, is unaware of the fact that it was a small group of beemen who started the movement and continued the long fight which finally led to this important protection of the food supply of the nation.

Editor's note: This last paragraph was written by Pellett long before high fructose corn syrup had been developed. Unfortunately, once this product became common and cheap, honey adulteration has again reared its ugly head. Honey adulteration continues to be a problem and the Food and Drug Administration often replies to pleas for help by stating that it is simply too underfunded and understaffed to strictly enforce laws against honey adulteration.

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The Classroom
by Jerry Hayes

Please send your questions to Jerry Hayes
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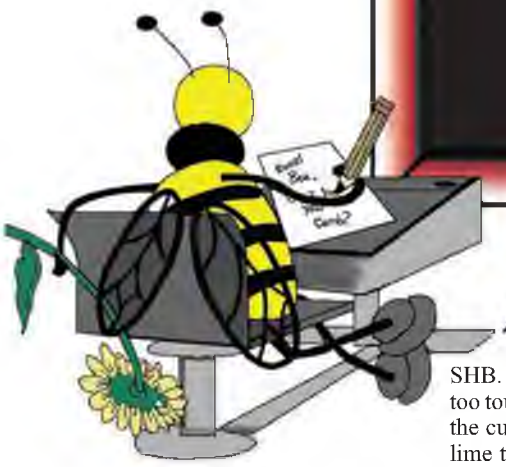


Q Small Hive Beetle Chemical Warfare

Could we use diatomaceous earth (DE) instead of vegetable oil in the trap tray for Small Hive Beetle (SHB)? It would be a lot less messy, but would dust from the DE get up into the hive and hurt the bees? Would the beetles crawl back up into the hive and bring DE with them?

Steven P. Christman

Small hive beetle larvae in honey comb cells. (Photo courtesy of the Florida Division of Plant Industry)

A DE is not really robust enough for SHB. The SHB larvae cuticle (skin) is way too tough for the DE particle edges to pierce the cuticle and damage them You could try lime that you can get as a soil amendment to put in the tray. Keep the bees out of it, as it will produce chemical burns on them as well as other insects and you. It burns the SHB antennae and makes orientation tough for them. It doesn't kill them, just severely damages them.

Q Mix Them Up

When making splits, should we be concerned about taking frames loaded with brood nurse bees from different colonies and mixing them into the new box? Normally, when combining colonies we use newspaper to separate them initially. Is it that the nurse bees are not as defensive? Thank for a reply,

Ken Sikora

When making splits, young bees mix well from different colonies and adjust to new conditions readily.

A Young bees are more easily mixed than older workers that are transitioning to becoming defensive foragers. Young naïve bees mix well from different colonies and adjust to new conditions readily. What you don't want to swap around are diseases like American foulbrood/European foulbrood/Chalkbrood, etc. So, be sure you are good at disease ID as you scan the frames of brood to transfer.

Q Poison By Any Other Name

Hello Jerry. This is Tony from Southern California. I hope you are doing well. I have a little question for you. I have around 15 gallons of sugar water and honey syrup that is beginning to ferment. Will it be okay to feed the bees later on or do I need to do anything with it now? Is it okay the way it is right now? You see, I don't want to bees to "get drunk". I want them working instead of sleeping. Your column is always interesting and useful.

Tony Nizetich
Temecula, CA

A Alcohol is bad for mammals and insects. Brains cannot assess and adjust to environmental conditions under the toxic effects of alcohol. Remember the kids in high school

or college who got so drunk they couldn't stand up and vomited all over. They poisoned their brains while waiting for their livers to detoxify the alcohol. You can heat the fermented alcohol "mixture" if you want and drive the lower boiling temperature alcohol off. Be sure not to overheat or caramelize the syrup because this is not good for the bees either.

Q LAYING WORKERS?

I am coming to you once again for your expertise. I inspected one of my hives today and was not able to locate the queen. However, over half of the frames had larvae in various stages of development and some cells had more than one egg in them. In addition, there were very few cells that had been capped. Do you think it is safe to assume that the hive is without a queen and that there are very busy laying workers laying unfertilized eggs? If so, how do you recommend going about requeening the hive? As always, thanks for the help.

Brian VanIwarden
Colorado

Multiple eggs in cells is often a sign of laying workers, but also can be a sign of a new queen adjusting to egg laying.

A

Brian, generally it takes several weeks for laying workers to develop. You said you saw lots of larvae, which means you had a queen within the last couple of weeks. Has the colony swarmed and maybe a new naïve queen is learning how to be a queen? Did you notice a loss of population when you opened up the colony—maybe not dramatic loss but less than you saw from last time that would indicate a swarm?

Laying workers will have multiple eggs in a cell, but a key feature is that the eggs will be attached to the side walls of the cells as the laying workers' abdomens are not as long as a queen's and won't reach to the bottom. Sometimes new queens will have two or three eggs in the bottom of a cell as they learn how to lay eggs.

I really don't think you need to requeen yet. Check every couple days and to see if you are still finding eggs and how many per cell and what location within a cell they are. Patchy, capped drone cells also often signals the beekeeper that he/she has laying workers.

If you determine that you do have laying workers, the best way to correct the situation is to create a nuc with a laying queen, brood and attending nurse bees from another colony. The nuc is then placed above the laying worker colony using the newspaper separation method. The two colonies will unite once the newspaper has been chewed away. The nurse bees on the nuc combs will protect the new queen and the laying worker problem will disappear as the new queen expands her brood nest.

The same thing is also accomplished when the beekeeper unites a weak laying worker colony with a queenright colony.

Q Black Sage

As an 86 years old amateur beekeeper, 2010 was to be my last year collecting honey on the Central California Coast, usually from Black Sage, that produces a light golden honey. This year the weather pattern was different. I noticed plenty of flowers, but fewer bees in the Sage.

Several weeks ago I extracted 250 lbs. of honey. At first I noticed that, even as fast as the extractor could run, too much honey stuck to the frames. Even after I set the frames out for the bees, it took a long time to clean them—the ants had to do the final licking!

As soon the honey began flowing, I noticed the viscosity. I cannot describe it, but will be glad to send you a sample. The honey is not yet crystallizing. It is smooth-flowing and has a pleasant taste. And there is the color difference: The honey is absolutely clear.

What I for over 30 years learned about beekeeping is from the *American Bee Journal*, and you—thanks. You sure picked an interesting way to make a living.

Excuse this long rambling question. I have read little about white honey. I tried going through the Internet, but did not have much luck.

Erik Jensen

Black sage produces an excellent water-white honey, which is heavy bodied, and has an excellent flavor. Black sage gets its common name from its dark foliage and the fact that the older flowers turn black and cling to the plant until next season.

A

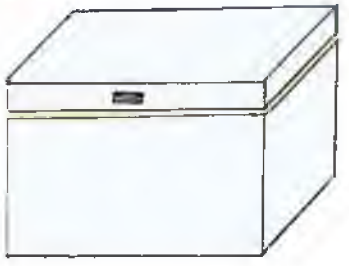
Erik, don't give up beekeeping yet! You don't start understanding honey bees, the botany and weather cycles until have at a minimum you 30 years of experience.

If I were to venture a guess, it would be that this was a dry period when the Black Sage was blooming. So, the honey moisture level is very low, probably 15% or less. Pure Black Sage does not crystallize. Sugar ratios are balanced and so it stays liquid. Color in a pure monofloral Black Sage honey is almost clear to very light amber.

It sounds like you and your bees did well. My guess is that if you contacted Dr. Eric Mussen at the University of California at Davis, he could tell you who at the University could analyze your honey, looking primarily at the pollen to ID for the primary floral source.

Thank you for the classroom compliment. Keep beekeeping; you are too young to stop. Or at least, train a young replacement☺

Q Cold Storage



An extractor that I ordered is on back order. If I were to freeze honey/pollen in the frame for some months (e.g., <6 months) would it damage them? It seems the enzymes might break down making the honey less desirable to eat and the pollen less nutritious for the bees. I imagine anything will dry out if you freeze it for long enough, and I've read that bees prefer fresh pollen. Would you advise against freezing?

Thanks

A

Yes, you probably prefer fresh strawberries to frozen. Frozen would be better than dried and dried would be better than none at all. Such is life. Freezing temperatures slow down all enzymatic processes. Cold retards food from degrading from bacteria, fungi and the enzymes they produce to eat your food. These small organisms don't have teeth; they have food-digesting chemicals called enzymes. That is why our diets have improved ever since refrigerators were invented. The coldest freezer you have is the best option for preserving the honey and beebread. It will be good. Be sure to let your combs warm back up to room temperature before trying to uncap and extract them.

Q Nervous Bees

Thanks for answering my past questions. I have been having problems keeping swarms from fleeing after they are introduced into their new hive. Should I screen them into the hive for a few days?

Jerry Hutchinson

A

Jerry, you could certainly screen the swarm in the hive for a day or so if you make sure that they do not get too hot. According to the area code on your email, you are in Louisiana. We have a few possibilities:

1. There is something repellent in your hives that you are installing them in. Could be a wax moth treatment or....?

2. The swarms are queenless and they are going home to find her. Swarms don't leave for long without a queen. This is not a suicide mission

3. Louisiana is home to a growing population of African bees. African bees will abscond at the slightest provocation. They don't have to be pure African bees, just have enough genetics to make them nervous.

4. Sometimes swarms just leave after they are hived for no apparent reason. Try hiving them in the late afternoon or early evening if possible. Another trick is to give them a frame or two of brood from another colony. The smell of brood is a big inducement to the swarm to stay put and set up housekeeping.

Since I have had to deal with African bees in Florida for a few years, if I were a betting man, I would pick #3.

Q Naturalists Discover Honey Dew

Dear Mr. Hayes, I want to tell you about something I recently observed in my neighborhood in Beaverton, Oregon. Our Oak trees (Pin Oak I think) are oozing a sappy fluid through their leaves. Honey bees are covering these leaves and seem to be working this sap somehow. My husband and I used to keep bees years ago, and I have never observed this behavior where bees actually concentrate on tree leaves rather than a flower crop. We have lots of flowers in the neighborhood, but no honey bees seem to be attracted to the flowers.

Last week my husband and I also witnessed sappy material coming from a tree and shrub leaves on a visit we made to the Gifford Pinchot National Forest in Washington State. We have never noticed this sap on leaves before. Don't know if there is any significance here, but it seemed strange watching the bees focus on the sap on these leaves.

I wish you good luck in your work with the honey bees, and hope that perhaps this might give you extra information that might aid you and your colleagues in your efforts to discover the cause of colony collapse.

Sue Pantages

Honeydew honey produced in New Zealand and sold as a premium honey variety.

A

Good Morning Sue. We have the same thing happen on the many native Oaks we have in Florida. There is another very small almost invisible insect called an aphid that feeds on the sap of Oaks and other trees and smaller plants, primarily from the leaves, as this is the easiest place to access the sap. Because this sap is not very nutritious, they have to process a lot of it. An aphid's mouthparts are designed to pierce a leaf and suck the sap out. Because they need so much sap to gain the proper nutrition, they keep sucking and the lots of sap makes a one-way trip through their stomach and gut and out the "other" end.

These "other end" excretions are high in sugar and are deposited on the leaves in a sticky film. The sugar content is many times higher than that in local flowers, so the honey bees ignore the flower nectar in favor of these aphid excretions. Honey bees are efficient when searching for food resources and this is an easy high carbohydrate food resource. During dry times of the year, it collects on leaves very thickly. Honey bees collect it and store it just like they would flower nectar, making a "honey" out of it. It is called "honeydew" honey and in some parts of the world, such as the Black Forest of Germany, there is a great surplus. There it is considered valuable and sold at a premium price.

What you are seeing is not sap, but aphid excretions that are high in sugar, which the honey bees collect. They can store the surplus, which in turn may be harvested by the beekeeper at times. Honeydew is often darker than the honey you normally collect, but not always. It also normally has a stronger flavor than honey. It is not a good winter food source for your bees since it contains higher levels of dextrins and mineral salts such as potassium. You can read more about honeydew in J.W. White's chapter on "Honey" in *The Hive and the Honey Bee* book available at www.dadant.com. The Internet probably also has quite a bit information on the subject.

Thank you for being so in tune and aware of what you are seeing with nature and honey bees. Most people are not and that may be part of our problem in general in this world. The disconnection of humans to the other worlds of plants, animals and insects is not good for any us. We are all in this together. That is one of the underrated benefits of beekeeping; it puts us in tune with nature.

Q Holst Milk Test For AFB

I read your column in the August issue of *ABJ* where a reader wanted a simple test for American foulbrood (AFB). There is an old one that works just fine. I have attached a reproduction of the original mimeograph of 1945. I extended the test to use on a microscope slide and the reaction is very rapid (less than a minute). I put two separate drops of the milk-powder solution on a slide, and into one I put a part of an AFB scale from the comb. Stir it for a few seconds and wait. The treated drop will coagulate in about 45 seconds. The second drop is the control. The vial method described in the mimeograph article works too, it just takes longer.

Sometimes it is helpful to have been around a long time.

Dr. Roger Hoopingarner
Michigan

A

Roger, you are absolutely right. I had forgotten about the Holst Milk Test for AFB. You aren't getting older; you are just getting better. Thank you for this.

August 22, 1945

A Simplified Procedure for the American Foulbrood Milk Test

by E. C. Holst, United States Department of Agriculture, Agricultural Research Administration, Bureau of Entomology and Plant Quarantine Division of Bee Culture

The milk test for American foulbrood has been modified as a result of experience in the field and further laboratory development. The revised method is simpler, gives a more definite reading, and eliminates the need for a water bath and thermometer. The following test is intended for the use of inspectors or large operators having frequent need for an American foulbrood test. A note is appended for the use of the method by the beekeeper who might want to perform the test only occasionally.

Materials needed are:

1. Skim milk powder
2. Distilled or tap water
3. One-dram homeopathic vials

Reconstituted milk is prepared from the milk powder by adding 4 level tablespoons to a quart of water. It is recommended that the milk be freshly made up the day the test is run, to avoid souring. Various types of water have been used with no unfavorable results. However, if there is any doubt as to the water, the test can be run with a distilled water check, and the results compared. Best results are obtained if the water is warm, but not uncomfortably hot. The test will work, though, at temperature of around 50° F. (10° C.). Under such conditions a somewhat slower clearing can be expected. If the water is cold, it should be warmed. Holding the vial in one's hand can easily do this, if only a few samples are to be run.

To run the test, place the sample in the vial, and add 20 drops of warm water (about ¼ of a vial) and shake. Then add 10 drops of the powdered milk solution, and again shake. If less than an entire suspected AFB scale is available, add 20 drops of water, but reduce the number of drops of milk proportionately. There may or may not be a fine curd after about 5 minutes, but this is no longer a significant part of the test. The test is positive if the milky suspension clears which usually occurs within 15 minutes, leaving a transparent, pale yellow liquid. Sometimes the clearing is so rapid that a test is definitely positive after 5 minutes. The difference between a liquefied positive test and a negative or check test is very striking if the vials are held to the light. Until familiar with the test as obtained with American foulbrood material, it is advisable to have a check vial, with only water and milk suspension, for comparison. With non-American foulbrood scales the liquid may sometimes become somewhat discolored, but the suspension remains cloudy during the 15 minutes of the test, and the test is considered as negative.

The test possesses a certain amount of flexibility, that is, it need not be performed in the field, exactly as described above. If for some reason the inspector cannot or does not choose to run the test immediately, the samples can be placed in the vials, and run later at the laboratory or at home. In fact, successful tests have been run with matchstick samples or ropy material, as are frequently submitted for diagnosis. In these cases only 5 drops of milk were used, since the ropy material is only partly removed by this technique.

Both as a matter of good practice, and also to protect the inspector, he should exercise care in disposing of the material in the vial after the test is run. The vials should be washed clean, and boiled for 20 minutes in water before reuse.

Reports of any interference with the test through water source, drug or chemical treatment and the like will be much appreciated. Also, whether any negative tests occur with larvae in the very early stages of American foulbrood.

Note: In case only one or a few tests are to be run, add 20 drops of warm water as before, shake, then add 5 drops of whole milk, (skim preferred) shake, and read as above. If less than an entire scale is available, reduce the amount of milk proportionately. For example, if ½ a scale is tested, add only 2-3 drops of milk.

Q

Insect Growth Regulators (IGRs)

I have a question about IGRs in cattle mineral blocks. We like to use this product for fly control, but we're not sure if it has any affect our honey-bees. None of the mineral feeders are open; they have rubber lids that the cows have to lift up to get access to the mineral.

We have eight hives, and just started keeping bees two years ago. Thanks for your help. I enjoy the classroom!

Brett Wright
Cushing, Ok

A

Good morning Brett. I found the attached research paper on insect growth regulators (IGRs) and honey bees in the European bee research journal called *Apidologie*. It sounds like IGRs can change how larvae develop and can change age-dependent activities of adult honey bees. Be sure the mineral blocks are covered.

Effects of insect growth regulators on honey bees and non-*Apis* bees. A review
Apidologie 32 (2001) 527-545

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(Received 26 December 2000; revised 17 May 2001; accepted 24 July 2001)
Abstract – The insect growth regulators (IGRs) are ecdysone or juvenile hormone mimics, or chitin synthesis inhibitors. They are more likely to be hazardous to larval insects than to adults. Application of JH mimics to adult honey bees may affect foraging behavior and some physiological traits. Topical and feeding tests revealed that application of IGRs to larvae might result in death and larval ejection by workers, malformed larvae and pupae with typical rimmed eyes, or malformed adults. Several laboratory "larvae tests" using artificially contaminated diets have been described for honey bees and bumble bees.

Who Is the Typical Beekeeper?

I don't say this in a negative or disparaging way, as I am a beekeeper, too, but we a unique group are we not? While the whole world is Entomophobic (fear insects), beekeepers embrace and build a relationship with an insect—an insect that will hurt you no less. We dress up in funny-looking protective gear and hold a can with smoke coming out of it like an old fashioned bomb. And, we wonder why our neighbors and the rest of the world look on us as an interesting sub-group or I have even heard the word "weird" used. Well, researchers Krengel & Schweigert at Bradley University have conducted a Beekeeper Survey that is pretty interesting as I look at the Preliminary Data that I was sent. The complete survey will be published, but let me share just a few things found out in this survey about "us".

- The **average** beekeeper is a 52-year-old male.
- Politically he is a moderate
- He has a stable personality, is a conscientious introvert and tends to be agreeable and open to new ideas.
- Of the 1300 survey replies, 5% were Commercial Beekeepers, 12.7% Sideliners and 82% Hobbyists.
- 5.8% had a high school diploma, 28.7% had some college or a 2 year associates degree, 19.7% had a 4 year degree.
- Most impressive, 12.6% have some post college education and a full 32% have a graduate degree which is 3 times that of the general population!
- There is more, of course, and averages are an oversimplification of data, but keep your eyes open for the full report. The only thing I question is that the average beekeeper has a "stable personality"!

Thank You for the Bees

by EUGENE MAKOVEC

The original photo was black and white, but has been colorized by our staff for this story.

Eugene F. Makovec collects a swarm of bees in 1950 at his home in Stetsonville, Wisconsin. Dad was only 25 years old in this photo, and had already been keeping bees for nine years

"Actually, it was sugar rationing that drove me into beekeeping."

Dad was dying of cancer, and we were talking about a number of things, bees included. I knew his father had also kept bees, so I assumed Dad came into the bees along with the Guernseys. He quit the 10th grade in 1941 to run the dairy farm when his last brother enlisted in the army. His father was not as young or as healthy as he'd once been and could not run the farm by himself.

As it turned out, Grandpa had stopped keeping bees several years before, and the equipment was sitting empty. It wasn't until the government clamped down on sugar supplies during World War II that the need for sweeteners got Dad thinking about honey. "My dad liked sugar in his coffee," he remembered. "He didn't have many luxuries, but this was one he insisted on."

"So the government didn't ration honey?" I asked.

"No," he replied. "In fact, beekeepers could get extra rations of sugar to feed their bees."

Whatever the reason, Dad took to beekeeping and never looked back. He ran as many as a dozen hives at one time (about 11 more than needed to sweeten the family's coffee), and I remember us always having at least two or three in the yard when I was growing up.

I was always a daydreamer as a kid. As the eighth of 10 kids, it was easy for me to get lost in the shuffle. When my head wasn't buried in a book, my mind was miles away from whatever chores I was doing on the farm. So, while I always thought honey bees were kind of cool, I had about as much interest in beekeeping as I did in milking cows. Besides, bees were always Dad's thing he did on his own, and he was never one to talk about stuff unless you asked about it.

I didn't ask about bees until after Dad quit beekeeping in the 1990s. But I found him more than willing to share. I was the first one to take up his hobby, and he gave me lots of advice, along with a bunch of his old equipment. Most of all, he just loved to talk about bees. Whenever I would call my parents about anything at all, he was the first to bring up the bees.

My brother Frank took up beekeeping several years after me, and brother Tom recently made his property available to a commercial beekeeper to place about 50 hives for the summer. In fact, on the day after Dad's funeral I was at Tom's house helping him catch a couple of swarms and assemble the equipment to house them. He had officially become a beekeeper. "Kind of a fitting sendoff to Dad," I said afterward.

Tom nodded. "He would have enjoyed this."

Dad lived about six weeks after his cancer diagnosis. We were all very fortunate that his mind was sharp and we were able to visit with him, ask questions, share stories … and say goodbye. The last time I saw him, about 36 hours before he died, he was very weak and had difficulty talking. But he was still alert and communicative. It was my last chance, and I told him how much I loved him and appreciated all that he had done for us kids over the years.

But I realized later that I'd never thanked him for the greatest joy he had given me.

Dad … if you're reading this … thank you for the bees.

Editor's Note:

Do you have a story about how you became a beekeeper?

Please send it to us at editor@americanbeejournal.com for possible publication. Eugene's story brought back many pleasant memories to me as I hope it does for you as well.

Visiting Vintage Americana's Beekeeping

by CHARLES and KAREN NIELSEN-LORENCE

Tucked in the unglaciated region of southwestern Wisconsin is a treasured historical site featuring a re-created rural village and museum. Stonefield Village near Cassville, WI, is a state historical site that showcases what a rural village would have looked like back at the turn of the 19th Century. Wisconsin, the dairy state, surely can be designated the 'land of milk and honey' since Adam Grimm from Jefferson, Wisconsin was instrumental in bringing the Italian queen bee to America. Wisconsin also was the home of G.B. Lewis Beeware and presently has several bee supply houses and commercial beekeepers. The University of Wisconsin houses the Dr. C. C. Miller collection of books on beekeeping.

In about 1964, the Wisconsin Honey Producers donated a honey house to Stonefield Village. It is patterned after an 1890s honey house near West Bend, Wisconsin. The honey house displays a wonderful variety of old beekeeping tools and paraphernalia. Hand-made hives….some of the first removable frame hives in the state…and an old wooden centrifugal extractor are on display. Old smokers, a Bingham uncapping knife, hive tool, basswood section boxes, comb foundation mills and a vintage straw skep are all exhibited.

Local honey is sold at the Stonefield Village gift store.

A wooden barrel extractor with a planetary cast iron hand operated gear drive is a highlight of the honey house.

Wisconsin had a flourishing honey industry in the early years. White sweet clover, yellow sweet clover, and alsike clover were all planted as forage crops and to condition the soil with the nitrogen in the roots. Basswood trees and black locust flourished. Before the advent of the movable frame hive, the Wisconsin beekeeper would have smoked the bees out of trees before cutting the tree down to harvest the honey. Log gums and straw skeps were the next step in the progression of keeping bees. No wonder the early consumer doubted the veracity of liquid honey. Most honey was merely cut in chunks from the comb and served to the family.

The late 1800s brought American foulbrood to Wisconsin and, in 1898, Wisconsin appointed a state apiary inspector to teach beekeepers in the state how to manage their bee yards to fight the disease.

Today, school students on field trips, families, and vacationers all revisit the past at the rural Wisconsin village of the 1890s – Stonefield Village near Cassville, Wisconsin. The honey house is always open and is a wonderful display of how today's beekeeping evolved.

(L) The barn at Stonefield Village welcomes visitors to the restored rural village, typical of a Wisconsin farming community in 1890. (R) A costumed guide takes visitors on a tour of the farm and includes a stop at the honey house.

(L) Two visitors at Stonefield Village try to decipher the label on the section box comb honey press. (R) This handmade hive is one of many donated to the historical village.

(L) Cold blast smokers are on display showing how beekeepers smoke their bees. (R) A beeswax foundation roller/press is used to make foundation for bee frames.

(L) View of the village through the honey house window where the antique honey containers were displayed. (R) A vistior to the honey house admires some pure beeswax.

Living With 15 Billion Snake River Bees

by CECIL HICKS

The Kindall's (left to right, Jim, Bill, Teke and Bob) gather at a local gas station in Payette, Idaho, before heading out for the day. Because of the potential fire danger, they've been mowing and cutting weeds and brush around their bee yards.

