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AMERICAN BEE JOURNAL

VOLUME 150 NO. 5 MAY 2010

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May Cover Picture

This beautiful photo of a honey bee foraging on an apple blossom was taken by Tibor I. Szabo, RR 1, Puslinch, Ontario, Canada N0B 2J0. Honey bees provide a vital source of pollination to both commercial and family orchards around the country.

The American Bee Journal ISSN 0002-7626

THE AMERICAN BEE JOURNAL (ISSN 002-7626) is published monthly at American Bee Journal, 51 S. 2nd Street, Hamilton, IL 62341. Periodicals Postage Paid at Hamilton, IL and at additional mailing offices. POSTMASTER: Send address changes to American Bee Journal, 51 S. 2nd Street, Hamilton, IL 62341. In the **United States**, $26.00 a year; two years, $49.30 and three years, $69.55. **Canada** $31.00 a year; two years $59.30 and three years $84.55. **Foreign** $44.00 a year; two years $85.30 and three years $123.55. Subscriptions stop at expiration date printed on label. Available in microfilm form at moderate prices by writing to National Archive Publishing Co., 300 N. Zeeb Road, P.O. Box 998, Ann Arbor, Michigan 48106. 1-800-420-6272.

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Due to size and content, we may be unable to publish all information received. Thank You!

REVIVING THE BOY SCOUT BEEKEEPING MERIT BADGE

Boy Scout Christopher Stowell Beekeeping merit badge inset.

Häagen-Dazs Ice Cream announced it is joining forces with 13 year-old Boy Scout Christopher Stowell of Troop 250, Skiatook, OK. Christopher is a beekeeper and is petitioning the Boy Scout Council for reinstatement of the Boy Scout Beekeeping merit badge that was discontinued in 1995. To sign the letter and petition, visit "The Buzz" page at **http://www.helpthehoneybees.com/#buzz**.

"Christopher is an amazing advocate for honey bees and serves as a great example of learning about a problem and working to find a solution," said Mara Lowry, Häagen-Dazs brand manager. "It's because of people like him that we continue to be encouraged and inspired to work to help both bees and beekeepers, and we urge everyone to do their part. Signing this letter and petition is one small but impactful thing people can do."

"Christopher says, "I believe that now more than ever before, the survival of the honey bee is important to all. If other boys are not encouraged to learn how to become beekeepers, the honey bee will surely die out. Not only do I feel this way, but beekeepers all across America believe in the importance of teaching the younger generations the importance of the honey bee."

He enlisted our help and that of beekeeping organizations across the country for their endorsement and pledge that they will help train the Boy Scouts interested in beekeeping.

We encourage you to send the letter for Christopher. Feel free to add your own thoughts in the designated area. Häagen-Dazs will print and send all of the letters to Christopher at the end of June to support his proposal.

You can also sign a petition at The Experience Project website (**www.experienceproject.com/helpthehoneybees**) to show your support.

Good luck Christopher! We appreciate your hard work! (From March 2010 The Minnesota Hobby Beekeeper Newsletter)

Bob Sitko
Minnesota

NATIONAL HONEY BEE DAY

August 21, 2010 has been designated as National Honey Bee Day. We are asking for state and county bee associations to participate, promote, and take advantage of this special occasion. The national honey bee day allows individual bee groups to benefit from a national approach by making our voices heard by the combined efforts of all participating.

National honey bee day 2009 consisted of 42 programs, across 16 states, all focused on educating the public and expanding the beekeeping industry. Some of the programs last year consisted of open houses at bee yards, educational programs at environmental centers, booths at county and state fairs, association membership drives, and honey-tasting events.

This past year beekeepers all across the country voted through the national honey bee day website for a national theme. The selected theme for 2010 is "Local Honey – Good for Bees, You, and the Environment!" This year we have a goal to double the number of groups participating. Please consider contacting your local association if they are not participating in this worthwhile program.

National Honey Bee Day is administered through "Pennsylvania Apiculture, Inc." a non-profit 501 (c) filed with the state of Pennsylvania.

For additional information please visit the website: **www.nationalhoneybeeday.org**

Mike Thomas

FIRST WORLD ORGANIC BEEKEEPING CONFERENCE SCHEDULED FOR BULGARIA

The First World Conference on Organic Beekeeping is going to take place in Sunny Beach, Black Sea Coast, Bulgaria, from 27 to 29 August 2010.

This unique beekeeping event is organized by the Bulgarian Apimondia member association NBPS (Bulgarian Beekeeping Union) and the Bulgarian Organic Beekeeping Association.

We are pleased to inform you that the conference website is now ready for abstract submission (**www.bee-hexagon.net/en/abstract.htm**) and registration (**www.bee-hexagon.net/en/registration.htm**).

For any further information or assistance in organizing your participation in the congress, please feel free to contact the conference coordinator Dr. Stefan Bogdanov at **info@bee-hexagon.net** or the Apimondia headquarters in Rome at **apimondia@mclink.it**.

Looking forward to welcoming you this summer in Bulgaria!

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*Internet: **www.apimondia.org***

VISIT WITH A BEEKEEPER IN SHENDI, NORTHERN SUDAN

Shendi is a town about three hours north of Khartoum in Sudan. Although Sudan gets a lot of bad press for its wars and conflicts in Darfur and the South, as Africa's largest country, most of its vast territory is free of conflict. My husband and I were in Shendi for several weeks in December 2009 for his archaeological excavation at Abu Erteila, about 40 minutes from Shendi town. As beekeepers and Arabic speakers, we naturally began to ask around town if there were any beekeepers in this mid-sized agricultural town next to the Nile river. I had brought some honey from our Rhode Island hives that was highly prized by our hosts in upper Shendi, the family of Abu Talib Osman and his energetic and engaging wife, Maha. Through this tightly knit society, we easily found a local beekeeper, Abdel Karim Sayed, who is a third-generation beekeeper. He has a large area of fertile lands just next to the Nile river where he has kept up to 10 hives over the years, learning the trade from his father and grandfather.

Beekeeping is not easy in this hot, dry climate where summer temperatures can climb to 120-130 degrees Fahrenheit. The forag-

The author with Sudanese beekeeper Abdel Karim in his fields with her Sudanese host family Abu Talib, wife Maha, and daughter Sajda

ing season is short and occurs in the winter months of January and February when the only flowering of natural and cultivated plants and trees occurs resulting in relatively low yields of honey at about 20-30 pounds per hive. He reported that he averages a total of about 200 pounds of honey from his 10 hives. This surprised us as we thought foraging months would be greater than in our temperate climate, but intense heat is a deterrent to natural flowering plants and honey flows. Abdel Karim uses Langstroth hives, although some traditional beekeepers in the Egyptian Nile Valley still use the long, tubular ceramic hives dating from Pharaonic times. He prefers Carniolan queens that he purchases from neighboring Egypt to the north. Beekeeping is no less expensive in Sudan than in the US. A package of bees purchased from Egypt is about 400 Sudanese Pounds (= $200), and a single queen sells for 40 Pounds, about $20 US dollars. Mr. Abdel Karim is a local businessman who owns a soap factory, so farming and beekeeping combine to make a diverse economic livelihood for him and his family.

Mr. Abdel Karim has suffered his share of losses like beekeepers around the world. However, his recent loss is unique. In 2007 the Nile River flooded and his 10 hives were destroyed (see picture) by the swirling river in his bee yard near to his farming fields. He reported that all of the bees fled the hives in advance of the rising waters, so they were not drowned. The bees are now are tantalizing him by living in the trees in his fields, he says, but he has failed to capture and regain a single colony or swarm. "I can hear them and they are active in the fields still pollinating my crops, but I have not attracted them back to the hives." He has Mango and Lime trees and grows fodder (birseem) for his livestock.

In January 2010 Abdel Karim plans to start again and slowly rebuild his bee yard. In our pleasant late afternoon conversation we discussed the challenges and rewards of beekeeping. He had not heard of colony collapse disorder and nothing like this has affected beekeeping in the region. He did describe the death of a man in his childhood from multiple bee stings, perhaps from the spread of African bees to the area that historically has more in common with Mediterranean patterns of beekeeping, rather than those of sub-Saharan areas where bees are "kept" in logs and trees, or a variation of the Langstroth box with slats, but without foundation.

The local family with whom we stayed were well aware of the health-promoting properties of honey and welcomed the jar of Rhode Island honey I brought as a gift. Sajda, the youngest daughter, was bitten in her sleep by an insect that caused her eye to swell. Maha, her mother, put the RI honey on her eye and the swelling disappeared overnight. Honey is highly valued, but native honey is scarce, so the Sudanese import honey from Saudi Arabia and China. Maha expressed interest in keeping bees, and indeed a local honey supply could be generated by small entrepreneurs placing their hives in the lush fields that line the river Nile.

Carolyn Fluehr-Lobban
cfluehr@ric.edu

Abdel Karim's hives after the Nile waters flooded his bee yard.

WISCONSIN HONEY BILL PASSES

Senate Bill 419

March 15, 2010—Wisconsin's Governor Jim Doyl signed into law The Wisconsin Honey Standard, Wisconsin Senate Bill 419. The bill provides legal recourse for honey producers harmed by the sale of adulterated honey. It also provides for a "Certified Wisconsin Honey" label on a voluntary basis.

December 3, 2009 - Introduced by Senators Vinehout, Lehman, Miller and Schultz, cosponsored by Representatives Garthwaite, Vruwink, Barca, Ballweg, Brooks, Clark, Hilgenberg, Kerkman, Knodl, Molepske Jr., A. Ott, Pasch, Pope-Roberts, Ripp, Roys, Schneider, Steinbrink, Tauchen, Turner, A.Williams, Young and Zigmunt Referred to Committee on Agriculture and Higher Education.

An Act to create 100.187 of the statutes; relating to: requiring the Department of Agriculture, Trade and Consumer Protection to establish standards for products sold as honey, prohibiting the labeling as Wisconsin certified honey of a product that has not been determined to meet the standards, prohibiting the labeling as honey of a product that does not meet the standards, and requiring the exercise of rule-making authority.

Analysis by the Legislative Reference Bureau

This bill requires the Department of Agriculture, Trade and Consumer Protection (DATCP) to promulgate rules that establish standards for products sold as honey and standards for the testing by private laboratories of samples submitted by persons who wish to sell honey produced in this state as Wisconsin certified honey. The standards for honey must be consistent with the standard for honey under the Codex Alimentarius of the Food and Agriculture Organization of the United Nations and the World Health Organization.

The bill prohibits labeling a product as Wisconsin certified honey or implying that a product is Wisconsin certified honey, unless the product has been determined by testing to meet the standards established by DATCP, DATCP has approved a summary of the testing, and the product was produced in this state. Under the bill, DATCP investigates violations of this prohibition and may bring an action to enjoin violations.

The bill also prohibits labeling a product as honey or implying that a product is honey, unless the product meets the standards established by DATCP. Any person who suffers damages as a result of a violation of this prohibition may bring an action against the violator to recover the amount of the person's damages or $1,000, whichever is greater, plus reasonable attorney fees.

The people of the state of Wisconsin, represented in senate and assembly, do enact as follows:

SECTION 1. 100.187 of the statutes is created to read:

100.187 Sale of honey and Wisconsin certified honey; rules, prohibitions. (1) The department shall promulgate rules that do all the following:

(a) Establish standards for products sold as honey that are consistent with the standard for honey under the Codex Alimentarius of the Food and Agriculture Organization of the United Nations and the World Health Organization, number 12-1981, as revised in 2001.

(b) Establish standards for testing by private laboratories of samples submitted by persons who intend to sell honey produced in this state as Wisconsin certified honey to determine whether the samples meet the standards established under part. (a).

(2) (a) No person may label a product as Wisconsin certified honey or imply that a product is Wisconsin certified honey unless all of the following apply:

1. The product has been determined to meet the standards established under sub. (1) (a) by a laboratory whose testing procedures meet standards established under sub. (1) (b).

2. A summary of the results of the testing performed under sub. 1 have been submitted to the department and approved by the department.

3. The product was produced in this state.

(b) The department shall investigate violations of this subsection and may bring an action for permanent or temporary injunctive or other relief in any circuit court against a person who violates this subsection.

(3) (a) No person may label a product as honey or imply that a product is honey unless the product meets the standards established under sub. (1) (a).

(b) Any person who suffers damages as a result of a violation of this subsection may bring an action for damages against the violator for the amount of the person's damages or $1,000, whichever is greater. Notwithstanding s. 814.04 (1), a court shall award to a prevailing plaintiff in an action under this paragraph reasonable attorney fees.

Pictured with Governor Doyl from left to right are: Alan Baldwin, Karen Buch, Tim Fulton, Senator Kathleen Vinehout, Dan Buch, Abby Tracy, 2010 Wisconsin Honey Queen, Wally Nass and John Piechowski.

USDA SEEKS COMMENT ON DRAFT PEST RISK ASSESSMENT ON HONEY BEES IMPORTED FROM AUSTRALIA INTO THE UNITED STATES

United States Department of Agriculture
Animal and Plant Health Inspection Service

The U.S. Department of Agriculture's Animal and Plant Health Inspection Service (APHIS) is announcing to the public that it has prepared an evaluation of the pest risks associated with the importation of honey bees from Australia. The draft pest risk assessment considers potential pest risks involved in the importation of honey bees into the United States from Australia after concerns that exotic honey bee pathogens or parasites may have been introduced into Australia. APHIS is making the draft pest risk assessment available to the public for review and comment.

This action was published in the March 15, 2010 *Federal Register*.

Consideration will be given to comments received on or before May 14. You may submit comments by either of the following methods:

· Federal eRulemaking Portal: Go to http://www.regulations.gov/fdmspublic/component/main?main=DocketDetail&d=APHIS- 2010-0001 to submit or view comments and to view supporting and related materials available electronically.
· Postal Mail/Commercial Delivery: Please send two copies of your comment to Docket No. APHIS-2010-0001, Regulatory Analysis and Development, PPD, APHIS, Station 3A- 03.8, 4700 River Road Unit 118, Riverdale, MD 20737-1238. Please state that your comment refers to Docket No. APHIS-2010-0001.

Comments are posted on the Regulations.gov Web site and also can be reviewed at USDA, Room 1141, South Building, 14th St. and Independence Ave., S.W., Washington, D.C., between 8 a.m. and 4:30 p.m., Monday through Friday, excluding holidays. To facilitate entry into the comment reading room, please call (202) 690-2817.

Federal Register
Vol. 75, No. 49
Monday, March 15, 2010

DEPARTMENT OF AGRICULTURE
Animal and Plant Health Inspection Service
[Docket No. APHIS-2010-0001]

Notice of Availability of a Draft Pest Risk Assessment on Honey Bees Imported from Australia

Other Information: Additional information about APHIS and its programs is available on the Internet at (http://www.aphis.usda.gov/).

FOR FURTHER INFORMATION CONTACT: Dr. Colin D. Stewart, Senior Entomologist, PPQ, APHIS, 4700 River Road Unit 133, Riverdale, MD 20737-1237; (301) 734-0774.

SUPPLEMENTARY INFORMATION:
Background

The regulations in 7 CFR part 322 restrict the importation, interstate movement, and transit through the United States of bees, beekeeping byproducts, and beekeeping equipment to prevent the introduction of pests into the United States through the importation of honey bees from approved regions. Australia is currently on the list of approved regions from which adult honeybees maybe imported into the United States under certain conditions.

In March 2002, APHIS issued a report assessing the risks of pest introduction into the United States in imports of honey bees (*Apis mellifera* L.) from Australia. The evaluation identified 15 pathogens and pests of bees in that country, all of which occur in the United States. The evaluation concluded that there were no quarantine-significant honey bee pathogens or pests occurring in Australia.

In the 7 years since the completion of the evaluation for Australian bees, new threats to the U.S. honey bee population have emerged. The most prominent threat is Colony Collapse Disorder, a mysterious syndrome characterized by the abrupt disappearance of a colony's adult worker bee population, leaving a substantial population of healthy brood, an absence of dead bees, and the delayed invasion of hive pests and robbing of hive stores by neighboring colonies. A link between the disorder, first reported in the United States in 2006, and honey bee imports from Australia has been suggested. The May 2007 discovery of colonies of the Asian honey bee (*Apis cerana*) near Cairns, Victoria, also has raised concerns that exotic honey bee pathogens or parasites may have been introduced into Australia with the arrival of this foreign bee. These developments suggest a need to reevaluate the risks involved in importation of bees from Australia.

APHIS' review and analysis of the risks associated with the importation of honey bees from Australia are documented in detail in a draft pest risk assessment (PRA) titled, "Evaluation of Pest Risks Associated with Importation of Honey Bees (*Apis mellifera* L.) from Australia" (November 2009). Findings presented in the draft PRA state that there are honey bee viruses present in Australia that are not known to occur in the United States. The draft PRA concludes that zoosanitary measures may be necessary to reduce the possibility of the introduction of these viruses to the United States via the importation of honey bees from Australia.

We are making the draft PRA available to the public for review and comment. We will consider all comments that we receive on or before the date listed under the heading DATES at the beginning of this notice. The draft PRA and the comments received may be the basis for a future change in the regulations.

The draft PRA may be viewed on the Regulations.gov Web site or in our reading room (see ADDRESSES above for instructions for accessing Regulations.gov and information on the location and hours of the reading room). You may request paper copies of the draft PRA by calling or writing to the person listed under FOR FURTHER INFORMATION CONTACT. Please refer to the title of the draft PRA when requesting copies.

Done in Washington, DC, this 8th day of March 2010. Kevin Shea, Acting Administrator, Animal and Plant Health Inspection Service.

[FR Doc. 2010-5573 Filed 3-12-10; 8:45 am]
BILLING CODE 3410-34-S

UPDATE ON MITE-AWAY QUICK STRIP™ REGISTRATION IN THE UNITED STATES

Press release from NOD Apiary Products

Mite-Away Quick Strip™ (MAQS) is currently registered in the State of Hawaii, under a Special Local Needs registration, granted to protect Hawaii's queen rearing and organic honey industry. Varroa was first discovered in Hawaii in June, 2007.
In January, California State Beekeepers Association applied for a Section 18 emergency registration for California. In response, the EPA stated that there "has to be a lack of viable alternatives", and there has to be the occurrence of a "non-routine event", in order to allow a Section 18 registration. As well, there is already a Section 18 in place, for Hivastan®, for States to draw upon. The current varroa toolbox includes Apiguard®, Apilife Var®, Apistan®, Hivastan®, Check-Mite+®, Mite-AwayII™, and the EPA even talked about the illegal use of Amitraz. The EPA did not see the need for another emergency registration.

Immediately, NOD will be pursuing a Section 3 (full federal) registration for MAQS, hoping that this will be expedited. EPA has indicated Section 3 applications for biopesticides, such as MAQS, are to be fast tracked.

Beekeepers under stress are continuing to call. Due to the lowest honey crop on record in the US last year, and the need to protect the industry from the varroa mites in the critical summer honey flow time, some state beekeeping associations are looking into pesticide registration options for MAQS at the state level. Whether or not the EPA will consider the record low crop in 2009 to be a "non-routine" event is unknown.

NOD Apiary Products will continue to support beekeeping industry initiatives as it strives to obtain the legal use of Mite-Away Quick Strips™ prior to the Section 3 registration being granted, likely in 2011.

Please note that only limited quantities of Mite-AwayII™ are available. Production of Mite-AwayII™ was discontinued in order to gear up for MAQS production. NOD is not planning on resuming Mite-AwayII™ production as we transition our registration into the MAQS product.

INDIANA BEE SCHOOL WAS A BIG SUCCESS

All participants in the Indiana Beekeepers' Association's Indiana Bee School VIII held on February 27, received a passing grade. The principal speakers were David Tarpy and Kirk Webster. We had a packed house; this being the first time ever that we had to enforce our registration deadline. The buzz of the new beekeepers continues to get louder each year. We only wish that the buzz of our honey bees would get louder. The **B.I.G.** (Bee Inspection Group) team of Ron Myers, Eldon Morehouse and Steve Doty reported their findings from the first year of their USDA North Central **SARE's** (Sustainable Agriculture Research & Education) grant. They received a grant: "Evaluation of the declining honey bee health and education of participating beekeepers". In 2009, they visited 54 different apiaries of beekeepers who volunteered to be a part of the study. Each one received a hive tool and a bee book "First Lessons in Beekeeping" for participating. These beekeepers had experienced a loss of 127 of their 282 hives (45.0 %) during the 2008/2009 winter. However, on a positive note, by summer of 2009, they had replaced those losses and added another 75 hives (26.6 %).