Idaho resident Bill Kindall estimates that in his 54 years as a full-time commercial beekeeper that he's managed and raised nearly 15 billion bees.

If you were ever on the TV game show "The Millionaire" and were asked the following million-dollar question, "What's the deepest canyon in the United States? Almost everybody would respond immediately the Grand Canyon in Arizona. Unfortunately, that's the wrong answer. Most people are surprised when they learn that in fact the deepest canyon in the U. S. and all of North America as well is "Hell's Canyon" on the Snake River that borders between the states of Idaho, Oregon and Washington.

For millions of years the waters of the Snake River have gouged out a deep path that winds below the surrounding mountain rims. On the Idaho east rim of the ten-mile-wide and 70 mile long Hell's Canyon gorge the taller peaks of the Seven Devils Mountains are nearly 8,000 feet tall. At one time gold seekers mined the river bars along this stretch of the river. Today this region is known as the Hell's Canyon Recreation Area and flat-bottomed jet boats skim across the numerous rapids hauling tourists on sight-seeing day trips. Whitewater rafting, camping, hiking, swimming, boating, fishing and kayaking are also popular summer seasonal activities in the region.

In the early 1800's explorers like Lewis and Clark turned back from attempting passage down the Snake River and sought a safer land route through the mountains on their trip to reach the Pacific Ocean.

The same western Idaho mountain slopes and river banks of the 1,038 mile Snake River that turned back the Lewis and Clark Corps of Discovery party 200 years ago, today provides honey bee yard sites for Kindall Apiary, a family-owned beekeeping operation, based out of Payette, Idaho (pop. 6,000). The town of Payette is located on the western edge of the Treasure Valley on the banks of the Snake River.

Payette is also the geographic location where the Snake River turns north for some 150 miles flowing through Hells Canyon before it eventually flows westward into Washington State and empties into the larger Columbia River in route to the Pacific Ocean.

The Kindalls are fourth and fifth generation beekeepers. Bill Kindall, at 71 years of age, claims he's slowed down a little (due mainly to health issues over the past few years). The family bee business manages some 3,000 to 3,500 hives and he now lets his three grown sons do most of the heavy work, as well as supervising the day-to-day operations. He stated that Kindall's Apiaries is kept all in the family, as there aren't any other employees.

Of course, he admits that his wife Judy is the "matriarch" of the family and rules everything. Besides helping with the bees, she also keeps track of the bookkeeping.

Married for 46 years, their sons (all full-

Looking down into Hell's Canyon some 5,000 feet below from a mountain ridge on Idaho's east-rim of the Snake River. The canyon mountains across the river are in the state of Oregon. Hell's Canyon is the deepest canyon in North America.

(L) Bill Kindall, a fourth generation Idaho commercial beekeeper at age 71, has been running bees around the Snake River and its tributaries for more than 50 years. (R) Bill said he's had a personalized Idaho license plate with the word Honey on it for more than four decades.

time fifth generation beekeepers) are Jim, 43; Teke, 40; and Bob, 37. Bill and Judy also have seven grandchildren.

The actual name of their family bee operation is W.C. Kindall Apiary. The bee business has been in existence since 1910 and was originally run by H (Henry) Wiedner, a well-known Idaho beekeeper. Bill and his dad (Charles F. Kindall) bought the business from Henry's widow in 1966, changed the name and later moved onto the property that included a house and barn that sets on the edge of Payette and is zoned commercial.

The old barn, built in 1910, has been used as a bee shop since its construction. This past winter, while they were in California, much of the roof was damaged from a windstorm. The structure has since been torn down and the Kindalls are planning to rebuild it sometime in the future.

He claims beekeeping is "kinda in their blood," as his mom's dad (William Alexander Grigg) was also a beekeeper, along with four uncles, three nephews and a few cousins. Bill's been keeping and working bees since he was old enough to pick up a hive tool and smoker. He's been full time since the age of 16, some 54 years ago. He says his tried and true beekeeping methods, which he's passed on to his sons, are based on practical experience and a process of elimination. His philosophy, "If it works, then continue doing it and if it doesn't, stop."

Bill said he had to make a life-changing career decision years ago when he began working fulltime with bees. "I asked myself whether I wanted to live to work bees, or work bees to live? I didn't want to be like some beekeepers who are a slave to their bees and are so busy they never have time to enjoy life."

He was born and raised near the town of Middleton, which is mid-way between his hometown and the state capital of Boise, some 50 miles southeast of Payette.

He has three brothers who are all full time beekeepers. Phillip and Joe live around the town of Cambridge (50 miles north of Payette) and Harvey lives in Livingston, Montana. Together they (all the Kindalls) have some 11,000 beehives between them. Bill said, "Although all my brothers have separate bee operations of their own, if there's a problem, or an emergency and a machine breaks down, we'll come and help each other as needed."

During the honey flow season they set bees at some 60 different bee yards up and down the Weiser, Payette and Snake Rivers in a three county-wide area. Although they don't pollinate agriculture seed crops in Idaho, there are a lot of onion fields in the Treasure Valley and their bees do forage on some of these fields. Bill said that years ago farming in the area consisted of perhaps 50 percent alfalfa seed, but today there's a va-

Here Bill checks some nucs in part of his bee yard on the outskirts of his home town of Payette, Idaho. He has used this yard site for decades, which is located in a horse pasture next to a hay field.

Bill checks on a new foundation he placed in a bee hive the week before.

(L) The Snake River flows by in the background at this bee yard site located on its banks. Note the brush and weeds grown up around this yard. The Kindall's have been busy this summer of 2010 mowing, weed whacking and scraping the ground to bare soil around their bee yards to prevent future fires. Bill said that an exceptionally wet spring has produced an excessive growth of tall brush and grass. (R) This view is looking north from a bee yard near the town of Weiser that is located on the western edge of the Treasure Valley in the Snake River Plain. Beyond Weiser the mountains begin and paved roads end.

riety of crops besides alfalfa and clover, including onions, sugar beets, wheat and corn.

The main honey-producing plants in the region, according to Bill, are dandelions in the spring and then in the summer it's alfalfa, yellow and white clover and loosestrife. In the fall the biggest honey bee forage is wild buckwheat. He said that if the area gets some rain, sometimes the buckwheat produces more honey in the fall months than the entire summer. He likes the purple loosestrife plants, even though state and federal agriculture departments term it a noxious weed and have tried to eradicate it.

Due to the fact that southern Idaho is basically a desert with hot summer temperatures, the Kindalls made a decision several years ago to concentrate their efforts on bee pollination in the California almond orchards for their main source of income instead of extracting honey.

For the 2010 season they signed pollination contracts averaging $140 per hive. He tells the story about one of his brothers who committed his bees to an almond orchard owner on one day and the next day he was contacted by another desperate owner who was willing to pay an additional $60, or $200 per hive.

They ship their bees to California each winter for almond pollination and have been setting them in the same groves there since 1976. Bill said that usually by January 15th of each year they'll start shipping bees to California by contracting a semi truck that makes six round trips with an approximate cost of $2,500 per round trip.

In looking back at the 2010 almond pollination season in California, Bill said, "It was one of the worst seasons I've seen in the past 30 years. The weather was cold and it rained most of the season. We sent 3,000 heavy, healthy hives to the almond orchards and most came back fairly light with little build up. In fact, the semi-truck hauling their bees back to Idaho averaged 3,500 pounds lighter per load on the return trip."

All honey supers (except for one per hive) produced from bees foraging from their yards are pulled off and placed into storage. Then, this super is later removed in the fall and placed into storage. After this super is removed, we begin feeding liquid syrup. On occasion, they do extract some small amounts of honey for sale, but currently their Dakota uncapper needs repaired, which they planned to do this summer.

Bill holds up a brood frame that's looking pretty good at one of his Snake River bee yards located near Weiser, Idaho (a few miles north of his home town of Payette) on the western edge of the Treasure Valley in southwestern Idaho. Bill said he gets stung on his hands occasionally, but he never wears gloves when working bees because "they're just too uncomfortable."

Bill explained that he's probably the only commercial beekeeper he knows who doesn't extract most of the honey, but he feels the bees benefit and it gives them a good healthy start, which they need in the spring when they return from California. If they have too, they'll also feed their bees and nucs with one-gallon jugs of sugar-water.

Every autumn they also yard (in a hundred acre field they've leased for the past 40 years) all their bees for a few cooler months on the Oregon side of the Snake River. In January, it's their sons' job to dig the hives out of the snow and inspect all the colonies before loading them onto a semi for transport to warmer weather in California.

Both Bill and Judy travel to California in mid-January to unload bees. Bill said that because the bees have already all been gone through by their sons before they arrive in California, "All we have to do is unload them and set them straight into the almond groves. By doing so there's less drift of bees away from the hives when they're released, plus you don't have to stop and feed them."

By the time the hives are shipped to the Golden state, they've been inspected and gone through several times and fall fed with sugar syrup. According to Bill, a semi will hold about 488 hives per load before it is maxed out weight-wise.

Bill said that when they pull the bees from their summer beeyards, they remove honey supers and place them into storage to be used in the spring for bee food when the bees return from California.

Bill explained, "In the past in the spring we've had to spend time and money pumping syrup for the hives. By adding a full honey super (which was set aside last fall) and splitting big hives, we don't have to stop and feed. It's more efficient and all we have to do is requeen if needed. There's also less

(L) Creating custom-made obsidian knives, handles and base holders is Bill's hobby. He often donates his knives (like this one made from Montana Diamond Willow with a Manzanita Cedar base) for fund raisers at annual northwest beekeeping and honey-producing meetings. (R) Obsidian is a glass-like rock made thousands of years ago when volcanic lava came into contact with water and cooled rapidly. Native Americans have gathered and used this material to make knives, arrow and spear heads for hundreds of years. Here Bill's holding an obsidian knife with a mahogany handle, lilac holder and maple stand that he made.

swarming."

In the past, Bill's main beekeeping job in Idaho was making queen cells. He said he normally raised between 6,000 to 7,000 queen cells per year and sometimes they'll have extras they didn't need. When they do, they'll usually end up giving them away to beekeeping friends.

But this year, he didn't raise queens, but instead bought queens from Jordan Demick, an eastern Oregon commercial beekeeper, to expand their honey bee genetic pool. They have mostly Carniolan honey bees in their hives.

Their bee equipment includes seven bee trucks: three one tons, a 1 ½ ton, two 2 tons, and one 2 ½ ton. Bill said normally, due largely to fuel costs, they just use the smallest truck that will get the job done. They also have three 4-wheel drive Jeep homemade forklifts, plus a Bobcat 130.

Bill's proud of his flatbed bee truck. He designed the flatbed by using an old truck frame that had been lying around in the weeds by the shop for 35 years. Not only did he weld the old frame onto his truck bed, but cut and laid heavy wood planking on it and painted the boards white. He also designed a removable board so he could expose the fifth wheel connection for their RV trailer that they use on weekend camping outings.

Bill said that because of all the rain they had this spring, they had to move one bee yard from the rapidly rising waters of the Payette River. Also, because of all this moisture, there's been an abundant growth of weeds and brush. "When everything dries out from the hot summer weather, I believe this year has the potential for having the worse fire conditions I've seen in the past 25 years."

Therefore, nearly all of their 60 bee yards are surrounded with high brush and weeds that have to be mowed, weed-whacked and then scraped down to bare soil to prevent damage from potential man-caused, or lightning fires. By mid-July 2010, Bill said his sons had been busy each day working in the hot sun in 90 degree plus weather weeding, mowing and clearing around and between hives. Bill said he welded a home-built scraper onto his Bobcat for the scraping duties.

When he's not working with bees, Bill keeps busy with his knife-making hobby which brings in an additional part time income of $2,000 to $3,000 per year. About eight years ago he started working with obsidian making knives, arrowheads, tomahawks and spearheads. He first learned the skill when he was about 11 years old from an old Paiute Native American from Nevada that his dad had befriended. It wasn't until decades later that he took up knife-making in earnest as a hobby.

Obsidian is a volcanic rock usually found in lava beds in North America ranging from California to Washington State in the Cascade Mountain Range. It occurred when lava spewing from an eruption cooled rapidly when it came into contact with water. The end result was a glass-like textured material, usually dark in appearance, with colors ranging from black, to dark green, to dark brown and occasionally with white clusters mixed in.

Bill explained that Native Americans have been using the material for thousands of years to make hunting and warring tools and it has a real sharp edge to it. In fact, obsidian is so sharp it is used for surgical scalpels in hospitals. Bill said he usually makes about 100 knives per year. Each year he donates some of his knives to the Idaho Honey Producers Association for an auction fundraiser at their annual fall meeting.

Judy makes stone necklaces as a hobby, which she also donates for sale at regional annual bee and honey association meetings.

Actually, Bill gives credit to his wife Judy for his knife-making hobby. She suggested that he do it as a hobby and stop complaining about the quality of homemade knives he'd seen at art and craft shows.

Judy recalls that every time Bill would see a homemade knife at an arts and craft show, he'd state, "I can do a better job than that. Finally, I told him to stop complaining and prove it by making his own knives. So he did."

Bill tells the story that several years ago, as they were returning from California after placing bees in the almond orchards, they were driving through a remote stretch of highway near Glass Butte, Oregon (between Bend and Burns). They stopped on a side ranch road when Judy spotted some obsidian.

While they were gathering a bucket of obsidian, the ranch owner drove up and asked what they were doing. They explained who they were and what they were doing. He said, "Oh, I've got a whole mountain of obsidian in the back of my place." He drew a map to the area, gave them permission to gather it and told them to be sure to shut the gates. Since then, they've made annual stops at the ranch to gather the rocks. They have also found another obsidian gathering location at Davis Creek in northeast California.

Over the years Bill has donated a number of his custom-made obsidian knives with hardwood handles and holders to Northwest beekeeping and honey-producing organizations as a fundraiser. Bill is part native American himself (Cherokee) and attends an annual Pow Wow for the Nez Perce Tribe at the town of Wallowa, in eastern Oregon, where he donates his knives to help raise money for that tribe's repurchase of reservation land fund.

As the sun sets on southwestern Idaho along the Snake River, commercial beekeeper Bill Kindall has learned to live with some 15 billion honey bees. Although age has slowed him down a little, he still keeps his beekeeping skills honed and sharpened just like his obsidian knives.

Growing Lavender and Making Delicious Honey in Southern France

by MICHEL DANIEL
Le Beaucet, Provence, France
http://milymiel.free.fr/indexUS.php

Lavender, in French *lavande*, comes from the Latin verb *lavare*, which means to wash—aptly named due the blossom's fresh, clean scent.

Lavender growing began in Provence (southern France) in around 1850. At first, wild lavender was gathered by hand on the hills and high plateaus. Modern lavender culture began around 1950.

Lavandin is a hybrid between *Lavandula officinalis* and *Lavandula spica.* It blooms from June to mid July, before it's cut and harvested. *Lavandula offinalis* grows at an elevation of 1800 to 4200 feet. It blooms from early July to early August. *Lavandula spica* grows at an elevation of 600 to 1800 feet. So, the first natural cross breeding happened between an elevation of 1500 to 1800 feet where both populations existed. Keep in mind that this hybrid is sterile.

History

During the years 1923/1924 farmers made 100 tons of lavender essential oil coming mainly from hand gathering (90%) and 1 to 2 tons of *lavandin* essential oil. By 1950 the *lavandin* essential oil crop had increased to 200 tons per year. Flower gathering was soon completely abandoned, with the advent of machine harvesting and modern production methods. By 1956 *lavandin* essential oil production was increasing, but lavender oil production was still around 80 tons. By 1980 *lavandin* essential oil production had increased to 1000 tons, while lavender oil production was still decreasing, down to around 65 tons. After 1995 *lavandin* essential oil had increased to 1200 tons with lavender essential oil production continuing to drop to 45 tons per year.

At this time, we have four types of *lavandin* (*Lavandula abrialis, super, sumian* and *grosso*). However, due to a major problem with a disease called "withering", the lifetime of the average acreage has decreased to 3 to 4 years from 10 to 12 years before the disease trouble began. *Lavandin grosso* is a resistant clone that is very productive.

Withering is due to bacteria transported by an insect called the *ciccadelle*. Lots of plants are affected and farmers spread insecticide, unfortunately also dangerous to the bees. In some areas, hives have been crippled or lost due to use of these insecticides.

How do farmers plant lavender and *lavandin* ?

Growing lavender is long process. Growers make plantings in beds and after

Long rows of lavender growing in southern France *(Michel Daniel Photo)*

Close-up of honey bee on lavender blossom *(Michel Daniel Photo)*

Attractive packs of lavender honey sticks produced by Michel Daniel and son. Available at http://milymiel.free.fr/indexUS.php *(Michel Daniel Photo)*

two years, they harvest the plants and replant them in long lines, usually in spring. With good rains in May and June, the first flower crops can be harvested in the second or the third year (so 4 to 5 years after the seed is in ground).

Since *lavandin* is a sterile hybrid, the increase method is accomplished with cuttings made on adult plants that are five years old.

Density of the plantings

Because of the machine cutters, plantings are done in long lines. The distance between two lines should allow room for both the tractor and the machine cutters. For lavender plants, growers allow 16 inches between two plants and 1.5 to 1.6 yards between rows. For *lavandin* plants, the distance is 20 to 30 inches between two plants and 1.6 to 2 yards between rows.

This equates to 12,000 to 15,000 plants of lavender or 8,000 to 10,000 plants of *lavandin* on two acres of land. The plants provide their best production after the third or fourth year.

Marketing

Ninety percent of the oil production is exported to the United States, United Kingdom, Germany and Japan. The world production for essential oil is more than 50,000 tons/year, but *Lavandin* essential oil production is only 1000 to 1200 tons/year and lavender essential oil production is only about 40 tons per year!

Lavender oil is extracted mostly from the flowers of the lavender plant, primarily through steam distillation. The flowers of lavender are fragrant in nature and have been used for making potpourris for many years. Lavender essential oil has also been traditionally used in making perfumes. The oil is very useful in aromatherapy and many aromatic preparations are made using lavender oil. Today, lavender essential oil is used in various forms including aromatherapy oil, gels, infusions, lotions, and soaps.

Possible lavender oil uses

Acne, allergies, anxiety, asthma, athlete's foot, bruises, burns, chicken pox, colic, cuts, cystitis, depression, insomnia, dermatitis, dysmenorrhea, earache, flatulence, head-ache, hypertension, insect bites, insect-repellent, itching, labor pains, migrane, oily skin, rheumatism, scabies, scars, sores, sprains, strains, stress, stretch marks, vertigo and whooping cough.

Lavender honey

In Provence, we harvest about 1000 tons of honey per season, with 600 tons of this production being classified as lavender honey. Thanks to the bees, the lavender flower yield is 10 to 15% more. Due mainly to the *mistral* (strong and cold northen wind), the lavender honey crops are not large, usually one super or around 35 pounds per hive. The year 2010 looks

My Land Cruiser and trailer loaded with supers for a lavender field honey flow. *(Michel Daniel Photo)*

A bottle of lavender honey and also a honey stick produced by Michel Daniel and his son.*(Michel Daniel Photo)*

encouraging and we are hoping for 45 to 55 pounds per colony. Unfortunately, some areas will produce almost nothing due to drought, wind and pesticides.

Lavender honey is generally acknowledged as one of the best honeys in the world. The wholesale price per kilo (2.2 lbs.) is around $7.80 USD and the retail price is often $13.00 to $18.00 USD per kilo.

Editor's note: Michel has worked for U.S. beekeepers before and would like to work in the U.S. again. If you have a beekeeping position open, please contact him via his website http:/milymiel.free.fr/indexUS.php. Email michel danielfr@yahoo.fr.

Machine harvesting of lavender *(Michel Daniel Photo)*

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North Carolina

A Successful State Meeting

by KIRSTEN TRAYNOR
Photos by MICHAEL TRAYNOR

Beekeepers from across the state of North Carolina slogged through molasses-like heat to gather in China Grove this past July for their summer meeting. Inside the cool halls of the Carson High School, beekeepers listened to talks, participated in workshops and mingled while browsing through the small trade show during the three-day event.

Halfway between Charlotte and Winston-Salem, China Grove is a rural town nestled in the Southern Piedmont of North Carolina. Many of the attendees drove in from out of town, staying in nearby historic Salisbury, a classic southern city with noble brick storefronts from the late 1800s and streets kept cool by old, majestic trees that encircle painted wooden Queen Anne and Colonial Revival homes. With over 2,000 members the North Carolina State Beekeepers Association (NCSBA) prides itself on being one of the largest state beekeeping organizations in the US. Most members are hobby beekeepers and look forward to the summer meeting as a mini vacation, a chance to reunite with friends and learn more about those industrious insects they house in their yards.

Every year the meeting migrates around the state. Three of the 50 plus local club associations joined forces to host the event this year. The meeting opened on a sleepy Thursday afternoon. Greg Clement, NCSBA president, welcomed everyone in the spacious auditorium. Soon thereafter Dr. Marion Ellis from the University of Nebraska took the stage to present a talk about our long-shared history with the honey bee.

Beekeeping History

Illustrating his talk with rich images, Ellis spun the threads of our common history into a vibrant tapestry. Until the 1600s honey was the only sweetener available to most of the world. Sugar cane, indigenous to the Asian tropics was not yet grown in vast plantations. The natives living in the Asian tropics knew its sweetness, chewing on the tough grass to release the sugary sap. Sugar cane was first crystallized in Persia. Sugar cane spread throughout the Islamic world during Mohammed's battles for Mecca in the late 1620s. Returning crusaders brought the sweetener to Europe. When the Spanish

(l) Greg Clement had just finished serving his term and welcomed all the members to the summer meeting. (center) Dr. Dave Tarpy of North Carolina State University introduces the plenary speaker. (r) Dr. Marion Ellis from the University of Nebraska presented two talks at the NCSBA summer meeting. The first on our close association with bees throughout history and the second on why French beekeepers can earn $16 per pound for lavender honey.

Dr. Jeff Harris from USDA's Baton Rouge, LA research facility presented information on VSH bees outcrossed to commercial stocks.

Participants browse the trade show at the NCSBA summer meeting in China Grove, NC.

infiltrated the New World, they brought along their sugar cane, where it flourished in the tropics.

Beets bred for extra carbohydrate sweetness were first turned into beet sugar in the 1800s in Germany. When England blocked the shipment of cane sugar to France during Napoleon's reign, the French emperor helped establish the French beet sugar industry.

Corn sugar is the newest of the major sweeteners on the market, a 20th century product. Initially heat and acids were applied to convert the corn's starches to sugars, but today anaerobic fermentation is applied instead.

Nature's oldest sweetener is honey. Our ancestors probably discovered honey could be fermented very early on, producing the world's first alcoholic beverage—mead. The Greeks wove intricate tales about their plethora of Gods whose lurid escapades were fueled by honey wine. The Vikings toasted their conquests in their mead halls, lifting their drinking horns high. Paradise to them meant feasting on wild boar and being served mead by virgin nymphs called Valkyries. Mead, magical and sacred, was the drink of high priests and lowly peasants. In medieval Europe, mead inspired fertility and verilty. Newlyweds imbibed a daily drink during their first moon shared together, and so the term "honeymoon" entered our language.

Honey has assumed many roles throughout history, including sidelighting as a preservative. The corpse of Alexander the Great was transported home in a honey-filled sarcophagus for burial. In Egypt honey helped embalm the wealthy.

Bees gift us with beeswax in addition to honey, providing light to accompany their sweetness. Before electricity beeswax candles lit churches throughout the world. Burning with a hint of sweetness and without smoke, beeswax candles were a premium source of light. In addition to light, beeswax proved useful in cosmetics, as a waterproofing agent, on writing tablets, and as an adhesive.

The first documented evidence of honey gathering can be found in Cueva de la Arana, the Cave of the Spider, dating back to 6,000 BC in Spain. An androgynous figure trusts its life to three thin ropes to rob honey out of a mountainside cleft. The painter who composed the image used a naturally occurring indent in the cave's wall to symbolize the hive. Large bees surround the figure without stinging. To this day, honey hunters in Cameroon still harvest this sweet delicacy in much the same manner. The enterprising Egyptians were probably the first true beekeepers, maintaining bees in stacked cylindrical hives that could be manipulated with smoke.

Settlers to the New World brought along the honey bee in skep hives in the 1600's. They quickly adapted to the new environment, often preceding the frontier, earning them the moniker "White Man's Fly."

Whereso'er they move, before them
Swarms the stinging fly, the Ahmo,
Swarms the bee, the honey-maker;
Whereso'er they tread, beneath them
Springs a flower unknown among us,
Springs the White Man's Foot in blossom.

H.W Longfellow
Hiawatha

Today the pollination efforts of the bee in the US are estimated to be worth $18.7 billion. These complex social insects inspire artists, scientists, writers and politicians. More books have been written about honey bees than any other insect. Each year over 1400 scientific articles related to bees are published worldwide. From children's books to Shakespeare, bees make their entrance center stage.

Marion Ellis finished his colorful tapestry of our close relationship to bees with a quote from Karl von Frisch, who won a Nobel Prize for decoding the honey bee's dance language. "The life of a honey bee is like a magic well, the more you draw from it, the more there is to draw."

In his mellow voice softened by a Tennessee accent, Ellis ended his talk: "Bees will fascinate you, if you let them."

Honey Bee Health

After Ellis' lighthearted romp through history, Dr. Jeffrey Harris spoke about the difficulties facing modern day beekeepers and how the Baton Rouge Varroa Sensitive Hygiene (VSH) stock could help minimize varroa when crossed into commercial bees. A brief synopsis of Colony Collapse Disorder headed up Harris' talk. Research indicates that CCD is multifactorial, with varroa, viruses, *Nosema*, and pesticides each playing a role. Since the widespread collapse of colonies we have learned that chemical residues exist everywhere in our hives, some brought in by the bees and others introduced by the beekeepers. Synergisms exist among some of the pesticides, so although each individual pesticide is not lethal, a combination of pesticides can prove deadly. Synergism also exists between pesticides and pathogens. Diet and malnourishment play a role in some colony collapses as does the stress of transportation.

With such a maelstrom of possible stresses, no one ailment stood out as the key factor responsible for colony declines. To

help the bees survive, Harris stressed it was key to keep varroa mites in check using an integrated pest management strategy, starting with steps of prevention. Intervention should start with mechanical control and monitoring of pest levels, before reaching for toxic miticides as a last resort.

While hobby beekeepers have the time to devote to their hives, commercial operations rely on their bees for their livelihood and cannot feasibly invest the same amount of management per colony. "How do large-scale beekeepers progress beyond the routine high-volume use of acaricides?" Harris asked.

For those who can invest more effort in both time and money to manage their bee colonies, he suggests a varroa-integrated pest management strategy that adopts the use of varroa-resistant stocks and a shift in cultural practices. Russian, Minnesota Hygienic and bees with the VSH trait all help to minimize the impact of varroa on the colony. The first steps for varroa intervention should include mechanical control via drone comb cutting, screened bottom boards and heat treatment of package bees. Mite levels should be monitored via sticky boards and sugar shakes in early spring and again in late summer. Each region will have different environmental conditions and thus distinctive mite threshold levels. Speaking with other beekeepers and extension agents in your region may give you insight on tolerable mite levels for your climate.

Only when the mite levels exceed the thresholds should beekeepers turn to pesticides, using only legal treatments. For the health of the hive it is best to apply the least toxic ones first and monitor to see if that has eliminated the mite problem. Be aware that synergisms can occur both with other acaricides and pesticides applied in the environment.

Harris then detailed varroa sensitive hygiene, stressing that the trait confers strong resistance to varroa when outcrossed into traditional stocks. In three separate trials, the VSH outcrossed stock proved its tolerance of mites. In short field trials lasting four months, the VSH hybrids had half the mite populations compared to colonies headed by regular commercial stocks.

In a three-year study in Alabama, 88% of VSH colonies and 76% of Russian colonies stayed below a treatment threshold, while the traditional commercial stock exceeded the economic threshold of mites in 40% of hives. The VSH colonies produced 52 lbs of honey on average compared to 59 lbs from the Russian hive and 46 lbs from the commercial controls. Queen losses proved to be a consistent concern for beekeepers across all three strains.

For VSH stocks to be adapted by commercial beekeepers, they must survive and thrive in a commercial environment. Dr. Bob Danka has been working with commercial beekeepers to see how the VSH hybrids hold up during the rigorous trek around the US. The hives overwinter in Louisiana, before heading into California almonds in early February. They return home in March to a holding yard in Louisiana. In April the hives are loaded for transport to apple orchards in New York. From apples the bees are moved to blueberries in Maine, then cranberries in Massachusetts. After so many rounds of pollination, they're brought to New York to recover and produce honey, before heading home to Louisiana to overwinter.

Dr. John Ambrose explains the benefits of adopting a new honey standard in the state of North Carolina.

Such a busy year is hard on the bees and many of the queens don't make it through the long trek. One-third of the original queens survived, one-third of colonies raised supersedure queens, and one-third of the colonies died. While such high losses surprised the researchers, the commercial operators ensured them such rates of attrition were standard. The VSH hybrids had acceptable survival. Bee and brood populations increased most on apples and declined while colonies pollinated lowbush blueberries and cranberries. No CCD symptoms were observed in any of the stocks tested in the experiment.

While most of the VSH hybrid colonies stayed below the varroa threshold limit of 10 mites per 100 bees, some colonies did exceed this acceptable level. Even when using varroa-resistant stocks, mite levels must be monitored. Beekeepers should intervene when mite levels start to rise above acceptable thresholds.

Unlike the simple freeze kill assay used to evaluate bees of the Minnesota Hygienic line, there is no simple assay to test for VSH. However, the USDA in Baton Rouge, LA supplies breeder stock to Glenn Apiaries (www.glenn-apiaries.com), who sells instrumentally inseminated VSH breeder queens. According to Harris, the breeder queens should be used to raise daughters that are then open-mated to your own stock. You can also obtain open-mated VSH queens from numerous commercial queen breeders.

After Harris' informative talk, the audience headed to the cafeteria for a light snack. I overheard animated conversations about the potential of varroa-resistant bees. Participants strolled through the trade show, purchasing books, t-shirts and hive equipment before heading to one of six different workshops.

German Hive Rotation System

My husband Michael and I hosted one of the workshops, speaking about the German Hive Rotation system developed at the Institute for Bee Research in Celle. The room quickly overflowed. Extra chairs were brought in and were snatched up quickly. With no place to sit, a dozen stood near the entrance to the room. We hadn't realized our talk would be so popular.

The German Hive Rotation System developed by German Master Beekeeper Helmut Schoenberger and former head of the institute Dr. Jost Dustmann minimizes the impacts of varroa while maximizing honey production. Young splits are built during the spring flow and then nurtured through the summer months, while the beekeeper follows the nectar flow with the original mother hive and produces honey. Toward the end of the season the two hives are recombined, and the new queen heads a super strong, virtually mite-free colony going into the winter. Biotechnical interventions and well-timed varroa control ensure a strong hive for the next year. Unfortunately, this article only leaves room for a brief synopsis of the rotation system and its the details that make it so successful.

Other Talks

The workshops ended and the conference broke for dinner on your own, reconvening afterward to hear the plenary address by Dr. Marion Ellis. Instead of a fact-filled lecture on how to manage hives, Ellis admitted he was a Francophile. He had fallen in love with France as a teenager, when his brother advised him to try a stint abroad so he could place out of college level language classes. A short summer stay turned into a yearlong sojourn. Since that initial trip, Ellis has returned frequently. In 2007 he spent a six-month sabbatical at the laboratory of bee researcher Dr. Yves le Conte at INRA in Avignon.

In France enterprising beekeepers earn up to $16 per pound for their lavender honey. "How can they sell their product as such a premium price?" Ellis asked. He believes in France honey is a highly appreciated commodity. For the French, food is not just something you eat, it is an experience. Although giant supermarkets have sprung up all over, the French still enjoy connecting with agricultural producers. They are willing to pay more for a local product at the market, taking pride in the purity of foods produced on French soil.

To demonstrate the French way of life, Ellis played a montage of photos his wife

The new master beekeepers are joined on stage by those who achieved their NC master beekeeping status in previous years.

had taken during their stay in the French Provence. French music filled the auditorium as one vibrant photo of the bread laden tables at the market faded into an image of lush lavender hills. The photos captured the French *esprit*, their love of life, color and family. A picnic of baguette paired with salami, cheese and a bottle of red wine. The town's square lined with spectators at the annual festival, where shepherds drive their flocks through the village. A honey festival overflowing with a selection of honey, mead, and nougat. The game of Petanque, similar to Bocce, played by all ages. During his stay, Ellis took the time to master the game. While at first the strange American tossing the metal balls at the diminutive wooded target aroused the amusement of the local regulars, by the end of his stay they invited him to join in their game.

The vivacious images of southern France coupled with harmonious melodies transported the audience across the ocean. Ellis' presentation mimicked a fine desert, a taste of bliss that hovers on the lips long after the last bite, a flawless finale to a lively day.

Reconvening early the next morning, the conference included two more days of talks, workshops and expert panels. My husband, Michael, and I presented a slideshow of artistic bee photography. (A small selection can be seen at www.flowerslovebees.com) We also spoke on organic varroa control and bee breeding in Europe.

Dr. John Ambrose presented a brief talk on the benefits of a honey standard. After a discussion period where members could voice their concerns and ask questions, the members present voted to accept with a resounding majority the implementation of a honey standard, similar to the one recently adopted in Florida. Any honey thought to be mislabeled can be reported to the state organization and they will work with appropriate state enforcement agencies to remedy the situation. Initially, the one reporting the claim is responsible for associated testing costs, but the NCSBA hopes to establish a fund in the near future.

The NC master beekeeping program has flourished in recent years, due in large part to the efforts of Dr. Dave Tarpy of North Carolina State University and several NC extension agents. At the banquet on Friday evening quite a few members received their master beekeeping medals of achievement as attendees enjoyed an indulgent dinner of NC barbeque. I understand regional feuds are fought over who serves the best barbeque in NC. By the contented silence that enveloped the table as we sat down to eat the hearty meal, the choice of caterer was a success.

An Active State Organization

Fueling good natured competition between the local chapters helps make the NCSBA a success. The clubs compete to win the coveted title of most active club, engaging in extensive outreach efforts throughout the state. Rewarding lifetime achievement and instilling a strong mentoring program where new beekeepers are paired with experienced beekeepers seems to encourage more active involvement. Participation in the state fair where the organization sells NC honey and honey sticks fuels the club's coffers, allowing them to host nationally recognized speakers.

The NCSBA should be proud of what it has achieved. Through dedicated beekeepers they even raised funds for and built a beekeeping exhibition at the NC Zoo in Asheboro that includes a live observation hive, an oversized walk-in skep and a pollinator friendly garden. By reaching out to the community, they help inform the next generation of the importance of bees. Such interactive exhibits may instill a lifelong love in some child, who will eventually find his or her way to keeping a hive.

Kirsten Traynor is pursuing a PhD in Biology at Arizona State University, focusing on the effects of brood pheromone on honey bee behavior. She can be reached at info@mdbee.com. Her husband Michael Traynor is a commercial and fine art photographer. A selection of his bee photos can be viewed at www.flowerslovebees.com. Together they manage Flickerwood Apiary in Maryland, producing nucleus colonies and gourmet honey.

The Traveling Beekeeper

Variations On New Queens

by LARRY CONNOR
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Beekeepers are skillful at finding ways to use available resources in their operations. Nowhere is this more evident than when it comes to finding ways to add queens to an existing or new colony. The queen rearing industry and the teachers of basic beekeeping tend to focus on the use of newly mated queens as the 'correct' way to introduce new queens. I have reviewed the many other options of queen introduction elsewhere and in my books. This past season I have had the opportunity to make further observations on two methods for new queen introduction that are not widely accepted by beekeepers in North America—48-hr queen cells and virgin queens. If you have read what I have written about these two subjects, this is an update.

48-hour old queen cells

About two years ago Dr. John Kefuss of Toulouse showed me the practice of shipping and using queen cells that are two days past grafting. Allowing that the larvae in the cells have a three-day existence as eggs, plus about a one-day existence before grafting, the individual bees in these 48-hr cells are approaching the end of their sixth day of development in a metamorphosis of a total of 15 to 16 days. The larvae are about midpoint in their larval development. John argues that the larvae are large enough to withstand time outside the colony and away from nurse bees, but still small enough so they will not crawl out of the cell when stressed.

At the three-day queen rearing class taught at the Farm in Galesburg, Michigan in July, one of the students, Dwight Wells of Troy, OH, asked if he could take some of the cells grafted on Friday evening to Ohio to see if they survived. He ended up taking 14 48-hr cells out of the cell finishers and put them into holders inside a small plastic insulated thermos. He did not heat or cool the cells, but put a damp paper towel over the top for a little humidity. (I feel that the royal jelly provided the needed humidity for the larvae). Within five hours he was outside Columbus (in a drive that takes me longer) and placing the cells into a cell builder owned by experienced queen producer Dana Stahlman.

The attached photo shows the cells that were produced. Of the 14 transported cells, 12 cells were drawn out and sealed. From this point on they were handled as ordinary queen cells.

At an earlier class in Lainsburg, MI we

(l) Queen cells about 48 hours after grafting. (r) Dana Stahlman of Ohio shows queen cells finished in his cell finisher/builder after being transported from Galesburg, Michigan in a small cooler, without bees, heat or cooling. Of the 14 cells moved, 12 reached the finished cell stage (Dwight Wells photo)

(l) A day or two before emergence, queen cells are placed into wood and screen emergence cages and put into a queen bank. (r) Eight frame queen bank holds emerging virgins. The bank has brood, but no queen. It is checked frequently for queen cells.

had a similar experience. Each student was able to take home 48-hr cells and place them in hives when they got home. Many were drawn out, mated and now head big colonies. The source colony for the graft was a hygienic queen with a measured egg-laying rate of 2200 eggs per day. It was an amazing queen and colony and this was a method for folks to take a genetic sample from that queen.

The potential for this is huge. Even a small hobby beekeeper can produce queen cells for his or her own operation and carry them to a second location. Or share these cells with another beekeeper located some distance away. Urban beekeepers can produce cells at home, in the city, and carry them to another location in the city or out into the country.

I am excited about the use of these cells as a way to 'swap' genetic stock between areas of a state or region. These are low-cost cells, since they do not represent the labor of completed cell construction and queen mating. The cells that develop will result in virgin queens that will mate with the local drone supply, an advantage if area beekeepers have set up a selection program to promote production of desirable, mite and disease resistant stocks. It is a low-cost way to 'sample' different bloodlines and evaluate the resulting queens and their colonies. It helps demystify the process of selection.

These cells are moved bee free and mite free. There is still the risk of transporting disease, but there is no brood comb involved in the transport, just a cell (I use plastic), royal jelly secreted by the nurse bees, and the larva.

Local bee clubs can sponsor cell swaps at summer field days, and each beekeeper who brings in cells could potentially return home with a variety of queens to observe in their hives. If these cells are finished and mated in strong five-frame nuclei hives, the queens can be evaluated for physical features (color, damaged legs and wings) and the brood pattern checked. Under-performing queens should end up in a bottle of alcohol to serve as a source queen pheromone in swarm boxes, while the best queens may be built into full-sized colonies or wintered in the nucleus the same way Brother Adam did in Buckfast England. That way only the best colonies and their queens start the next spring season.

Teaching beekeepers to use virgin queens

Since April neighbors Cathy King, Craig Fuller and I have been producing queens by grafting. We have used a number of the resulting queens to install into new colonies, nuclei mostly, for mating and establishing new colonies. Extra virgin queens are sold to local beekeepers for pickup at the Farm, and this comes with a mini-short course on how to use virgin queens. Craig and Cathy are swapping the opportunity for training in queen rearing and beekeeping for a full range of beekeeping activities. This way they are not employees.

After the ususal disasters, counting errors and missing paperwork, we have developed a good system of grafting 12-24 hr old larvae into clean plastic cell cups, putting them into a cell starter (a closed, screened box filled

(l) Placing cap onto the queen cage used for holding virgins 3 to 5 days prior to emergence. (r) Placing the virgin between two frames of sealed brood in a nucleus made up in late August for overwintering.

with the nurse bees from one hive plus frames of honey and pollen and a sponge filled with fresh water). The cells in the starter are moved the next day to a cell finisher/builder. This is a two-story colony with the queen confined below a queen excluder and 2-4 frames of open brood above to attract nurse bees.

Once the queen cells are sealed and before the first one emerges (and destroys her sisters and our hard work), we place the cells into a wood and screen cage on a bar holding about 20 of these cells. The queens are emerged in these cages, protected from each other's intent to cause harm. After the queens are emerged, we remove the cell base and let the queen crawl out of the cage. Then, we pick her up, mark her, and place her into a JZsBZs plastic queen cage with queen candy. These are then put onto a rack, back in the builder/finisher hive that now serves as a queen bank.

Of course, a few queens have been lost during this marking process, but that is a reflection of our inexperience. The advantage I feel this system offers is that we know that we have a good queen. We can pinch small queens at this time, and select only queens that were well fed in the builder/finishers and have wide thoraxes. Rather than losing queen cells during introduction, we know we have placed a live, viable, marked queen in each hive.

The education and training part

Many beekeepers have been told that they should never use virgin queens. This is wrong. I have used virgin queens since the mid 1970s with good results. Do I lose queens? Of course. They must be freed from the cage and mate. I look for an 80% or higher success rate with this process when there are adequate drones and good weather for mating (higher than with queen cells).

Virgin queens are queens, and must be protected before they are released to a new group of bees. The cage provides this protection, and allows bees to feed and obtain pheromone from the queen.

We instruct beekeepers to place the caged queen with the plastic cell cap firmly pushed in so the bees cannot release the queen too quickly. It is my observation that queens that are freed from a queen cage in less than three days are morely likely to disappear from the colony. For that reason we ask beekeepers to keep the queens in the cages with the cell caps on for a period of three to five days. Then, they are instructed to remove the cap, check the queen candy in the tube for softness, and then return the caged queen to the hive, right were she was. Most of these queens are liberated within one day.

If the queen is dead in the cage at three days, I see that as a good thing. No time wasted wondering. Get another queen in there after you search for a side-comb virgin the bees have produced or you moved by accident.

Some beekeepers like to direct release the queens into the colony by opening the cage (after a minimum 3-day confinement) and letting the queen walk out. The challenge here is that this is a virgin queen and she is still very good at flying. I did a few of these this summer and found that many of the queens took to the wing. The cooperative ones flew up and promptly returned. A few flew off and some made it back and others did not. These are marked queens, and we look for that mark to confirm that it is our 'lady'.

Newly caged virgin queens (all with colored marks to determine mating accuracy) are ready to go to the mating yard. They may be banked for a week or more before being used in mating colonies.

We have been blessed with a good amount of rainfall this summer, but there have been many days for good mating flight. We continued to mate queens into September. These head nuclei colonies that we plan to winter.

Virgin age

To play it safe, we try to provide virgins that are under 14 days of age (post emergence). While we have had some success with 28-day-old virgins getting mated, we also had a few that went into drone production, and did not mate. I admit we need more data on the age of these virgin queens for release and mating, but it is encouraging to have a stockpile of virgin queens in a queen bank that are available for making increase, replacing failed matings or to sell to local beekeepers.

Biggest problem

Our biggest problem using virgins this way is to maintain paperwork or mark the colony that needs to be revisited to remove the queen cap. By shear forgetfulness we have kept virgins caged and unable to mate in nucs for two to three weeks with the queen alive. By then the brood has all emerged and the bees are expressing various types of displeasure with beekeeper brain failures! Many times the queen is dead, but you know she is dead and can deal with the situation right then. When you have two or three dozen nuclei hives and you know you have one which has a cage that must be removed, and you forget which one, it gets frustrating.

Customers seem pleased to use virgin queens, which we sell for much less than a mated queen. The more experienced beekeepers are getting about 80% successful mating with these queens, and I am very pleased with that. We are trying to graft only from stock that has demonstrated some resistance to varroa mites, is free of any bee disease (especially chalkbrood) and survived the past winter. I see this as a key step in developing a locally adapted bee that can be kept chemical free. That is what smaller beekeepers want and expect in this market. We make no guarantees about performance of the queens, but will replace a queen that is not accepted by the colony. The loss may be due to beekeeper error, but we have found that it is important to educate the customer, and a free replacement is a small cost for customer satisfaction. Since we do not ship queens, the beekeeper must pick up the replacement.

Acknowledgments

Thanks to Cathy King and Craig Fuller for help with making these queens and photos.

The three books by Dr. Lawrence Connor are *Increase Essentials, Bee Sex Essentials,* and *Queen Rearing Essentials.* They may be ordered from most bee supply dealers or via PayPal from the wicwas.com website.

Honey Bee Biology

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A Queen Rearing Method with Top-Bar Hives: Grafting Small Batches of Queens, Part 1

Queen rearing is a rewarding endeavor with practical benefits, too. Locally produced queens from stock becoming resistant to mites (particularly varroa) and other pathogens should be highly prized. These queens help beekeeping become less dependent on miticides. Furthermore, these queens reduce the beekeeper's labor in applying nonchemical controls.

To produce queens, beekeepers customize their methods by selecting parts of other queen rearing techniques or by devising methods on their own. I have been tinkering with my method for decades. Plus I had the extra endeavor of developing a queen-rearing system adapted to top-bar hives. Along with that I wanted all the design components of my top-bar queen-rearing system to be able to scale up to a commercial level of queen production. What follows is a summary of my system, probably unique in the annals of queen rearing. Independent of the equipment, top bars or frames, I have added tips hopefully useful to those experienced in rearing queens or beginners just getting started.

Queen cell cups can be purchased from bee suppliers in either wax or plastic. In older bee books, there are methods for making queen cell cups from wooden dowel rods dipped in melted wax. Years ago I was fortunate and obtained a custom-made set of aluminum plates, weighing 15 pounds, that makes 114 queen cell cups at one time. After spraying the plates with a vegetable oil, as a releasing agent, the plates are put together, and melted wax is poured into the little holes (see Figure 1). When cooled, I pry the plates apart, and pop out the queen cell cups with the eraser end of a pencil (see Figure 2). Even after discarding a few culls, each run nets over 100 cups. After a couple of weeks, the vegetable oil evaporates. These queen cell cups have an extra thick base that facilitates handling them as queen cells, a feature I prefer in general even if working with other styles of queen cell cups.

My queen cell bars are extra wide (1 ½ inches) to hold a double row of cells instead of the usual single row of cells. Before the bees seal the newly made queen cell bar in wax and propolis, I mark grid lines on them to guide the placement of the queen cell cups. After warming the thick wax base of the queen cell cup on something hot, even a metal surface in sunlight, I press the cup on the bar and give it a one-quarter turn, and it is quickly attached (see Figure 3). This attachment is strong enough to hold the queen cell, but not too strong. When the queen cells are mature, they must be gently cut from the bar.

For grafting, admittedly the tedious part of queen rearing, here is my set up. (There are queen-rearing kits designed to avoid grafting.) The three main queen-cell production parts are within a few steps of each other: breeder queen colonies (the source of the larvae), the building where I graft, and the colonies receiving the queen-cell cups with the new grafts, which construct the queen cells. I'll call these colonies the cell-building colonies. (They start and finish the queen cells.) In the breeder-queen colony, I restrict the queen to one new empty comb, which had no previous brood rearing. Overnight she lays eggs in the comb. After three days the eggs hatch, and I graft one-day-old larvae, which are about the size of an egg (see Figure 4). These larvae are difficult to see down in the cells. I can sympathize with beekeepers' frustrations with grafting. My attitude is that the wee critters are going to come out of the cells. And that's all there is to it. Here is my procedure.

First, I remove the breeder queen from the comb, then gently brush the bees off the comb. Do not shake the comb (the same goes for a frame), which might disturb the larvae on their tiny pools of worker jelly. I cut out a piece of comb containing the larvae and wrap it in a damp cloth to keep the larvae from drying out. My top-bar queen-rearing equipment could

Figure 1. Pouring queen cell cups.

(L) Figure 2. Pushing the queen cell cups out of their molds. (R) Figure 3. Attaching the queen cell cups to the cell bar. I use the hot side of the smoker to melt the base of the cups a bit so they will stick to the bar.

Figure 4. A larva the right size for grafting. For a natural scale, I also stuck an egg to the back edge of the grafting tool.

easily handle producing hundreds of queen cells per week; currently I just graft small batches of cells, around 20 – 30. A small piece of comb, square about five inches on a side, has plenty of larvae.

The grafting room is my bee house where I keep 30 top-bar observation hives. In hot weather both ends of the building have drop-down screen doors for ventilation so the observation hives do not get too hot. For a graft, I close up the building (for a half hour or so), sprinkle water on the floor, and turn on the fans to increase the humidity inside. Just before I graft, I turn off the fans so the air is still and moist. The elevated humidity helps keep the tiny larvae from drying out in the queen cell cups. I graft the larvae "dry," that is, I do not prime the queen cell cups with royal jelly. A dry graft is susceptible to drying out, but I put each queen cell bar in the cell-building hive as it is finished. The hives are only a few steps away, and as described below, a queen cell bar can be put in a hive in a mere matter of seconds.

Here is the grafting lay out: a tilted working surface, the bars with the queen cell cups, an adjustable light, a small but very sharp knife, and a grafting tool (see Figure 5). Grafting on a tilted surface is more comfortable, and the angle, a little different for everyone, works with the light to better illuminate the larvae. About an hour before I graft, I put the bars with the queen cell cups in the cell-builder colonies to let the bees acclimate to them. Quite often, the bees will begin applying bits of wax to them even in that short time. Now having been retrieved, the cell bars are ready to receive the larvae.