As for three of the biggest commercial beekeepers in the State, they lost 1810 (35.2 %) of their 5142 hives. By summer, they had replaced all but 9% of those losses. Part of that 9% was the selling of nucs to small beekeepers, which has become a big business for them.

The second part of the grant involved the purchase of a microscope so that the B.I.G. team could inspect for nosema. A sample of 30+ bees was taken from each of 225 different hives at the 54 locations. Nosema was detected in 57 (25.3 %) of those samples. We were hoping to be able to differentiate between *Nosema apis* and *Nosema ceranae*, but haven't been able to do that so far. We are working with Purdue University on that issue. They have done DNA studies on some of the samples for us. We have one more year to complete the study. Some beekeepers are reporting 60-70% losses already for this recent 2009/2010 winter. A poor nectar flow in the late summer and fall plus having a long sustained cold winter are likely to be the major contributors to those losses. Even though times continue to be very challenging, the beekeepers of Indiana continue to be positive.
Article by Steve Doty (jsdoty@indy.net)

PENNSYLVANIA HONEY QUEEN CROWNED

The Pennsylvania State Beekeepers Association is proud to announce that Teresa Bryson was selected as the 2010 Pennsylvania Honey Queen during its annual winter meeting in Lewisburg, PA.

Teresa, 18, lives with her family on Walnut Grove Apiaries, a small sheep, goat and honey farm in Chambersburg, PA. In addition to caring for a hive of bees and the other farm animals, Teresa is a sophomore at Hagerstown Community College, double majoring in Forensic Science and English.

Teresa is an active 4-H member, having been involved in the Franklin County 4-H program for the past ten years. Through the various clubs she attends, Teresa has received numerous Best of Show awards, the Junior Achievement Award, I Dare You Award and has been chosen for state level competition for several of her projects. Moreover, Teresa is an agricultural educator at the 4-H Agricultural Center, instructing local students about the importance of Agriculture in Franklin County.

Teresa Bryson, 2010 Pennsylvania Honey Queen

In her free time, Teresa enjoys reading, sewing, working in the family apiary and caring for the many animals on her families small farm. As the 2010 Pennsylvania Honey Queen, Teresa will travel throughout the state promoting the beekeeping and honey industries by attending schools, fairs, festivals and participating in media interviews. In addition, Teresa will represent Pennsylvania in 2011 as she competes for the American Honey Queen title in Galveston, Texas.

VERMONT

Organic Beekeeping Principles and Practices

May 15-16, 2010
5/15 - 1:30 p.m - 6:00 p.m. (Optional beginner session at 9 am)
5/16 - 9:00 a.m. - 5:30 p.m.

This workshop covers topics suitable for small-scale commercial and hobby beekeepers, with a primary focus on intermediate and advanced methods. For beginners, a special Saturday morning session that covers hive construction and layout, the basics of bee biology, and handling bees is strongly recommended. The rest of the workshop, Saturday afternoon/evening and all day Sunday, presents natural and organic beekeeping topics and practices not ordinarily covered in lectures and articles, including: presence and mindfulness in the beeyard; swarming as an expression of the bees vitality; working with swarms and making nucleus colonies; non-toxic mite and foulbrood control; apitherapy; over-wintering, and an appreciation for the role that pollinators play within the Earth's ecosystem. Weather permitting, the day will be punctuated with visits to the hives, where techniques for handling bees are demonstrated with opportunities for hands-on experience by workshop participants. Bring a veil, if you have one.

Presenter: Ross Conrad, author Natural Beekeeping

Location: Metta Earth Institute, 2234 Geary Rd. South, Lincoln, VT 05443

Fee: $95 Includes snacks. Meals and lodging may be pre-arranged. Please call for more information. (802-453-8111 ask for Gillian)

To register call: 802-545-2396
http://www.dancingbeegardens.com/Workshops.html
http://www.mettaearth.org/classes.php4

VERMONT

The Vermont Beekeepers Association will hold their annual summer meeting Saturday, July 24, 2010 at the Long Trail School in Dorset, VT. Registration & refreshments begins at 8:30 a.m. Meeting runs from 9:15 a.m. - 4:00 p.m. and a potluck lunch will be served. Guest speaker: Prof. Marla Spivak of the University of Minnesota. For more information call Bill Mares 802-863-4938 or email: **bill.mares@gmail.com**

NEW HAMPSHIRE

Charles Andros, former NH/VT Apiary Inspector, will hold a beekeeping workshop from 1-3:30 PM on Saturday, May 15, at 18 MacLean Road, Alstead, NH 03602. Look for the "BEE" sign on the south side of Walpole Valley Road. Topics of discussion: finding queens, requeening and 2-queen colonies, pollen collection, swarm control, supering, and bee venom therapy. Bring a veil, if you have one, as we shall be opening some colonies. We'll be inside if it is a rainy day. Water and chair may also come in handy. Registration required. email: **lindena@sover.net** or call 603-756-9056.

NEW YORK

Here is an updated list of organic beekeeping events at the Pfeiffer Center this spring and summer. PLEASE NOTE that the date for the summer workshop has changed; it will be on June 19, not June 26. And we are delighted to announce that Ross Conrad will give an additional workshop on Apitherapy on June 20. This may be taken by itself, or in combination with the

June 19 workshop for a 10% discount on both.

June 19, Chestnut Ridge, NY. Summer Organic Beekeeping, with Ross Conrad. Focuses on seasonal tasks including working with swarms and preparing for the honey harvest. 9 am to 6 pm, $95 ($135 combined with June 19 workshop). 845-352.5020 x 20 **info@pfeiffercenter.org www.pfeiffer center.org**

June 20, Chestnut Ridge, NY. Apitherapy: Health and Healing from the Hive, with Ross Conrad. Focuses on seasonal tasks including with swarms and preparing for the honey harvest. 9 am to 1 pm, $55 ($135 combined with June 19 workshop). 845-352.5020 x 20 **info@pfeiffercenter.org www.pfeiffercenter.org**

PENN STATE POLLINATION CONFERENCE

The Penn State Center for Pollinator Research is Sponsoring an International Conference on Pollinator Biology, Health and Policy

Pollinators are essential for both plants and animals in agriculture and natural ecosystems, but there have been dramatic declines in pollinator populations worldwide. Pollinator decline has not only alarmed the scientific community, but gained prominence in the popular press, raising the public's awareness about threats to our ecosystem. The causes for pollinator decline are complex, and it is thought that a combination of many stressors are responsible, including pests, pathogens, environmental toxins, and disruptions in landscape ecology resulting in reduced nutrition and habitat. Addressing these issues will require multidisciplinary research approaches, the development of novel management and conservation practices, and a strong commitment to disseminate the results of these studies to students, the public, and policymakers. As part of its commitment to address pollinator health and conservation, Penn State has recently established a Center for Pollinator Research, comprising 26 independent research, extension and outreach groups across the university. One of the first goals of this Center is to bring together researchers, policymakers, and conservationists in an international conference on pollinator biology, health and policy, to begin to bridge the gaps in our knowledge that are necessary to address this complex issue.

When: Saturday, July 24, 2010 12:00 p.m. -Wednesday, July 28, 2010 p.m.
Where: The Nittany Lion Inn, State College, Pennsylvania 16803. 800-233-7505
For Registration Questions Contact:
Office of Conferences and Short Courses, The Pennsylvania State University, College of Agricultural Sciences, 301B Ag Admin Building, University Park, PA 16802
Toll free: 877-778-2937 or local 814-865-8301
Email: **csco@psu.edu**

For Program Questions Contact:
Christina M. Grozinger, Associate Professor, Department of Entomology, Director, Center for Pollinator Research, Center for Chemical Ecology, Huck Institutes of the Life Sciences, Pennsylvania State University, Chemical Ecology Lab 4A, University Park, PA 16802
Phone: 814-865-2214
Fax: 814-863-4439
Email: **cmgrozinger@psu.edu**
Webpage: **http://www.grozingerlab.com**

OHIO

Latshaw Apiaries 2010 Instrumental Insemination Three Day Course

Join us September 8-10, 2010, for the second annual instrumental insemination course taught by Dr. Joseph Latshaw. This course is designed to help individuals learn the *science* of instrumental insemination and the *art* of perfecting the benefits this valuable technique. The course will be limited to six participants to maximize the benefits of a small group setting. Ample opportunities for individualized instruction and plenty of practice will be provided.

Dr. Latshaw has over 20 years of beekeeping experience and specializes in the design and production of instrumental insemination equipment. Dr. Latshaw has designed two insemination devices: the Latshaw Instrument and the new Latshaw Micro Instrument. Dr. Latshaw's insemination skills and his extensive background in honey bee genetics have allowed him to significantly contribute to the beekeeping community by providing exceptional breeder stock to commercial queen and honey producers across the United States.

Dr. Latshaw has hundreds of hours of teaching experience, and he is a frequently sought after speaker. Join him for this great opportunity to learn the instrumental insemination technique. Applications are required. Enrollment will be closed when the course is full. Please visit **www.Latshaw Apiaries.com** for additional information and an application. We look forward to working with you.

FLORIDA

2010 HONEY BEE SEMINAR
Beginning & Intermediate

Hosted by the
Tampa Bay Beekeepers Association

When: Saturday, May 15th, 9:00 a.m.
Where: Upper Tampa Bay Park, 8001 Double Branch Rd, Tampa, FL 33635

Topics: Everything a beginning beekeeper needs to know:
Hive Construction, Starting a Hive, Honey Extraction, Bee Transport, Queen Bee's, Nectar Sources, Wax Rendering, Apitherapy, Looking Inside the Hive, and More! **Door Prizes!!**

Registration: (Includes seminar and lunch)
$20.00 -- before May 8
$25.00 -- day of seminar
$5.00 -- spouses

Please note—there is a $2 entry fee at the park

For more information call: 727-393-3065 or 757-688-9069 or visit **www.tampabay beekeepers.com**

GEORGIA

Young Harris College and the University of Georgia are offering the nineteenth annual Beekeeping Institute, May 13-15, 2010 at Young Harris, GA. The Institute is one of the largest and most comprehensive beekeeping educational events in the Southeast. Classes are offered for beekeepers at all levels of experience, from beginner to advanced. The Institute sponsors training and certification for the Georgia Master Beekeeper Program and the Welsh (U.K.) Honey Judge Program. The Institute is a three-day series of lectures and workshops covering a range of beekeeping topics. Students are encouraged to participate in the annual Honey Show. Along with honey, the Honey Show accepts entries in photography, art, candles, section comb honey, mead, and beekeeping gadgets. Facility limitations force us to cap enrollment at 150. A printable registration form and complete program information are available at: **http://www.caes.uga.edu/departments/ent/bees/young-harris/documents/bee-institute-2010.pdf**.

For more information, contact Ms. Detsy Bridges at 706-542-9035 **detsyb@uga.edu** or Mr. Jim Kenaston at 706-769-1736 **kenaston@uga.edu**.

TENNESSEE

The Heartland Apiculture Society (HAS) annual conference will be held July 8-10, 2010 on the campus of Tennessee Technological University (TTU) in Cookeville, TN. For more information contact Jim Garrison, president of HAS at **jimg1850@live.com**, or go to the HAS website at **www.heartlandbees.com**

The Tennessee Beekeepers Association (TBA) annual convention will be held October 29-30, 2010 on the campus of Tennessee Technological University (TTU) in Cookeville, TN.

For more information contact Ray Turner, Exec. VP for TBA at **rturnerbee@wmconnect.com**, or Jim Garrison, president for TBA at **jimg1850@live.com**

MISSISSIPPI

Beekeeping Workshops/Shortcourses

May 7-8 in Verona at the MS Ag & Forestry Experiment Station ($10.00)
May 14-15 in Jackson at the MS Ag & Forestry Museum ($10.00)
June 2-3 in Hattiesburg at the MS Extension Service Bldg. ($10.00)

Please contact Harry Fulton, P.O. 5207, MS State, MS 39762, fax to 662-325-8397 or email to **pixie@mdac.state.ms.us** or **harry@mdac.state.ms.us** If possible, please register two weeks in advance for a workshop, so we will know how many people to plan for.

ILLINOIS

Queen Rearing Course May 14-15, 2010

Every beekeeper can benefit greatly from raising their own queens. Join us at Long Lane Honey Bee Farms in Central Illinois on Friday and Saturday, May 14th & 15th for a two-day comprehensive queen rearing training adventure. On Friday we begin at 9 am with indoor presentations on queen rearing and grafting until lunch. After lunch each student will be led through the entire process of grafting, from the selection of the right aged larvae, transporting the frame to the grafting room, grafting and placing grafts into cell bar frames and placing grafts into the starter nuc.

On Saturday we begin at 9 am with indoor presentations until after lunch. In the afternoon we are in the field learning how to prepare starter nucs, a finishing hive and the use of the Cloake board and queen Castles. Then, at near the end of the class around 3pm, each student will remove their grafts from the day before for evaluation and will be given transport containers to transport their grafts home to be placed into a finishing hive. Dr. Stu Jacobson will be speaking as well. This is hands-on, so all beekeepers must bring a hat and veil or suit. Hive tools are provided. Lunch on Friday & Saturday is provided. Included in the course, each student will receive our booklet on queen rearing, a grafting tool, a three-frame wooden transport nuc, a cell bar, a cell bar frame and 20 plastic queen cells. Cost is $179 for the two-day course and the listed supplies.

SOUTH DAKOTA

The South Dakota Beekeepers meeting will be held in Aberdeen South Dakota on July 9 and 10 of 2010 at the Ramkota Inn. To make reservations call 605-229-4040 before June 8th. The rooms will be held for us to this date and be sure to ask for the South Dakota block. The rates are $84.99 + tax.

The general meetings will start at 1 p.m. Friday the 9th with speakers and other information. The banquet and auction will be held Friday evening. Saturday morning will be speakers and an informal session with the business meeting starting around 10:30 am. Advisory board meeting will start at 10 a.m. Friday prior to the general meeting.

NEW MEXICO

Hands-on Natural Topbar Beekeeping Classes with long-time beekeeper Les Crowder Certification Classes in Santa Fe, NM May 16, May 23, June 20. Backyard Beekeeping in Albuquerque, NM, May 23. Backyard Beekeeping in Rio Lucio, NM, May 9, June 6. Out of Towner's intensive in Rio Lucio, New Mexico August 19-22. **www.fortheloveofbees.com** or email **fortheloveofbees@kitcarson.net** (575) 587-2065.

ALBERTA

The 57th Annual Beaverlodge Beekeepers' Field Day will be held on Friday June 25, 2010 at the Agriculture & Agri-Food Canada Research Farm in Beaverlodge, Alberta, Canada.

The program will begin at 10:00 a.m. and will include outdoor demonstrations, as well as talks from professionals on the latest findings in bee research. Our guest speaker this year is Dr. Tom Webster of Kentucky State University. Also in attendance will be Provincial Apiculturalists and representatives from the Canadian Honey Council, the Alberta Beekeepers' and the Alberta Honey Producers' Cooperative.

Don't miss the FREE noon BBQ sponsored by honey industry members. For more information contact Dr. Steve Pernal at: **Steve.Pernal@agr.gc.ca**

SLOVENIA TO HOST THE THIRD INTERNATIONAL APITHERAPY FORUM

Did you know that Dr. Filip Terč (1844 - 1917), a doctor and beekeeper from Maribor (Slovenia), who successfully cured 543 out of his 658 of patients suffering from rheumatic diseases, is considered the father of apitherapy? For several years, his birthday, 30 March, has been celebrated as World Apitherapy Day.

This is one of the reasons why Slovenia decided to organize the international forum under the auspices of Apimondia at the end of this September that will be held under the 'Keeping Healthy through Bees' motto. This forum, which will undoubtedly be the biggest international beekeeping event in 2010, will bring together the greatest experts from the field of apitherapy and techniques of obtaining healthy bee products. These experts will present the latest findings of their research. In order to bring the event closer to the general public, national and international beekeepers and others, the technical consultations will be accompanied by the API-EXPO international beekeeping exhibition offering various workshops and popular lectures dealing with a variety of topics. This will be a true beekeeping festival aimed at bringing the bees and their general benefits for human kind closer to all generations, young and old.

In the second half of the previous century, the Medex company from Ljubljana, specializing in bee products, organized three highly noted international symposia on apitherapy, so Slovenian beekeepers have quite a tradition in this field. The Apimondia 2003 Congress was another wonderful experience.

Similar to other developed countries, official medical science in Slovenia looks upon apitherapy with distrust and keeps its distance. The greatest reproach that some doctors make is that healing substances in bee products are not standardized and they change from year to year and from one place to the other. This is very true. Each Aspirin Plus C tablet contains exactly 400mg of acetylsalicylic acid and 240mg of ascorbic acid or vitamin C, regardless of whether it was manufactured in Germany or anywhere else, this year or five years from now. Fresh willow pollen contains both of these active ingredients and current observations show that it has more beneficial effects for people than Aspirin, but each year, the quantity of these two important components differs. And this is why such pollen cannot be recognized as a drug.

It is interesting that official medical science recognizes the immense power in pollen and bee venom. The first can confine a person with allergies to bed and incapacitate him for weeks. A single bee sting can kill every two hundredth resident of Slovenia who is allergic if medical care is not received on time. But beekeepers know that both pollen and bee products can help prevent or even treat various diseases, as previously stated. Most doctors do not see this, do not know it or refuse to learn about it. Perhaps they will change their minds if we manage to bring them as listeners to this year's forum. This is why we have invited the best experts to hold lectures, as they will present strong scientific evidence of the usefulness of bees for our health.

In defense of official medical science, however, it needs to be said that certain improvements are evident: an increasing number of doctors have been successfully using honey to treat wounds.

Slovenian beekeepers invite the readers of *American Bee Journal* to come to Slovenia at the end of September and experience our beekeeping festival in a friendly atmosphere.

More about the Apimedica and Apiquality forum is available online at **www.go-mice.eu** or **www.czs.si**

Franc Šivic
Vice-President of the Slovenian Beekeepers' Association

TURKISH BEEKEEPING SAFARI

Our very special *Bees for Development* (BFD) Beekeepers Safari to Turkey takes place only every second year, and will take place again this summer from 24 July to 5 August.

Our hosts in Turkey are generous and welcoming, ensuring everyone's comfort and safety. The Safari includes bee experts, as well as professional tour guides. All who have participated in this Safari (in 2006 and 2008) have found it to be a fantastic experience, visiting places that are off the usual tourist circuit. You can read accounts at http://www.beesfordevelopment.org/safaris In addition, the March issue of *Bees for Development* (BFD) Journal features one of the log hive beekeepers that we visit during the Safari.

Places are limited and we are contacting you because you have expressed interest in our Safaris. The Safari represents exceptional value for the money, as the cost includes all travel from arrival in Turkey to departure, including four internal flights, all meals, snacks and accommodations, plus permits for national parks and reserves.

We are happy to assist if you need any more details about the Safari, and we look forward to hearing from you.

Helen Jackson
Bees for Development
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Phone +44 (0)16007 13648
E-mail: **info@beesfordevelopment.org**
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Beetle Jail
Entrance Trap

Beetle Jail Jr.

Beetle Jail Jr.
Shown open

World Honey Market

UNITED STATES

High winter colony losses and difficulties in obtaining adequate and timely supplies of package bees, nucs and queens continued to be a major topic of concern at bee meetings and short courses around the country. Further aggravating this problem was the cool, rainy early spring in the South and California that delayed queen rearing and package bee production. Breeders have been very busy trying to accommodate as many orders as possible, but a survey in late March indicated that many companies were booked until later this spring.

Beekeepers in the South and California were coming into their swarming season as spring wildflowers and trees came into full bloom. Orange flow reports from Florida were still sketchy with some beekeepers reporting good production, while others felt the flow in their area was below normal. Migratory beekeepers will be moving colonies back from the West Coast to their home states soon before the major alfalfa and clover flows begin. The almond pollination season turned out well for growers who were able to secure sufficient colonies for their groves. A large colony loss among beekeepers bringing colonies to California caused a severe last minute bee shortage. Almond rental prices are expected to remain the same or increase by $10 to $20 for the 2011 season.