For illumination, I use a circular fluorescent light. It does not emit much heat compared to an incandescent bulb. The larvae are tiny, and heat from a bulb can quickly bake them. With the sharp knife, I slice more than half of the cell walls off the new comb. Now the larvae are much easier to see. Without any previous brood rearing, the white wax is easy to slice with a sharp knife. I prefer a scalpel (with snap-on replaceable blades). The blade needs to slice through the cell walls and not just crush them. I have used dark brood comb too. The old cocoons fray upon cutting the cell walls, but the larvae are a little easier to see against the dark background. (Without cutting down the cell walls, which I used to do, it's best to graft from dark comb.)

For a grafting tool, beekeepers have different preferences. I have done it with various ones, homemade and manufactured. One of my favorites I made from a welding rod. The metal core is carefully filed down to pick up the tiny larva, and just as important, to safely set her down in the queen cell cup. If the entire larva is on the grafting tool, getting her off unharmed is virtually impossible. With this kind of tool, some part of the larva should hang off to

(L) Figure 5. My grafting set up. (R) Figure 6. A grafting tool with a retractable tongue. The tongue can be seen in the next picture as thin piece of metal. The flat piece makes a comfortable fit in the hand. For scale, the tool is in the handgrip in the standard hive body.

Figure 7. The grafting tool disassembled.

help slide her onto the floor of the queen cell cup. The rod can be cut to a custom length, and its thick diameter has a comfortable feel in the hand. Simple grafting tools are available from bee supply companies. I have bought them over the years and can't help filing the ends to give a custom tip for my grafting. In my queen rearing toolbox, I have a set of small files and an ultra-fine emery board (for the final finish). These files are available from hobby shops. The grafting tool should approach the larvae from the outside of her "C" shape, away from the ends. With my small piece of comb, I can just rotate it if needed to get the next correct approach. In addition when grafting, the larva cannot be flipped over or bumped against the cell walls when transferred. The cell bar sits on the slanted surface. After I transfer a larva, I move a little piece of wax beside the next empty cup so I don't need to hunt for where I left off on the row of cups.

The grafting tool with a retracting tongue made of very thin metal (called the Master Grafting Tool in the Dadant catalog) does a good job and is a clever device (see Figure 6). First you depress the lever on top of the tool, which extends the tongue. The tongue slips right under the entire larva. To set her in the queen cell cup, slowly release the tension on the lever, retracting the tongue, sliding the larva off of it. As the larva comes off the tongue, I give it a little hook motion so she keeps her natural "C" position a bit better as she slides onto the floor of the cell cup. My advice is to rinse the tool right after finishing the graft. I just put a drop of clean water in a queen cell cup, hold the tongue in it, and repeatedly depress the lever a few times, extending the tongue.

If the tongue ever becomes stuck in the hollow shaft, presumably from dried worker jelly, depressing the lever can bend the back-end of the delicate tongue (near where a screw clamps down on it). The fix is easy. I take the tool apart (see Figure 7) and straighten out the back end of the tongue. Then, I insert the back end of the tongue into the shaft (just a few millimeters) to clear it. The grafting-end of the tongue has a precise but gentle curve to help pick up larvae. Do not change that bend, and make sure to put the tongue back in its original orientation when reassembling the tool. The tongue extension will also need a bit of adjustment so depressing the lever extends the right amount of length, but doing that is not difficult. As part of my set up procedure before a graft, I check to make sure the tongue moves properly.

Right after grafting a bar of queen cell cups, I wrap it in a damp cloth and take it to a cell-building colony only a few steps away. This colony has been prepared to provide an optimum environment for rearing queen cells. It is queenless with about three pounds of young bees shook directly from the brood nest of one or more colonies from the out-apiaries. The bees need to be young since they are predominantly the nurse bees that can readily convert pollen (protein) and honey or syrup (sugar) into royal jelly to provision the queen cells. In the cell-building hive is a special frame for holding the bars of queen cell cups. Ironically, these are the only "frames" in my entire top-bar operation.

On one side of the special queen-cell frame is a comb of mostly pollen (and the rest honey). On the other side is a comb of pollen and honey with a little patch of brood to draw the nurse bees to the queen cell cups. Sometimes I put in additional combs of honey and pollen. One comb next to the feeder, which is in the rear of the hive, is just empty. That comb gives the bees a place to store sugar syrup from the feeder. After remaining queenless and feeding on the syrup for 24 hours, the bees are ready to accept the grafted queen cell cups. When I come to a cell-building hive with my bar of newly grafted queen cell cups, I want the bar of cups to go inside quickly.

Here is where the top-bar hive design is so beautifully adapted to these and other frequent queen cell bar manipulations. My cell-building hives are under a shed roof adjoining the bee house so they do not need metal covers, eliminating that bit of handling. Unlike frame hives where the bees can go between the (more narrow) top bars, a top-bar hive has wider top bars, which touch along their entire lengths, forming a kind of solid roof. (The top bars space the combs.) The queen-cell frame is one of these top bars (which is even wider), and it has a handle on top of it (see

(L) Figure 8. Queen cell-building top bar hives. Note the handle on top of each hive. Those are the queen-rearing frames, which hold the queen cell bars. The other top bars have just combs. (R) Figure 9. Demonstrating how to install grafts in a top-bar hive. Normally bees would be clustered right above the inserted cell bar. I try to slip the bar right into the festoons of bees. I put a blank cell bar below the one with cell cups to reduce festoons starting from the cell cups. Shown in the foreground is a cell bar with a double row of cups. (This is not the standard way to open a top-bar hive, which is from the end.)

Figure 10. Sealed queen cells on the upper two bars as single rows. For comparison, the third bar has new grafts just 24-hours old. Except for one, the bees have begun extending the cell walls on the cups, indicating acceptance of the larvae.

Figure 8). To quickly install a bar of newly grafted queen cell cups, this hive is perfect. Using the handle, I merely pick up the queen-cell frame, just a few inches, slip in the cell bar from the side, and let the frame down – in seconds it's done (see Figure 9). Even when checking the queen cells, little or no smoke is needed and the nurse bees are hardly disturbed. Figure 10 shows a frame I built in 2000 with some queen cells from this past summer. This frame holds a maximum of 60 queen cells in three bars of 20 cells (as a double row of 10 cells.) My older style of queen-rearing frame, built around 1990, holds a maximum of 74 queen cells in double row cell bars. I usually just use the middle two cell bars of that one (see Figure 11).

Next time we will continue with the queen rearing (sorry about splitting up the article, but I could write a whole book on queen rearing). And I'll show how I use my easy-to-open observation hives like mating nucs. I can check to see whether my new queens have mated anytime, day or night, rain or shine.

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Figure 11. A queen-rearing frame matching the cross section of the hive. The frame can tilt back while removing queen cell bars. Pins in the ends of the cell bars fit into a groove of the frame to keep the cell bars from sliding out.

Marla Spivak
Getting Bees Back on Their Own Six Feet

Part 2 of 2 parts

by M.E.A. McNEIL

A hands-on researcher is finding ways for bees to defend themselves.

Dr. Marla Spivak is as at home in the bee yard as she is in the lab. She is developing the connection between research and beekeepers.

The idea came to Marla Spivak as she looked at a map of the United States, sitting in her office at the University of Minnesota, where she is a professor of apiculture. If the picture of her were a cartoon, a light bulb would appear above her head.

She is prone to having these sparks of perception. The first one came some 20 years ago, when she realized that our well-meaning medication of honey bees would come to naught, and that bees "need to develop their own defenses against diseases and parasites." She revived some old research and, together with Gary Reuter, developed the Minnesota Hygienic line – bees with the olfactory ability to identify and remove brood infected American foulbrood, chalkbrood and Varroa. Then, she gave over the process of developing hygienic bees to all comers.

Another insight into bees' self-defense came from hearing a research talk about propolis-gathering ants that have low microbial activity in their nests. Her lab subsequently discovered that the honey bee immune system is quieted in the presence of a layer of propolis enveloping the inside of a bee hive. A further realization – that there could be more specific application to bee and even human health — resulted in an ongoing study to fractionate propolis in order to discover its active components.

Three Minnesota beekeepers now have open-mated lines that test as well for hygienic behavior as the original instrumentally inseminated MN Hygienic stock. And the propolis studies have influenced respect for the precious substance, which was long regarded as a nuisance. Still, the overall decline of the honey bee, according to Jeff Pettis, head of the USDA Beltsville bee lab, is "unsustainable."

For three years Spivak had been pondering the question: What more can be done for bees to help themselves, "onto their own six feet"? The map she was contemplating in her office was marked with the locations of the queen producers in the U.S. Quite a few were in the South, but the map showed that the vast majority of American queens, with the exception of Hawaii, come from Northern California. The larger producers there, she knew, sell 20,000 to 50,000 queens a year – some up to 70,000. The smaller ones in the area produce around 10,000, all in a three-month period. It's the continental center for queen rearing, the source for much of the genetics across the country. Of course, she thought, the answer was right there, simple and clear. What if those queen producers became the agents of change?

Many of the California queen breeders are located around the northeast edge of the Sacramento Valley at around 39°N at the foot of the Cascade and Sierra Nevada ranges. They are that far north because most are long-time family operations originally situated there for trade with Canada – started by Homer Park, Oliver Hill, Harry Laidlaw and others. The Koehnens have been there over 100 years. Northern California beekeepers shipped thousands of packages each spring to replenish Canadian apiaries that were routinely killed off every winter. When the Varroa mite was found in the U.S., the border was abruptly closed by the Canadian government – to no avail it turned out, but it left the breeders with huge stocks and drove many bankrupt. The new focus became queen rearing for the domestic market. "Although they are further north than is ideal for early queen production, it may be a blessing," said Spivak, "Because no queens can be sold within 100 miles of any AHB (African honey bee)

Spivak in the bee yard with Bob Koehnen, whose family has bred bees in Northern California for over 100 years. Photo: Alison VanAlten

Buzz Landon checks a 24 hour hygienic test at his apiary in an almond orchard. Spivak looks on as he finds that his bees have cleaned out nearly 100% of the dead brood.

sighting."

Her idea was, in concept, a good one, but people are more difficult to manage than insects. Spivak is quick to make the point that these people don't need to be told how to keep bees. "These guys know what they're doing. I think these bee breeders do an amazing job of selecting and raising good quality queens. They are really concerned about their bees' health. If you spend some time with them, you see how they handle their bees; they are being extremely delicate and careful. So my idea isn't to change what they are doing, I just want to enhance what they are doing. I want to help them help their bees defend themselves against diseases and mites. And I want to help them decrease chemical use so they can sell queens across the nation—change the genetics across the nation in a way that would be beneficial."

She knew what hadn't worked. Beekeepers come to conferences, and they "sit and listen to the lectures by university people — dense talk, dense data. They don't learn that way. They go out in the hallways and ask others, what's working for you?" Even if there were more state apiary inspectors in California, their job would be to prevent the spread of diseases. And there is only one university extension apiarist west of the Rocky Mountains, the respected Eric Mussen, who does not have enough hours in a day. What if a team on the ground provided a liaison between producers and researchers – like farm advisors for beekeepers? Such people are common in agriculture: The pest control advisor or the crop consultant.

In 2008 Spivak, together with her technician Gary Reuter, grad student Katie Lee, and colleague Alison vanAlten,[1] went on the road in Northern California, visiting 19 queen breeding operations who agreed to see what she was about. Wherever they were welcomed, she explained her idea and tested colonies for hygienic behavior and pathogens. Building trust was a slow process. In 2009, Lee — along with Betsy Ranum and weekly rotating help from Spivak, vanAlten or Reuter — again spent the month of March visiting each bee breeder open to the idea.

In the spring of 2010, Spivak was on the road near Chico, California, having just analyzed hygienic tests for a breeder. "Their numbers were not so great this year" she said, "But that's no judgment. They wanted all of their colonies to be hygienic. They wanted it, and that's enough. They have to want it and they do. That was great. We can easily make that happen."

What she is saying is that all news in this project is good news, whatever the results. It provides a base of information for decision making. For example, Spivak tests for the fungus *Nosema ceranae* (which has replaced *Nosema apis*). Thus far, the uses of the data have ranged from comparisons between treated and untreated colonies or those that have and haven't gone for almond pollination, elimination of costly treatments shown to be ineffective, and elimination of treatment where spore counts were low – allowing for the emergence of resistance and an indicator of good breeding stock.

A change in Nosema sampling was made when Dennis vanEnglesdorp, the Pennsylvania State Apiarist, toured some bee yards with her to discuss the project this year. Spivak explained the thinking: "The young bees can pick up spores, either from the comb or through trophallaxis. It takes about 12 days for those cells to start invading the stomach lining of the bee. You can't see the infection until the bees are about 12-16 days old; that's what some laboratory experiments show. Inside bees are 1-14 days old, and most of the foragers are outside. If you sample foragers, you are sampling in favor of finding it. If you sample nest bees, you are biasing in favor of not finding it…So we decided to take some inside-outside samples."

In apiary after apiary, Spivak gathered bees with a bee vac made by the innovative Reuter.[2] In a nearby shed, honey house or barn her Brazilian student Renata Borba counted out piles of 120 test bees, crushed them and shook each group into 1 ml water. (She now skips the laborious step of removing the abdomens at the suggestion of vanEnglesdorp.) Seated on an upturned bucket or a super, Spivak peered through the microscope that she brought from her lab, looking for Nosema spores in the prepared samples. For every colony she counted spore by spore against a hemacytometer, a grid used for counting blood cells; then she prepared a report for each beekeeper.

The next stop of the day was at Can-Am Apiary, named for the once thriving cross-border commerce in bees. Leonard and Linda Pankratz greeted Spivak warmly and wasted no time getting into the testing since

Renata Borba, a University of Minnesota entomology student, and Gary Reuter, Spivak's assistant, prepare a drone trap at Pendell Apiaries in Northern California.

Spivak's student and assistant, Renata Borba and Gary Reuter, follow a drone trap at Pendell Apiaries in Northern California for a study of drone viability conducted by Dave Tarpy at North Carolina State University.

Borba, left, and Spivak pour liquid nitrogen onto circles of brood, setting up 24 hour hygienic testing at an apiary of Dan Suhre, who looks on.

Spivak is working with Ned Euliss, above, a wildlife biologist, on his idea to study colonies of bees placed near bee forage provided by the new farm bill. Euliss is with the U.S. Geologic Service Northern Prairie Wildlife Research Center in North Dakota.

they still had to bank queens. Then Leonard Pankratz, a long experienced beekeeper, showed Spivak something he had never seen before – robust, healthy larvae and adults adjacent to dwindling pupae. He wondered if there could be a connection to the spraying of the fungicide Pristine on a nearby orchard. There in the bee yard, Spivak dialed Jamie Ellis at the University of Florida and then Reed Johnson at the University of Nebraska and explained the problem to the researchers. Both agreed to add the chemical to the list of those they are testing on brood and promised to get back to her.

She was on the road again, watching the clock, aiming to meet Buzz Landon at his apiary in an almond orchard.[3] She and Borba wanted to check the results of their 24 hour tests on time — circles of brood frozen with liquid nitrogen. They would see how well the bees have cleaned out the cells, an indication of hygienic behavior. A non-hygienic colony can take as long as six days.

Landon, a young, gentle-spirited guy, has 500 hives in almonds and reports a 10% loss for the last year – a third of the national average. He keeps his bees in the Chico area almonds February thru mid-March then breeds queens and makes nucs in his local yards. The tests looked good – very good: some circles were 100% clean of dead brood, and others were well on the way. Spivak remarked that his comb looks new. "The comb is like the liver," she explained to Borba, "It absorbs everything."

Spivak recommends replacing comb within the brood nest every three to five years, even though it is costly to both the beekeeper and the bees. She points out that old comb harbors spores from American foulbrood, chalkbrood, and Nosema which can remain viable for years. It also absorbs pesticides, which accumulate to the detriment of the bees.

Landon explained that chemical companies have field days with tents and refreshments to sell treatments, but there is no objective information for beekeepers and queen producers. "As it is now, someone phones and says so-and-so is doing something or other, and we all start doing it." So why not, he asked, have a field day for this project?

(L) Frank and Sheri Pendell pause in the midst of a work day at Pendell Apiaries. In the background, Gary Reuter and Renata Borba of the tech team project work at the mating nucs. (R) Leonard Pankratz of Can-Am Apiaries selects nucs for testing by Marla Spivak.

Spivak uses a bee vac, invented by her assistant Gary Reuter, to gather a sample of bees for Nosema testing. Renata Borba waits to bag the bees, while Leonard Pankratz works ahead in his apiary.

Testing for Nosema by (from left, clockwise) Renata Borba, Marla Spivak, Esmeralda Garcia and Georgina Garcia. The Garcias, grafters at the apiary of Pat Heitkam, are counting out bees to be put into dilution by Borba and read for spores by Spivak.

Spivak is gathering such ideas as plans for the team take shape. Another suggestion is experimental apiaries to test treatments the beekeepers are interested in, for example, the walnut oil that one has asked about. "What form the team ends up in, I can't say," she remarked. "I'm going to have to let go of my baby because how the project evolves is going to be bigger and better than I can anticipate — and that's good," she said.

And so it went, as Spivak traveled the back roads – listening, testing, observing, answering, counting bee samples and leaving the beekeepers with results to make decisions on their own.

Spivak makes reports on testing in the field for each beekeeper to evaluate and use in determining practices.

Reuter and Borba made the next trip to Northern California, staying a night up a remote valley in the camaraderie of Frank and Sheri Pendell in Stonyford.[4] The Pendells count the isolation of their apiaries as an advantage for breeding bees. The task at hand, to which the researchers devoted the better part of a day, was to find the Pendell drone congregation areas and send samples to David Tarpy at North Carolina State University. He is studying the reproductive quality of commercial bees; in this case, he will test the viability of the semen in the drones as well as genetic diversity. The work is funded by a grant from the USDA National Research Initiative.

Last year, Spivak brought a master of drone sleuthing, Chip Taylor of the University of Kansas, to California to show Tarpy and beekeepers how to do the trapping. Armed with that tutelage, Reuter and Borba each took a weather balloon attached to a long net trap baited with queen pheromone and run out with a fishing rod and reel. They parted and began trolling the open landscape. Drone flights started reluctantly that day, with workers pushing males out the door in the early afternoon. It was an hour before Borba's voice crackled in the walkie-talkie: "I have one." One drone does not a DCA make, but it was more than Reuter's lure had attracted. So they walked together, their eyes skyward on the trap, for two more long, hot hours, fishing the sky. They followed a few drones until Frank Pendell joined them; he had a sense for it, and they soon came into what felt like a booming concert of buzzing, with comets of bees rushing overhead. Borba systematically sampled different areas of the congregation, urging the drones, one by one, into small shipping cages. Back at the apiary, Sheri Pendell carefully packaged the cages with attendants for an overnight cross-country journey. The UPS truck was making its long way up the valley as the team passed it, rolling down to their next task.

In November, 2010, Katie Lee will move to Chico to continue the work, which has been funded for six months by the National Honey Board and the Almond Board. She will work out of an office at the University of California County Extension in Oroville.

Lee has developed a standard method to sample colonies for Varroa.[5] Spivak explains: "Beekeepers were just saying I have mites, I'd better treat. Or they were just blanket treating by the calendar. We wanted to come up with a standard way for beekeepers to estimate the number of mites easily, very quickly and with precision, so if beekeepers speak of mite levels they are all using the same currency. She sampled mite levels in almost a thousand colonies in commercial apiaries and worked with some really good statisticians in the entomology department. She came up with recommendations that will give good precision: Take 300 bees. (We have a gizmo that measures 300 bees that Gary Reuter invented.) Using powdered sugar, shake the mites off the 300 bees. If you find 10 mites in 300 bees, divide that number by 3 to tell how many per 100 — 3.3. Multiply by 2 to compensate for the number of mites that are inside the sealed brood cells and in the pupae. She did a lot of research for that simple conversion factor, that multiplication by two — the result of a lot of sampling and statistics. So that is 6.6,

Renata Borba, Spivak's student, cages trapped drones for shipment to Dave Tarpy's project on viability.

Ray Olivarez begins a frozen brood test for the hive of one of his most prized breeder queens, "Montana". He is one of the large-scale queen breeders working with Marla Spivak on a program to institute the equivalent of farm advisors for beekeepers.

and that would say that you have 6.6 mites per 100 bees, which is probably at a treatment level for commercial colonies in California."

The long-term goal of that research is to reduce the amount of pesticide use in honey bee colonies for the control of Varroa. Guidelines will be provided for beekeepers to make educated treatment decisions based on the sampling plan.

A growing number of apiaries have opened to the bee advisors, from large producers like Ray Olivarez in Orland to Dan Suhre, whose sons Eric and Adam each keep apiaries independently in cooperation with him in Glenn. Bee breeder Pat Heitkum said of the project, "It could be industry-changing. I don't think anyone has had entry into all the bee breeders before. They have all opened up to her. I think that's unprecedented."

Katie Lee will be the first formal bee tech – the title is yet to be decided. Lee, who Spivak describes as "friendly, super-organized and motivated," will have boots on the ground this fall.

Not every good idea that Spivak works on comes from her, but she knows one when she sees it. The new farm bill specifies that fallow land set aside in the Conservation Reserve Program (CRP), often seeded to attract game fowl, must be seeded with legumes for pollinators as well. Ned "Chip" Euliss of the U.S. Geological Survey studies climate and land use and their effects on wildlife. His project will place honey bees next to CRP land, measure their health and follow them on their migration into California. Spivak has received a grant from the USDA to work on the idea together with Euliss and Pettis. They will look at the protein and lipid content in the bees, as wells as their immune system function to determine how the landscape affects their well being and diversity. They will also measure the abundance and diversity of native bees, a subject close to Spivak's heart.[6]

"It's an important grant. The results can change policy for pollinators and land use. It's really exciting," said Spivak.

Another project has the potential of having wide effect for beekeepers throughout the nation. Spivak is working with Vera Krischik, a colleague in entomology at the University of Minnesota. Together with their graduate students, they will examine the effects of two chemicals, the neonicotinoids imidacloprid and thiomatoxin, on honey bees and bumble bees. The EPA is interested in the outcomes in order to determine their regulatory language for the chemicals.

The bee lab at the University of Minnesota that is housing this pivotal work serves a five state region– the top honey-producing area in the U.S. But the facilities are outdated and inadequate and are physically separated across the St. Paul campus. Spivak's vision is for a new research lab with an educational component for the public. "This would be unique in the nation, if not the world, to have a research facility and a public space in that facility," she said. The lab would contain ongoing research as well as exhibits and demonstrations. Funding, which would include positions for an apiculturist, curator and a grad student, is sought from private and public sources.[7]

News of the recent decline of the bees was so disheartening that Marla Spivak thought of her public lecture as the "bee bummer talk", but no more. Her inspirations have helped to turn that downward spiral: many lines of bees with hygienic behavior now proliferate; the queen breeder advisory project is launched; propolis studies have provided valuable understanding of natural bee defenses. Together with the forage project and the neonicotinoid investigation, all promise to have wide-ranging effect. Spivak says of her penchant for these strokes of insight, "I don't take credit for it. The only part I take credit for is that I'm trying to stay open."

1 Leader of the Ontario Bee Breeders Tech Transfer Team

2 Plans for the bee vac are at: www.extension.umn.edu/honeybees/components/freebees.htm, "Bee Sampling Vacuum Attachment"

3 Buzz's Bees, P.O. Box 274, Richvale, CA 95974, (530) 882-4302, buzzsbees@pulsarco.com

4 Pendell Apiaries, P.O. Box 40, Stonyford, CA 95979, (530)963-3062

5 Lee KV, Moon RD, Burkness EC, Hutchison WD, Spivak M. 2010. Practical sampling plans for *Varroa destructor* (Acari: Varroidae) in *Apis mellifera* (Hymenoptera: Apidae) colonies and apiaries. *Journal of Economic Entomology.* In press

6 Evans, Elaine, Eric Mader, Marla Spivak, M. Managing Alternative Pollinators: A Handbook for Beekeepers, Growers, and Conservationists, 2010

7 See www.BeeLab.umn.edu

Managed Pollinator CAP
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http://www.beeccdcap.uga.edu/
http://www.extension.org/bee%20health

Breeding a Better Bee: A Promise Unfulfilled—So Far

by NICK CALDERONE, Cornell University
STEVE SHEPPARD, Washington State University

•The past few years have been difficult for many sectors of the beekeeping industry both in the US and abroad. Many beekeepers have experienced exceptionally high losses, and while *Varroa destructor* continues to be the number one cause of colony mortality, a substantial proportion of recent losses are suspected of being due to another condition called Colony Collapse Disorder or CCD. To date, many questions about the exact nature and cause or causes of CCD remain unanswered. The CAP project was established to study colony health and to evaluate possible causes for CCD. Regardless of the ultimate findings, the bigger question centers around the remedies that will be employed by beekeepers to ensure colony health in the future.