With all the snow and rain this year, a number of our reporters were hoping for a bumper clover and alfalfa honey production year. However, they are scrambling to build up colonies in time to take full advantage of these flows. The next major flows on the East Coast include tulip-poplar, sumac and black locust. California beekeepers were hoping for greatly improved honey flows this season since good ground moisture has been received and reservoirs are back to normal levels in many locations.

The EPA's refusal in March to grant a temporary Section 18 permit to the NOD Apiary Product's new varroa control, Mite-Away Quick Strips (MAQS), has beekeepers scratching their heads regarding the EPA's lack of understanding on this important topic. The EPA felt there were enough varroa-control products available under the current Section 18 permits to take care of the varroa problem, but beekeepers are saying just the opposite. NOD Apiary Products is now trying to obtain a Section 3 General Registration for the MAQS formic acid mite control.

The domestic honey supply remains very short at present. Buyers have been actively looking for remaining stocks of 2009 crop honey, but little is still available. Offering prices continue to increase at the wholesale level, but few beekeepers have been lucky enough to have any honey left to sell. Meanwhile, retail sales also continue to be listed as fair to good over most of the country with consumers showing a preference for locally produced honey when it is still available.

In related honey news, the FDA appears to be clamping down on "food fraud" in the United States, according to an article published March 30, 2010 in the *Washington Post*. Included in the article was the problem of honey adulteration. According to the *Post* article, "At the FDA's first public meeting on food fraud last year, groups across the industry complained that it is not doing enough." Due to earlier refusal of the FDA to consider establishing a National Honey Standard of Identity, many state beekeepers' associations are working to pass their own state honey identity laws. Florida, California and Wisconsin, respectively, have been the first three to successfully enact such legislation.

In the illegal Chinese honey import case against Yong Xiang Yan, the Northern District of Illinois U.S. Attorney, Patrick J. Fitzgerald, has offered the defendant a plea agreement. At the time of this report, no word had been received yet on acceptance of the plea agreement or possible sentencing.

NORTHEAST—The last half of March and early April brought much milder weather to this area, which suffered a long, hard winter by most accounts. Colony losses have been high, but beekeepers are now able to feed and work surviving colonies in preparation for making divides to restock deadouts in April. With the return of warmer temperatures, many trees and wildflowers are starting to bloom, which is greatly helping colony buildup. Many packages, nucs and queens have been ordered, but due to cold weather earlier in the season, southern package bee and queen producers are not only running behind normal, but also some booked up much earlier than normal. If warmer weather continues through the spring season, early honey flows could be excellent since ground moisture is plentiful. Beekeepers, however, are scrambling in order to have their colonies strong enough to take advantage of early flows. Spring flooding continues to be a major problem in several Northeastern states

Both the wholesale and retail honey markets have been quiet since locally produced honey inventories were exhausted quite some time ago.

MIDEAST—After a long, difficult winter with record snowfall, the spring season came all at once in March putting beekeepers into high gear. Everything was starting to come into bloom at once. Surviving colonies were building up quickly and beekeepers were busy sorting and cleaning deadouts, while at the same time making sure existing colonies didn't become too crowded and swarm. Winter losses have been estimated at between 25 and 50% by a number of our reporters. However, many beekeepers plan to recoup these losses through splits, nucs or package bees. Unfortunately, the cold weather in the South has delayed the season by two or more weeks, so this will mean beekeepers may miss a couple precious weeks of buildup weather. Ground moisture is excellent, so ground plants like clover should be plentiful if the weather cooperates. The next main flows include tulip-poplar, sumac, black locust and various wildflowers.

Local honey inventories were exhausted several months earlier, so consumers are eager to purchase new crop honey once it is available.

SOUTHEAST—The spring season was slow in starting due to cold, rainy weather persisting well past normal in this area. As a result, the whole season was two to three weeks behind. This not only has hurt and delayed spring colony buildup, but package bee and queen producers were having a difficult time keeping on schedule with their shipments. Many booked up early due to the heavy demand this year, and then the cold, rainy weather delayed apiary work. In late March producers were scrambling to fill orders as best as they could under the difficult circumstances.

Winter losses were about 20 to 30% in the Southeast, which some reporters now call

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

	Northeast	Mideast	Southeast	Southwest	East Central	West-Central	Inter-Mountain	West
Wholesale								
White lb. Blk.	$1.40-$2.20	$1.45-$2.00	$1.30-$1.70	$1.35-$1.70	$1.50-$2.00	$1.40-$1.75	$1.30-$1.60	$1.25-$1.60
Amber lb. Blk	$1.25-$1.60	$1.20-$1.75	$1.20-$1.50	$1.20-$1.60	$1.35-$1.75	$1.20-$1.60	$1.25-$1.50	$1.20-$1.50
1 lb. CS 24	$50.00-$80.00	$45.00-$82.00	$48.00-$90.00	$51.00-$85.00	$52.00-$75.00	$55.00-$81.00	$60.00-$95.00	$57.00-$92.00
2 lb. CS 12	$59.00-$80.00	$58.00-$72.00	$60.00 $68.00	$58.00-$73.00	$59.00-$79.00	$51.00-$78.00	$57.00-$76.00	$60.00-$77.00
5 lb. CS 6	$72.00-$88.00	$58.00-$87.00	$60.00-$76.00	$57.00-$75.00	$57.00-$86.00	$60.00 $84.00	$59.00-$85.00	$59.00-$88.00
Retail								
Jars 8 oz.	$.96-$2.50	$1.00-$2.25	$.89-$2.50	$.90-$2.25	$.95-$2.75	$1.05-$2.50	$.99-$2.20	$1.00-$2.75
Squeeze Bear 12 oz.	$1.89-$3.50	$2.00-$3.75	$1.75-$3.20	$1.40-$3.25	$1.99-$4.45	$1.59-$3.75	$1.55-$3.50	$1.50-$3.60
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-$5.00	$2.70-$5.25
Jars 2 lb.	$3.99-$6.75	$3.95-$7.00	$3.99-$5.49	$3.00-$6.25	$3.25-$8.00	$3.29-$6.50	$3.25-$6.25	$3.50 $6.50
Jars 1 1/2 lb. (Pint)	$4.50-$6.75	$4.25-$6.00	$3.50-$6.00	$3.58-$6.50	$3.25-$5.50	$3.50-$5.50	$3.75-$6.00	$4.75 $7.00
Jars 3 lb. (Quart)	$5.50-$9.75	$5.95-$15.00	$5.79-$10.00	$5.25-$9.25	$5.00-$11.50	$4.50-$10.00	$5.10-$9.75	$5.00-$10.50
Jars 4 lb.	$7.50-$9.25	$5.00-$10.00	$7.00-$8.75	$6.00-$9.70	$8.00-$12.00	$5.50-$13.00	$6.00-$9.00	$5.95-$9.25
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-$18.00
Creamed 12 oz.	$2.50-$4.25	$2.50-$4.00	$2.49-$3.20	$2.25-$3.99	$2.00-$3.90	$1.99-$4.00	$1.75-$3.75	$1.75-$3.85
Comb 12 oz.	$3.00-$5.00	$2.50-$5.00	$2.25-$4.25	$2.50-$5.50	$2.50-$4.75	$2.50-$5.50	$2.50-$4.75	$2.75-$5.50
Round Plas. Comb	$3.00-$5.50	$2.25-$4.50	$2.50-$4.00	$2.00-$5.25	$2.25-$4.99	$2.00-$5.50	$2.25-$5.00	$2.50 $5.50
1 Gallon	$15.00-$25.00	$12.50-$26.50	$14.50-$25.00	$15.00 $25.00	$15.00-$30.00	$15.00-$27.00	$15.00-$30.00	$15.00-$30.00
60 lb.	$115.00-$145.00	$84.00-$125.00	$85.00-$120.00	$80.00-$130.00	$82.00-$140.00	$80.00-$135.00	$85.00-$130.00	$80.00-$130.00
Beeswax								
Light per lb.	$1.70-$3.50	$1.70 -$2.75	$1.70 -$3.00	$1.70 -$2.50	$1.70 -$2.50	$1.70 -$2.50	$1.70 -$2.50	$1.70 -$2.50
Dark per lb.	$1.60-$3.00	$1.60 -$2.35	$1.60 -$2.25	$1.60 -$2.25	$1.60 -$2.25	$1.60 -$2.25	$1.60 -$2.25	$1.60 -$2.25
Pollen								
Wholesale per lb.	$3.50-$6.50	$3.50-$8.00	$3.00-$6.00	$3.00 $5.00	$3.25-$6.00	$3.25-$6.00	$2.50-$6.00	$2.50-$5.50
Retail per lb.	$5.50-$15.00	$7.00-$15.00	$6.00-$15.00	$6.00-$10.00	$7.00-$15.00	$7.50 $15.50	$7.00-$12.00	$7.00-$15.00

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

HONEY MARKET FOR THE MONTH OF FEBRUARY 2010

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

(From March 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)

Dakotas - Alfalfa white $1.52
Clover white $1.45 - $1.55
Florida - Wildflower extra light amber $1.45
Wildflower light amber $1.30
Mississippi - Soybean light amber $1.35
Montana - Clover white $1.50 - $1.52

Canada - Canola white $1.49 - $1.55

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 $1.42 - $1.53
Brazil - Mixed Flowers extra light amber $1.45
Vietnam -Mixed Flowers light amber $1.12 - $1.19

the "new normal" for colony losses. Then, cold, rainy conditions held on well past normal. In fact, some wildflowers and tree blossoms such as titi were frozen back and then had to rebloom. With adequate ground moisture and better weather, Florida beekeepers are anticipating a fair to good orange, tupelo, gallberry and palmetto flows. Farther north, numerous wildflowers, berries and trees were coming into bloom. Beekeepers mentioned tulip-poplar, privet hedge, and early clover as coming into bloom. Swarming was later than normal, but beekeepers were starting to receive swarm calls in late March and early April.

Migrators, who were in California for almond pollination, were beginning to return as this was written. Some were going directly to other Southeast crops for pollination work, while others were positioning colonies for remaining major honey flows. Honey inventories are quite low and prices continue to climb for remaining stocks. In addition, some packers are trying to lock in commitments for 2010 honey production. Prices quoted by our reporters are varying from $1.50 to $1.60 for white honey and $1.40 to $1.50 for amber grades.

SOUTHWEST—Beekeepers have been very busy now that warmer weather has returned and honey flows have begun. Losses over winter were estimated to be about 20%, but most beekeepers have already repopulated these deadouts by making divides. Migratory beekeepers are starting to return from California for honey flows in their home states. The spring was a long time coming, but once the weather finally warmed up, colonies are making up for lost time. Flooding was a problem earlier with all the rain, but this problem is subsiding now. Package bee and queen companies are running about two weeks behind schedule and they say demand has been very strong again this year.

Maple trees, elm, cedar, pine and numerous fruit trees bloomed first, but now many wildflowers have come into bloom as well. With the plentiful moisture received earlier, these flows are expected to be better than normal. Along the Gulf Coast Chinese tallow is starting to bloom as well. In Texas, the so-called "brush" flow has begun from the many wildflowers in bloom. In Louisiana and Arkansas numerous wildflowers and berries are coming into bloom. Clover and alfalfa should begin blooming in late April and into May.

Honey remains in short supply throughout the region, except where packers are buying foreign honey for use in the industrial and retail markets. However, demand for locally produced honey is very strong.

EAST CENTRAL—After a long, hard winter spring-like weather began in March. As we indicated last month, many colonies perished due to the long period of bitterly cold weather between Jan. 1 and March 1. In fact, some beekeepers said their bees never had a cleansing flight during this time. In addition, some tightly packed clusters could not move to new honey stores and simply starved. More beekeepers are planning on wrapping or packing their hives this coming fall to avoid some of these losses. Winter loss reports are varying from a low of 20% to a high of 75%, according to most of the beekeepers we surveyed.

The first maple and willow pollen came a couple weeks later than normal, but once it started, surviving colonies seemed to respond well to the early pollen, in addition to beekeeper-provided pollen substitute patties and sugar syrup feeding. Package bees, nucs and queens are in heavy demand, but supplies are limited from the South and California. In addition, deliveries are in many cases running about two to three weeks late due to the cold spring in the South and all the rainy, cool weather in California. As this was written, beekeepers were eagerly anticipating the blooming of fruit trees and dandelions, which will be quickly followed by wild mustard and black locust. Beekeepers are anticipating good clover and alfalfa flows in late May, June and July since ground moisture levels have been replenished by all the snow and rain. Fortunately, fears of flooding have lessened considerably since March and April when many rivers were out of their banks.

Demand for honey at both the wholesale and retail levels remains excellent, but little local honey remains unsold. Prices for white honey are varying from $1.60 to $2.00 and amber grades are selling at $1.40 to $1.75 per pound at the wholesale level. Packers are actively seeking remaining stocks of honey, as well as locking in commitments for 2010 crop honey.

WEST CENTRAL—This was a tough winter for West Central bees. Even those beekeepers who took many of their colonies to California often suffered extremely heavy colony losses. Colonies overwintered in West Central locations succumbed to the long, cold winter. Beekeepers who packed, wrapped or overwintered colonies in buildings were the lucky ones this winter because their bees were spared the unrelenting cold, windy weather that took such a heavy colony toll. Most beekeepers were planning to repopulate their deadouts via nucs, divides, or packages. Unfortunately, those relying on purchased nucs or packages from companies in the South or California may not be able to obtain all the bees they need and on time. Beekeepers are working hard to rebuild colonies before the main flows begin. The thousands of colonies taken to California for almond pollination will be returning in April.

Quite a bit of colony feeding was being done where spring flowers were not plentiful yet. As this was written, maple, willow, elm and early ornamentals were in bloom, but dandelions and fruit trees were just beginning to bloom in the southern parts of the area. Next in line for mid to late May will be black locust and yellow sweet clover. With all the moisture in this area due to snow and spring rains, many beekeepers believe this will be a bumper year for clover and alfalfa nectar production. Areas that were in danger of severe flooding may have been spared this year if later heavy spring rains do not force rivers out their banks again.

Honey stocks are the lowest that many beekeepers can remember in this area. Packers have called every commercial and sideline beekeeper they could find seeking their last lots of 2009 crop honey. Offering prices have jumped substantially above the $1.50 mark, but this has not helped most beekeepers, who simply do not have any significant honey left to sell due to the poor crops and strong demand. Some packers are trying to obtain commitments from beekeepers for their 2010 honey production. Retail honey demand also continues to be strong for locally produced and packed honey.

INTERMOUNTAIN—It was a tough winter for bees taken to California, as well as those colonies overwintered in home yards. Most commercial beekeepers from this area routinely move their bees to California for almond pollination or to a southern state to build up colonies in order to make divides. A number of beekeepers who took bees to California for almond pollination suffered heavy colony losses in either late 2009 or early 2010. Some beekeepers were not able to provide all the colonies they had promised almond growers.

Montana reporters said that the western half of their state enjoyed a rather mild winter, but the weather was more severe in the eastern half of the state. Migratory colonies were scheduled to start returning to Intermountain locations in April. As this was written, maple, elm and willow pollen were available, but wildflowers and dandelions had not yet bloomed. Beekeepers on location were feeding colonies or cleaning deadouts in preparation for repopulation with divides, nucs or packages. Quite a bit of snow and rain have provided good ground moisture and replenished reservoirs. This moisture should help clover and alfalfa flows once warmer weather returns in May and June.

Very few wholesale lots of honey remain unsold and packers have been seeking out any remaining 2009 stocks. In addition, locally produced honey is becoming harder to find on the store shelves due to poor 2009 crops and continued excellent consumer honey demand.

WEST—Some Cahfornia beekeepers were continuing with their spring pollination work, while others were transitioning from almond pollination to honey production. With all the rainy weather earlier in the year, beekeepers were hoping that brush flowering in the foothills would be heavy. Many wildflowers and bushes have come into bloom, including sage and buckwheat. The weather had warmed considerably and the rains have let up. This has allowed many more hours per day of good foraging weather. Earlier in the season, colonies received a nice boost from manzanita, bottlebrush, fruit trees, wild mustard and assorted wildflowers.

A big problem this spring has been colony collapse, especially in apiaries scheduled for almond pollination. The phenomenon has not affected all beekeepers since some reporters have said that their bees came through this period in great shape and are now building up normally.

Oregon and Washington beekeepers enjoyed a relatively mild winter, while much of the rest of the country suffered during the bitterly cold months of January and February. As a result, colonies overwintered well in many apiaries. However, colony collapse disorder has also reared it head in parts of the Northwest causing beekeepers to scramble to make up losses before the start of the pollination season and spring honey flows.

Despite all the rainy weather during the earlier almond pollination season, growers believe colonies were still able to do a good job with pollination. The almond set appears to be excellent. Almond pollination prices will probably increase somewhat in 2011 due to the extreme shortage of bees that developed this season due to CCD-related deadouts, as well as fewer migratory beekeepers making the difficult trip across the country. The big question facing many beekeepers is, "Do I lock in a contract price now or wait, hoping prices will increase significantly due to feared bee shortages." It's always a big gamble. It paid off this year for some beekeepers, but the year before, holdout beekeepers without contracts were left out in the cold with no place to set their bees for almond pollination.

The honey supply situation remains acute. Few commercial beekeepers still had honey to sell and buyers are trying to obtain beekeeper commitments for 2010 honey production. Offering prices are definitely higher, but few stocks are selling now due to the general domestic honey shortage. Retail sales also continue to strong for locally produced and packed honey. However, many beekeepers sold out in late 2009 and won't have new crop honey ready for sale until a little bit later this year.

American Bee Journal Editor

GEORGE W. YORK

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

In turning the *American Bee Journal* over to George W. York, Thomas G. Newman, its former editor, had the following to say:[1]

"The policy of the *Bee Journal* will be unchanged, but its influence will no doubt be extended, for Mr. George W. York, the head of the new firm, is an educated young man, and full of vigor; he is a good writer, and has earned a noble reputation for honor and integrity. He is also a practical printer, and having been our valued assistant for the past eight years, is fully competent to so manage the *Bee Journal* in the future that it will lose none of its reputation for punctuality and general typographical excellence. In fact, it could not have been committed to more competent and worthy hands. Let all give a cordial welcome, and a generous support."

Newman then gives us the following biographical sketch: "George Washington York was born on February 21, 1862, in Mount Union (near Alliance), Stark county, Ohio, where his father, John B. York, was completing the course of studies in Mount Union College, which is there.

"When George was seven years old, the York family (which later consisted of 10 members) moved upon a farm of nearly100 acres, in Randolph, Portage County, OH. Here he found ample opportunity to work as well as to grow. Each winter he attended the country school, and at the age of 16 years began teaching in the district schools of the surrounding township. He continued with this until he was 20 years old, except the time spent upon the farm during summers, and studying at Mount Union College, from the Commercial Department of which he was graduated in June, 1882. He continued there for a time as instructor in penmanship, mathematics and bookkeeping.

"In the Spring of 1884, after a most successful term of teaching, we met Mr. York while visiting our nephew, Mr. B. Harding, where Mr. Y. Had boarded during two or three winters that he had taught the district school of which Mr. Harding was a director, in Kent, Ohio.

"Being much pleased with his attainments and industrious habits, we engaged Mr. York as an assistant in the office of the *American Bee Journal*, and in due time he followed us to this city, and entered upon his labors. Here he learned the printing business, and step-by-step advanced to positions of confidence and responsibility, until, during our late and long-continued indisposition, he has had the entire editorial management of the *Bee Journal*, and that work not only received our approval, but has merited, as well as received, the commendation of many of our readers and patrons.

"He is, therefore, not a stranger, but a faithful friend and co-worker, who steps into our shoes, wears our mantle, and we feel sure will be received by all as a successor worthy of much esteem."

At that time the *Journal* was a weekly costing $1 a year published at 199 Randolph Street in Chicago. Newman's name remained as one of the editors until the October 6, 1892 issue when the cover design was changed to a wood cut of a straw skep in front of a rail fence, and York's picture headed the page "Editorial Buzzings" wearing a "Globe" Bee Veil.

In his obituary in the *Journal*,[2] it is related, "In 1892, when he took the reins as editor and publisher of the *American Bee Journal*, in his introductory remarks,[3] he said, 'We shall try to treat all with kindness and impartiality. Our motto has long been 'Thue recht and furchtst niemant' ('Do right and fear no one'). We see no reason to change it now.' Nor did he change it during his long and active life."