•**Background:** The negative consequences of the industry's growing dependence on chemical solutions for managing pest problems have become increasingly evident the past few years. AFB has developed resistance to Terramycin, and catastrophic losses to mites have become commonplace as mite populations evolved resistance to pesticides. Not only have chemicals become less effective, research has shown that pollen and beeswax in hives are both contaminated with chemicals applied by beekeepers (coumaphos and fluvalinate) as well as by a broad array of other pesticides applied by growers of a variety of crops. These residues can cause serious damage to colonies in terms of reducing a bee's length of life and increasing its susceptibility to pathogens and parasites. Poor acceptance rates and an increased frequency of non-acceptance, drone layers and supersedure of many commercially available queens may also be caused by or exacerbated by this contamination. Interestingly, the remedy for much of what ails the industry has been available for the past 70 years.

In the 1930's, several individuals (O.W. Park. F.B. Paddock and F.C. Pellett at the Iowa Agricultural Experiment Station in Ames, IA) collaborated in the development of American foulbrood (AFB) resistant honey bees. In the 1950's, E.G. Brown of Sioux City, IA developed the 'Brown' line of AFB resistant honey bees at his wax rendering plant. These bees were used by Prof. W.C. Rothenbuher (first at Iowa State and later at Ohio State) in the early 1960's to develop his AFB resistant line of honey bees – named the Brown line. An AFB susceptible line was obtained from another beekeeper named Van Scoy. With these two lines, Rothenbuhler investigated the genetic basis of AFB resistance. In 1964, he published what was to become a classic paper in behavioral genetics in which he demonstrated that resistance to AFB could be largely attributed to two independent behavioral traits: uncapping and removal of diseased brood by adult workers. He dubbed this mechanism 'hygienic behavior'. Subsequently, a number of other traits were identified that also contributed to AFB resistance. The years since that seminal work have seen a genetic (and selectable) basis identified for a number of other important traits including removal of freeze-killed brood (a surrogate for Rothenbuhler's original hygienic behavior), resistance to acute bee paralysis, resistance to tracheal mites, resistance to varroa mites, pollen hoarding and length of life.

Unfortunately, the translation of these findings into commercially viable honey bee stocks has not proceeded as rapidly as the basic research. Instead, beekeepers have relied on a series of antibiotics and pesticides to control pathogens and parasites in their hives. The principal reason for this is simple: antibiotics and pesticides are

Nick Calderone

Steve Sheppard

generally easy to use and inexpensive in the short- term, while selecting and maintaining stocks of superior stocks of bees is labor intensive and expensive. Today, the bee industry finds itself at a crossroads. It can seek yet another set of chemical treatments to solve its immediate problems with AFB, mites and CCD. However, if recent events teach us anything, these too will add to management costs, be effective for only a short time, accumulate in combs, exacerbate current problems with colony health and increase the chance of unacceptable levels of residues in hive products.

•**Bee Breeding:** The alternative to more chemicals and the roller-coaster ride they provide is to establish a breeding program for the production of high quality, pathogen and parasite resistant stocks of bees. Methods for selection, stock maintenance and the production of commercial queens are well developed; so, there are no technical impediments to such a solution.

The General Method: When Rothenbuhler developed his AFB resistant stock, he noticed that while they were highly resistant to AFB, they were also exceptionally defensive and not especially productive. Clearly, it is of little benefit to invest in the development of a resistant stock of bees if they don't also exhibit a number of other desirable traits. So, it seems reasonable to start a breeding program with a large number of colonies and an initial evaluation for a suite of desirable traits like honey production, wintering ability, defensive behavior and the presence of any obvious signs of disease. Further selection for freeze-killed hygienic behavior, varroa sensitive hygienic behavior, tracheal mite resistance and nosema resistance can be limited to the top 25% or 50% of this initial population based on the initial assays. Breeder queens from this population would be transferred to queen producers who would produce large numbers of queens for use by beekeepers.

Stock selection and the production of queens for consumers are two different processes. Stock selection is an ongoing process that is based on established principles of animal breeding. Once a population exhibits useful levels of the traits under consideration, those traits need to be maintained. This requires continued evaluation and selection. Queen production is a separate process. Queen producers take breeder queens developed by breeders and use them to produce queens for sale to beekeepers. Like stock production and maintenance, queen production must also follow certain basic principles to ensure viable queens that produce colonies that exhibit the desired traits. Stock production and queen production are specialized activities that are best performed by different operations that coordinate their activities.

Selection versus diversity: Selection, by definition, reduces variation as it produces a population of similar individuals or, in the case of honey bees, similar colonies. This loss of variation occurs primarily with respect to the traits under selection. This is a good thing because you want to end up with a population of superior bees without any of the inferior ones. However, variation can be reduced for other traits as well; and that may not always be desirable. Recently, several studies have shown that colonies with high levels of genotypic diversity among workers have significant advantages over colonies with less variability. This is believed to be one of the principal reasons why queens mate with such large numbers of drones. Each of a queen's mates provides a different set of genes, and the resulting mix of workers exhibit a high degree of genotypic variability.

One group of traits that will experience a reduction in variation consists of traits that are closely linked to the trait under selection. Other traits are less affected; however, another phenomenon called *drift* can affect variation for these traits as well. Because most populations under selection are relatively small and only a fraction of individuals are chosen to produce offspring for the next generation, all of the available genetic diversity is not passed on to succeeding generations, and this results in a gradual loss of potentially valuable variation in the breeding population. The larger the starting population, the longer it takes for this process to reduce variation for traits not actually under selection, but the process is inevitable. This reduction in variation is especially noticeable at the sex locus which results in what beekeepers refer to as 'shot-brood'. The phenomena of linkage and drift are both important to the design of successful breeding programs.

When queen producers rear large numbers of production queens from a small number of breeder queens, the chance for inbreeding – a reduction in variability – is high. As part of the CAP project, we are studying the degree of genetic variation in several large beekeeping operations that have experienced CCD during the past few years and comparing those data to operations that have not had CCD. We hope to learn two things from this study. First, whether or not there is a decreased level of variation in the CCD operations; and second, whether or not there are significant differences among operations that might fruitfully be exploited in the design of a breeding program.

Long-run sustainability: Relying on a single breeding population as the sole source for all production queens would be undesirable for several reasons. First, it would limit the future gene pool to whatever was incorporated into the initial population, and that would slowly diminish over time due to drift. Second, different regions of the country require different traits in bees for optimal performance. Therefore, a number of programs need to be established throughout the country with the base populations established independently of each other. This will ensure a maximum amount of variation at the beginning, and each population will differ from the others to some degree. Stock from the different populations can be exchanged from time to time to sustain variation if needed.

Selection methods: Selection assumes that one has good assays to evaluate stock. As part of the CAP project, Dyce Lab has worked to improve the accuracy of two of these assays. First, the accuracy of the freeze-killed hygienic tests can be improved by repeating the assay on colonies more than once and using the average response as the selection criterion. One positive finding from that study was the observation that the average level of hygienic behavior in an unselected population was considerably greater than the average level reported 10 years ago. This suggests that there has been progress incorporating genes for hygienic behavior into the general population. Second, assays for nosema resistance rely on being able to accurately assess the level of nosema in the colony. Since *N. ceranae* is new to the US, we have worked to determine the optimal sampling methods for making that assessment.

•**Stock certification:** The recent report by the National Research Council of the National Academies - *Status of Pollinators in North America* - recommended the establishment of a stock improvement program and the implementation of an independent stock certification program. A certification program will greatly facilitate the success of the breeding program because it will provide consumers with assurances that they are purchasing superior stock and will provide producers with an economic incentive to invest in the development of those superior stocks. This will all come at a cost, but stock certification is a common practice in plant and animal breeding where it has been used with great success. When you consider that there is already an enormous cost being paid in terms of poor queens, diminished colony health and colony replacement, the cost of selected stock and stock certification should be competitive.

•**Tech transfer:** Tech transfer provides the mechanism for successfully moving from theory to practice. Techniques for stock selection, stock maintenance and queen production are well established and can be developed into a viable breeding program. The success of any such program will require cooperation among commercial queen producers with experience in large-scale queen production, researchers with expertise in selection protocols and mating programs and extension personnel who make recommendations to beekeepers. Towards this end, CAP personnel are working on a *Bee Breeding and Stock Maintenance Manual* for commercial breeders and queen producers.

Beekeeping Behind Bars

by SAM HAPKE*

Leslie Slater attempts to capture a swarm settled on prison razor wire. (photo: Doug Raines)

For novice beekeepers, the fear of being stung can be the biggest mental hurdle to overcome. Until their bodies grow accustomed to venom through repeated exposure, fledglings must often deal with pulsating welts and fiery itching at the site of stings. However, aside from physical annoyance and perhaps an unsettling anticipation of more pain, there are few weighty consequences to those first few stings—unless, of course, one is in a prison, where I found myself last summer, training offenders at the Cedar Creek Corrections Center to keep bees as part of the Sustainable Prisons Project (The Evergreen State College, Olympia, WA).

While examining a brood frame in a newly installed colony, one of my students was stung above his right eye. Given that his was not the first sting sustained in our course, neither my seven students nor I thought much of the incident at the time. I left that evening brainstorming the next day's activities and cataloging the materials I would need to pack, unaware that my student's gift from a defensive worker was swelling markedly and had transformed from a physical headache to a political one.

Beehives are not yet a common sight in prisons, and prior to their arrival in two Washington State facilities, swollen faces were almost always the result of another offender's angry fist, elbow or knee. That July night, my student's Quasimodo-like appearance was assumed to have a similar explanation, and it took discussions between him, several staff members, an administrator, and another student to finally convince the collective administration that a sting was the truth rather than a creative excuse to shirk the punishment of solitary confinement.

The following morning, the Sting Log was born. This was nothing more than a bound notebook containing signed and dated descriptions of every sting; entries were added to corroborate stories that beekeeping lumps had not come from less wholesome activities. Although simple and quick to maintain, the book provided an invaluable convenience for my students in their daily co-existence with prison staff.

The Sting Log incident was among several unforeseen challenges I encountered while teaching beekeeping in prison (e.g., signing out one set of equipment at a time from a double locked box was another); however, it was the familiar elements of beekeeping that proved to be the clearest testament to our cherished pastime. Bees, in all their fascinating glory, were still bees behind prison bars. Despite living where no bee box had gone before, my students installed nucs, searched for queens, boiled syrup, controlled swarms, set up observation hives, extracted honey, and made lip balms. Among the hives and gardens, their thoughtful questions fueled in-depth discussions on insect anatomy, colony pests, disease diagnosis, and pollination ecology. The use of beesuits was abandoned faster than I anticipated, falling victim to the macho competition inherent in many prison activities; once one offender removed his suit after seeing me work without one, the rest basically had to follow.

As the administration grew to trust my students, the educational opportunities for them quickly surpassed my initial expectations for what could occur in a prison. I was able to bring in a microscope and tools to dissect giant grasshoppers and allow students to practice tracheal mite dissections. Despite little formal scientific training, the students devised a way to transfer colonies from *Langstroth* hives to top-bars and took weekly data on colony growth and comb use after the switch.

Although I would love to describe more details of my experience with prison beekeeping, I have the even greater privilege to introduce a remarkable graduate of the program. Daniel, or "Travatte" as I was required to address him at the facility, was the first beekeeping trainee at Cedar Creek Corrections Center. His successful early work with Vicki Briggs, a counselor at the facility, was a major inspiration for expanding the program to include other offenders. Daniel's fervor for all things *Apis* led him to become the consummate beekeeper at Cedar Creek. I'll never forget his excitement after receiving Laidlaw and Page's *Queen Rearing and Bee Breeding*, followed by his accurate recitation of its contents a mere 24 hours later. He translated those personal studies into a fruitful attempt to graft eggs into homemade queen cups. Daniel was an active collaborator in my teaching and he repeatedly supplemented my lessons with pertinent anecdotes. His rigorous, unprompted course notes recorded a daily summary of our activities and the status of each hive, and his colorful pamphlets promoted the program to visiting families and administrators. Daniel has since been released from Cedar Creek and I wish him the best of luck in his new life on the outside.

The following piece is further evidence of Daniel's boundless intellect and passion for honey bees. Before I leave you to read Daniel's wonderful work, I want to emphasize one last point about the prison program.

***Lead Biologist/Beekeeping Programs**
Sustainable Prisons Project
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Doug Raines (right) (Stafford Creek Corrections Center) instructs offenders to use a honey extractor. (photo: Sam Hapke)

Daniel Travatte teaches M. Jefferson the anatomy pertinent to tracheal mite diagnosis. (photo: Sam Hapke)

In Daniel's piece, you will see that I am repeatedly referred to as "the biologist" and might assume that academic training is necessary to run such programs. However, that is not the case. The seeds for the prison beekeeping programs were planted by two visionary staff members, whose imagination and diligent efforts prior to my arrival paved the road for these courses. Vicki Briggs was a full-time counselor at Cedar Creek; she volunteered her precious time to introduce Daniel and a few others to the few hives on the grounds. Doug Raines was serving as the Environmental Officer at Stafford Creek Corrections Center when he first brought a few colonies past the fences to share with offenders. The expansion of the Sustainable Prisons Project allowed him to devote large blocks of his time to co-teaching alongside me. Doug was my mentor as I navigated the prison environment and he greatly facilitated the teaching process by generating offender interest and organizing materials. In fact, Doug brought his own hot knife and extractor into the facility for our honey harvest lessons! Both Vicki and Doug were able to begin hobbyist operations inside prisons with little more than prior beekeeping knowledge and a connection to the prison system.

I urge anyone interested in expanding this idea to contact your local prison administrators and discuss the prospect of volunteering. Our program proved immensely rewarding for all of those involved, including me, and might be a good fit at other similar institutions. Program costs can be offset by donating equipment or building it onsite. Many prisons have woodshops on the grounds, where hive materials can be rapidly and inexpensively built. Indeed, almost all of the equipment used in the Washington programs, including sturdy *Langstroth* and top-bar hives, was built inside the prisons by offenders. I welcome any contact from curious and ambitious readers and could speak to my contacts at the Washington programs about connections to other facilities across the country. I can be reached by email at shapke@wsu.edu.

Our work was supported by the Washington State Department of Corrections as part of the larger Sustainable Prisons Project at The Evergreen State College in Olympia, WA. More information on that project and its extraordinary founder, Dr. Nalini Nadkarni, can be found at www.sustainableprisons.org.

Sam Hapke (middle) points out the characteristics of a drone to several students. (photo: Doug Raines)

WASHINGTON STATE PRISONERS LEARN THE ESSENTIALS OF BEEKEEPING IN PRISON BEE PROGRAM

by DANIEL TRAVATTE

Cedar Creek Corrections Center in Littlerock, Washington is a minimum security prison that houses approximately 500 inmates. The superintendent of the facility, Mrs. Hisami Yoshida, is dedicated to making the institution more eco-friendly by supporting many "green" programs, one of which is beekeeping. Beekeeping is a unique program for prisoners to be involved in, as I am unaware of any other prisons that have a program to the scale that we have (Stafford Creek Corrections Center in Aberdeen just started up a small bee program modeled on ours).

Cedar Creek has increased the size of our beekeeping program by partnering with The Evergreen State College. This partnership provided the prison with a biologist to teach us the biology side of beekeeping and scientific method. I have been caring for the bees since my arrival here almost 3 years ago. The involvement of the biologist and the addition of the new colonies that were brought in this year have been an excellent learning experience for me. I had never kept bees before coming to prison. I've found it fascinating, satisfying work, and have learned a whole lot.

I was primarily trained by one of the correctional counselors, Vicki Briggs, caring for the three hives we had before the partnership with the college. She is a hobby beekeeper herself and as a counselor here she became the staff member who managed the bees. We made some splits in the spring with the two colonies that survived the winter and had a total of eight colonies. One of our colonies had an extremely prolific queen. We also had been making lotion and lip balm products with the wax from the hives here.

When Evergreen arrived they brought in an additional 21 colonies (in 4-frame nucs). Ten interested inmates that signed up were included in the two-day a week class held by the Biologist Sam Hapke. We were taught the technical aspects of beekeeping and a lot of bee biology. We learned how to graft, check for *Varroa destructor*, and check for tracheal mites with a microscope. We also learned many treatment strategies for bee parasites, both chemical and organic. However, in practice we only used the organic techniques here.

We also got a lot of face time with the bees so we are more comfortable around them. I always wore a suit for the first year in the program. However, I discovered that I tended to get stung more when wearing one. I'd had bees fire off like missiles into my bee suit through a gap in the zipper. I had about 30 bees flying around in my veil one day and probably 200 more trying to get in. We were pinching them through the mesh to kill them. Another time I had the bees so angry at me they were stinging right through my socks. On many other occasions we would be chased all the way back to the units after removing our bee suits. It was suggested I try not using the gloves and see how it went. I now rarely wear a suit. I hardly ever get stung anymore. I'm a lot more careful when and how I handle the bees and get immediate feedback if I'm being too rough.

We've learned that different colonies have different personalities. Some are just plain mean; so I put the gloves and suit on. Others are rather docile and don't seem to mind when we go through the hive. We have two apiaries—an upper one and a lower one. The lower one seems to have conditions that make most of the colonies down there a bit more aggressive. We often refer to this one

(L) Biologist going through a Langstroth hive with part of the class in our lower apiary. (R) Practicing my newly acquired grafting skills.

Here I'm measuring the comb in the bar hives with some of the class.

I'm sweeping a swarm into our swarm nuc; most of the time they would alight in this particular tree outside of our upper apiary. This became a common occurrence later in the summer as our colonies started splitting themselves or absconding and we didn't catch them in time.

as "The Wild Bunch". It's a covered apiary and in a small valley surrounded by trees, so it gets less sun. We're thinking that may be the reason the bees are meaner there, but the jury's still out on that one.

We also started taking comb measurements, extensive field notes, and ran experiments with Kenyan bar hives. Since bar hives are not easily found for purchase, they were made here at the prison by inmates in the maintenance shops. Actually, almost everything we use in the bee program here is made at the prison by inmates, including the more common Langstroth hives. We still have a large amount of those types of colonies. We will be comparing winter survival in these versus the bar hives.

We made extensive notes on all of the colonies whenever we worked a particular hive. We would note how well the colony was building up, how aggressive the bees were being, and how well they were holding up to invasion by wasps and baldface hornets. We had a particularly bad time with wasp and hornet invasions this year; we lost a couple of bar hive colonies because of this.

The first sign a colony was going to abscond was they would stop laying, stop storing nectar and pollen, and the comb would start to empty out. Then, they would all just take off. Nothing would be left behind but empty comb. This was suicide for the bees this late in the season (this happened in late August), but apparently they felt they would not have made it if they stayed. I had never seen so many of these predator insects after our bees. The prison is in the middle of the woods in SW Washington State, so there is a lot of habitat for these types of insects.

We purchased some yellowjacket traps and placed them all around the apiary. This helped to reduce the yellowjacket numbers a great deal. These traps lured the yellowjackets in with an attractant specific to them, so not a single honey bee was trapped. However, the traps did not work on the baldfaced hornets, so we spent considerable time manually squashing them every day we were out in the apiary. Eventually, I made some traps out of plastic pop and water bottles and baited them with tuna juice. This worked to lure in all the predator insects and again did not attract honey bees. In hindsight, traps should have been put out sooner.

For feeding the Langstroth hive colonies, we started by simply placing a feeder bag on top of the frames. After several weeks of this, I found it was quite wasteful. We had a lot of empty Zip-Loc Bags to dispose of. So, I obtained a quantity of #10 tin cans from the facility kitchen and added an empty hive body to the top of the Langstroth hives to contain the feeder can. This saved us money by not having to buy commercially made feeders.

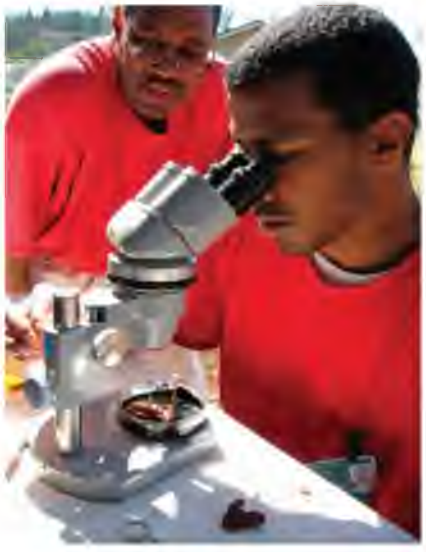
We would throw a bunch of scrap wood pieces and a screen from a bee package in the can to give the bees something to crawl out on. We used a similar method to feed our bar hive colonies, as well by placing the feeding can behind the divider. These methods worked beautifully and we had very few bees drowning after I added the screen with the sticks.

This was also another way to recycle; since Cedar Creek is a model prison when it comes to sustainability. Cedar Creek practices sustainability efforts with many "green" programs to teach us about environmental responsibility. In addition to our bee program, we also have a worm farm/compost, multiple organic gardens and greenhouses, endangered Oregon spotted frog hatchery, and rainwater cisterns. All of these sustainability programs are what are considered by us to be the most desirable jobs to have in the prison and are the most sought after.

During the winter months this last year we made about a thousand lip balms and nine hundred hand balms with the surplus wax from our colonies last summer. Several interested inmates, including myself, make these products in correctional counselor Briggs's office.

We use a pretty simple formula 1:5 for our lip balm and 1:6 for our hand balm. Just beeswax, olive oil, and flavoring or scent, depending on what we're making. For lip balm flavoring we purchase essential oil or flavoring oils for baking. Last year we made lippy lime, lemon peppermint, cherry peppermint, cherry lemon, peppermint, alluring almond, lemon almond, and my personal favorite, cherry almond. For hand balm we would use essential oils, candle scent oil, or

(L) I'm thrilled to have captured yet another swarm. (R) Placing the swarm into a regular Langstroth hive.



We were able to use a microscope to dissect large grasshoppers to learn about insect taxonomy. We also learned how to check for tracheal mites in honey bees and were given time to practice with the biologist.

Some of our custom labels I made for the bee products we make here. The Bee Tier lotion label goes on the lids of all the moisturizing balm containers. Note: I live on B Tier.

I made an observation hive to display live bees at our Science Fair Family Friendly event for the last two years. I had a stethoscope so they could hear what the bees sounded like in the hive and a magnifier to get a closer look. The kids really enjoyed seeing the live bees on the comb and I was able to teach them all about honey bees.

baking flavoring oil. Last year we made almond, vanilla bean, tangy tangerine, piña colada, lime, and my favorite, vanilla tangerine.

Our bee products are given away at family-friendly events (we have several family-oriented events every year that are geared toward our children, ie: science fair, back to school, etc). In addition, our products are given away to the volunteers around the holidays and at our Volunteer Appreciation banquet every year.

Our bee program is truly unique. It provides something positive for us do, think about, and talk about while incarcerated. It also gives us something to look forward to every week as well. This program is something we actually want to participate in. It's a positive activity I can take home with me. This is a program that we as inmates greatly benefit from. The Department of Corrections benefits by providing programming for us and production of bee products for use here in the kitchen and for other programs. The Evergreen State College benefits by gathering data and experience for their graduate students. Therefore, everyone benefits from these programs by working together to meet their needs with less cost to the taxpayers.

Honey Bees of Borneo: Exploring the Center of Diversity

A Book Review

by RANDALL HEPBURN

Honey Bees of Borneo: Exploring the Center of Apis Diversity by Nikolaus Koeniger, Gudrun Koeniger and Salim Tingek published by Natural History Publications (Kota Kinabalu, Borneo)

The United Nations declared 2010 to be the International Year of Biodiversity. It is a celebration of life on earth and of the value of biodiversity for our lives. We could not have had a greater contribution to this ideal than that associated with the publication of this extraordinary book "Honey bees of Borneo: Exploring the centre of Apis diversity" written by Prof. Nikolaus Koeniger, Dr. Gudrun Koeniger and Dr. Salim Tingek and published by Natural History Publications (Borneo). Between them, these authors represent more than 60 years of experience of studying and photographing the "Cinderella" honey bees of Borneo: *Apis andreniformis, A. cerana, A. dorsata, A. koschevnikovi, A. nuluensis* and the alien *A. mellifera*.

Although the authors are distinguished scientists, the research discussed is presented, not as a difficult scientific monograph, but actually in an almost "coffee-table" beekeeper-friendly way. The language is very accessible and many of the photographs stunning. Of course, the information in the book is completely up to date and it is illustrated with nearly 250 photographs (almost all in color) as well as line drawings.

It is fair to begin by asking "Why study honey bees in Borneo?" Because they are part of our diminishing heritage and this large island holds six of the nine known honey bee species, of which three, *A. andreniformis, A. koschevnikovi* and *A. nuluensis* are extremely poorly known. This first chapter ends with a beautiful photographic glimpse of these unique honey bees. Chapter 2 provides all of the necessary background information on the social structure of honey bee colonies which are basically single parent (mother) families run mainly by lots of daughters, the offspring of several different fathers (drones). The drones produced by the incumbent queen are actually her sons without having had fathers. The queen mother is long-lived and the daughters short-lived and together they constitute the basis of a superorganism. The drones are along for the ride and

Fig. 1. *Apis cerana* bees: the most common honey bee species in Borneo on a comb inside the nest of the colony. (Koeniger photo)

About the reviewer

Randall Hepburn had his first exposure to honey bees in the USDA laboratory at Baton Rouge in the days of Otto Mackensen, WC Roberts and Steve Taber. The sting lasted. After completing the usual degrees in entomology (Louisiana State and then University of Kansas), he spent a postdoctoral year with HE Hinton at the University of Bristol before moving to South Africa. Over the last 40 years he worked first at the University of the Witwatersrand in Johannesburg (where a considerable number of unpleasant *A. m. scutellata* 'accidents' occurred, and then at Rhodes University in Grahamstown, environs of the local honey bee, *A. m. capensis*. He retired as Emeritus Professor of Entomology 10 years ago (which means he still goes to work but is not paid!).