In February 1893,[4] the offices the *Journal* were moved to 56 Fifth Avenue "in order to get better accommodations, and for greater convenience." In the January 4, 1894 issue,[5] there appears a biography of Thomas G. Newman, who then was publishing the *Illustrated Home Journal*. It tells that in the October 1893 issue of that publication, Newman gave the *American Bee Journal* this kindly notice: "Friend York's energy is fully sustaining the reputation of that 'Old Reliable' weekly. As a 'child' which we tenderly cared for, for 20 years, we are proud of its success in its 'wedded life,' and wish it unbound prosperity."

George W. York, editor of the *American Bee Journal* from 1892--1912.

York continued the *Journal* as a weekly with two volumes each year, as Newman had begun in 1891, but with the January 3, 1895 weekly issue, the page size was changed from 6 by 9 inches to 8 by 11 inches, and it has remained this sized ever since. In the August 16, 1894 issue, York initiated a "General Questions" department[6] answered by Dr. C. C. Miller, a feature that was to become of importance to the Journal, and was continued through the September 1920 issue. In the first issue in 1895,[7] York commented: "the 35th year of the *American Bee Journal* begins with this issue. It is just a trifle older than its editor. Few periodicals can say that. . . Still, I trust that the *American Bee Journal* may from year to year be-

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

come stronger and more vigorous in its ability to furnish unexcelled weekly apicultural information to its readers, both near and in earth's remotest bounds!" York was not only a good writer, but a "flowery" one.

During York's 20 years as editor and publisher of the *Journal*, its offices were changed several times. In March 1896,[8] they were moved to the third floor of a building at 118 Michigan Street. Then, on New Year's day of January 1901,[9] the floor occupied by the *American Bee Journal*, and the bee supply and honey business, was made a complete wreck by water due to a fire in floors above. Fortunately, the January 2nd issue was in the hands of the printer and was saved, but York was not sure whether the next issue would be out in time and comments that, if so, it will probably be the first time in 20 years, on the publisher's account, that it had failed to be placed in the Chicago post office on time.

Because of the fire, York decided it would be best to seek another location and this time the offices were moved a short distance away at 144 & 146 Erie Street.[10] For a long time, York had been an agent for the A. I . Root Company's bee supplies and was also engaged in the honey business. In an advertisement in the October 8, 1903 issue,[11] York published a statement that the bee supply business was being transferred to the A. I. Root Company, to be conducted as a Branch Office, and in March 1904[12] he announced moving the *Journal* office to 334 Dearborn Street and stated, "We are devoting our time and attention to the weekly *American Bee Journal*."

Starting in the June 21, 1906 issue of the *Journal*, York initiated a new masthead with a picture of L. L. Langstroth on the left, one of Charles Dadant on the right, with bees and clover blossoms in between and the words "*American Bee Journal*", superimposed in the center. This masthead, with variations was to be continued for many years after the *Journal* was purchased by C. P. Dadant in 1912.

A new address for the Journal appears in

A drawing of George York wearing a Globe Bee Veil appeared at the beginning of his column titled "Editorial Buzzings."

the May 9, 1907 issue, but no announcement or reason for the move is mentioned. Perhaps York was too disturbed over the fact that the postage rate on periodicals mailed into Canada had bee quadrupled and York was forced to announce that hereafter the price of $1 a year would have to be increased to $1.50.

Then, the front cover of the June 27, 1907 issue carried "An Important Announcement" by George W. York & Co. This read in part: "For 26½ years the *American Bee Journal* has bee issued every week, but it has been found that there are only so many beekeepers who are sufficiently interested in bees to think they need a weekly bee-paper. What we want is a large constituency, hence we believe that by publishing the *American Bee Journal* once a month, and making the subscription price 25 cents a year, we will be able to reach the goal of our ambition sooner, and at the same time do a better service to all. (The yearly price to Canada will be 35 cents; to England and other foreign countries in the Postal Union, 50 cents a year.) Thus the *Journal* became a monthly at 25 cents a year (except Chicago where it was 50 cents) and it still is published today as a monthly publication.

But Editor York had miscalculated somewhere along the line, and the September issue announced the subscription price at 50 cents a year, except Chicago where it was 75 cents, in Canada 60 cents, and in all other

When York became the full-time editor in October 1892, he changed the cover design to a woodcut of a straw skep in front of a rail fence.

countries in the Postal Union, 25 cents a year extra for postage. Then, a year later,[13] York announced that, after giving the subscription price a year's trial, they had determined they could not profitably maintain the *Journal* at the low price of 50 cents a year. Thus, the price was increased to 75 cents a year (3 years for $2.00, or 5 years for $3.00) in the United States and its possessions, also Mexico and Cuba (except in Chicago, where the post office department required the addition of 2 cents per copy for postage, making it $1.00 a year; to other foreign countries, such as England and Australia, it was $1.00 a year, and to South Africa and other countries not in the Universal Postal

In the June 21, 1906 issue York began using a new masthead with a picture of two influential and successful beekeeping pioneers. L.L. Langstroth was placed on the left side and Charles Dadant was placed on the right side.

Union, it was $1.25 a year.

Although Dr. C. C. Miller's questions and answers had been an important section of the *Journal* for many years, his name first appears on the masthead as associate editor in the August 1909 issue. Although in his 79th year, the good Doctor was still enjoying life with his bees, then 125 colonies in his home apiary, and would continue to take care of things from Marengo, Illinois.[14] On the same page York announced that the *Journal* offices were now moved temporarily to 193 E. Superior St. in Chicago, but after September 1, would be permanently located at 146 W. Superior Street. And in the December 1909 issue,[15] York announces that beginning with the January 1910 issue, the price of the *Journal* would be $1.00 a year in the United States (except in Chicago, where it is $1.25) and Mexico; in Canada $1.10; and in all other countries in the Postal Union, 25 cents a year extra for postage.

When York moved the offices of the *Journal* to 146 W. Superior Street, he had hoped to not move for a long time, but the January 1911 issue[16] carries a notice that, in order to secure more room, and for better transportation facilities, the offices were moved to 117 N. Jefferson Street, within one and two blocks of two of Chicago's railway stations.

In the May 1912 issue of the *Journal* appeared this "Special Announcement,"[17] which we quote here in part: It was dated April 1, 1912, Chicago, Illinois, and was signed by George W. York & Co.

"We have this day transferred to Mr. C. P. Dadant, of Hamilton, Ill., the *American Bee Journal*, including its mailing lists and good-will, and also the future business of George W. York & Co., with good-will . . . .

"Mr. York, of course, will always be interested in the success of the *American Bee Journal*, with which he has been connected for 28 years, and which he has edited and published for 20 years.

"We bespeak for Mr. Dadant the hearty support and co-operation of bee-keepers everywhere. He is abundantly able to produce a bee-publication second to none, and doubtless will in a very short time make the old *American Bee Journal* better than it has ever been before.

"Thanking all who have co-operated in any way with us during the past 20 years, and wishing all our friends and readers of the old *American Bee Journal* a bright and happy future, we are,

Yours very truly,
George W York & Co."

York guided the *Journal* through a period when commercial beekeeping was growing up. He not only knew, but kept close contact with most of the leaders of the industry of that period. In 1892, when he purchased the *Journal*, from Newman, he was treasurer of the North American Beekeepers' Association, and continued in that capacity in 1893, becoming its president in 1896. This organization became the United State Beekeepers' Union in 1897 with York as its first president. This was changed to the National Beekeepers' Union and York served as its secretary in 1902. This, in turn, became the National Beekeepers' Association and York was its vice-president for 1907 and 1908, and its president from 1909 through 1912. And there is a record that he was the manager of the American Honey producers' League in 1905.

Now York was ready to retire. He bought a home in Idaho and prepared to "go west and live a life away from the busy hum of the city."[2] But 10 years of a life of ease was not for a man who had been so active and busy. So, in 1922 he took over the little magazine of the Alameda County (California) Association, moving first to Spokane and then to Seattle, Washington, and finally to Alhambra, California.

Three years before his death, he was afflicted with paralysis, but his indomitable will to be active enabled him to continue its publication until a few days before his death. George W. York retained his faculties and his ambitions to his last day. He was just as interested in the future of beekeeping as he was over fifty years before when he became the assistant to Editor Newman. Thus, another pioneer died in Los Angeles on Aug. 6, 1937.

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Next Month—*American Bee Journal* editor Dr. C. C. Miller

Importation of New Races of Bees

From the "History of American Beekeeping"

BY FRANK C. PELLETT*

Most clues to the introduction of honey bees to this country by the early settlers has been lost, but the bees were early established and, finding the environment favorable, gradually spread by natural swarming until the common black bee of Europe had occupied most of the country.

When Samuel Wagner, first *American Bee Journal* editor, and the Rev. L. L. Langstroth began reading the European bee magazines, their attention was called to the merits of a new race, the Italians. In early editions of his hook, Langstroth published letters from Wagner telling of interest in this race of bees by beemen in other European countries. He told of the experience of a Captain Baldenstein, who was stationed in Italy during the Napoleonic wars and then became interested in the bees of Italy. At the close of the war he returned to his castle in Switzerland and then sent two men to Italy to secure a colony of Italian bees, which finally reached him in September, 1843. His writings for the *Bienenzeitung* interested Dzierzon, who, in turn, imported Italian bees to Germany, Feb. 19, 1853.

Dzierzon interested Samuel Wagner in them through his writings in the German magazines which Wagner read with care. In 1855 Wagner and Edward Jessup, of York, Pennsylvania, made an attempt to bring Italian bees to America. The attempt was a failure due, it is reported, to the robbing of the nucleus of its honey by a ship's officer. At any rate, the bees were dead on their arrival for lack of proper provision.

In 1858-59 a second attempt was made by Samuel Wagner, Langstroth, and Richard Colvin. They sent an order to Dzierzon by the surgeon of the steamer by which the bees were to have been brought back to them. The surgeon left the ship to engage in other business and the shipment was not made. Later in the year, they did receive seven queens, and on the same steamer Mr. P. J. Mahan, of Philadelphia, brought queens which were reported to be of doubtful purity. By the following spring all of the imported stock is generally thought to have died, so nothing had been accomplished. Mahan had applied to the chief of the Agriculture Division, then a branch of the patent office, for permission to import bees from Italy under his authority. Although Mahan offered his services gratuitously, his offer was declined because the official felt that he was not justified to draw on public funds for so unimportant a matter. S. B. Parsons, a botanist, was commissioned to travel in Italy for the purpose of securing plants for trial in this country. The decision was finally made to authorize him to buy a few colonies of bees as agent for the U. S. Government. Parsons bought 10 colonies of bees on the order and also 10 for himself, which were forwarded on the steamer *Argo* and landed in New York, April 18, 1860.

According to an account of this importation written by Langstroth, who examined the shipment after arrival, the bees arrived in charge of a young Austrian named Bodmer. Langstroth stated that the shipment was divid-

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

This 1866 Langstroth ad appearing in the *American Bee Journal* was one of the first ads that advertised Italian queens for sale.

GREAT IMPORTATION

OF

ITALIAN QUEEN BEES.

On the 17th of August I will start for the old continent, to visit the great queen-breeding and bee-keeping establishment of Prof. Mona, in Italy, to whom I sent an order for **ONE HUNDRED** (100) Queen Bees, with instructions to have them ready for delivery to me on the 15th of September. Having to-day received a reply from Prof. Mona, stating that the queens will be ready for delivery at that time I think I can notify the readers of the Bee Journal, and bee-keepers in general, that if I am successful in bringing in these queens, I shall probably have one half of their number for sale; and those desiring to supply themselves with imported queens of undoubted purity, can be accommodated. The price at which they will be sold will not exceed

TWENTY DOLLARS EACH,

and may possibly be less than that. *Further.*—After the 15th of May next, I will sell medium-sized colonies of bees, with imported queens, in movable comb hives for

THIRTY DOLLARS;

and colonies with queens of my present stock fully tested, in swarming hives, for

TWENTY DOLLARS.

After my return from Italy, I will further sell a small number of tested queens reared by me

AT FIVE DOLLARS EACH.

I intend to sell queens cheaper than any other breeder, who has a genuine article of Italian bees. I will have my price list published early next spring in the Bee Journal. Having shipped fifty-three colonies by Express last spring, without losing a single one, I feel confident that I can send them next spring and guarantee their safe arrival. My stock now consists of six hundred (600) colonies, four hundred and fifty of them in movable comb hives; and bee-keepers may therefore confidently rely on having their orders filled.

I shall be able to supply orders *for imported queens* by Express, direct from New York, on my arrival at that port on my return from Italy. Those desiring to have queens thus sent, can be accommodated by addressing order to me, care of the Editor of the American Bee Journal, Washington, D. C.

ADAM GRIMM.

Jefferson, (Wis.,) July 20, 1867.

Adam Grimm from Wisconsin was another early importer and seller of Italian queens

ed into three lots, part of which were addressed to the U. S. Government, part to Mahan, and the rest to Parsons. All the bees for the Government and for Mahan were dead and only a few left alive in the third lot. Only two queens were saved from the entire lot.

On the advice of Langstroth, one of these queens was placed in the hands of Wm. W. Cary, of Coleraine, Massachusetts. The other was left in the care of the Austrian, who accompanied the shipment. Bodmer, according to Langstroth, failed to raise enough queens to pay for the black bees and the honey, which were purchased for his use, while Cary was very successful and Italianized a large apiary for Parsons, besides filling all his orders for queens. One hundred eleven of these queens were carried to California by A. J. Biglow, 108 of which arrived in good condition. These bees went by way of the Isthmus of Panama and thus endured a very long voyage.

The bees, which Parsons brought over, were purchased for him by a man named Herman, a German beekeeper who was author of a book on the Italian bee. They were shipped in cigar boxes with the combs merely wedged in. The loosening of the combs on the way killed some of the queens, while others were drowned with their bees in the honey. As a net result for the expenditure of $1,200 on the part of Parsons and the Government, only two queens were safely established in this country.

Herman came to this country some years later and was employed by another man in Philadelphia to purchase a large number of queens for him in Italy, but every queen died on board the steamer.

Bodmer brought over a shipment for Wm. Rose, of New York City, which arrived safely, but it is said that he was not very successful in their management after arrival.

The demand for Italian queens was so heavy that numerous efforts were made to import them, with a heavy percentage of failures. Langstroth started rearing queens for sale and for a time was the principal source of supply.

Just what disposition was finally made of the original importation by Mahan is uncertain. In 1897, O. O. Poppleton wrote the story of Dr. Jesse Oren, who lived for many years in Black Hawk County, Iowa. He was said to have bought the first Italian queen that ever crossed the Mississippi River, from Mahan in 1860 for $22.50. From this we would assume that some of the offspring of the Mahan importation lived, and, if so, he is entitled to credit for the first importation which survived. Edward Kretchmer claimed to have bought the first Italians to come to Iowa, from Parsons in the fall of 1860.

Wm. W. Cary successfully reared a large number of queens for Parsons from one of the two Italian queens of the first successful importation.

In 1867 Adam Grimm went to Italy for the purpose of importing queens. One hundred queens which he brought back all died on the way and the attempt ended in disappointment. Three years later he made another attempt and this time reached New York with 69 queens alive. Some were sold to New York beekeepers, but 40 were reserved for the purpose of improving his own stock. This was the largest importation which had arrived up to that time. Grimm offered queens for sale for a time but found much dissatisfaction among his customers, and after a year decided that he would not offer queens for sale any longer.

In 1868, Charles Dadant ordered queens from Doctor Blumhoff, of Switzerland, and received three alive and vigorous in the spring of that year. Blumhoff died the following winter and although Dadant made another attempt at importation, the bees were prepared improperly and few of them arrived alive.

Ellen S. Tupper, a prominent Iowa woman, and editor of the *American Bee Journal* for a few years, was a leader in the ranks of western beekeepers. She visited Dadant and, as a result, she offered to provide funds to defray his expenses for a trip to Italy for the purpose of importing queens. He sailed from New York in July, 1872. Returning in September with a shipment of 400 queens, he was much disappointed to find only sixty queens still alive. The combs in the boxes were alive with moths, and he was unable to fill a sixth of the orders for imported queens.

Then, came a long and grievously disappointing series of attempts to succeed. Dadant tried several shippers, but always some difficulty arose to bring disaster on the attempt. Finally, he got in touch with Guiseppe Fiorina, near Venice, and success crowned his efforts. Fiorina shipped the queens in boxes three inches in width by four inches in length by two and one-half inches deep. Air was let into the boxes by slits in the end. The boxes were placed four in a row and tiered three-deep with only three on the top row. In a package were placed two tiers with some space between for ventilation. The bees were given two combs, one filled with capped honey and the other dry comb. During the progress of these experiments Dadant discovered that the bees did not need water in shipment. When water was used, shipments arrived dead, while better success came after it was left out of the cage.

Some years later, Dadant wrote that he had received more than 250 queens per year, on an average, from Fiorini for a period of eight years. Dadant continued to import Italian queens for many years and it was he who finally solved the problem of successful trans-Atlantic shipment. This was accomplished at great expense and although he received good prices for imported queens, it is doubtful whether the venture ever proved profitable. He stated in 1873 that each of his imported queens had probably cost him more than $20, but he did not regret the outlay.

EGYPTIAN BEES

In October, 1866, an announcement appeared in the *American Bee Journal* that the Society for Acclimatization in Berlin had imported Egyptian bees to Germany and that arrangement had been made to bring them to this country at an early date. This was followed by a series of articles from German bee magazines and from English beekeepers which stimulated interest in the new race.

In the December issue of the same magazine appeared an advertisement of L. L. Langstroth & Sons to the effect that they had obtained Egyptian queens from the Berlin Society of Acclimatization and would be prepared to fill orders for them the next season. While Langstroth imported the first Egyptians, they were bred extensively by Wm. W. Cary.

While Langstroth continued to advertise Egyptians to the end of 1868, they did not prove satisfactory for American conditions and never attained much popularity.

BEES FROM CYPRUS AND THE HOLY LAND

Interest in new races of bees grew rapidly, and efforts were made to obtain them from the far ends of the earth. The expense and risk of importation was greatly reduced after the costly experience of the pioneers in importing Italians, but still the cost was high.

Whenever a group of beemen came together for a convention, there was sure to be a discussion of some race of bees as yet unknown in America. The high prices at which imported queens were selling was sufficient to attract those of an adventurous nature in the hope of profiting by the first introduction of something better than was already available.

In 1878 it was announced in the *American Bee Journal* that C. W. and H. K. Blood had sent a messenger to the Island of Cyprus for the purpose of importing Cyprian bees. This seems a bit confusing, since in the previous issue, April, 1878, these same men had advertised that they had wintered their Cyprian bees successfully and would be prepared to offer Cyprian queens for the coming season at ten dollars each. The advertisement stated that their stock had been forwarded to there direct from the Island of Cyprus and that no other bees would be bred in the vicinity, thus insuring purity.

Whether this was the first successful importation is not clear. Charles Dadant had made an attempt in 1876, having the bees sent to his correspondent in Italy for reshipment. When they arrived in Italy, all the combs were smashed and the queens were dead. At the national convention, November, 1879, Dadant stated that only two queens had reached America up to that time.

In August, 1877, Hardin Haynes, of Illinois, wrote a letter to the *American Bee Journal* telling of his Cyprian bees which were


ITALIAN BEES!

Imported and home-reared queens, at reduced prices. Sent short distances by mail. Send stamp for circular and price list.

M. QUINBY,
St. Johnsville, Montgomery co., New York.
April 1868—4ts.

Italian Queen Bees!

If you want to get the worth of your money, send for my circular. All queens sold by me are warranted as pure as there are any in this country.

WM. W. CARY,
Coleraine, Franklin co., Mass.
April 1868—3ts.

TO BEE-KEEPERS!

Regular Importation of Italian Queen Bees
FROM DR. BLUMHOFF'S CELEBRATED APIARIES.

Several successful importations of Italian Queens have satisfied me that by means of Dr. Blumhoff's improved method of packing bees, I can sell Imported Queens for

TWELVE DOLLARS,

Sent to any address by express, from New York, with guarantee of safe arrival.

Dr. Blumhoff is already known to the readers of the *American Bee Journal*. See volume III, pages 11 and 43, July and August numbers, 1867.

For reference and particulars apply to the subscriber, sole agent in the United States for the sale of Italian Queens from Dr. Blumhoff & Co's Celebrated Apiaries, at Blasco, near Lago Maggiore.

CHARLES DADANT,
Hamilton, Illinois.
July 1, 1868.

ITALIAN AND EGYPTIAN BEES.