About 30 years were devoted to fundamental research on the enigmatic Cape honey bee, *A. m. capensis,* which attracted a small flurry of honey bee biologists from Germany, Austria, Ethiopia, China, UK and the USA. After he and his colleague, Sarah Radloff, published "Honeybees of Africa", they quickly realized the need for new pastures and headed to then unknown to us, Southeast Asia. This lead to a decade of field work to clarify the shocking mess in the classification of what then passed for the Oriental wax bee, *Apis cerana.* This period was extremely productive and included many visits to Myanmar, Thailand, Indonesia, Malaysia, Borneo, Cambodia, China and Vietnam. Work was concentrated on *A. cerana, A. florea,* and *A. koschevnikovi* while the giant honeybee, *A. dorsata,* was assiduously avoided based on the experiences of an old friend, Roger Morse. Nonetheless, beyond belief, the Koenigers find them agreeable company!

At present, Hepburn (an entomologist) and Radloff (a statistician) are in the final stages of production of a comprehensive, multi-authored monograph "Honeybees of Asia" under the aegis of Springer-Verlag. Concurrently their research is concentrated on the biology, particularly absconding, of the dwarf honey bee, *A. florea* in Thailand.

Fig. 2. A honey bee queen (*Apis cerana*) in the center of a retinue of worker bees. (Koeniger photo)

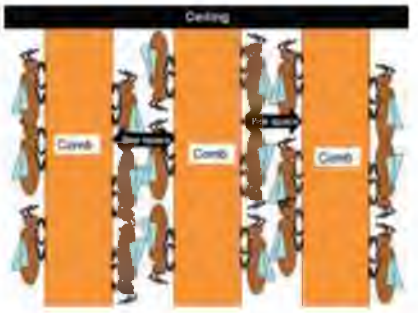


Fig. 3. In the cavity-dwelling honey bee species (*A. cerana, A. koschevnikovi, A. nuluensis* and *A. mellifera*) the distance between the surfaces of two neighboring combs, called the "bee space" permits the bees to move and work without hindering bees on the opposite comb. (Koeniger illustration)

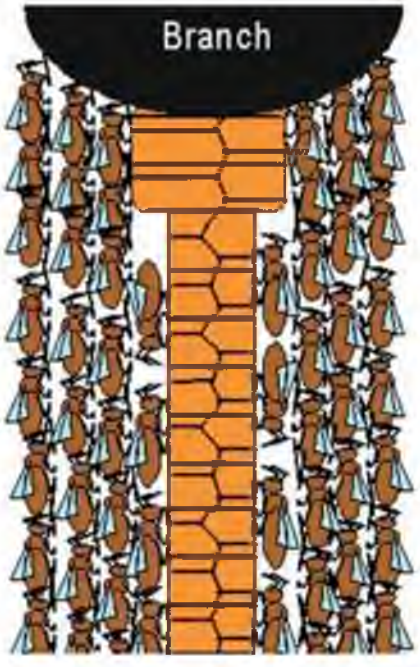


Fig. 4. Schematic cross section of a giant honey bee (*A. dorsata*) colony. At the top of the nest, attached to the nest branch, honey and pollen are stored in elongated comb cells. The honey cells are prominent at the upper edge of the comb. The comb cells below serve for brood rearing. The comb is covered by a multi-layered curtain of worker bees, which hangs down from the nest branch. Within the "bee space" (between the inner chain of worker bees and the comb's surface) worker bees move freely and, among many other activities, rear the brood. (Koeniger illustration)

Fig. 5. Schematic cross section of a colony of the dwarf honey bee of Borneo, *Apis andreniformis*. The comb is built around a small twig. At the top there is the broad honey storage area with elongated comb cells, below which are comb cells for brood rearing. The brood comb is covered on both sides by a multi-layered curtain of worker bees, which hangs down from the nest's broad honey portion. Within the "bee space" (between the inner chain of worker bees and the comb's surface) worker bees move freely and, among many other activities, rear the brood. (Koeniger illustration)

contribute nothing aside from their spermatozoa on mating flights.

Clearly, the combs are the backbone of the colony and play major roles including brood rearing and honey storage. The latter is really a fuel reserve to see the colony through hard times. The combs also facilitate thermoregulation and provide a substrate for vibration during the course of waggle dances. The combs are also compartmentalized so that each kind of bee has its own cradle: worker sized and drone-sized cells and queen cells. Supporting all of this physical equipment is the ability of bees to provide dual air-conditioning, both heating and cooling, which for the bees, as for us carries costs. While stored honey is the social energy bank, pollen is effectively "tinned protein".

Chapter 3 is devoted to "Who is who in honey bees" and here descriptions, richly supported by photographs show the fundamental differences between the three cavity-nesting species, *A. cerana, A. koschevnikovi* and *A. nuluensis,* and the single comb, open-air nesting dwarf honey bee, *A. andreniformis*, and the giant honey bee, *A. dorsata*. This is followed by a pair of chapters on the fossil ancestors of honey bees and their relatives and a discussion about the origin of honey bees and it is pointed out that, given quite a lot of missing evidence, the quest for the evolution of honey bee species is still elusive.

The authors then move on to tropical mobility, and if anything is unique about these bees, it is their endless swarming, absconding, and migrations. A great deal of the authors' own researches has been directed towards mating and reproduction. Indeed, they captured the very first photos of a natural mating of a virgin queen and a drone and more detail is photo-documented in this chapter. Firstly, the drones leave their nests for mating and assemble near the canopies of prominent trees (drone congregation areas = DCA), each species at a different height and flying out at different times from their mother nests. On arrival of drones at a DCA, queens attract drones which chase after them. The first successful drone grasps a flying queen from above, inserts its large endophallus in the genital tract of the queen and then dies. After sperm transfer is completed, the queen separates from the drone and then mates with

Fig. 6. A colony of *Apis andreniformis* has built its comb around a small branch. On the branch the comb cells are elongated and form of a convex platform which is permanently covered by layers of worker bees. A curtain of bees hangs down from the platform enclosing the brood area. (Koeniger photo)

Fig. 7. An empty comb of *Apis andreniformis*. The broad top around the branch is white and contains honey. Brood is reared in cells below the twig. (Koeniger photo)

several more drones. Finally, the queen leaves the DCA carrying a visible mating sign. A day or two after successful mating the queen never mates again and begins to lay eggs.

The specificity of mating behavior is elegantly shown in a cross-fostering experiment with colonies of *A. cerana* and *A. koschevnikovi*. Capped drone brood of each colony was transferred to the opposite species so that the *A. cerana* colony contained both capped drone brood of both *A. cerana* and *A. koschevnikovi* and, vice versa. When the drone adults emerged and matured, each species flew out to their species-specific DCA's at their own species-specific mating times.

In food resources and communication (chapters 8 and 9) the authors consider how honey bee colonies optimize foraging success. Success is based on a few scout bees that find profitable forage sites and then inform the colony by means of the famous dance language. The cavity-nesting species dance on a vertical plane in the dark and must convert the coordinates danced against the real position of the sun. In so doing, they convey both the distance and the direction of a food source. On the other hand, the dwarf *A. andreniformis* dance in the open light on the single combs and in a horizontal plane during which they point their dances in the direction of the food source and provide only distance information in the dance. *A. dorsata* dances on a vertical plane. So, three different modes of waggle dances occur, depending on the surface attachment of the nest.

Colony defense against predators and parasites (chapter 10) reflect what the authors consider to be a natural balance. The honey bee sting, ultimately a modified ovipositor, is a formidable instrument, especially when it becomes a large group response and is exercised as a kamikaze suicide mission against vertebrate predators. These include the Asian sun bear which, having encountered honey bee defensive behavior, retreat from a cache of honey even if a recorded hissing sound of a colony is played from a hollow log. Bee-eaters and honey buzzards also make a precarious living hunting giant honey bees. Turning to insect enemies, an entire genus of hornets, *Vespa*, hunt honey bees and while the wasps catch their share, if they come too close to the nest, they will be killed in a tight heat-ball of bees which raise the temperature above the lethal limits of the wasps and at the same time probably asphyxiating them. Ants, a cosmopolitan curse to beekeepers, reach new heights in the formidable weaver ants. Then, there are the usual depredations of wax moths and parasitic mites.

Three chapters (11, 12, and 13) are devoted to beekeeping as practiced with the native honey bees in Borneo. In traditional beekeeping, honey-hunters gather at night and construct a ladder of bamboo which they connect to a tree with pegs. They use a burning torch to fend off the bees and

Fig. 8. A schematic drawing of the different locations of drone congregation areas (DCAs). (Koeniger drawing)

bring the honey down in buckets. The honey is then sold directly to consumers. On the other side of the central mountains of Borneo, in Kalimantan, Indonesia, there is an ancient form of *A. dorsata* beekeeping with *"tikung"*, man-made nesting planks, situated in a great fresh water swamp where only low vegetation occurs. The giant honey bees adopt these elevated planks and the beekeepers harvest as they wish. This method, known in the West as "rafter-beekeeping" is a rapidly spreading practice throughout southeast Asia. *A. cerana*, on the other hand, has traditionally been kept in pots or more commonly in hollow logs. Professional beekeeping based on movable frame hives has proven very effective and is spreading in the land.

Two final chapters (14 and 15) discuss the introduction of *A. mellifera* into Borneo and enter a plea for equal rights for Asian

Fig. 9. Even in the highly defensive *Apis dorsata*, newly arrived swarms are (generally!) docile and close distance observations by co-author (GK) did not require a bee veil or any protective gear. For colony defense, the establishment of the colony's territory and precise information on the location is a fundamental requirement and these bees have not yet acquired information on their surroundings and territory. (Koeniger photo)

honey bees, respectively. This species is a coddled bee, dependent on imported pollen as well as veterinary medicines. Unfortunately, these bees are able to transmit all of the disease and parasites to which they are prone to the Asian species. It is hoped that the authorities consider these risks carefully, as well as improving honey production in *A. cerana*. These combined problems warrant extremely careful considerations. And, as to equal rights, it can be noted that in the regulations of the European Community (EC), honey is actually defined as the product of A. *mellifera*!! Admittedly, the honeys of southeast Asia usually have a higher moisture content than those marketed in the West, but anyone who has savored longan, jujube, snowball or persimmon honeys will know the EC is riding a nobbled horse.

The book ends with an appendix including a simple key for identifying the honey bee species of Borneo and cites further readings and contact organizations. The publication closes with a very useful glossary. The book may be obtained directly from the publisher Natural History Publications (Kota Kinabalu, Borneo) at their Internet website.

Fig. 10. The trunk of a bee tree with a new ladder and scars of former bamboo pegs. The scars of more than 20 bamboo ladders (some scars were on the opposite side of the trunk and are not visible in the photo). So, honey gatherers had climbed the tree at least 20 times for about 10 years. (Koeniger photo)

SICK BEES

PART 3

The Bee Immune System

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In my previous article, I proposed a model for the in-hive positive feedback loops that may lead to colony collapse. Before I can further explain the model, we must understand more precisely how the bee immune system functions, as it appears to be that the mechanisms leading to the disappearance of bees are rooted in an immune response gone awry.

The Honey Bee Immune System

The definitive sign of colony collapse is the often sudden "disappearance" of the worker force. This disappearance appears be mainly due to an aspect of the bee colony-level immune response that normally helps to purge an infection, but that when conditions favor certain positive feedback loops, can result in excessive or complete depopulation of the hive. To better understand what happens, we need to have a firm grasp of how the bee immune system functions.

The soundbite version that we all heard when the honey bee genome was sequenced—that bees had "fewer immune genes than other insects"—was rather misleading. The honey bee colony is a complex super-organism, with physical, chemical, and behavioral defenses at various levels—at that of the individual cell, the individual bee, the full colony, and at the level of the local population. Bees have a robust and effective immune system—they just do things a bit differently than the solitary flies to which they were compared.

Behavioral Boundary Barriers

A honey bee hive is a densely crowded, moist and warm environment with many closely related individuals. In other words, this is the perfect setting for parasites to exploit. Since honey bees have survived for millions of years, it's evident that they have figured out ways to keep the ever present pathogens at bay.

The first line of defense is to avoid a fight in the first place. Bees do so by not allowing parasites to gain a foothold—they are relentless in their scrubbing and scouring of the inner surfaces of the nest cavity and in the grooming of their body surfaces (watch how amazingly quickly bees clean up any "accidents" in an observation hive!). They also sterilize all surfaces with antimicrobial secretions in their saliva (such as glucose oxidase, which produces the strong disinfectant hydrogen peroxide), and by "stealing" components of the plant immune system by gathering the highly antimicrobial resins found at leaf buds and wounds, and bringing

A returning forager with a load of antimicrobial plant resins on her leg. When the resins are scraped off and applied to the inner surfaces of the hive, they are then called "propolis." The varnish of propolis creates a waterproof line of defense against parasites and pests. Photos by the author.

them back to the hive—at which point they are called "propolis." Bees use propolis to form an antibiotic envelope around the colony—they put a heavy layer around the entrance, coat the inner surfaces of the cavity, seal all crevices with it, and coat the face of the combs.

The coating of propolis has been demonstrated to inhibit AFB (Antunez 2008), fungi, and wax moth; Marla Spivak has demonstrated that propolis from some regions is effective against varroa, and is investigating its effect on viruses. Of great interest is the recent finding (Simone 2009) that the presence of propolis appears to decrease the necessary investment in immune function of bees—thus, the bee colony, by self-medicating itself with antimicrobial chemicals from plants, incurs less of a metabolic cost in fighting pathogens! ***Perhaps we have been shooting ourselves in the foot by breeding for bees that don't use much propolis!***

In order to help prevent the spread of brood diseases, each larva is isolated into its own scrupulously-cleaned cell, which it later lines with a layer of silk cocoon, which helps to protect the pupa from contaminants in the cell wall.

The primary manner by which a pathogen can enter a colony is by hitching a ride back on or within a forager, which could pick it up from a flower contaminated by the last visiting insect, from water, or especially by robbing out a sick hive (*is that stolen honey really worth it?*). So the colony has "rules" to minimize the transmission of such incoming pathogens to the most critical and vulnerable parts of the hive—the queen and her broodnest.

Certain requisite forager behaviors set up "checkpoints" that serve to keep from introducing parasites or toxins into the broodnest. Foragers bring a flood of nectar back to the hive, which creates a major potential avenue for pathogen introduction. So, let's take a look at how bees process that nectar.

First, foragers that become ill after tanking up on toxic nectar (or pesticides) simply don't return to the hive. Those that do successfully return are still not allowed to directly deposit their nectar in the combs nor feed it to the brood—they must first pass it to a mid-aged receiver bee. Both the forager and the receiver use their proventriculus (meaning "in front of the stomach") to remove pollen grains, dust, *and* infective spores from the nectar. This amazing structure consists of four fringed lips that "gulp" up and expel the nectar in the crop (or "honey sac"), filtering any particles out of it, kind of like a baleen whale filtering plankton from sea water. Some lines of bees are more efficient at filtering than others (Sturtevant 1953), which may thereby help to confer resistance to AFB and nosema upon their colony.

In addition to filtering out spores, bees secrete antimicrobial enzymes into the nectar. Not only that, but they also maintain cultures of two specific "friendly" lactic acid bacteria in their crop (Forsgren 2010). These beneficial bacteria inhibit the growth of yeasts and disease-causing bacteria and fungi.

Pollen foragers, on the other hand, *do* directly deposit their loads at the periphery of the broodnest. Painstaking work by Martha Gilliam indicated that bees inoculate pollen loads with beneficial molds and bacteria that produce antibiotics that aid in the preservation of the beebread, and that are antagonistic to pathogenic organisms. The ARS Tucson Lab is currently following up on Gilliam's groundbreaking research. To further isolate the brood from any pathogens in raw pollen, the beebread is then eaten and digested by nurse bees and converted into royal jelly (similar to the way in which a mammal converts raw food into milk), which contains antimicrobial fatty acids and peptides.

A forager covered by Scotch Broom pollen enters the broodnest to look for a cell in which to place her load. Pollen loads are a potential source of pathogens from other insects which may have previously visited the flower. Bees process the pollen first into beebread, then into antibiotic-rich jelly for feeding to nestmates. In this busy scene, two bees are engaging in trophallaxis at the lower right, to their left a pair are "antennating"—likely sharing pheromones. At the lower left, a worker has her head in a pollen cell; above her a varroa mite is hitching a ride on a bee's thorax.

Hygienic Behavior

Should a larva sicken or die, it is removed by mid-aged undertaker bees (Arathi & Spivak 2001), which no longer engage in feeding of the brood. This disease resistance mechanism was first demonstrated by Park, and was termed "hygienic behavior" by Rothenbuhler (1956). Steve Taber (1982) promoted selectively breeding for it by using a "freeze killed" brood field assay. Marla Spivak has since picked up the ball, and has encouraged a number of commercial queen producers to start selecting for this desirable trait.

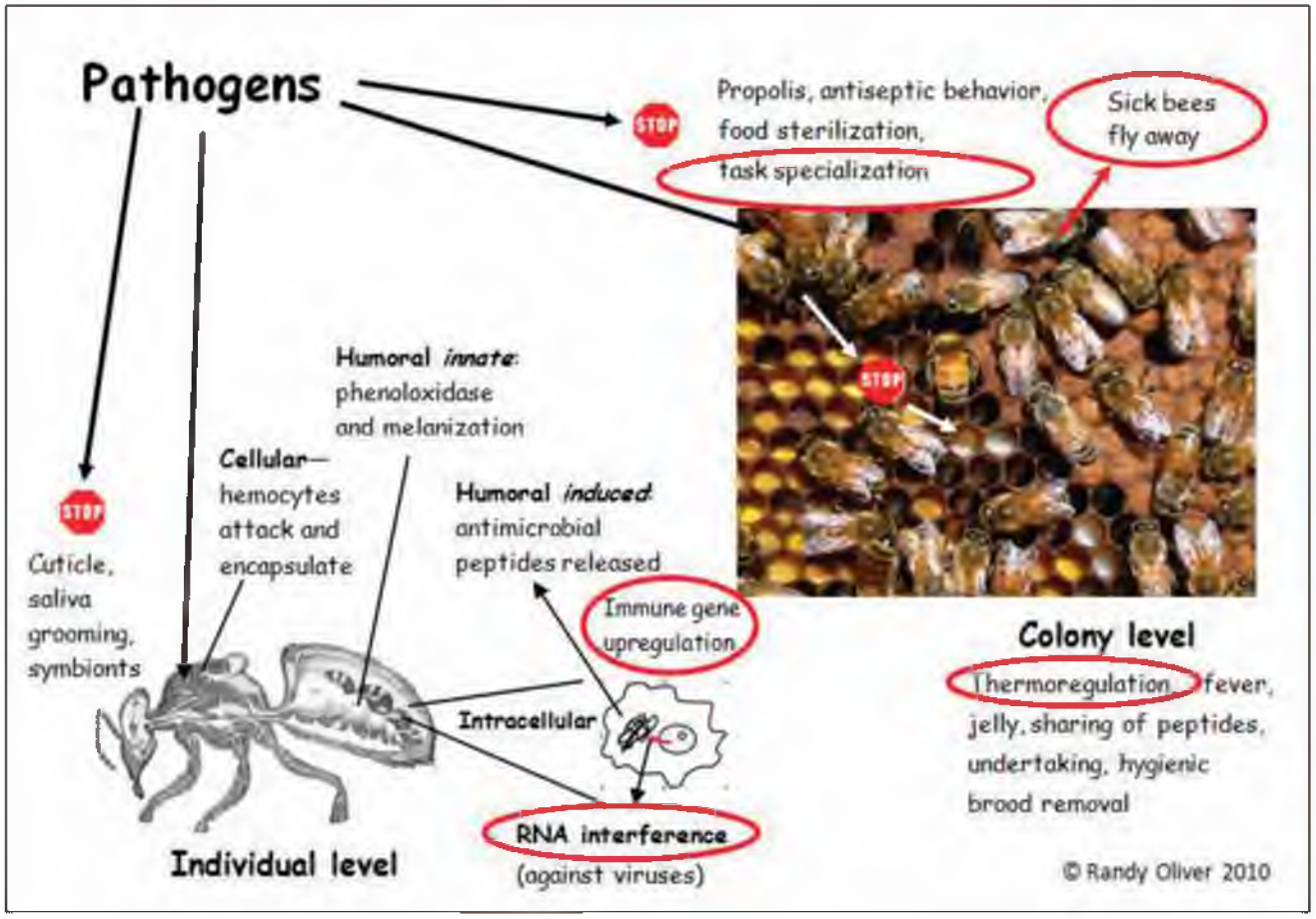
There are apparently at least seven genes involved in hygienic behavior (Lapidge 2002); the critical component appears to be the ability to detect the odor of sick brood, so that it can be removed before it becomes infective (Wilson-Rich & Spivak 2009). Because of this time constraint, the authors suggest that bees be selected for what they term "rapid-hygienic" behavior. ***Note that such removal of dying brood can result in an irregular pattern of uneven-aged brood ("shotgun pattern" or "spotty brood"), and may be an indication of an otherwise invisible virus infection.***

Evans (2006) puts the effectiveness of colony cleanliness into perspective:

A testament to this hygiene is the fact that, even when facing severe colony-level infections by bacterial pathogens such as [AFB] *(for which < 10 spores are normally fatal to young larvae)..., the vast majority of larvae show no signs of exposure.*

Other Behaviors

Several bee pathogens are sensitive to temperature, and the individual bee or the colony may create a "fever" to kill nosema (Martín-Hernández 2009), chalkbrood (Starks 2000), or even mites (Currie 2008). As indicated in my model for colony collapse, chilling and the lack of thermoregulation may play a major role in the multiplication of pathogens and the bee immune response to them.



A simplified schematic diagram of the honey bee immune system. The various components work together against the wide variety of pathogens that bees encounter. The "stop" signs indicate barriers to pathogen introduction. The functions circled in red are involved in my model of colony collapse. Bee cross section from Snodgrass 1910.

Finally, bees may even sacrifice themselves or abandon their hives in order to try to get the upper hand against parasites. The natural host of varroa, *Apis cerana*, simply absconds should the mite population build up (Anon 1990), thereby leaving many mites behind in the brood. Both the Savannah bee (*A.m. scutellata*) and the Africanized honey bee are also noted for their swarming and absconding behavior. European honey bees rarely abscond, but in my experience it appears that colonies heavily parasitized by varroa or *N. ceranae* may swarm more readily. ***This may be a behavior to try to get away from parasite buildup—swarms seem to build up exceptionally well on new, fresh, pathogen-free combs.***

Colonies may also "blame the queen" should they get sick, and attempt to supersede her—leaving behind a new queen with a potentially more successful mix of genes. The downside to this behavior is that the remaining colony in the hive is dependent upon a newly-emerging queen successfully mating and taking over egglaying duties. Unfortunately, in such a sick colony, there is a substantial chance that the new queen may emerge already infected (say with DWV or Black Queen Cell Virus, which is strongly associated with nosema infection). Or, the supersedure queen may simply not be able to find enough healthy drones for proper mating. In either case, the end result would be a queenless colony. ***The increased viral loads since the arrival of varroa (along with the associated miticide residues) may help to explain the greater degree of queenlessness that we observe in our hives compared to 20 years ago.***

Colonies in temperate climates normally undergo a massive loss of older cohorts of bees in both early spring and fall. Note that these are the same periods of time in which nosema builds up. ***It may be that the colony uses these "cleansings" of old, infected bees to flush parasite epidemics prior to summer buildup or overwintering.*** I will return later to the individual behavior of sick bees removing themselves from the hive.

Mechanical and Physiological Barriers

The bees' first line of defense is simply to avoid, exclude, remove, or kill the bad guys before they can actually infect a bee. The bee is well protected from most pathogens by its strong, waterproof cuticle. As long as this biologically-active armor remains unbroken, viruses and bacteria are generally held at bay (***I will revisit the significance of the breaching of this armor by the varroa mite***). Even the trachea (breathing tubes) are lined with (a water permeable) cuticle. Should the cuticle be injured, the exposed hemolymph (the fluid filling the insect body cavity functions as both "blood" and intracellular lymph, but does not carry oxygen) quickly clots in a manner similar to that of mammals. Immune cells (hemocytes) engulf any foreign invaders at the wound site; then a chemical cascade initiating with the enzyme phenoloxidase melanizes the clot into an inert and impermeable barrier. Note that rough handling of bees breaks off their body "hairs" and exposes the haemolymph temporarily—this brief breach may allow viruses to enter the bee's body.