We will continue to make frequent importations of these bees, from all the best sources in Italy and Germany. Having been largely engaged in breeding the Italian variety for the past eight years, we refer with confidence to our customers in every State in the north and north-west. We shall continue the business during the season of 1868, breeding only from such sources and in such limited numbers as will enable us to guarantee the *purity* and *beauty* of every queen sent from our apiaries. Those wishing such queens will do well to make early application. "First come, first served." Our circular and price list for 1868, (copy-righted) will be sent free to all desiring it.

L. L. LANGSTROTH & SON,
Oxford, Butler Co., Ohio.
February 1, 1868.

A. GRAY,
REILEY, BUTLER COUNTY, OHIO,
Importer and Breeder of
ITALIAN & EGYPTIAN QUEEN BEES.
Purity, and Safe Arrival of Queens Guaranteed.
SEND FOR A CIRCULAR.
May, 1868, 3 t.

Other early ads for Italian queens, as well as "Egyptian queens".

greatly admired by all his visitors, but the source was not mentioned. It is recorded, also, that Julius Hoffman had secured some of this stock from Europe.

It remained, however, for D. A. Jones, of Beeton, Ontario, to bring the Cyprians to this country in such numbers as to give an opportunity to try them under a wide variety of conditions.

At the Michigan beekeepers' convention in 1879, a committee had been appointed consisting of President Cheney, Frank Benton, and H. M. Roop to look into the matter of importation of desirable foreign races. Frank Benton was a graduate of the Michigan College of Agriculture, a good linguist, and familiar with bees. When Jones was considering attempting importation on a large scale, he was attracted to Benton as a suitable partner. Together they went to Europe in the autumn of 1879, and after visiting at several points, settled at Larnica on the Island of Cyprus where they established an apiary for the purpose of breeding queens. Bees were purchased in the vicinity and Jones also went to Syria to secure bees from that country. In June of the following year, Mr. Jones returned to his home in Canada with a large number of queens, leaving Benton behind to continue his work.

At the Michigan beekeepers' convention in 1880, Jones reported concerning his trip and told of his difficulties in Cyprus. He also described the Holy Land bees, which he had brought back along with the Cyprians. Both were now made available to all who wished them, and for a time much interest was manifested in the new bees. The Cyprian race proved to be too cross for comfortable manipulation, and within a few years there were few who cared to buy stock of that race.

GIANT BEE OF INDIA

At the close of the season, Benton went farther afield in search of *Apis dorsata*, the Giant bee of the far east, which had been reported as something superior. He was determined to obtain the best to be had and spent large sums in the effort. Benton visited Ceylon, Java, and India in search of the big bees. In Ceylon he saw many colonies, mostly in inaccessible situations, but after great difficulty he succeeded in securing four colonies.

In a letter to Jones, Benton called them

Frank Benton (in the foreground) worked for the Bureau of Entomology specializing in Apiculture. He was known during his time as the "white hunter of beekeeping". Benton made two extensive trips abroad investigating and attempting to import various races of bees into the United States. Although he was interested in many different races of bees, he was particularly fascinated with the giant bee of India, *Apis dorsata*, but failed to establish them in this country.

wonderful bees and described them in glowing terms. They were as large as queens, with shining blue backs and wings, and orange-colored bands on their bodies, having the appearance of beautiful hornets. They built combs four or five feet in length and had half a bushel of bees to the colony.

At a critical time in the enterprise, Benton came down with a fever, and the bees were neglected on the long voyage and finally lost. However, it is doubtful if this particular bee ever could be used to advantage in honey production, since its single large comb would be difficult to adapt to any kind of workable hive. Much attention was given to a discussion of this bee in the bee magazines, however, for several years, and it is doubtful whether anything attempted in the history of American apiculture aroused such great interest on the part of beekeepers generally.

HUNGARIAN BEES

About 1879, Henry Alley imported bees from Hungary, but appears not to have profited by the experience. In his book it is recorded that he found difficulty in keeping them pure and that they proved unprofitable on account of their great propensity to swarm. In later years some attention was given to the so-called Banat bees, named from the locality in Hungary from which they came. They never, however, assumed any great importance in the eyes of American beekeepers.

CARNIOLAN BEES

Frank Benton remained abroad for a period of 11 years, during which time he studied the bees in many countries and remained in correspondence with American beekeepers. From time to time, he wrote articles for the American bee magazines and continued to stir the interest in further tests of foreign races of bees. Benton sent queens to some Americans in the fall of 1883, as evidenced by a letter from A. J. Norris, of Cedar Falls, Iowa, who, in the *American Bee Journal* for February, 1884, proposed to establish a Carniolan apiary from progeny of a queen received from Frank Benton "last fall."

D. A. Jones established the *Canadian Bee Journal* in April, 1885, and in the first number told of having bred Carniolans on his Islands in the Georgian Bay the previous season, so he had them as early as 1884. In that magazine, Frank Benton advertised extensively for Cyprian, Syrian, Carniolan, and Italian, as well as Palestinian queens, all reared in their native lands. At the time his address was Munich, Germany. Benton's articles in the *Canadian Bee Journal* and in the American bee periodicals appear to have been the source of much of the interest in the Carniolans, and he very probably furnished most of the queens which came to this country at that time. In his advertising he stated that he had several times visited Carniola and inspected many apiaries, and had kept the Carniolan bees side by side with the Italians and found them the gentlest race of bees known.

TUNISIAN OR PUNIC BEES

While in the East, Benton made at least one trip to the coast of Africa and investigated the Tunisian bees, afterwards known as Punics. He probably offered queens of this stock direct from Africa at the time, but little attention seems to have been paid to them.

In 1891 John Hewitt, of Sheffield, England, sent two queens of this race to T. G. Newman, editor of the *American Bee Journal*. Doctor C.C. Miller also received two such queens from the same source. Both of the Newman queens and one of Miller's were lost, but Miller safely introduced one. E. L. Pratt, a well known beekeeper of that day, was writing much in their praise, and Henry Alley, of Wenham, Massachusetts, also advertised them as "the most wonderful race of bees on earth." In his magazine, *American Apiculturists,* for August, 1891, Alley stated: "The imported stock in my yard was very expensive and required courage for the investment. I probably paid a larger price for my Punic bees than any man ever before paid for queens of any race. Imported Punic queens are now offered at eight dollars each, and the price may go even higher."

In the same issue of that magazine, E. L. Pratt offered Punic queens for one dollar each.

Interest in the Punics was short lived. Although pratt wrote articles for several magazines in which he lauded them highly, numerous criticisms began to appear. In July, 1892, *Gleanings* published an article, which included an extended account of the Tunisians (Punics) written by Benton, who had seen them in their native land. He described them as small, very black and spiteful stingers, as well as bad propolizers. They had so little to recommend them that there was no reason to continue to push them after the novelty of a new introduction had worn off.

CAUCASIANS

It was only after Benton had been placed in charge of bee culture in the United States Department of Agriculture and made his second trip abroad, that Caucasian bees became well known in this country. In 1905, he visited the Caucasus and sent queens to America. Among them, some were sent to Herman Raushfuss, of Englewood, Colorado, who continued to rear queens from the descendants of the original importation for a number of years. It appears that Rauchfess had already imported some queens of this race from Germany.

This 1891 ad from E. L. Pratt advertises Carniolan and Punic queens for sale.

Honey Bee Biology

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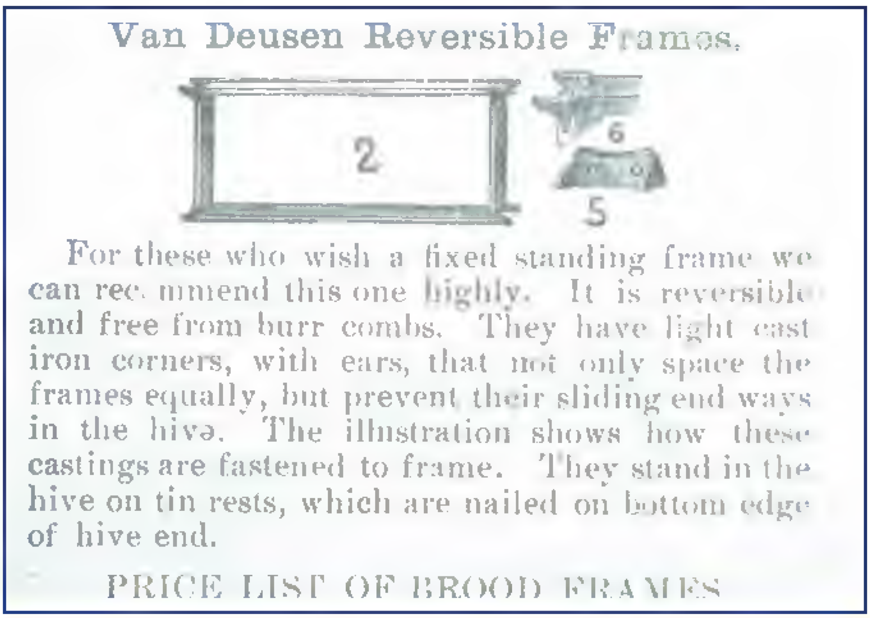
Apicultural History, Top-Bar Hives, and Comb Building Behavior Make an Interesting Mix

In the previous article, we examined a brief history of the modifications to the Langstroth frame. For efficient colony inspection, self-spacing frames are essential. We saw an original Hoffman frame, a real rarity, that led to the simplified self-spacing frame of today. Having combs built straight in the frames is also a necessity. Before foundation was widely available, we learned last time that beekeepers of the late 1800's provided bees with a comb starting edge to work from either as a wood strip or a "V" under the top bar. Building upon the previous article, this one combines apicultural history and bee behavior during comb construction that I have observed from keeping bees in 200 top-bar hives for well over 20 years. Hopefully this interdisciplinary approach will be illuminating.

Once I met a commercial beekeeper in Virginia who made comb honey by the ton from several hundred hives. He had the most unusual brood frame. Immediately upon seeing them, I knew their origins – Van Deusen Reversible Frames. The beehive version of taking a giant leap *back* in time a century or more. These frames have little cast iron corners with protruding "ears," as they were called, that spaced the frames (see Figure 1). These are also free-standing frames. The lower ears of the frames rest on two thin strips of tin nailed under the bottom ends of the brood chamber. The brood chamber requires no frame rest (rabbet), which of course simplifies its construction or frames can be used in a standard brood chamber (with the tin strips).


Van Deusen Reversible Frames.

For these who wish a fixed standing frame we can recommend this one highly. It is reversible and free from burr combs. They have light cast iron corners, with ears, that not only space the frames equally, but prevent their sliding end ways in the hive. The illustration shows how these castings are fastened to frame. They stand in the hive on tin rests, which are nailed on bottom edge of hive end.

PRICE LIST OF BROOD FRAMES

Figure 1. The Van Deusen reversible frame shown in the 1892 W. T. Falconer Manufacturing catalog, located in Falconer, New York.

Ponder this immortal and elegant aspect of the Van Deusen frame: the wooden part of the frame, like any other in a beekeeping operation, weakens over time from general wear and gnawing wax moth larvae. Eventually the frame becomes too rickety and is discarded. The wood part – not the *ears*. Cast iron ears had not been made since probably some time in the 1890's. So the precious ears, saved like a treasure, were nailed into the next batch of frames (see Figure 2). Over the decades, they passed through at least three beekeeping families, originating in New York, as the hives in this operation were bought and sold. No telling though how many bee generations scurried over those ears. Digging deeper revealed some curious history about the Van Deusen frame and little-known behaviors about bees building comb.

Since the frame is not suspended, but rather stands, and with all corners the same, the frame is *symmetric*. A beekeeper can remove a Van Deusen frame, turn it upside-down and put it back into the hive. Try that with a modern frame. But why would you? That is, why would a beekeeper want to replace brood frames *upside-down*? Granted it's hard to conjure up one reason for such a strange maneuver. Would you believe beekeepers from more than a century ago had two good reasons for this? Originally, the Van Deusen frame was designed for produc-

Figure 2. Old ears in new wood. For comparison the other frame has seen many years of service. See how the cast iron ears from the two frames touch and space the frame. When these ears were poured as molten red-hot metal, hive design creativity flourished. Uniform standard hives lay off in the future.

ing comb honey. A problem with comb honey production was having too many unfinished sections. To help the bees finish them, the accepted old practice was to "reverse" the frames (particularly I think towards the end of the nectar flow). The band of honey, normally at the top of the brood comb, would be switched to the bottom. Bees will not maintain that arrangement (unless the colony has no empty comb above, that is, conditions are excessively crowded). The bees will move the honey upwards, and into the comb honey sections and hopefully finish filling them. (These sections were directly above the brood nest in a single super.)

The other reason for reversing frames probably resulted from not using complete sheets of foundation. Even if the bees built the comb straight in the frame, upon finishing it, the bees rarely attached the comb to the bottom bar. Instead, they left a gap between the lower edge of the comb and the bottom bar, a gap of about three-eighths of an inch wide[1]. This bottom gap made the combs weaker. Most likely it led to more breakage during colony inspections or when moving hives over rough dirt roads with horse and wagon. (This chronic bottom gap problem is not observed when foundation extends through the bottom bar, another reason for using complete sheets, though that reason is seldom acknowledged. I did see commercial bee operations in India with truckloads of hives moved over rough roads. The broken combs mostly had the bottom gaps. The starting foundation had not extended all the way to the bottom bar. From horse and wagon to the truck, history repeats itself.)

The gap between finished comb and the bottom bar becomes essentially a bee space. In my top-bar hives (Figure 3), the bees do the same thing. They build comb from just foundation strips (see below), my version of a comb starter, a situation very similar to that in the hives of the late 1800's. Upon completing the combs, the bees rarely, if ever, attach them to the hive floor. Rather they just leave a bee space under them, which is their passageway (Figure 4). Therefore, back in the historical hives, the bees were most likely treating the bottom bars like the *floor* of the hive. (Also for this time period, 1880's and into the 1890's, beekeepers did not use double brood chamber hives, particularly for comb honey production. So for the brood frames, *all* their bottom bars are next to the hive floor.)

To strengthen the comb, the beekeeper from a century ago needed a way to make the bees fill in this troublesome gap. The trick was to *move* the gap to the top of comb – by reversing the frame. While it might seem unlikely, it's claimed the bees would fill in the gap when it's *above* the comb. When I first read about this technique, I figured it would work. Here's why. First assume there is no super, then the reversed frame would have the gap near the *very* top of the hive. Now this situation is similar to an experience with my top-bar hives.

A very windy spring caught a few of my hives light on stores and flipped them over. The hives, located a three-hour drive away, remained upside-down for several weeks. To put it in our historical context, the wind "reversed" all the combs. The gaps the bees left at the bottom of the combs and floor had become gaps between the top of the combs and ceiling. I learned the hard way that bees would not tolerate long thin gaps up there. They may leave a few holes for walkways, but mostly the little welders fill in the gap, making hive and combs all one. I had to cut out the combs to fix them, a long miserable job. Likewise it seems reversing a Van Deusen frame would have fixed their bottom gap problem.

The comb-starting techniques we examined in the previous article do not lie dead in the past, forgotten on the yellowing pages of old bee journals. Rather they have returned to the present, reincarnated in another hive, the top-bar hive. One technique I have heard of is to cut a center groove down the middle of the top bar. Then, for the wood strip (a comb starting edge), a beekeeper fills the groove with popsicle sticks (inserting them parallel to the bar). This avoids having to rip numerous thin strips on a table saw. This modern method is essentially the same as having the frame with the wood strip (comb guide) under the top bar. In addition, somewhere I saw a booklet or article on top-bar hives where the underside of the top bar was cut as a "V," complicating the simplicity of the hive. This method uses the old frame idea with the V-shaped top bar.

A typical top-bar hive question I get is how to make the bees build straight combs

Figure 3. A couple of my top-bar hives in the big snow that paralyzed the mid-Atlantic this past winter. The bees weathered the storms without incident. The sloping sides of the hive are thought to minimize the comb attachments and make it easy to remove combs for inspection.

Figure 4. A top-bar comb. Toward the upper corners, the bees will usually attach the comb, but almost never to the hive floor. Even the lower edges of the comb are rarely attached to the hive. This is a comb of cotton honey from a long summer nectar flow with no swarming.

Figure 5. The end of a comb off its top-bar. The top bar is to the right and the middle of the comb is centered properly. I do not have this problem very much anymore. This comb can be straightened and fixed in a few minutes.

Figure 6. Attaching foundation strips to about 700 top bars. The hives in the left foreground are full of top bars. On the tilted board are the strips ready to be attached with melted wax. The top bars are then placed in the empty hives to the right. With so many top bars, I need consistently straight combs.

from the bars. The wood strip is not always satisfactory (which probably goes for the "V" strips too). Furthermore, my suspicion from "reading between the lines" of the old bee literature was that beekeepers of the past were not generally satisfied with these designs either. Here is one way comb construction can deviate from the comb guides. As mentioned in the previous article, bees elongate honey cells. When bees build a set of combs, they sometimes bulge the honey cells, particularly toward the upper corners, on one comb before they lengthen the adjacent comb. When the bees extend that next comb, it must curve to avoid the bulging ends of the preceding comb (see Figure 5). As this problem repeats, the set of combs begins to curve. If the curvature is severe, combs become attached to multiple top bars.

What will deter excessive comb bulging (and just a general curvature of the comb) is an adjacent sheet of foundation. When foundation first became readily available, it could be expensive for beekeepers. Not surprisingly, they sometimes cut foundation sheets into strips, and attached them to the top bars with melted wax, using the strips more like comb starter. That works unless the strips are too narrow. To keep my top-bar combs straight, I mimic the *top* of a full sheet of foundation by providing a *wide* foundation strip (about an inch an a half). Figure 6 shows my setup for attaching the foundation strips with molten wax to a big batch of top bars.

Standard equipment has made the beekeeping industry more efficient and profitable. Nonstandard operations, now so exotic, are reminders of past historical diversity. Some of those old designs had their illuminating points, perhaps in unexpected ways that are even relevant to research today. One should keep in mind that in subtle ways the hive design itself limits the manipulations on the bees (say with suspended frames) and may narrow our observations on them (as with complete foundation sheets) and cause us to miss some of their interesting behaviors.

Acknowledgments

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

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The Classroom

by Jerry Hayes

Please send your questions to Jerry Hayes,
17505 NW Hwy 335, Williston, FL 32696
Email: gwhayes54@yahoo.com

Q Should I Buy Queen Cells?

Since queens seem to be dying shortly after I get them, I am considering ripe queen cells. But, I have read that one has to very careful when handling them. The Postal Service is not designed to be careful. What are the chances of getting them from their breeding places to Illinois alive and well?

A

Dave Miksa in Florida raises about 100,000 cells each year for sale to mainly commercial beekeepers. They have developed a system to transport hundreds of queen cells by the buyer. It is important to keep queen cells at a certain age in a certain position, warm, humid and not jiggled, bounced or shaken if possible. That leaves the Postal Service, UPS, Fed Ex, DHL or any other commercial delivery service out of the picture. Drive to Florida, pick up your several hundred queen cells and drive back to Illinois with the queen cell transport box securely next to you in the passenger seat.

JZ BZ Queen Cell Shipping Carton

Q Politically Touchy

What do you think about all of the Australian packages of bees coming in for almond pollination?

A

You are right Jeremy, lots of package bees from Australia have been brought in over the last several years to fill in the gaps caused by shortages of U.S. colonies. Approximately 1.3 million honey-bee colonies participate in almond pollination for this $2 billion dollar crop. California can only provide about 500,000 colonies internally, so the rest have to come from outside the state. Almonds absolutely, positively have to have honey bees to pollinate or their $2 billion value slips and growers obviously do not want it to slip. Can Australian packages come into the United States economically and contribute to almond pollination? The answer seems to be yes, which is a good thing for the almond industry.

However, some Australian honey-bee import critics speculate that Australian bees are weak genetically because they have not been challenged by varroa and other varroa-implicated health issues. They have not participated in the survival of the fittest scenario. According to some critics, Australian bees seem to succumb to various new parasites and diseases rather quickly in the United States.

The problem from my perspective is that if they survive long enough to possibly provide virgin queens and drones, these Australian honey bees can mate with our "survivor" bees and, of course, make them weaker genetically, compounding problems we already have. However, the $2 billion dollar almond industry will not be denied. Nevertheless, if Australian honey-bee imports should falter for any reason, and U.S. colony availability continues to worsen, look for the Mexican border to open up to them to bring their AHB colonies to the California almond groves.

Q Nosema... Fungus or Protozoan?

Jerry, in a recent communication with a member of the Washington State Beekeepers Association, I was told that Nosema is caused by a "fungus". This was a surprise, as I believed it was caused by a microsporidian. So, my first question: Cause of Nosema...fungus or microsporidian?

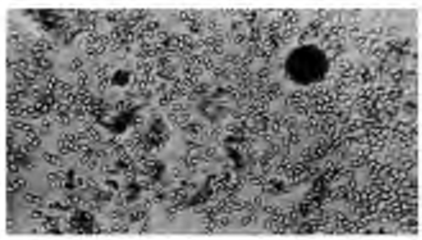
Second question: If it is a fungus, why does an antibiotic (Fumagilin-B) work at all, since antibiotics are effective on bacteria, not fungi?

Thank you,
Morris

A

Hello Morris. You are correct that the causative organism is a microsporidian, either *Nosema apis* or *Nosema ceranae*. Nosema is one of those diseases, which has both protozoan- and fungus-like characteristics. It was classified as a one-celled protozoan before and now with more advanced taxonomic techniques, it is a micro (really small) sporidian (spore-forming) life form.

Fumagilin-B, the commonly recommended antibiotic to control this bee disease, is also used widely for patients with HIV/AIDS because it controls fungus growth in people with compromised immune systems caused by this disease. Remember, antibiotic means anti (against) biotic (life). The term antibiotic is a catchall for bactericides, virocides, fungicides, etc.



Nosema spores
from *The Hive and the Honey Bee*

All of that to say—The causative agent for Nosema is now classified as a microsporidian. And, sometimes Fumagilin-B works and sometimes it doesn't. Now that should clear it up :)

Q Chemical-Free Beekeeping

Hi Jerry, what I want to know is information you may have on keeping bees free of chemical use. Many Thanks.

Buddy

A

I think using a variety of integrated pest management (IPM) techniques can get you away from many chemicals generally used in beehives Buddy. Hygienic queens, screened bottom boards, drone removal, powdered sugar dusting every 3-4 days, rotating 3 frames or so of comb out yearly, and continuous surveying will keep you on top of most varroa and disease issues. These techniques are certainly not perfect, but pretty good. You may still have varroa population booms at times that have to be knocked back with Apiguard or Mite Away II.

Removing the infected comb and destroying it can control bacterial disease like American foulbrood (AFB). Sometimes antibiotics have to be used as a tool. The key point is that you have to know your bees and be a good manager and that requires you to keep tabs on what is going on inside the colonies. This is certainly possible, but proves hard for most people. But, you are not *most* people, so you can do it!

Q Confused About Sugar Dusting

I may have missed an episode on sugar dusting bees for varroa. Please, could you explain where you stand on this issue? I refer to the abstract of your paper in the *Journal of Apicultural Research,* which concludes that powdered sugar dusting did not significantly reduce varroa levels and your continuing advice in this column, which appear to contradict one another. Thank you.

Regards,
Ben Rees
United Kingdom

A

Ben, I am old enough, and you may be old enough as well, to know that there are vast swatches of gray in this world and relatively few firmly black and white, yes-or-no answers. When you focus on worldly "science", it is a process that is always in flux with new information arising to update previous data, which at one time was thought to be the final answer or at least pretty close. So, I guess you are right that I have seemed to contradict myself.

Dr. Amanda Ellis, who led on this research in our lab, did great work and gave some insight into powdered sugar dusting within the parameters of the research over a year's time. The data presented in the *Journal of Apicultural Research* paper was that when you *treat every few weeks* that it certainly knocks off phoretic mites, but the varroa adjust and increase reproduction. So, over a year's time, even though these treatments remove lots of mites, the mite count has not significantly changed. Would it have grown more if the mites had not been removed? But, the population certainly seemed to hold its own.

We have done some preliminary trials using powdered sugar dusting *every 3-4 days* to remove phoretic mites as they continuously emerge from reproducing in cells. This does not give them a chance to re-enter cells and reproduce. They cannot catch up biologically or reproductively. After doing this for 4 -5 weeks, we have covered all brood cycles and mite levels are very, very low. Is this labor-intensive method practical is the question? Probably it is for some, but not for the majority.

I think removing mites from your colonies of honey bees is a good idea. And, removing mites using powdered sugar is a sane idea that works under application methods as noted above. The more you do it, the better the long-term results are. I would rather someone try using powdered sugar as often as possible to remove mites and hopefully postpone a "chemical" treatment than simply go to "chemicals " first. So, thus arises my apparently contradictory stand. I hope it makes sense!

Q *The Birds and the Bees*

I am not a bee expert in any sense of the word, but in doing a bit of searching on the Florida Agriculture site, I downloaded and read your February column "The Classroom"—very good, very informative! The reason for my correspondence is two-fold:

1.) Several years ago, before the honey bee decline was widely noted and documented, I noted hundreds of dead honey bees in my pool skimmer, on a daily basis in the late summer through December. I never gave it much thought, but now I wonder why? And, because I had never observed this occurring in 30+ years, it seemed rather peculiar. Then, came all the media coverage relating to the decline in bee populations? Was the virus manifested by the bees attempting to learn how to "swim" or did they die as a result of their weakened condition?

2.) Now, I have another problem—too many bees! I am a "humming birder", and as such have sugar water feeders up in the winter months (September through March). In 30+ years I never had a problem with bees until this past November and it continues. In my contacts with others who also host "over wintering" hummingbirds, they also report the same problems I have and they are not within a 3-4 mile radius of my Florida home. I don't wish to act rashly in trying to control them, but can you shed any light on why we experiencing such an increase in their numbers? In years past we always had the bees in fewer numbers and they were not a problem. The large number of bees was a problem prior to the freezes and the loss of the majority of our flowering plants, so I don't think the colder winter is the primary reason!

Many thanks for your time.

Joe Misiaszek
Lakeland, FL

A

I am not a bee expert either after these many years. Anyone who says they are is a liar.

1) Honey bees are attracted to swimming pools (perennial question) because of their need for water to drink, of course, and the chorine salts in the water, which helps them tell their sisters where the correct water source is. When they get there, they fall in and drown, sometimes in the hundreds or thousands. Not unusual. Basically, this tells you that there are honey bees relatively close by.

2) We have African bees displacing genetically based managed honey bees in the feral environments in Florida. The "wild" bees that were so prevalent years ago disappeared due to introduced parasites, and diseases. There was a gap and now that environmental gap is being filled in by the defensive, aggressive African Bees. Central and South Florida is home to a growing wild population of these bees.

They like hummingbird feeders for the nectar-like food resource, just as well as the hummingbirds do. Put mesh guards on the "feeding tube" so that the bees cannot access the sugar syrup, but the hummingbirds, with their longer beaks, can use the feeder. Also, be sure none of the feeders leak or drip and this will discourage foraging honey bees. You have provided free food for the hummingbirds and any other creature that can get to the free food.

These bee foragers are not a physical hazard to you, but they do indicate a nest or colony possibly close by. Take a look at our web site found at: **www.doacs.state.fl.us/pi/plantinsp/apiary/apiary.html**. Under the section entitled Diseases, Pests and Unwanted Species is lots of information about African Bees that you should know about.

Comment: Dangerous Gifts?

Your answer in the Classroom about "carbonated honey" made me laugh. Last season I tried to copy a successful beekeeper I know and I extracted some of my uncapped honey. I guess I did not handle it properly and it fermented. It has a sharp fermented taste and smell and swelled out some of the plastic bottles that I stored it in. However, before realizing my mistake, I had given away some of it as gifts. Man, I hope they eat it before it blows up! From now on, it's just completely capped and cured honey for me ☺

Signed,
Mr. too embarrassed to say

Beespace

Metal frame spacer

I ordered some frame spacers from a bee supply company in the Northeast and in the catalog right next to the picture of the spacers they have a blurb about not using them with new foundation. There wasn't any other explanation. You have been around the block a few times, and a lot of us readers out here have been very successful by listening to your advice. You couldn't be wrong.

Thank you,
Mark

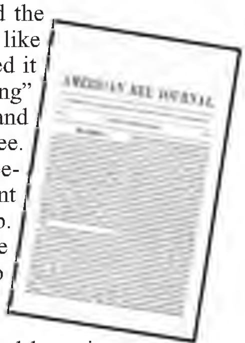
Well Mark, I was wrong once that I know of :) so be aware that it can happen again! I agree with the advertisement that you read that says the goal is to have the foundation "drawn" out as perfectly as possible. And, that is more possible if frames are spaced properly, knowing perfection is elusive. Bee space is important, so that frame and comb orientation is within appropriate distances and frames maintain movability. Ten frame "boxes" are designed for ten frames that are, in turn, designed for the proper distance called "bee space". When you put nine frames or eight frames (as is normally done with spacer kits) in a 10-frame box, then this important "bee space" can be changed and the comb building may not be as uniform as one would like. However, the reason nine or eight frames are spaced in a 10-frame box is so the individual cells on the comb are lengthened. Therefore, when the comb is full of honey and capped, it is easier to uncap.

There is always a chance that the comb will not be perfect when the factory spacers are installed and comb drawn in that environment, but they are minimal. Remember that installation of the beeswax foundation must be straight and perfect in order to have straight and perfect comb. If the comb ultimately is not what you want, you can use a hive tool or knife to sculpt it and give the bees another chance. Bees are more apt to build comb when they have lots of carbs (honey or sugar) to produce wax from their wax glands. I think I would start with the nine-frame spacers and see how your bees respond. It should be fine.

Pruning the Combs?

I am reading the past issues of *American Bee Journal* (available at **http://bees.library.cornell.edu/**)and in the April 1861 issue under Monthly Management, it says, "Now, when the weather becomes settled and fair, and the workers are returning in crowds with pellets on their thighs, is the proper time for *pruning* the combs." What is "pruning the combs" all about? I've never read anything like that before!

Thanks,
Steve
New York



In 1861 they used the term "pruning" just like they would have used it to describe the "pruning" or removal of limbs and branches on a fruit tree. However, in the beekeeping world it meant removing old comb. There was knowledge even 150 years ago that comb was a valuable resource and to preserve it and keep it as long as possible was efficient. They also knew that **old comb** was a reservoir for potential disease and could affect honey color if these dark combs were used for honey storage. So, they had systems of old comb removal called "pruning", something we now often term "comb culling". This was removal of whole frames of old comb and/or cutting out the old comb from frames. And *voila* one has "pruned" the old comb from a colony.

Does Fumagilin-B Work?

Would you feed Fumagilin-B routinely in the spring? Is it effective against *Nosema ceranae*? Thank for the service you give to beekeepers.

Gregory Stoddard

Nosema, both *apis* and *ceranae* varieties, are sensitive to some degree to Fumagilin-B. Basically, you want healthy bees going into winter. These bees are physiologically different than "summer" bees.

I am a much happier person when things are black or white, but this is not the case with most things in life. The problem with Nosema is that not all bees are infected in a colony at the same time. It appears at irregular intervals or not and it can cause health problems or not, depending on the time of the year it appears strongly.

Unless you survey your bees and get a spore count (at this time a million spores per bee is considered not good), you don't really know when to treat and if your treatment will be effective. Most people/beekeepers just treat and hope the stars are aligned and it all works. There is a saying in business that 50% of advertising is a waste. They just don't know which 50%. The same goes for Nosema treatments.

Gregory Responds

Thank you for the time and consideration you have given my question. I reread the answer you gave to a question in the February Classroom. I, too, feed Fumagilin-B every spring. To me, it is like the Varroa conundrum. One either makes the effort to do the mite count, drone comb replacements, etc., or stop keeping bees. Beehavers are extinct. As Yoda in the Star Wars movie said, "Either do, or not do, there is no try."

I hope to thank you in person someday and I would love to have your autograph on my copy of your book.

Best Regards
Gregory

Growing Into Commercial Beekeeping

by Blake Shook
DesertCreekHoney.com
Blue Ridge, TX

I believe I began beekeeping like many others: Slightly timid around bees (and people), uncertain in my ability to find one queen bee amidst thousands of workers who all seemed to be doing the bee dance at once, and highly skeptical of these people who called themselves "beekeepers". In my all-knowing 13-year-old head they simply had to be somewhat neurotic to be so excited about their career working with millions of stinging insects. Not that I didn't think beekeeping had its perks, but really, there had to be an easier, less painful way to achieve the American Dream. I never believed those guys who claimed to get used to stings anyway. My two milky white 5-coats-of-paint beehives were plenty for me. Besides, I didn't want to go into all that debt to become a large-scale, or even sideline beekeeper.

Fast forward 7 years. If you peer into a bee yard in Houston or Dallas, you may see the exact same guy madly driving a forklift preparing a few of over 800 hives for California almond pollination, wearing a floppy plastic, (very stylish) hot yellow rain jacket, happily whistling between terrific bursts of thunder and ignoring an occasional sting from a dissatisfied southern garden fairy. Maybe you can see him sitting in front of a computer, designing new labels and conjuring up marketing strategies. You may also watch the same guy passionately speaking in front of crowds of beekeepers, sharing the knowledge he has been so blessed to learn, and sharing the simple (debt free) story of his growing business. I'm not sure what changed in me during that seven-year period. Perhaps I became a beekeeper…perhaps I lost a few neurons or brain cells. I'll leave that judgment up to you.

A few months ago I was speaking at the Louisiana State Beekeepers Convention where I met the Florida State Apiary Inspector, Jerry Hayes. After giving a presentation on the story of my business, Jerry asked me if I would be interested in writing this story for the *American Bee Journal*. His words were that he hoped it might be inspiring to others. My hope with this story is not a chance to obtain five minutes of fame, but an opportunity for me to share what I have been able to accomplish, and how you can easily do the same thing. What follows is the highly abridged story of my business (Desert Creek Honey), broken down, year by year.

In 2004 I was exposed to an addiction for the first time—the addiction of beekeeping.

As beekeepers, we all hope for "boomers" like this hive.

Moving colonies

A close encounter with some of my bees

Taking a break after loading a truck

A couple of my bee yards

One of my 2005 marked queens

A local beekeeping organization in North Texas (Collin County Hobby Beekeepers Association) was giving away beekeeping scholarships to teens. It provided everything needed to begin beekeeping: 1 beehive, all the equipment, and a 20-hour training course. My parents thought that to broaden my horizon, this would be an interesting hobby for me. Little did my parents know where this "hobby" would lead. As a tightwad-in-training at 13 years old, I heard "free" and was instantly on board. Little did I know that as a tightwad, I had already met the first requirement for being a successful commercial beekeeper.

I won that scholarship, along with five other teens, and was thrust into the world of beekeeping. That first year was not different to that of many new beekeepers—1 beehive, some interest, a few books, and very little money. After catching a few swarms for the fun of it (the one my Dad and I caught 25 feet high in downtown McKinney during rush hour was exciting… but, that is another story), I grew to 3 hives by the end of my first year.

Moving on to 2005, my beekeeping started to become more interesting. Unknown to me, I had been bitten by the bee bug. By splitting my surviving hives and catching swarms, I was able to grow to 25 hives. The only way I was able to do that was to buy all the used equipment I was able to find. I also built a very small "shack" as my equipment workshop. One thing which gave me a tremendous boost in my potential career was beginning to work for John Talbert, a sideline beekeeper. I can't emphasize enough the importance of working alongside a beekeeper who actually knows what he or she is doing. John continued to teach me beekeeping throughout 2005.

2006 flew in (excuse me, buzzed in) much more quickly than I expected. With the new year came a much deeper enthusiasm and appreciation for beekeeping. I'm sure many of you can relate…your third year in beekeeping you finally begin to grasp this delicate art, and can begin to help others do the same. In 2006 I became more involved in our local association, and was asked to become the delegate. Not only did this increase my involvement in the local industry, but it caused me to begin to share with others what I thought I knew about beekeeping, thus refining my own knowledge. I grew to about 100 hives, again by simply splitting my 25 hives from the previous year, and gathering swarms. At this point I was making enough money from selling honey to buy lots of used equipment, but still not enough to begin buying new equipment to rotate the older equipment out.

In 2007 beekeeping became a passion. Interestingly enough, stings somehow didn't seem to hurt like they once did, and I could actually find queens! Now that I grasped the basics in beekeeping, I decided to try rearing a few queens. One of my first experiences in queen rearing was dealing with a rebellious hive led by a virgin queen, intent on swarming. Away the swarm would fly to a nearby branch, just beyond my reach. I swear I could hear them giggling in delight as I struggled over the fence and up a ladder to retrieve them for the third time. Finally, exasperated, I grabbed the virgin queen and with a smug, all-knowing look on my face, proceeded to clip her wings. I'm afraid it was a few days later before I realized that virgin still needed those wings to perform a rather important function! This was my unfortunate introduction to queen rearing. I attended several of Larry Connor's queen rearing courses after that instance. In 2007, I also had the opportunity to send 20 hives to California to pollinate almonds…not only was that an exciting experience, but it provided an exciting boost in my income. I have loved almonds ever since. 150 hives via splits was the expansion for 2007. Other essential building blocks for me included speaking at the American Beekeeping Federation Convention in Austin promoting our club's Youth Program, and becoming the vice president of our local association. All of these things forced me to learn even more about beekeeping, beekeepers, and served to further my enthusiasm. I can't stress enough the importance of being involved in whatever association you belong to—you will be amazed at what it will teach you. This year I also began to sell honey in a few local stores. This provided me with an important source of income, which enabled me to begin buying some new equipment.

2008 was a pivotal year in my business. I liken that year to where many sideline beekeepers may currently be. I was making a decent gross income, and was about to graduate from high school. I had the choice to begin full-time beekeeping, or put that career on hold and head to college. Perhaps you are in a similar position, and are trying to decide if you should take the leap and end your current job and pursue beekeeping, or keep it as a sideline business.

I had always heard the common joke that there is money in beekeeping because you keep putting it there. Though funny, I often found myself wondering how much truth that saying held. I found it to be good for a laugh in any crowd, but also not quite true. There really is money in the beekeeping industry if you are resourceful and willing to work. So, after graduating at the head of my class (hold the applause, I was home-schooled), I pursued full-time beekeeping. At this point I was selling honey to 5-8 local stores, and this enabled me to expand to 200 hives with lots of new woodenware. I was able to raise over 1,000 queen cells, and sell over 200 mated queens (complete with both wings), finish a second term as Collin County Hobby Beekeepers Association (CCHBA) vice president, build a small honey house, and begin running the same youth program which introduced me to beekeeping. Needless to say, I had dived off the deep end.

2009 was my first complete year as a full-time beekeeper/salesman/speaker/officer/janitor. Perhaps one of the most important things which happened last year was my business partnership with bekeper John Talbert. Through the past five years John was always there, guiding, directing and advising me. In 2009 John and I began to work all of our hives together, and began to operate largely out of the same facility. He and his wife became, and are, much more like grandparents than business partners. Having someone like John, or at least an experienced beekeeper ready to guide you is one of the most important factors to growing your operation. In 2009 I was honored to become CCHBA's president, as well as a director for the Texas Beekeepers Association. I was also able to further improve my existing website **desertcreekhoney.com** (with the help of a good friend), grow to 400 hives, begin helping John build a packing facility, and prepare to sell honey in chain stores. I tried to also focus on diversifica-

Two of my honey labels

tion…the concept of not putting all of your eggs into one basket. I began selling lots of creamed honey, nucs, began helping teach the class (alongside John) which taught me beekeeping, sending hives to California, selling pollen and soaps, selling products online and focusing on marketing. It was, indeed, a full year!

2010 has just begun, and already seems to be a promising year. My goal is to grow to 600+ hives by this spring. Combined, John and I should have 1,200-1,500 hives by the end of this year. We sent 200 hives to California for almond pollination, are almost done with our bottling facility, and are set to sell over 200 nucs to the ever-growing classes we are teaching. Honey sales are excellent (though I still need to get into a few

Some of my packaged creamed honey

chain stores), and I'm looking forward to finishing my second term as CCHBA President. It has been a long time since I was unsure about beekeeping, and I have long since thrown the "neurotic beekeeper" idea out the window and decided that we beekeepers are "unique" as John says—not "strange". All one has to do is discover the wonderful world of beekeeping.