The weakest chink in the bees' armor is the gut, the place where the inside of the bee meets the myriad potential pathogens from the outside world. The gut must juggle being a barrier to invading parasites of all sorts, yet still afford permeability for the digestion of nutrients. The foregut (that portion from the mouth to the stomach) is lined with a cuticle that can slough off should pathogenic bacteria (as opposed to beneficial bacteria) attach to it. I've already described the action of the proventriculus, which would then fil-

ter such sloughed lining into the midgut.

Insects protect the midgut with a neat trick—they line it with a protective chitinous inner sleeve called the peritrophic membrane, which helps to protect the delicate midgut epithelium from both spiky pollen grains as well as potential invaders (nosema spores, when they germinate, must harpoon their polar bodies through the peritrophic membrane and spear an epithelial cell in order to infect the bee). The gut lumen is chemically hostile to pathogens—it is mildly acidic, and the epithelial cells produce digestive enzymes and defensive peptides and binding proteins. ***Nevertheless, the gut still appears to be the main avenue through which AFB, EFB, chalkbrood, and viruses infect the bee.***

Individual Systemic Immune Response

The insect "innate" immune system is basically similar to that of humans (Kavanagh 2007) although insects do not exhibit as complex an "adaptive" or "acquired" immunity" (such as our formation of antibodies specific to new pathogens). Since some of the terminology may not be familiar to the reader, I have diagramed it. (See diagram on previous page.)

The first order of individual immune response is to recognize "self" from "foreign." The bee immune system recognizes invaders by keying in on specific proteins present on each type of pathogen (i.e., the surface proteins of bacteria are different than those of say, fungi). Bees have "constitutive" or "innate" defenses that are always present and at the ready, such as roaming hemocyte cells and enzymes in the hemolymph. The hemocytes recognize invaders and signal the enzyme phenoloxidase to start a cascade of chemical response, generally ending in either the engulfing or encapsulating of the invader, killing it with a barrage of powerful chemicals (e.g., quinines, phenols, and reactive oxygen species). The hemocytes involved may then apoptose (kill themselves) and be coated with dark melanin polymers (you can see these dark areas in white dead pupae being removed by bees).

This innate defense system works ***fast***—Haine (2008) found that the mealworm beetle can nearly clear its system of an injection of 4 million bacteria in about 30 minutes! During this quick response (pay attention here, as we are getting to a potentially important aspect of colony collapse), the hemocytes release chemicals that penetrate the cell nuclei, and cause them to upregulate certain immune response genes, which then transcribe RNA messengers to exit the nucleus, and then move to the ribosomes to ***translate the genetic instructions into antimicrobial peptides***. This is called the "induced" response, and takes at least 1-3 hours to get going (after 99.5% of the bacteria have already been killed), and 12-48 hours to reach peak levels. The induced response can last for weeks, ***and it appears that these peptides can be passed to nestmates to confer them resistance prior to being infected*** (something that solitary insects can't do).

Note that the antimicrobial peptides are produced largely in the fat bodies—so there would be less of this sort of response in forager bees, which don't maintain their fat bodies. This makes sense, since foragers aren't expected to live for long. However, keep in mind that the bees in protein-hungry colonies are unable to develop their fat bodies fully—this one point where nutrition ties in to immunity.

Surprisingly, Jay Evans found that these genes are not upregulated in bees from CCD colonies, even though the bees are full of pathogens! There are a few potential explanations for this finding that come to mind:

The bee hemocytes are not recognizing the pathogens as foreign (suppression of recognition systems, perhaps by viruses?).

The colonies could be protein-starved.

Something is suppressing the transcription of the genes, or their translation to peptides. Note that viruses can do this very thing, which I feel may be a big clue!

Haine and her collaborators suggest something very interesting:

Our experiments showed that those bacteria that survived exposure to the insect's constitutive immune response were subsequently more resistant to it. These results imply that induced antimicrobial compounds function primarily to protect the insect against the bacteria that persist within their body, rather than to clear microbial infections.

Two arguments favor our idea that long-lasting antimicrobial activity has evolved as part of a two-stage process, preventing resistance evolution in bacteria and/or managing persistent infections. First, bacteria readily evolve resistance against individual antimicrobial peptides in isolation, and recent work [Pham 2007] suggests that phagocytic haemocytes are responsible for the immune reaction against secondary infections in insects.

This finding suggests two thoughts relevant to bee health—(1) ***that the lack of antimicrobial gene upregulation in CCD hives would make the bees more vulnerable to secondary pathogens*** (I'll get back to this later), and (2) any bee ever bitten by a mite will need to expend energy for the rest of its life to maintain the upregulated peptides.

As bees "age," they shift their immune response tactics from hemocytic (cellular) response more toward phenoloxidase-based immunity (Schmid 2008). The implications of this finding are not completely clear (e.g., why do bees allocate the job of cell cleaning to newly-emerged bees?) This again ties in to the best use of resources—an aged bee has little reason to ramp up a long-term metabolically-expensive immune response. ***However, this finding may have implications in collapsing colonies, in which younger and younger bees must take the place of foragers***. Wilson-Rich (2009) make an interesting observation:

Because nurse bees are not as immunologically competent as foraging bees, they are not as well equipped to combat the increased pathogen exposure that older foragers encounter In the absence of foragers, younger nurse bees prematurely transition to precocious foragers…This behavioral shift is likely to negatively impact colony fitness, regardless of the pathogen pressure… In this light, foraging bees may play a similar role as vaccinated individuals in a population by providing a type of herd immunity [via trophallaxis?], and in their absence the disease resistance capacity of the group is likely compromised.

This "herd immunity" concept is interesting, as Traniello (2002) found that termites (which live in a social structure similar to that of bees) appear to be able to "prime" other nestmates' immune response to pathogens. This avenue of immunity is still speculative for bees, but I'm guessing that they still have a lot of tricks up their sleeves that we have yet to discover! O.K., I know—more than you wanted to know about the bee immune system. But the mystery of colony collapse starts to fade the more one understands bee immunity. I'm going to break here, but we'll get into some real meat in the next article.

References

I am deeply indebted to the authors of the following reviews, which I recommend for further reading:

Evans, JD, & M Spivak (2009) Socialized medicine: Individual and communal disease barriers in honey bees. *J. Invertebr. Pathol.* doi:10.1016/j.jip.2009.06.019 ***Free download***

Evans, JD, et al (2006) Immune pathways and defence mechanisms in honey bees *Apis mellifera*. *Insect Molecular Biology* 15(5): 645–656.

Siva-Jothy, MT, Y Moret, and J Rolff (2005) Insect Immunity: An Evolutionary Ecology Perspective. Advances in Insect Physiology Vol. 32: 1-47. ***Free download***, google the title

Wilson-Rich, N, M Spivak, NH Fefferman, and PT Starks (2009) Genetic, Individual, and Group Facilitation of Disease Resistance in Insect Societies. *Annu. Rev. Entomol.* 54:405–23. ***Free*** http://www.extension.umn.edu/honeybees/components/pdfs/annurev.ento.53.103106.093301.pdf

Schmidt-Hemple, P (1998) Parasites of Social Insects. Princeton Univ. Press

Citations

Anon (1990) Beekeeping with oriental honeybees (*Apis cerana*). FAO Agricultural Services Bulletin 68/4

Antúnez, K., Harriet, J., Gende, L., Maggi, M., Eguaras, M., Zunino, P., 2008. Efficacy of natural propolis extract in the control of American foulbrood. *Veterinary Microbiology* 131, 324–331.

Arathi, HS, and M Spivak (2001) Influence of colony genotypic composition on the performance of hygienic behaviour in the honeybee, *Apis mellifera* L. *Animal Behaviour* 62: 57-66.

Berthoud, H, A Imdorf, M Haueter and J-D Charrière (2006) Colony mortality and bee viruses. Proceedings of the Second European Conference of Apidology EurBee Prague (Czech Republic) 10-16 September 2006

Chen, YP and R Siede (2007) Honey Bee Viruses. *Advances in Virus Research* 70: 33-80.

Currie, R (2008) Summary of Take Home Messages- CHC – AGM January 2008, Canadian Honey Council.

Evans, J.D., Armstrong, T.-N., 2006. Antagonistic interactions between honey bee bacterial symbionts and implications for disease. BMC Ecology 6.

Evans, JD and JS Pettis (2005) Colony-level impacts of immune responsiveness in honey bees, *Apis mellifera*. *Evolution* 59(10):2270-2274.

Genersch E, Ashiralieva A, Fries I (2005) Strain- and genotype-specific differences in virulence of *Paenibacillus larvae* subsp. larvae, a bacterial pathogen causing American foulbrood disease in honeybees. *Appl Environ Microbiol.* 71(11):7551-5.

Gilliam, M (1997) Identification and roles of non-pathogenic microflora associated with honey bees. FEMS *Microbiology Letters* 155: 1-10.

Haine, ER, Y Moret, MT Siva-Jothy, J Rolff (2008) Antimicrobial defense and persistent infection in insects. *Science* 322: 1257-1259.

Kavanagh, K and EP Reeves (2007) Insect and Mammalian Innate Immune Responses Are Much Alike. *Microbe* 2(12): 596-599.

Kralj, J, and S Fuchs (2009) *Nosema* sp. influences flight behavior of infected honey bee (*Apis mellifera*) foragers. *Apidologie* 41(1): 21-28.

Lapidge, KL BP Oldroyd, M Spivak (2002) Seven suggestive quantitative trait loci influence hygienic behavior of honey bees. *Naturwissenschaften* 89(12):565-8.

Martin, SJ, BV Ball,and NL Carreck (2010) Prevalence and persistence of deformed wing virus (DWV) in untreated or acaricide-treated *Varroa destructor* infested honey bee (*Apis mellifera*) colonies. *Journal of Apicultural Research* 49(1): 72-79.

Martín-Hernández, R, et al. (2009) Effect of Temperature on the Biotic Potential of Honeybee Microsporidia. *Appl Environ Microbiol.* 75(8): 2554–2557.

Nachbaur, A (1996) SAD & BAD Bees. http://www.beesource.com/point-of-view/andy-nachbaur/sad-bad-bees/

Naug, D, and S Camazine (2002) The role of colony organization on pathogen transmission in social insects. *Journal of Theoretical Biology* 215: 427–439.

Park, O., Pellet, F., Paddock, F., (1937) Disease resistance and American foulbrood. *Journal of Economic Entomology* 30, 504–512.

Pham LN, MS Dionne, M Shirasu-Hiza, DS Schneider (2007) A specific primed immune response in Drosophila is dependent on phagocytes. *PLoS Pathog.* 2007 Mar;3(3):e26.

Pruijssers, A and MR Strand (2006) PTP-H2 and PTP-H3 from *Microplitis demolitor* Bracovirus Localize to Focal Adhesions and are Anti-Phagocytic in Insect Immune Cells. *J. Virol.* doi: 10.1128/JVI.02189-06

Richard, F-J, A Aubert, and CM Grozinger (2008) Modulation of social interactions by immune stimulation in honey bee, *Apis mellifera*, workers. *BMC Biology* 6:50.

Rothenbuhler, W.C., Thompson, V.C., (1956) Resistance to American foulbrood in honey bees; I. Differential survival of larvae of different genetic lines. *Journal of Economic Entomology* 49, 470–475.

Schmid MR, Brockmann A, Pirk CW, Stanley DW, Tautz J., (2008) Adult honeybees (*Apis mellifera* L.) abandon hemocytic, but not phenoloxidase-based immunity. *J Insect Physiol.* 54:439–444.

Simone, M., J Evans, M Spivak (2009) Resin collection and social immunity in honey bees. *Evolution 63-11: 3016–3022.*

Snodgrass, RE (1910) The Anatomy of the honey bee. US Government Printing Office.

Starks, PT, CA Blackie, TD Seeley, (2000) Fever in honeybee colonies. *Naturwissenschaften* 87, 229–231.

Sturtevant AP & IL Revell (1953) Reduction of *Bacillus larvae* spores in liquid food of honey bees by action of the honey stopper, and its relation to the development of American foulbrood, *J. Econ. Entomol.* 46, 855–860.

Taber S, (1982) Breeding for disease resistance. *American Bee Journal* 122(3):177-179.

Traniello J, Rosengaus R, Savoie K. (2002) The development of immunity in a social insect: evidence for the group facilitation of disease. *Proc. Natl. Acad. Sci. USA* 99(10):6838–42.

Wilson-Rich, N., ST Dres, PT Starks (2008) The ontogeny of immunity: development of innate immune strength in the honey bee (*Apis mellifera*). *Journal of Insect Physiology* 54: 1392–1399.

Bee Pastures: Floral Havens Where Pollinators Can Prosper

by MARCIA WOOD
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Beautiful wildflowers, perhaps as alluring to bees as they are to people, might someday be planted in "bee pastures." These floral havens would be created to help propagate larger generations of healthy, hard-working bees.

Pesticide-free bee pastures can be "simple to establish and—at perhaps only a half-acre each—easy to tend," says entomologist James H. Cane. He's with the Agricultural Research Service's Pollinating Insects Biology, Management, and Systematics Research Unit in Logan, Utah, about 80 miles north of Salt Lake City.

Cane has conducted bee-pasture-related experiments for about 4 years, working both in a research greenhouse and at outdoor sites in Utah and California. He says species of pastured pollinators could include, for example, the blue orchard bee, *Osmia lignaria*. This gentle bee helps with pollination tasks handled mainly by the nation's premier pollinator, the European honey bee, *Apis mellifera*.

Today, millions of bees are needed, every year, to pollinate orchards and fields. Planting pastures for native blue orchard bees, for instance, could help meet that need. Cane estimates that, under good conditions, blue orchard bee populations could "increase by as much as four- to fivefold a year" in a well-designed, well-managed bee pasture.

Cane gives this brief explanation of how the pasture idea would work: Blue orchard bees would be taken out of a bee manager's winter storage and brought to the pasture, where they would emerge from their cocoons, mate, and, if female, lay eggs, before dying.

The following year, some of the new generation of bees that developed from those

Chinese houses (*Collinsia heterophylla*).

California bluebell (*Phacelia campanularia*).

Entomologist James Cane examines wildflowers in a Logan, Utah, test plot.

Blue orchard bee on a California five-spot flower (*Nemophila maculata*).

Baby blue eyes (*Nemophila menziesii*).

Lacy (or tansy) phacelia (*Phacelia tanacetifolia*).

eggs would be brought to commercial almond orchards to pollinate the trees' cream-white blooms. But most of that generation would be returned to their parents' pasture to produce yet another, hopefully larger, generation.

Ideally, this cycle would continue year after year, with each year's new generation larger than the one it replaced.

Best Bets for a Bountiful Bee Pasture

In their experiments, Cane and colleagues have studied wildflowers that might be ideal for planting at bee pastures in California. In particular, the team was interested in early-flowering annuals that could help bolster populations of blue orchard bees needed for pollinating California's vast almond orchards. The research resulted in a first-ever list of five top-choice, bee-friendly wildflowers for tomorrow's bee pastures in almond-growing regions.

These native California plants are: Chinese houses (*Collinsia heterophylla*), California five-spot (*Nemophila maculata*), baby blue eyes (*N. menziesii*), lacy or tansy phacelia (*Phacelia tanacetifolia*), and California bluebell (*P. campanularia*).

Though blue orchard bees gathered nectar and pollen from all of these species—a key requirement for wildflowers on the list—the bees' obvious favorite was the bright-pink blossoms of the Chinese houses plants.

Wildflower species had to have more attributes than merely appealing to bees, however. Cane's team made sure that each of the select species flourishes in the same climate and soil as that of almond orchards, and that the wildflowers bloom at about the same time of year as those trees.

These features help make it feasible and practical for bee managers who are busy fulfilling a commercial almond pollination contract to—at the same time—manage a bee pasture.

The wildflowers also met other criteria: They are rich in pollen and nectar and are reasonably easy to grow. And their seed is commercially available.

There was yet more that the researchers determined before deciding that the wildflowers were pasture-perfect. For example, the scientists either newly determined or confirmed the amount of pollen and nectar produced by the plants, and they noted the timing and duration of the bloom. They estimated how many flowers were produced per acre, then calculated the "carrying capacity" of each species, that is, the number of blue orchard bees that these plants could nourish.

Cane estimates that every 10 square yards of pasture that is planted with a mix of these five attractive flowers could provide enough pollen and nectar to support 400 mother bees. In turn, these pastured parents could produce enough progeny to—the following year—pollinate 3 acres of almond trees.

Two bee businesses in California are already using the findings to propagate more bees, Cane notes. He collaborated in the research with support scientist Glen Trostle at Logan; former Logan technician Stephanie Miller; AgPollen LLC colleague Steve Peterson, and others. ARS and the Modesto-based Almond Board of California funded the studies.

Cane notes that the bee-pasturing approach could perhaps be developed for other regions where other tree crops that blue orchard bees pollinate are grown, such as the cherry, apple, or pear orchards of the Pacific Northwest.

Bee pasturing isn't a new idea. But the studies by Cane and his collaborators are likely the most extensive to date.

For the foreseeable future, bees will remain in great demand. And the bee pastures that Cane proposes are in perfect harmony with the pollination needs of almond blossoms and wildflowers alike.

Conservation Reserve Program Offers Pollinator Habitat Incentives

New rules passed by the USDA now offer financial incentives for the establishment of pollinator habitat through the Conservation Reserve Program (CRP). The limited time program sign-up, which opened Aug. 2, 2010 to new enrollments, provides one of the largest pollinator conservation opportunities ever in the United States.

The CRP program, first established in 1985, is the largest private land-owner conservation effort in the United States with up to 32 million acres eligible for enrollment through the USDA's Farm Service Agency. Program participants take highly erodible land out of crop production, and establish permanent vegetation to protect topsoil and provide wildlife cover. Contracts which run 10 to 15 years provide annual rental payments on enrolled land, and cost-share assistance for establishing vegetative cover.

New rules which go into effect today offer priority ranking for land enrollments that include pollinator-friendly wildflowers and shrubs. Under the current CRP enrollment system, landowners who want to participate are ranked against one another to prioritize enrollments that offer the most conservation benefits. To receive a higher score on the pollinator ranking criteria, participating farmers must plant at least 10% of the CRP acres in wildflower parcels (or at least one acre for CRP enrollments less than 10 acres in size).

The addition of a pollinator habitat incentive for CRP has been promoted by numerous wildlife and pollinator conservation groups in recent years, and the new ranking system now offers one of the largest potential habitat creation opportunities of its kind ever for native bees, butterflies, and managed honey bees, all of which have experienced significant decline in recent years due to habitat loss and other factors.

In developing the new CRP technical requirements, the USDA's Natural Resources Conservation Service (NRCS) worked closely with Dr. Marla Spivak, a leading honey bee researcher based at the University of Minnesota, and the California-based advocacy group, Partners for Sustainable Pollination. Now, as the enrollment period for new CRP contracts begins, the NRCS is working with the non-profit Xerces Society for Invertebrate Conservation to develop wildflower seeding recommendations for states like Pennsylvania, Wisconsin, Illinois, Indiana, and Oregon. Those recommendations will focus on selecting native wildflower species that are abundant pollen and nectar sources, and that are most likely to thrive in their respective regions.

Rural landowners interested in more information about CRP, including the current sign-up period which ended August 27th, should contact their local Farm Service Agency office. For location information, visit their web site at http://www.fsa.usda.gov .

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The Other Side of BEEKEEPING

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The Apiaceae — The Parsley or Carrot Family

Before it became the fashion to end all plant family names with –aceae, the Apiaceae was generally called the Umbelliferae. As described here, the description of the family includes the Hydrocotylaceae, Angelicaceae, Daucaceae and Umbellaceae of some authors. This seems to represent the current trend.

Depending on the reference consulted, the family consists of between about 250 and 300 genera and between approximately 2800 to a little more than 3000 species. The family generally inhabits the temperate and boreal regions of the Northern Hemisphere, and tropical representatives are frequently found in mountainous areas. About 25% of the genera and 10% of the species are native to the U.S.

The family is generally made up of biennial or perennial herbs, occasionally woody plants, but only rarely, trees. The stems are often stout, furrowed and hollow between the junctures of leaves or branches (internodes). The alternately placed leaves are usually compound, often pinnately compound, and the leaf stems (petioles) commonly form sheathes at their base. Members of the family are often aromatic.

The individual flowers are usually small to minute, usually bisexual and radially symmetrical. There are usually 5 sepals, petals and stamens (5-merous), though sometimes petals are absent. When present, the petals are usually yellowish or whitish. The ovary is in the inferior position[1], composed of two carpels[2], each with one ovule[3] and a style.

The inflorescence usually takes the form of a compound umbel[4]. There is also an inflorescence type that forms a somewhat cylindrical or conical head. For those of us who have associated the family with plants like Queen Anne's lace, this form has a tendency to raise our eyebrows and cause us to shake our heads! The fruit is a schizocarp[5].

The family has considerable economic importance. It contains numerous food plants (carrots, parsley, parsnips, and celery), spices/seasonings (coriander, caraway, anise, fennel and dill), and ornamentals (eryngo, rattlesnake master, sea holly, angelica and cow parsnip). Some have been used for medicinal purposes in the Western world and probably still are, to a small extent. They seem to be used more extensively for medicinal purposes in other parts of the world.

Some cause a dermatitis in sensitive individuals (examples:wild parsnip and cow parsnip). Depending on how sensitive the person is to the plant, the dermatitis can be quite severe. There are also some deadly poisonous plants in the family (examples: poison hemlock and water hemlock). **One should not even taste members of the family unless there is absolute certainty about its identification.**[2, 13 & 21]

Carrot, (wild forms: wild carrot, Queen-Anne's lace, queen's lace, devil's-plague)

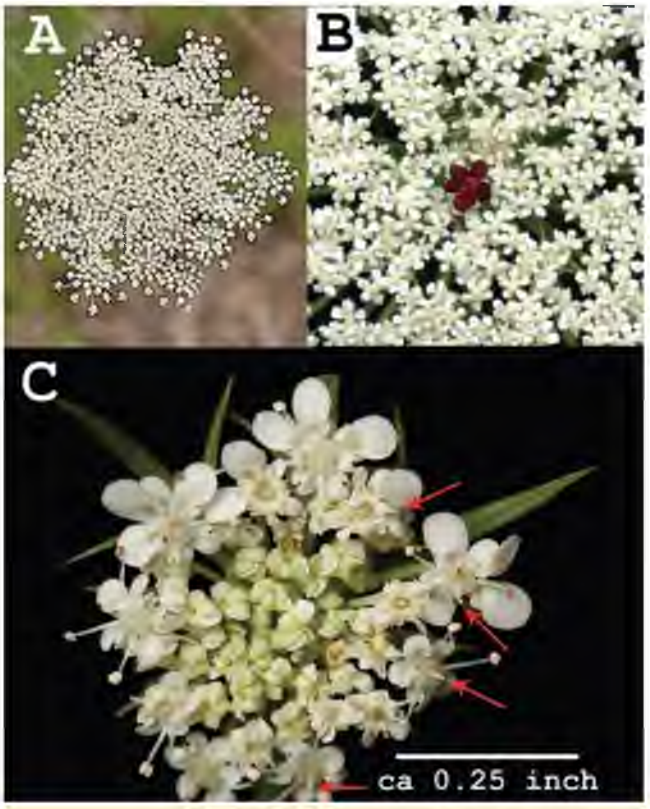
Scientific name: *Daucus carota*

Origin: Carrots are thought by some to have come from a natural variant of wild Queen Anne's lace in Afghanistan, and were domesticated there and in adjacent regions of Russia, Iran, India, Pakistan and Anatolia, a process that may have started 2000-3000 years ago[12].

Plant description: There are two groups of carrots, an annual tropical type and a biennial temperate zone type. Carrots are generally erect herbs with finely cut pinnately compound[6] leaves with long stems that often form sheaths at their base. In its vegetative state (first year of the biennial form) it can be 20 to 50 cm (7.9 to 20 inches) in height, and in its flowering state can be 120-150 cm (47 to 59 inches).