Here is the take home message of this whole article—I am a 20-year-old kid. If I can grow a beekeeping business from nothing, to something of a success without getting into any debt, so can you! I don't have any special skills or abilities—just a willingness to work, accept help, and pray regularly. Many have done this before me, and many after me can as well. This story is not meant to be a how-to article, but my hope is that the main goal has been accomplished—that you are inspired to give this a try yourself, and to see that there is indeed still hope and profitability in our fascinating industry.

The Traveling Beekeeper

Catching Swarms and Doing Bee Removals

by LARRY CONNOR
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Lots of new beekeepers and many small-scale beekeepers remove swarms every season as a means of obtaining lower cost bees (they are never 'free'), and a certain number of them do bee removals, often called 'cut-outs' of colonies that are established in trees, buildings and other structures.

Swarms

Swarm removal sounds easy. You simply drive up to a newly landed swarm, shake the bees off the branch and into a box, seal up the box, and drive home where you will dump the bees in front of an empty bee hive body.

Swarm removal, in reality, can be much more complicated. You may need to use a ladder or even a cherry picker to reach the swarm. There is a good chance that the swarm may fly to a permanent location between the time you get the call and the time you get into the car or truck and arrive on the site. Sometimes the swarms are really small, and not worth the fuel to drive to pickup the bees. Then, you charge that up to being a good member of the beekeeping community.

If you have never done a swarm removal before, it is not difficult. If you obtain good, secure access to the swarm it is just a matter of shaking (or brushing) the bees AND THE QUEEN(S) into the box or container.

We define a swarm by the queen that goes with it. If a colony leaves with the mother queen (the one that went through the winter), we call it a Prime Swarm (usually just the old queen, but sometimes daughter queens fly when Mother cannot join them due to injury or some other factor). It is often the largest and will range from 8,000 to 20,000 or more bees, the equivalent of one or three packages of bees. The parent colony has sealed swarm queen cells that will produce unmated queens that will not fight until the decision is made to produce an After Swarm. Colonies average about one and a half swarms per year, so there is a pretty good chance that an after swarm will be issued and will carry many virgin queens with it. These queens fight to determine the

(l) Shirley and Horacio's backyard apiary, mainly of bees removed from buildings and swarms.
(r) Bee swarm in grill. About 80% of the bees are defensive. These colonies are not kept.

(l) Horacio with one of the many birdhouses he and Shirley have removed because they are filled with bees. (r) Entrance of birdhouse hive, showing bees and comb inside.

winner only after the swarm has entered its final nesting spot. After swarms are smaller, 4,000 to 10,000 bees and often have multiple queens. When I captured a swarm at the Farm, I got one or more queens, but left some behind. It was a large swarm and what I got was a good colony. But part of the swarm reformed on the tree with an uncaptured virgin and flew away after a few days and is established within the neighborhood. The swarm was at the top of an old apple tree and we could get the bed of the truck into the maze of brush to work, but not comfortably.

Container used for swarm catching

If you can lift a nucleus box, cardboard nucleus box, or an empty box of most any sort, this is fine for shaking/brushing bees into. Many of us have left the office after getting a swarm call, grabbing a copy paper box from the copy room with a sliding lid. These are great for catching swarms—in a pinch—since the lid can be gently slid back onto the box and air holes punched with a hive tool to provide air until the bees can be installed back in the apiary.

There are amazingly elaborate boxes in the literature and on the market for catching swarms. Some incorporate vacuum cleaner devices to suck the bees out of the trees and into the box. You certainly can have a lot of fun with these devices, and may become quite proficient at swarm catching by using one, especially swarms high off the ground.

Cost of swarm removal

If the swarms are free, how can they have a cost associated with them? If I drive an hour to get a swarm in a work truck, take off time from work, buy special equipment, and bring a buddy along who needs to stop for food and drink—these are costs. So swarm bees are not really free, but you know they are less expensive than other methods of starting new hives. Finally, you can charge for swarm removal and learn that PEOPLE WILL PAY TO GET RID OF FLYING STINGING INSECTS. Current rates seem to be in the $50 to $100 range. If people do not want to pay, you can give them the name of a new beekeeper, a teenager perhaps, who will do this for nothing and for the experience.

Care of swarms

I use the biological method of introducing swarms into a new home. I shake the bees at the entrance, perhaps on an old bed sheet, so all the bees, including the queens, walk into the cavity. I place frames of drawn comb, a frame of food (pollen and honey) and foundation in the hive so the bees will like what the find when they crawl inside. The bees seem to like being shaken at the entrance better than dumped into the hive and sealed up. Often swarms on foundation fly away because they don't approve of the new home you picked for them. The behavior of walking into the hive is an important piece of biology, as it seems to complete the swarming instinct behavior.

Feed swarms with one to one sugar syrup for several weeks to a month. This will continue their instinctive urge of build beeswax comb. They will start foraging for pollen and nectar almost as soon as they arrive in the box, so a source of carbohydrate is excellent and will stimulate more pollen foragers and rapid brood buildup.

Once the colony is established, examine it carefully for any problems and then put it into your production cycle within the apiary.

Advantages of swarms

Swarms carry honey in the stomachs of the bees. This is digested to produce beeswax. A strong swarm can produce a full box of comb in a few days, more if fed sugar syrup. Swarms usually come from vigorous hives, and can be and real asset.

Risks of swarms

There is a small but statistically significant chance that swarms will carry spores of American foulbrood in the honey in their stomachs. Some beekeepers put antibiotics into the sugar syrup as a preventative. I simply watch the brood combs very carefully for any appearance of any diseases and eliminate the swarm if I see Foulbrood or other problems.

In more parts of the country than in the past the risk of capturing swarms that carry African genes or are entirely African is growing rapidly. Sunbelt areas are particularly at risk, but areas in the country with a huge influx of migratory beekeepers from these areas increases the risk of getting African bees or genes into your apiary. Watch for any signs of defensive behavior and remove or requeen the colony as needed.

Swarm catching by using bait hives is a popular method for swarm detection and removal, especially in areas of African bees. The beekeepers work under contract to manage a series of bait hives and weekly visit the hives to check for swarms. If found, the swarms are destroyed. This is often used in public areas: golf courses, playgrounds, retirement communities, campgrounds, amusement parks, etc. These services are potentially profitable when well managed.

Bee Removals

When swarms are not captured by a beekeeper, they enter empty bee tree cavities, the sides of buildings and other spaces. When these are near humans they create a potential risk and the property owner will pay for their removal. These bee removals are also called 'cut-outs' by beekeepers since the bees must be cut out of the walls of a building.

In some parts of the country bee removals are an important source of income for many small-scale beekeepers. They see the removal of these bees as a source of bees and their stored honey (selling this honey in special containers and at a higher price). They also see these bees as a source of good genetic information, as survivors, and want to test the daughters of these queens in their apiary. (In my opinion there is no guarantee that these bees possess any special genetic traits, but there is no reason not to produce daughters from these colonies and test them).

Bee removals are work. Beekeepers

Once the colony builds comb, it will not leave to go to another site. With the cold winters of Northern Texas, these colonies may not survive in the wild, unless protected by vegetation or buildings.

doing this sort of work have a flat fee or a minimum fee and go up from there. The fee per nest may be $250 and higher. When I was visiting St. Croix, a group of beekeepers were removing four colonies from one concrete block wall, and charging for each colony. This is an important source of bees on the Island, and while the bees are African, the comb pieces are wired onto the frame and managed for honey production.

Beekeepers talented in both colony removal and structural carpentry can do very well with the cut out business, and build their colony holdings. This is a great source of income during a slow construction economy.

A Small-Scale Removal Operation

In November of last year I visited with Shirley and Horacio Acevedo in Princeton, Texas. Horacio retired in 2000 from Texas Instruments after 28 years with the company. The couples' interest in beekeeping began when they were working for Texas Instruments in El Salvador where they met an old farmer who kept bees on the roof of his house. In their 'retirement' the couple does hundreds of swarm removals and cut-outs a year, taking the bees back to their apiary and harvesting the honey. They charge for their services, even for swarm removal ($50 to $200 for swarm removal, $300 to $800 for removal of feral colonies from buildings, depending on the distance from their home and the difficulty of removing bees).

They have traveled 100 miles one way for removals. If a potential client does not want to pay for the swarm removal, they turn them toward a young member of the Collin County Hobby Bee Club who will do the removal for nothing.

More and more, the bees in their North Texas area are getting "excessively aggressive." They report that five years ago about 80% of the colonies were gentle, and now only 20% are kept for their own apiary behind their home in Princeton. The aggressive colonies are allowed to fly free when they arrive home. They do not bring in any other bee stock.

They sell honey and other hive products at local festivals, where people seek out their very dark honey. They have four children, but none of them are interested in keeping bees. They do not use any pesticides on their bees other than moth crystals for stored comb protection. They let their bees requeen and swarm as is their nature. Most of the time they do not feed their bees, but will feed a fall swarm with honey in a Boardman feeder.

Acevedo, Shirley and Horacio
10717 CR 1114
Princeton TX 75407
www.acebees.com

Interested in learning Queen Rearing? Why not attend one of Dr. Connor's classes? Check www.wicwas.com for classes with openings for June and July. And check out *Queen Rearing Essentials*, available from the website or your favorite bee book seller.

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The Primer Pheromones and Managing the Labor Pool

Part II

by Randy Oliver
ScientificBeekeeping.com

In the first part of this article, I explained how the allotment of the hive labor pool was largely controlled through communication via the process of sharing protein-rich jelly via trophallaxis, plus non-feeding interchange of low volatility "primer" pheromones. I now continue with a summary of our current state of knowledge of the complex process of labor allotment within the hive.

The "Purpose" of the Hive Economy

Perhaps we should first define the "purpose" that drives the honey bee economy. The ***function*** of bees in nature is that they pollinate plants, but that's just a convenient symbiotic collaboration that allows them to follow their true ***purpose.*** Note that the fickle bee doesn't care about any particular plant's success—for example, they will abandon species with low-sugar nectar (such as pears) the moment that a more attractive nectar becomes available (as from apples).

The ***purpose*** of the bee economy is that of successfully passing the workers' genes into the next generations via drones or swarms—i.e., ***colony reproduction***. So let's look at how this works—starting with a fresh swarm. Its first order of business after moving into a new cavity is to build comb and store enough honey so that it can both make it through the winter *and* build up early enough the next spring to swarm ***before the main honeyflow***. They will also generally need to replace their aging queen mother via supersedure. Come fall, they must then shift from foraging and broodrearing to the production of long-lived "winter bees." Then, in spring, they strive to madly expand their population, produce new queens and drones, and to send off one or more fresh swarms (colony reproduction). Not very romantic, but if you understand the bees' purpose, you can better work *with* them, rather than *against* them.

Practical Tip: If you constantly keep in mind that the bees' goals are invariably geared toward reproduction and winter survival, then you can use the bees' innate behaviors to your advantage. Here's a quote that I read to all my newbee beginners:

> *"The bees have their definite plan for life, perfected through countless ages, and nothing you can do will ever turn them from it. You can delay their work, or you can even thwart it altogether, but no one has ever succeeded in changing a single principle in bee-life. And so the best bee-master is always the one who most exactly obeys the orders from the hive"—from* The Bee-master of Warrilow, *Ticknor Edwards, 1920.*

So here's what's interesting to me— the colony must strike a delicate balance between maintaining enough nurses to care for the brood and to produce jelly for the queen and foragers; plus delegate the optimal number of workers to the foraging force; yet maintain the right amount of mid-aged honey processors to support them. How the heck does the colony "know" how to allocate the right proportion of workers to each critical task? Not only that, but any established balance must be quickly readjusted when a honeyflow starts or ends!

So what are the proximate causes that regulate colony balance and response to the environment, not to mention the initiation of swarming or supersedure? At this point I'd like to closely investigate the interactions between pollen and nectar income, the transfer of jelly, and communication via pheromones.

A Model

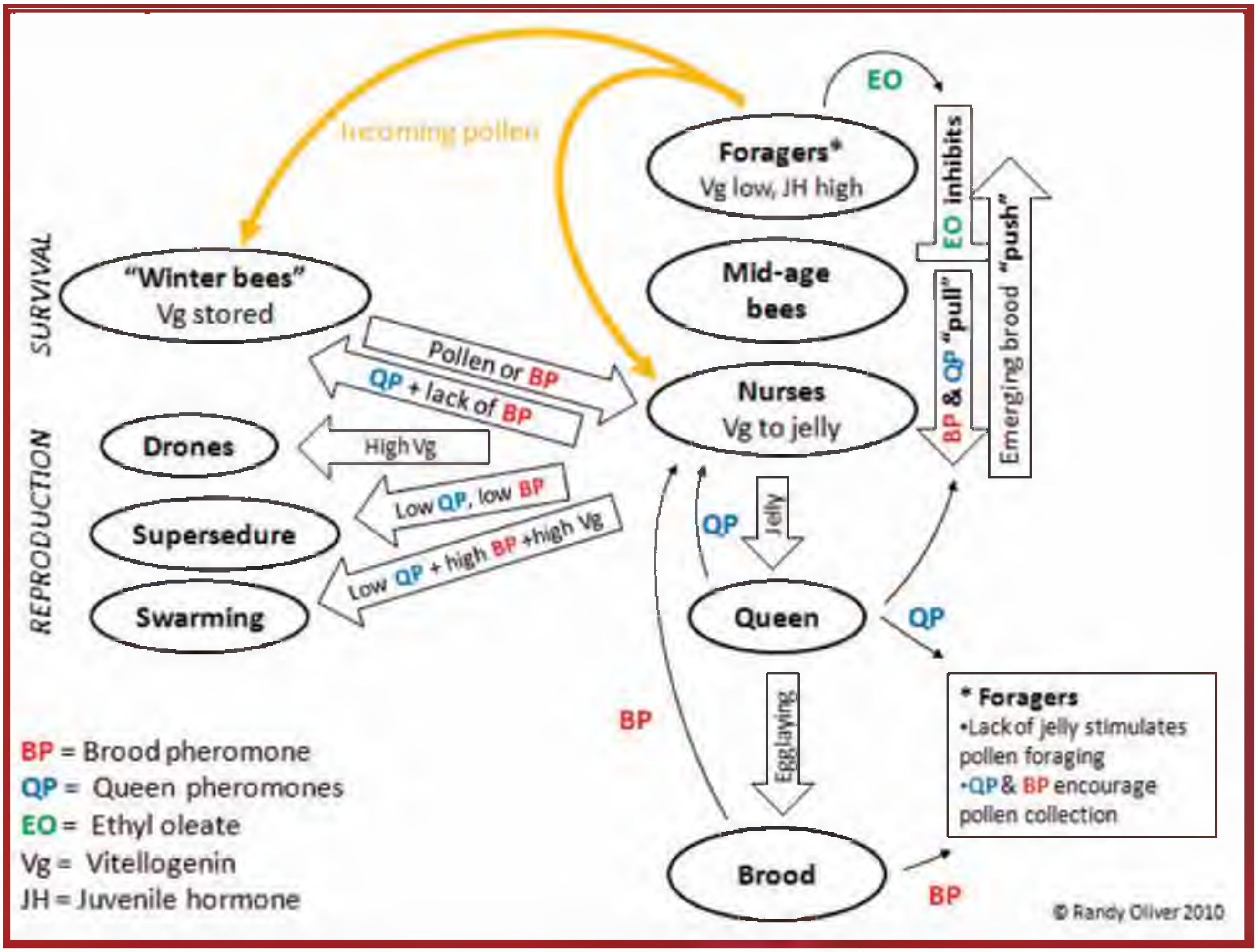
On my first trip to Australia, a lady beekeeper cracked me up when she thanked me for "translating what the 'boffins' (researchers) say, into English." I realize that by this point, this article is starting to sound a lot like boffin talk. So I'm going to take a bold step, and create a diagram that summarizes our current state of knowledge on the influence of the primer pheromones within the colony. In the model, I hope to illustrate how the "adaptable workforce" that I described in my last article is continually adjusted in response to colony needs. Please realize that this graphic is a very simplified version. It will be helpful for you to refer to it throughout the rest of this article.

OK, there's a lot of information in the graphic! But I feel that it is worth taking the time to study it carefully, in order to get a better feel of what's going on in a hive. Let's start with the most important input to the economy of the hive—a pollen flow.

The colony responds quickly to incoming pollen. A pollen flow is the signal to rouse diutinus bees (during winter or drought) out of their "survival" mode. They gorge on the precious protein, and start feeding jelly to the queen, who responds in turn by initiating egglaying. The queen continually announces her presence, behavior, location, and likely her state of fertility and hunger, by secreting ***queen mandibular pheromone***, along with several lesser pheromones. I'm intentionally calling them collectively ***"queen pheromone"* (QP)**.

As soon as the eggs hatch, hungry young larvae start pumping out "feed me" **brood pheromone (BP)**. This BP in turn causes the diutinus bees to shift from vitellogenin storage in their fat bodies, to mobilizing it into their blood, the better to produce jelly.

Practical application: races of bees



A simplified diagram of the transfer and effects of primer pheromones upon bee physiology, "aging," and task behavior; and colony reproduction and wintering. Note the overriding importance of fresh pollen income, and the multiple effects of brood pheromone and queen pheromone. Also note the "push/pull" on mid-aged bees to maintain a balance between foragers and food processors.

from extreme climates (such as the Primorsky Russians or Africans) are far more responsive to changes in pollen flows than are those from Mediterranean climates (such as Italians). The keepers of Russian bees also tell me that Russians are less responsive to artificial pollen supplements than are Italians.

Since there is still not enough BP in circulation at this point to demand that very many bees take on nursing duties, the remaining "winter bees" are free to respond to the dances of pollen- and nectar-collectors, and are recruited into foraging. At the same time, the rising level of BP from the increasing amount of brood stimulates those foragers to collect more pollen (Pankiw 2004)!

As long as there is abundant brood (secreting BP), the nurses know that there is a laying queen (due to BP and QP), and that they need to continue to devour pollen in order to make enough jelly to feed everyone. High titers of BP and QP "pull" ***against*** the maturation process of nurses into mid-age bees, keeping them in the broodnest (Toth 2005). (I want to give credit to Harris (2008a) and Johnson (2010) for the "push/pull" analogy).

Then, as fresh adult bees emerge from their tighly-packed cells, they physically take up more than three times as much comb space as they did as pupae!

Practical application—predicting colony strength prior to almond pollination: Say that you're inspecting your hives *two weeks prior to bloom*. For colonies wintered in cold/cool areas, this inspection occurs at the critical time when they are transitioning from their winter lull to serious spring buildup. At this time, the aging "winter bee" population is dying off at the rate of a half to full frame of bees during this two-week period (Harris, unpublished data), assuming that the colony is well fed, and not having problems with mites, nosema, viruses, etc.

Since you've only got two weeks, only existing sealed brood can possibly add to the adult population. So for the colony to grow in strength over the next two weeks, it would need to have sealed brood in excess of maybe a third to half a frame. Each *full frame* of brood (or equivalent) over that amount will increase colony strength by about three frames of bees. So, for example, a healthy 5-frame colony would need to have about 1½ full frames of *sealed* brood to make 8-frame grade two weeks later. (You can do the math for other colony strengths.)

The resultant crowding as a consequence of worker emergence ***physically displaces*** the older nurses toward the cooler periphery of the broodnest. The newly-emerged bees engage in cell cleaning and capping, while they gorge on pollen in order to develop their brood food glands, and to mature their wing muscles in the warmth of the broodnest. In a few days, they begin to produce jelly and act as nurses.

Meanwhile, the displaced nurses are no longer exposed to as much BP or QP. As a consequence, these "mid-aged bees" now *ignore* the brood (not my job anymore!), but rather start paying attention to the other hive tasks at hand—packing pollen, receiving and processing nectar, building comb, cleaning debris, ventilating, and guarding.

Mid-aged bees are physiologically fully developed, and in short order can engage in most any task. But most important, they serve as nectar receivers and processors to take the incoming nectar from the foragers.

Any incoming nectar is transferred from foragers to receivers in the dance area near the entrance, who then carry it up to the top of the brood nest for immediate use by the nurses, or for processing any excess into stored honey. Should they not find empty cells in which to place nectar, they are forced to hold it in their crops—this storage stimulates their wax glands to go into production, which then allows them to build new comb.

Practical application: this is when you will see "white wax" or "whitening of the combs," meaning that the hive needs more storage space (or that it is ready to draw foundation).