The root of the commercial carrot has a straight compact cylindrical or conical form about 2-5 cm (0.79-2 inch) in diameter at the top, and is 5-50 cm (2-20 inches) in length. Wild types often have a more branched root form. The root portion of the carrot comes in a variety of colors that range through white, black, purple, red, green, yellow and orange. The orange carrots, to which we in the US have become

1 **Inferior position: when it appears that the petals and stamens come from the top of the ovary.**
2 **Carpel: The basic unit that makes up the female part of the flower.**
3 **Ovule: an immature seed. Each carrot flower is, therefore, capable of producing two seeds.**
4 **Umbel: a flat topped or convex flower arrangement with the individual flower stems arising from a more or less single location. Compound umbels are composed of several to many small umbels.**
5 **Schizocarp: a dry fruit without openings for the seeds to emerge, but instead splits into single- seeded segments (in this case two) at maturity.**
6 **Pinnately compound: A compound leaf (separated into distinct leaflets) with the leaflets arranged along the side of the midrib, reminiscent of the sides of a feather.**



Daucus carota flowers. **A**. An entire umbel of a commercial carrot variety. **B**. The center of a wild carrot (Queen Anne's lace). Notice the central red flower, which is found in some, but by no means all wild carrot umbels. **C**. An outside umbel of a commercial carrot cultivar. The central florets have not yet opened. Notice the pistils protruding from the center of the flower (see arrows). This can be best seen on some of the outside florets along the right-hand side of the umbel. Most of the other pistils are projected straight up and all that can be seen is the tip of the style. Also notice the disklike structures from which the pistils extend. This is the location of the nectar secretion. While there are five stamens in a carrot flower, they are fragile and are dropped early in the life of the flower. All photographs of the commercial cultivars were taken in the author's garden; the wild carrot photo was taken on an adjoining property, both a little north of Lansing, MI. Photos taken: A, on 7/24/2009, B. on 6/27/2010 and C. on 7/29/2009.

accustomed, were derived from a mutation in Netherlands during the 17th century, and, therefore, have a narrow genetic base, since they have been derived from only a few 18th century cultivars.

The main carrot inflorescence consists of a 5 to 6 inch diameter terminal primary compound umbel consisting of small white flowers. Below this, there is a series of lesser umbels that decrease in size the farther down on the plant they are located. The different orders of umbels usually flower successively at 8-12 day intervals with the flowering of a single umbel lasting about 7-9 days. The outer umbellets (subumbels) of each umbel are first to flower and this is followed by the flowering of more central subumbels. The pollen at the center of an umbellet is larger than the pollen from the flowers on the periphery of the umbellet, and is also frequently also more fertile than that from the umbellet's edge[12]. The individual flowers are usually perfect, but in the lower parts of the plant there is a tendency to produce male flowers. The ovary of the individual florets is inferior, and the pollen is released before the stigma becomes receptive. In normal flowers, after the pollen is released, the stamens are quickly shed. In the production of hybrids, the stamens of the male-sterile flowers either become petals (petaloid type) in which case they are not shed, or the anthers degenerate and wither before the flower opens (brown-anther type). A normal bisexual flower has five functional stamens and two styles, each leading to a locule[7] of the ovary. Each locule has a single ovule and, therefore, each flower can produce two seeds.

Nectar is produced on the surface of a swollen disc located on the upper surface of the ovary and is easily available to a variety of insects. It apparently both reflects and fluoresces under ultraviolet (UV) light. The anthers are also UV reflective[6]. Because bees can "see" UV light, these properties may be part of the guidance system that directs insects to the pollen and nectar resources of the flower. The center of the top umbel of the wild Queen Anne's lace frequently, but not always, has a small central reddish floret. Its significance is unknown to me. It is sometimes suggested that it attracts pollinators.

Distribution: Nearly all the carrots grown in the U S. are biennials, meaning they will not bloom and produce flowers until they have experienced a winter (vernalization). Carrots that are grown for eating, therefore, will be of no benefit to bees. Originally carrot seed production was carried out primarily in California. Sometimes, however, the winters were not cold enough for vernalization to occur or the summers were too hot for good seed development. As a result, much of the carrot seed production industry has moved to parts of Washington, Oregon, and Idaho. While hybrid carrot seed production is possible, for a variety of reasons it is easier, cheaper and more productive to produce open-pollinated carrot seed. As a result, carrot seed production is split into two production systems; hybrid seed production for the fresh market where quality and appearance are paramount, and open-pollinated production for the processing industry. Approximately 85% of the hybrid carrot seed production is carried out on the eastern side of the Cascade Mountains of Oregon in Jefferson, and surrounding counties [27 & 28]. The distribution indicated by the accompanying map represents that of the wild Queen Anne's lace.

Blooming period: Burgett et al.[4] provide a blooming date for Oregon as late June to mid August.

Importance as a honey plant: Oertel[18], from his questionnaires, found carrot to be important in CA and ME. "Wild carrot" was reported as important in CA. Ayers and Harman[1], from their questionnaires, found carrot to be important in WA, OR and ID. In each instance, the crop was reported to provide commercial pollination opportunities. The difference between the two reports apparently reflects the shift in location of commercial carrot seed production described under **Distribution**.

Both John Lovell[15] and Pellett[19] state that wild carrot produces nectar only occasionally. Lovell defines occasionally as about once every ten years. Pellett cites what appears to be a personal letter from a Pennsylvania beekeeper indicating that he had never seen a bee on wild carrot until 1921 when it "yielded freely" for a time in his locality. Milum[17] places wild carrot it in his minor honey plants list. Burgett et al.[4] state that it is worked mainly for pollen.

Honey potential: Actual honey potential data for carrot appears to be scarce. While it doesn't appear to be among the best of honey plants, it can divert bees from onion pollination (see September 2010

[7] **Locule: as used here indicates the chambers of the ovary that contain seed.**

issue). On the other hand, Franklin[8] describes an incident in 1961 where four strong hives of bees located near an approximately half acre carrot plot could not be made to work the carrots despite redistribution of the hives around the field or the herculean attempt of spraying trails of carrot honey from the hive's entrances to the carrot plot.

Honey: There seems to be a difference of opinion about the quality of carrot honey. Harvey Lovell[14] states, "The honey is usually described as white with a mild flavor." This statement isn't changed in the Goltz[10] edition of this work. On the other hand, a number of authors describe it quite differently. John Lovell[15] describes it as "Yielding a white honey with the flavor of the foliage, which granulates in a few months." After sampling a few carrot leaves, I have concluded that I wouldn't consider honey with that taste to be of high quality. Pellett[19] describes a sample he received from a California beekeeper as, "very dark in color with a strong flavor." He also provides the following quote from Tom Davis of Sacramento, CA, "(the) honey is dark amber and strong (in) flavor. It is somewhat turgid and granulates within two weeks after extraction. It foams quite a bit when heated denoting the presence of yeasts...." Vansell, in his 1931 *Nectar and Pollen Plants of California*[25], describes the honey as being "of light amber color". This is changed in the 1941 Vansell and Eckert[26] edition to, "The honey is dark in color and strong in flavor." Burgett et al.[4] state that the honey from cultivated carrot is "strong flavored" and is used for colony winter feed or by the bakery trade.

Pollen: Carrot flowers are protandrous[8], the pollen being released on the first or second day after the flower opens with the stigma becoming receptive on the third or fourth day, and then remaining receptive for week or more[9]. The pollen is available to a wide variety of insects, perhaps most notably members of the superfamily Apoidea[9][2].

Additional information:

Carrot pollinators

Bohart and Nye[3] studied the insect pollinators of carrot in Utah over a three-year period in three different habits. In these studies they found 334 insect species from 71 families that were, to varying degrees, important in the pollination of carrots. They devised an efficiency rating system for the insects that most commonly visited their carrot plots based on the amount of loose pollen carried on their bodies, their size, flightiness (indicating tendency to cross pollinate) and their contact with stamens and stigmas as they moved across the flower heads. Pollen collecting honey bees received their highest rating (6). About this group they say, "In the case of honey bees the pollen collectors literally wade across the heads, swinging their abdomens back and forth and scraping the pollen from stamens with their forelegs." Nectar-collecting honey bees received only a rating of 4 because they, "stand higher on the flowers, move about less, and lap up droplets from the exposed nectaries." Their categorization of the various groups they found associated with carrot flowers is presented in Table 1. It's an interesting group when one speculates why they are there. Some of them are there for the floral resources of nectar and pollen. That's clearly why honey bees and bumble bees are there. The solitary Apoidea provision their young with pollen. Other visitors probably provision their young with "insect burger" and/or themselves are predators. In both cases, they are there for the kill. Some are probably primarily there for nectar to be used as "flight fuel" so they can go on about their daily routines. Some of the males might have been there to find mates. Some are there to feed on the internal juices (not nectar) of the plants; others to directly feed on the flowers. The researchers come to an interesting, and to me *at first* startling conclusion, that because all insect visitors feed on available resources at the flowers, large numbers of inefficient pollinators tend to reduce, rather than increase pollination, because they remove the resources that attract the efficient pollinators. In some cases they may even remove the pollinators. Pollination indices were developed by multiplying the various individual efficiency ratings by the corresponding numbers of the groups seen in the carrot fields. Honey bees were next to the bottom of the index ratings, just above the tiny flies. The top-rated sphecid wasps probably were there for "flight fuel" so they could go on about their daily predatory routines, or they might have been using the flowers as a "killing field" in order to provision their young with "insect burger". The larger flies placed just under the sphecid wasps. Many of them masquerade as bees or wasps and were probably there mainly for the nectar and pollen, though the males may have been there, at least in part, to find mates.

Table 1. Efficiency ratings of carrot pollinator groups[3].

Highly effecient
Female Apoidea (see footnote 4)
Stratiomyidae (medium and larger flies)
Large Syrhidae (bee-like flies often seen at flowers)
Sphecidae (genus *Tachytes-generally large predatory wasps*)
Moderately efficient
Most Sphecidae (generally largish predatory wasps)
Large Muscoidea (housefly-like flies)
Large Vespidae (paper, potter and mason wasps)
Small male Apoidae (see footnote 4)
Moderately inefficient
Small syrphidae (bee-like flies)
Chrysididae (smallish wasps -- often parasites of wasp and bee larvae)
Small Vespidae (paper, potter and mason wasps)
Ichneumonidae (parasitic wasps)
Rhopalidae (plant feeding bugs)
Small Muscoidea (housefly-like flies)
Highly inefficient
Very small Diptera (flies)
Chalcidoidea (generally very small wasps-- often egg and larval parasites of other insects)
Miridae (small plant feeding bugs)
Coccinellidae (Ladybird beetles--mostly insect predators)
Braconidae (small wasps--parasites of other insects)
Imature Acrididae (grasshoppers--plant feeders)

The researchers recommend that carrots raised for seed should be grown in diverse habitats that would provide greater numbers of natural pollinators. The immature stages of many of these larger flies live in wet and decaying matter and they suggest that providing sources of this type of material near carrot fields would probably improve pollination, and the best way to raise the honey bee pollination index values would be to eliminate competing bee forage and avoid competing crops.

Genetics of Hybrid Carrot seed production

The genetics of male sterility is similar to that of the onion (see this column September 2010). In the September 2010 column I used the word *epistatic* to indicate the "on and off" effect genes can have on other genes in a different location. While that is basically the definition of epistatic, I see it now as a bad choice of words. When the genetic material that controls male sterility is in both the cytoplasm and nucleus the term cytoplasmic male sterility (CMS) is used. It results from an interaction between the genes in the nucleus and a male sterility factor in the cytoplasm. The cytoplasmic factor controls male sterility and is inherited only from the female plants (male sterile plants). Genes in the nucleus can turn off the cytoplasmic control, and if the cytoplasmic factor is not such that it would produce male sterility, the nuclear genes essentially have no effect on pollen production, and the plant produces pollen. Successive inbreeding in carrots quickly reduces plant vigor and, therefore, seed production of carrot hybrids are normally the result of the three-way cross, (AxB) x C, because this procedure produces considerably more seed than the single AxB

[8] **Protandrous: pollen is released before the stigmas are receptive.**

[9] **Superfamily Apoidea: A group of Hymenoptera generally known as bees that collect pollen for their larvae. In North America it is largely the honey bee and the bumble bees that are social, the remainder of the superfamily is largely solitary.**

hybrid cross [12] using inbred A and B lines[10].

Pollination challenges related to honey bee behavior

In the beginning, breeding hybrid carrots was pretty challenging. To be effective bees must transfer pollen from male-fertile to male-sterile plants. Erickson and Peterson[6 & 7] in studies done between 1974 and 1977 and working with petaloid type male sterility[20] in cages, found the following: (1) Male-fertile lines usually, but not always, bloomed ahead of the male-sterile lines and rarely was the bloom synchronized, the difference being as much as 30 days, (2) Five distinctly different aromas were generally noted among various male-sterile plants while only a single aroma was typical in nearly all male-fertile lines, (3) Flowers from male-sterile lines ranged in color from white to green, while all the male-fertile lines produced white flowers, (4) Generally the male-sterile plants produced less nectar than the pollen donor[11], and there was an indication that differences in percentages of nectar solids might also exist. All of these differences would allow the bees to show considerable fidelity to particular lines. As an example, in their 1973 and 1974 studies only 8% of bees initially marked on the white male-fertile line moved to the white male-sterile line and only 5% moved to a green-male sterile line. In their 1976 study 8.5 % crossed over from fertile line-1, 23.6% crossed over from fertile line-2 and 33% crossed over from fertile line-3[12]. Clearly carrot breeders need to pay close attention to developing parental lines that are quite similar.

The results of Rodet et al.[20] in a caged study, using the brown-anther type of male sterility, are somewhat different than those obtained by Erickson and Peterson who apparently used the petaloid type. As one might expect, there were more pollen gatherers on the male-fertile lines than on the male-sterile lines, but in these studies the bees were equally distributed on the different carrot lines. On the male-fertile lines, the pollen gatherers had 14,446 pollen grains while the nectar-gatherers had 9582 grains. On the male-sterile lines the bees had 916 grains, which suggests a relatively small crossover rate between the lines. The researchers seem to argue that this low crossover rate resulted not so much from a fidelity to a particular line, but to a fidelity to a foraging area and "competition between foragers of one colony for the same foraging space". If that is the case, one would expect that fields with landmarks (field corners, buildings and roads etc.) would be particularly troublesome.

Clearly as we began to develop hybrid carrots, there were many problems to be solved. Apparently many of these problems have been largely solved. As mentioned above, the US fresh carrot market is dominated by hybrids. While the older literature exploring the problems is relatively easy to find, *I think I see* a trend that the published solutions are becoming less frequent. I *speculate* that this to some extent is accounted for by a change in whom is doing the research . Once much of the plant breeding was done by, or at least done in conjunction with, university personnel. Back then, the mantra at these institutions was "publish or perish". Today much of the plant breeding is done by the seed companies, and in some cases, large pesticide companies, and *I speculate* that the information that is collected is now considered proprietary.

Need for isolating carrot breeding fields

Carrots are highly protandrous, and therefore, likely to have a high level of cross pollination if other varieties are available. To investigate this, Thompson[23] planted plots of orange rooted carrots as seed parents surrounded by a white rooted variety. Many of these transplants didn't survive to produce flowers, and the ratio of white to orange transplants can't be determined from his article, but there were many more white rooted than orange rooted plants involved. They found the percentage of self-pollination ranged between 0.0 and 2.5 % with an average of 1.1%. The researchers also reported on a similar earlier experiment by another researcher where the percentage of selfing was 2.4%. Thompson went so far as to suggest that hybrids could be made by planting small numbers of one variety along with larger numbers of another variety, and then harvesting the seed of the smaller planting. He pointed out, however, that this would not be economically practical for commercial hybrid seed production because of the "wasted" space occupied by the pollen parent. He also pointed out that other tests needed to be done because all carrot varieties might not act the same. Thompson's research does suggest, however, that some degree of isolation would be necessary to produce seed that would provide pure plantings of a given carrot type.

Franklin[8] proposed a series of isolation distances similar to his proposal for onions (see September 2010 column) for the production of both orange open-pollinated varieties, as well as for orange hybrids. In general the recommended distances for open-pollinated varieties were less than for hybrid seed production, and within each system the distances recommended increased as the differences in carrot type, shape and/or color increased. The recommended distances for open-pollinated varieties ranged from 1 mile down to 1/4 mile while those for hybrid seed production ranged from, 3 miles down to 1/2 mile. Kalia[12] states that the isolation distance for fields producing commercial seed crops should be 1000m (0.62 miles) and this should be increased to 1600m (0.99 miles) for "basic seed" production. Presumably, isolation should also include at least some isolation from wild carrots (Queen Anne's lace).

Spacing carrot lines for hybrid seed production

Franklin studied the effect of distance between the male-fertile plants to male-sterile plants during 1963 and 1964. The field was laid out with 21 rows of male-sterile plants between a two single rows of male-fertile plants. The 288 ft long rows were spaced 3 ft apart, and the blooming dates of the two varieties coincided closely. In 1963, the two outside male-sterile rows averaged 21.5 lbs of seed, while the two central rows averaged yields of only 12.1 lbs of seed. In the 1964 study, the two outside male-sterile rows averaged yields of 9.4 lbs of seed, while the two central rows averaged 8.9 lbs of seed. The authors concluded that in 1963 there was a diminishing seed yield toward the center of the field, but that this didn't happen during 1964. I found no explanation for the poorer overall yields of 1964 as compared to 1963.

Takahashi[22] states in Japan the ratio of male-sterile to male-fertile plants ranges between 2 to 4 male-sterile plants to 1 male-fertile plant. Kalia[12] reports that a 4 to 1 ratio is common and this is often grown in an 8 to 2 arrangement.

Number of bees recommended for pollination

In a four-year study (1954-1957) Hawthorn et al.[11] studied pollination in: (1) uncaged carrot plots, (2) cages with honey bees, (3) cages that admitted only "tiny" insects and (4) cages that were designed to essentially be insect free. They found the carrot seed yield of the carrots caged with honey bees and the yields from the open field situation to not be statistically different except for the year 1957, when the honey bee populations in the field were exceptionally low, which was reflected by exceptionally low seed yields from the open plots. Based on the lowest average yearly population of caged bees over the four years, they estimated that 8 bees per square yard "is apparently as high as the plants can use to advantage". They also speculated that smaller populations would probably work just as well, but admitted they hadn't the data to back such a claim.

In addition to producing lower seed yields, with the exception of 1957 when the honey bee population in the field was exceptionally low, the open-field plots and the plots caged with honey bees provided significantly higher quality seed than the other caged plots. During 1957 the open field plots also produced high levels of poor quality seed. McGregor[16] doesn't suggest a number of colonies per se, but based on the research by Hawthorn et al. just reported above, suggests at least 8 bees per square yard, regardless of the

[10] Inbreeding produces plants that have many gene locations occupied by the same two genes (homozygous condition), but usually inbreeding reduces vigor. Two homozygous plants when crossed produce hybrids that are very much alike and the resulting hybrids frequently have their vigor restored.

[11] This apparently occurred in the caged studies, but *to me*, the greenhouse data found in the authors' Table 1[6] seems to indicate that in the greenhouse, the results were reversed with the number of microliters of nectar produced/plant varying between 0 and 500.

[12] In the third instance much of the fertile line had been removed during flowering and the results were, therefore, in question.

number of colonies needed to provide that number.

Delaplane and Mayer[5] provide references for recommendations for *open-pollinated* carrot seed production of 2 to 4 hives per acre (5-10 hives per ha) with an estimated literature average of 3 hives per acre (7.5 hives per ha). For *hybrid seed production* they recommend 4-6 hives per acre (10-14.8 hives per ha). Alternatively, they suggest 6-8 bees per square yard (7.2- 9.6 bees per square meter) and provide an estimated literature average of 7.3 bees per square yard (8.8 bees per square meter).

References

1. **Ayers, G. S. and J. R. Harman. 1992.** Bee Forage of North America and the Potential for Planting for Bees. In The Hive and the Honey Bee (J. M. Graham, Ed.), Dadant and Sons. Hamilton, L.
2. **Baumgardt, J. P. 1982**. How to Identify Flowering Plant Families--A Practical Guide for Horticulturists and Plant Lovers. Timber Press. Portland, Oregon.
3. **Bohart, G. E. and W. P. Nye. 1960.** Insect pollinators of carrots in *Utah. Utah Agricultural Experiment Station Bulletin* 419.
4. **Burgett, D. M., B. A. Stringer and L. D. Johnston. 1989.** Nectar and Pollen Plants of Oregon and the Pacific Northwest. Honeystone Press. Blodgett, OR.
5. **Dellaplane, K. S. and D. E. Mayer 2000.** Crop Pollination by Bees. CABI Publishing. New York.
6. **Erickson, E. H. and C. E. Peterson. 1979a.** A synchrony of floral events and other differences in pollinator foraging stimuli between fertile and male-sterile carrot inbreds. *Journal American Society of Horticultural Science* 104: 639-643.
7. **Erickson, E. H. and C. E. Peterson. 1979b.** Problems encountered in the pollination of cytoplasmically male-sterile hybrid carrot seed parents. *Proceedings of the Fourth International Symposium on Pollination, Maryland, (*1978): 59-63.
8. **Franklin, D. F. 1970.** Problems in the production of vegetable seed. In: The Indispensible Pollinators, A Report of the Ninth Pollination Conference, Hot Springs, Ark, Oct 12-15, 1970. University Arkansas Agricultural Extension Service MP 127: 112-141.
9. **Free, J. B. 1993.** Insect Pollination of Crops (2nd Edition). Academic Press. Ltd. London.
10. **Goltz, L. R. 1977.** Honey Plants--A revised edition of the original Honey Plants Manual of Harvey B. Lovell, Ph.D. *Gleanings in Bee Culture* 1977.
11. **Hawthorn, L. R., G. E. Bohart and E. H. Toole, W. P. Nye and M. D. Levin. 1960** Carrot Seed Production as Affected by Insect Pollination. *Utah Agricultural Experiment Station Bulletin 422*.
12. **Kalia, P. 2004.** Root Vegetable Crops**.** In: Hybrid Vegetable Development. Singh, P. K, S. K. Dasgupta, and S. K. Tripathi Eds. Foods Products Press. New York.
13. **Liberty Hyde Bailey Hortorium Staff. 1976.** Hortus Third. A Concise Dictionary of Plants Cultivated in the United States and Canada. Macmillan Publishing Co. Inc. New York.
14. **Lovell, H. 1966.** Honey Plants Manual: A Practical Field Handbook for Identifying Honey Flora. A. I. Root Co. Medina, OH
15. **Lovell, J.H. 1926**. Honey Plants of North America. A. I. Root Co. Medina, OH.
16. **McGregor. S. E. 1976.** Insect Pollination of Cultivated Crop Plants. Agriculture Handbook No. 496, Agricultural Research Service. United States Department of Agriculture. Washington D. C. This publication is being updated and is available on the web at gears.tucson.ars.ag.gov/book
17. **Milum, V. G. 1957.** Illinois Honey and Pollen Plants. Contributions from the Department of Horticulture, University of Illinois. Urbana, IL.
18. **Oertel, E. 1939.** Honey and Pollen Plants of the United States. U. S. D. A. Circular 554 U. S. Government Printing Office. Washington D.C.
19. **Pellett, F. C. 1978.** American Honey Plants. Dadant and Sons, Hamilton, IL.
20. **Rodet, G., J. P Grosse and A. Bonnet 1991.** Foraging behavior of Apis mellifera L. on male-sterile and male-fertile inbred lines of carrot (*Daucus carota* L) in gridded enclosures. The 6th International Symposium on Pollination, Tilburg, The Netherlands, August 1990. *Acta Horticulturae* 288: 371-375.
21. **Smith, J. P. 1977.** Vascular Plant Families. Mad River Press. Eureka, CA.
22. **Takahashi, O. 1987**. Utilization and seed production of hybrid vegetable varieties in Japan. In: Hybrid Production of selected cereal oil and vegetable crops (Eds. Feistritzer, W. P. and A. F. Kelly. FAO Plant Production and Protection Paper 82. pp 313-328.
23. **Thompson, D. J. 1962** Natural cross-pollination in carrots. *Proceedings Amcerican Society of Horticultural Science* 81: 332-334.
24. **USDA, NRCS. The PLANTS Database,** Version 3.5 (http://plants.usda.gov). National Plant Data Center, Baton Rouge, LA 70874-4490 USA
25. **Vansell, G. H. 1931.** Nectar and Pollen Plants of California. University of California Agricultural Experiment Station Bulletin 517. Berkley, CA.
26. **Vansell, G. H. and J. E. Eckert. 1941.** Nectar and Pollen Plants of California. University of California Agricultural Experiment Station Bulletin 517 (1941 Revision), Berkley, CA.
27. http://www.ag.ohio-state.edu/~seedsci/vsp02.html
28. http://extension.oregonstate.edu/catalog/pdf/em/em8879-e.pdf

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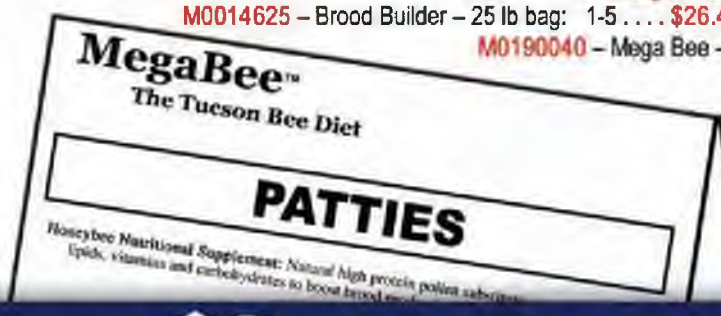

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1 pound	12	1 (58 mm)	M001962	8	$8.49
1 pound	24	1 (58 mm)	M001972	14	$16.30
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