If there's no immediate task at hand, mid-age bees just wait in reserve, or patrol around looking for something useful to do. Johnson (2009) proposes that such patrolling may serve two important functions— that of assessing colony needs, and maintaining a flux of eager workers ready anywhere in the hive to jump on any job that needs to be done.

This is an important point! As long as workers are nurses or mid-age bees, they can live for a long time. However, as soon as they start foraging, the clock starts ticking. Active foragers during an intense honey flow only live for two weeks at best. So, it would be counterproductive for mid-age bees to transition to foragers unless they are truly needed. Better to wait and bide their time as long-lived "general labor."

The bees have developed a clever way for the mid-age bees to tell if there are enough foragers—the foragers secrete a pheromone (ethyl oleate (EO); Leoncini 2004) that inhibits the mid-age bees' maturation process (by keeping Vg high)! Whenever there are not enough foragers (honey flow on, pesticide kill, adult bee disease), the EO inhibition is relieved, and mid-age bees rush to fill the void.

In an expanding colony during springtime, there will be a low nurse/brood ratio, thus BP titers will remain high, so the colony population will be mostly "house bees." However, once colony growth starts to peak, there is then a shift toward a higher nurse/brood ratio, BP titers drop, and there will be a large population of middle aged bees at the ready to take advantage of the main honeyflow.

Practical application: in order to produce the most honey, the beekeeper tries to time colony growth so that the population peaks just as the main honeyflow begins. This may be tricky, since the weather often does not cooperate. Successful management may involve appropriate stimulative feeding to promote growth, or splitting and swarm control to reign it in. In beekeeping, timing is critical!

Since foraging is the riskiest behavior for a bee (other than colony defense), workers simply stay busy in the safe confines of the hive until they are needed to forage. But what happens when they are stressed, and somehow sense that they may not live much longer? In that case, they get their sick butts out of the hive, and work themselves to death, even in conditions that healthy bees wouldn't normally fly in! (Amdam 2004, Lin 2004, Higes 2008, Lourenco 2009). In a review by Tofilsky (2009), he explains that "workers that are infected, poisoned, injured or affected by other harmful factors start to forage and perform other risky tasks at an earlier age than their healthy nest mates."

Practical effect: You can see how an in-hive epidemic of viruses or nosema can push bees into foraging behavior faster than the broodnest can replace them, which *can result in the rapid depopulation of the hive!*

This ingenious feedback arrangement allows the colony to best conserve its workforce, yet still be able to take advantage of any sporadic honey flow at the drop of a hat. Indeed, during the flow, the mid-age nectar receivers may flood the broodnest with curing nectar, and effectively shut down the queen's egglaying (provided that there is not enough drawn comb available directly above the broodnest). This frees up even more nurse bees to take the place of nectar processors that have graduated into foraging! Once the flow is over, the bees can then "dry out" the broodnest, and the queen can get back to laying to replace the often substantial portion of the population that is lost in the frenzy of foraging.

Practical application: Note how the storage of nectar in the broodnest can shut down broodrearing. It makes a big difference exactly where supers of drawn comb or foundation are placed, and how queen excluders are used. Some simple hive manipulations (such as reversing the brood boxes or "checkerboarding") to create a "break" through the honey band above the brood nest, so as to better allow the nectar transporters access to the empty combs above, can be used to help control swarming, and to produce larger honey crops (see the observations by Walt Wright).

In those areas of Australia with long, intense honeyflows, beekeepers keep the broodnest from becoming plugged by running a single brood chamber below an excluder, and by placing supers of wet drawn comb ("stickies") directly above the excluder as often as every week. This practice keeps open comb directly above the brood—exactly where the mid-aged bees prefer to place nectar.

A point to note is that BP also affects the foragers—it encourages them to forage for pollen. So during a strong nectar flow, when there is little young brood, there is less incentive for foragers to restock the broodnest with pollen. This can have consequences down the road, when the colony tries to rebuild after the main flow.

Harris (2008a) found that "During the summer, most bees [die] within 5–7 weeks of emergence, so colonies must maintain very high reproductive rates if they are going to produce large colonies that are biologically or economically viable." The point is, that as soon as broodrearing slows (generally in late July), the colony population can drop rapidly, since workers continue to die at an early age.

Practical application: After a strong honeyflow (especially a pollen-poor one), the colony may be lacking in enough pollen to recover its population by new broodrearing. This can lead to colonies going into fall in weak condition!

One last item of interest: When a colony is starving, there is no reason for young bees to waste time nursing or building comb—the colony needs food, and fast! When emerging bees don't find enough food in the hive, they tend to simply fast-forward and begin foraging precociously (and preferentially for nectar) (Schultz 1998, Nelson 2007, Marco Antonio 2008).

OK, that's enough for now—we've covered the right side of the model. Next month I will continue with a discussion of the primer pheromones, and the colony reproduction on the *left* side of the model.

Acknowledgements

I could not begin to compile the information necessary for my writing without the steady assistance and suggestions by my friend and collaborator Peter Loring Borst, to whom I am again greatly indebted. I also wish to express my gratitude to some of the giants in this field of research who took time to review this article for accuracy: Drs. Gro Amdam, Zachary Huang, and Gene Robinson. I also appreciate the generous correspondence from Lloyd Harris, and Drs. Heather Mattila and Brian Johnson. I would also be greatly remiss not to tip my hat to that great bee behavioralist, Dr. Tom Seeley, who has inspired a generation of bee scientists!

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The Mystery of the Hive

Part One of Three Parts

Whispers in the Dark

by PETER LORING BORST
Ithaca, NY

As the plight of the honey bee has been in the news so much, beekeepers find themselves explaining beekeeping to more people than ever. One thing that non-beekeepers are surprised to learn is that most of the life of the bee takes place in pitch black darkness. Whatever organization and communication goes on in there simply does not involve light or seeing. One can easily imagine a stadium full of 70,000 fans finding their seats, enjoying a football game, and getting back to their cars in total darkness, right? Well, no, but the honey bee colony performs such a feat using an interesting assortment of signals. In fact, the whole animated creation is involved in signaling in one way or another, the study of which is called biosemiotics. From the tiniest colonies of bacteria, to vast fields of blooming clover, signals are sent and received, enabling living creatures to feed, reproduce, and clean out the trash.

Since recorded time, people have been poking into beehives to try to make sense of what is happening inside. Naturally, our tendency is to try to understand what we *see* going on. The ancient Greeks set in place the concept that the single large bee is the Basileus, or King. They observed the retinue, or King's Court and assumed this group of close advisors carried the wishes of his royal highness to the rest of the teeming minions. Labor was divided up between housekeepers, guards, scouts, soldiers, and so on, all with marching orders from the King. This imagined hierarchy held sway for centuries until brighter minds grasped the fact that the King was a female and that *she* spent the better part of her time laying eggs, like a termite queen. Pretty soon the whole story began to unravel as it was revealed that nobody is in charge, that a bee colony is run on the principle that everyone simply does what they're supposed to do.

Students of the hive are generally acquainted with the somewhat fanciful literature of honey bee lore. In fact, the first book I read about bees was Maurice Maeterlinck's "The Life of the Bee." Maurice was a wonderful combination of playwright and beekeeper. If I tell you that he wrote an essay titled "The Intelligence of Flowers" (1906) you will get a sense of where he was headed. In fact, in the preface of his book on bees he states:

> It is not my intention to write a treatise on apiculture, or on practical beekeeping. I wish to speak of the bees very simply, as one speaks of a subject one knows and loves to those who know it not. I do not intend to adorn the truth.

However, he goes on to challenge the concept of the queen being the ruler of the hive and substitutes a mystical notion:

> She is not its queen in the sense in which men use the word. She issues no orders; she obeys, as meekly as the

(above) A worker bee stands alert to permit foragers with the right scent

(right) The bees of the hive exchange honey laced with special substances humblest of her subjects, the masked power, sovereignly wise, that for the present, and till we attempt to locate it, we will term the "spirit of the hive."

Insights from Ants

Scientific research on ants was beginning to point in exactly the opposite direction. It began to emerge that the queen herself might be the regulator of the hive after all. First and foremost in this story is William Morton Wheeler, who became obsessed with the study of ants in Austin, Texas around 1899. He soon became curator of invertebrates at the Museum of Natural History in New York City. In 1910 he published "The Ants" which was to become *The Book of Myrmecology* for the next 50 years. Wheeler coined several terms which remain with us still. The word "ethology" was created to describe what we are doing here, trying to understand the behavior of animals. He was the first to propose the term "superorganism" to refer to the extended association of thousands of creatures which singly, could not survive on their own. Wheeler also introduced the concept of "trophallaxis" which is the transfer of food and other substances from mouth to mouth by insects. This process is central to the story I am about to present.

Regardless of whether the queen is or isn't in charge, how do the thousands of bees know what their job is at any moment? For example, beekeepers will tell you that if a hive is nudged, a few guards may appear at the entrance, but even if the hive is given a good hard thump, still only several hundred guards appear to defend the entire group. Not every bee sees it as her duty to guard the hive. Just like a city under siege, the majority of the citizens wait patiently for the defenders to protect them from invaders large and small. Close observers of the hive have discovered that there are various phases honey bees pass through, sort of like Piaget's stages of child development. But with bees, it is not so closely dependent upon age. There is a seasonality to the life of the hive which requires more of some types of bees at different times of the year. Still, even with such division of labor, simply having a ready workforce isn't sufficient to get the job done.

So, one thinks, doesn't there have to be some kind of organization of labor in a colony? If every bee simply did whatever she felt like, the various tasks could not get done in an orderly fashion. Imagine a crew of laborers building an apartment building. Obviously, everyone must know what her task is and *when* it is time to perform it. The electrician can't show up to put the wires in before the frame is built or after the sheet rock is nailed up. She may have to wait for weeks to come back in and install the light switches and fixtures that go on after the paint crew has left. How does a honey bee colony handle the need for the organization of labor, is there oversight, just who is the boss here? When summer comes and bees are returning with buckets of honey, why doesn't the whole hive rush out and join the harvest?

A healthy, laying queen emits a rich and attractive scent

What are they doing in there?

New work done by Brian Johnson throws some light on this question. He spent countless hours observing bees and recording which activities they spend the most time doing. He then developed a computer program, which mimics their activities and shows how their approach is optimized for getting the hive work done efficiently. You may be surprised to learn that one of the chief occupations of "middle aged bees" is to quit work and saunter randomly about. Brian saw that bees engaged in a particular activity, generally quit after an hour and dispersed about the hive. Then, they would begin other tasks, rather than returning to what they had been doing. However, key to this is what he calls patrols. The hive bees spend a lot of time patrolling, not simply looking for work. After doing this, they begin to work again wherever they happen to be, instead of going to work where the need seems greatest. This avoids the occurrence of all hands being on deck, rather than dispersed throughout the ship. There may be times when many hands are needed in one place, but generally it is more beneficial to have the work force evenly distributed, especially in a case where there is no command and control, no oversight, no leadership taking work requests and handing out orders. In other words, the workers themselves are the foremen as well, surveying the entire job site, and then contributing what they can.

The Evolution of Insects

In order to understand honey bee colonies, it really helps to look at insects and evolution. Fortunately for us, there are thousands of types of insects and they represent all of the various stages of evolution that appear to have taken place since the very first insect-like bug crawled the earth. In this article, we will only be looking at Hymenoptera, however. This order of insects includes the ants, wasps and bees and is characterized by having membraneous wings and a complete metamorphosis, like the one that butterflies undergo. That is, there is a distinct egg, larva, pupa and adult stage. However, the larvae are not mobile (like caterpillars) and must be cared for until they become pupae and are sealed in their cells. Not all Hymenopterous insects form colonies, so it is interesting to compare the ones that don't with the ones that do, and this will form a very important part of the story.

The origin of ants is lost to history, but biologists believe that they descended from wasp-like ancestors about 130 million years ago. Ants form large colonies like honey bees do, they have division of labor, but only the reproductives have wings. The rest of the ant colony is wingless and has other features that make them distinctly different from the queen ant. The ant colony shares much in common with the honey bee colony, as well as the wasp colony, so it is useful to look at them all together. Most of the activities of ants and wasps take place in the dark, just like in our bee hives. Ants may live many feet below the surface and their nests are often organized into different compartments dedicated to various activities ranging from nurseries to gardens. So again, the labor is highly organized and one would tend to assume that there is some form of non-visual communication.

Hornets do it too

Bees and wasps are very similar in many ways. Wasp colonies can become very large. In Hawaii, invasive wasps have become a serious problem. According to Erin Wilson of the University of California at San Diego, she estimated that one colony on Maui had as many as 600,000 individuals, compared to a few thousand in a typical wasp nest. "Rather than having a nest the size of a football, you'll have a nest the size of a '57 Buick," Wilson said. "Our largest colony had four nest entrances that were just like fire hoses of wasps coming in and

The queen is surrounded by admirers clamoring for her attention

out." But not all species of bees, wasps and ants form large colonies. Some live singly or form very small groups, which are more like a little family than a teeming metropolis. These are extremely useful for studying division of labor.

There is a vast number of wasps and bees whose lifestyle is not communal. These are called solitary. Some examples include carpenter bees (*Xylocopa*), leafcutters (*Megachile*), and orchard mason bees (*Osmia*) and such wasps as mud daubers (*Sceliphron*), pollen wasps (*Pseudomasaris*), and potter wasps (*Eumenes*). These insects are simply concerned with reproduction. The mature female finds or makes a suitable nest, provisions it with food, lays an egg and flies off, never seeing her young ones. Probably, these insects are similar in habit to the ancestors of social insects and so one can suppose that many of their instincts will be inherited and expressed in the behavior of colonies of insects.

In a cold climate, a mated bumble bee queen will hibernate over the winter and in the spring begin to raise a small family. She hunts for a suitable nesting site, forages for nectar and pollen, and builds small cells in which to lay eggs. The eggs hatch into larvae which have to be fed and protected until they emerge as miniature versions of the mother queen. These bees have the genes of regular queens, but according to how much they are fed, they are stunted and do not develop all of the features of a mature bumble bee queen. In a sense, the bumble bee queen creates a group of slaves, which carry out the work needed to enlarge the nest. They apparently lack the instinct or inclination to go off and form colonies of their own. This fact gives a glimpse of how much larger Hymenoptera colonies may be able to control the activity of their thousands of individuals, whose genetic makeup is not different from their parents or their siblings, yet their habits and roles are decidedly distinct. When one observes insects that form true colonies such as paper wasps (*Polistes)*, yellow jackets (*Vespula*), stingless bees (*Melipona*) and the various honey bee species (*Apis*), one sees much the same thing, only on a larger scale.

Let's do lunch

An early pioneer in the field of insect study was Auguste Forel, a Swiss psychiatrist. According to Charlotte Sleigh, renowned myrmecologist:

> One particular aspect of ant behavior that fascinated Forel was the mutual solicitation for food that ants performed almost constantly. Forel interpreted the mutual type of feeding as highly pleasurable, almost erotic, for all the ants concerned. The regurgitating ant with her backward-flung antennae has a look of ecstasy, and undoubtedly feels as much enjoyment as the one which is swallowing.

William Wheeler considered feeding to be the central activity of the colony. It was generally believed that something in this feeding process was responsible for creating the different types of ants found within the nest, a phenomenon which is called polymorphism. This refers to the division of insect colonies, such as ants, into a number of distinct "castes". Additionally, Wheeler's inquiries into mutual feeding suggested to him an intricate mesh of *trophallactic interactions*. To him, the exchange of food was not just a pleasurable activity, or a technique of controlling development of the castes, but a means of communication. Yet, it is also all of these combined.

Wheeler was not content to describe the functions of ant colonies, but began to expand the ideas he had hatched into applications regarding human activity. He pointed to the socialist trends in post-Revolutionary Russia that were creating an underclass of suppressed and indoctrinated workers, compelled to carry out the work of the superorganism-like society. Then, as now, the chief beneficiaries were not the workers themselves, nor the nebulous "good of all", but naturally it's the leaders, the elite, that benefit most from the ceaseless toil of so many loyal comrades. Forel, meanwhile, found the suggestion that the workers were somehow drugged as pathetic, likening it to the pervasive use of alcohol which he associated with the suffering of his psychiatric patients.

The Brave New World of Ants

The Huxley brothers, Julian and Aldous, followed William Wheeler's discoveries closely. Julian used the new knowledge to write his own book on ants, and Aldous famously penned "The Brave New World."

Bees can feel, smell, even taste with their ever curious antennae

The concept of controlled development was thoroughly explored by Aldous in his science fiction tale of a world where human society is tightly controlled. There are five castes, raised in hatcheries like ants. The top caste develops naturally to its full potential, while the lower castes are chemically stunted to retard their physical and mental growth. The whole of society is further regulated by the constant consumption of the drug Soma, which ensures complacent obedience and prevents any form of rebelliousness, anarchy or sense of individual entitlement.

This proved to be a recurring theme in science fiction for many years to follow. Who can forget the scene in "The Matrix" of thousands upon thousands of humans in cells, being used solely for the energy they can provide to the computer system of which they are merely components? The theme of genetically modified humans or semi-mechanical humans, which have all the valued characteristics except independent will, is as perennial as poppies. However, the control of human populations via drugs is unfortunately a bitter reality. Once addicted, the glory of free will is quickly replaced by a dire necessity of maintaining a steady supply of the substance to which one has haplessly become enslaved.

Such is the stuff that great books and nonstop scary movies are made from. But — that's not all there is to our story. Join us next month for more adventures in the Mystery of the Hive! To be continued.

Acknowledgements

I would like to thank the many people who have helped to make this story somewhat complete, but most of all Anne Frey, Sarah Kocher, Mea McNeil, Carole Stone, Randy Oliver, and of course, the ever present Tom Seeley.

How to "TALK BEE" with Children

The Honey Bee Project

by DEBRA ROBERTS

I am a fool for bees, children and state fairs. Every year, I volunteer time at the Buncombe County Beekeepers Chapter booth at the North Carolina State Fair. In 2006, I was dispensing *I Love Honey* stickers to children who had found the marked queen in our observation hive, when I noticed a woman enter the building. She was holding the hand of a child on either side of her. The observation hive was right in the middle of our table and all the bees were clearly under glass (i.e. no buzzing free-rangers). She took one look at the hive, screamed, and yanked her children from the building (and I do not exaggerate). I daresay that set a tone for their relationship with bees and possibly the whole of the natural world. I was working the booth with my husband, Joe, that day and I turned to him and said, "I feel like someone has thrown down the gauntlet. I *have* to educate children about the honey bees (so they can educate their parents)." And so, a short time later, The Honey Bee Project was born.

The Honey Bee Project is a non-profit children's honey bee education project that has "talked bee" with thousands of children at state fairs, festivals, summer camps, and in classrooms. Our invitations grow annually. Through our years of experience, we have been able to identify what children are most fascinated with, what they are confused about and afraid of, and what lights them up so they can appreciate the magical role that honey bees play in all our lives. We have learned, from children, how to help them become better honey bee stewards.

After five years of talking and teaching "bee" to children, I now feel like English is my second language. It is good to be bee-lingual. If you are reading this article in the *American Bee Journal*, you have probably already been invited to speak to children. Or you will. It comes with the territory. I hope you will say yes because even if you have only been beekeeping for ten minutes, you already have something of value to share. A little bit of good information and a lot of bee love go a very long way with children. And feel free to harvest any of the following suggestions that interest you, because they are tried, tested and on tap.

Some of the best advice I got from elementary school teachers, when I first started, was to arrive in the classroom with a variety of things "in my basket" to teach, with the understanding that if you only get *one point* across in one session, you are doing a good job. That one important thing for me has always been conveying my passion for honey bees. For children to meet an adult who is unabashedly in love with bees, as much as they are with their dogs and cats, makes a big impression and is a revelation. That I also wear wings and antennae doesn't hurt, but nothing holds a (beeswax) candle to my love for these tiny precious winged beings. Children respond back with their beautiful hearts and wonderful questions.

If we are presenting in a classroom, I like to talk to the teacher ahead of time to find out what the students are studying, so I can weave what I'm sharing into that, if possible. Teachers are also treasure troves of special hand signals or words for "quiet', which come in handy (and are also useful in adult bee club meetings). And remember to begin by introducing yourself because children will really be curious about who you are.

Here is what has worked for us. We come with three intents: We begin by briefly addressing concerns and confusions about honey bees; we spend a lot more time on things to appreciate about them; and we leave the class with specific ways children can help the honey bee.

Concerns and Confusions

Bees sting and there is no getting around that. I head right into this territory by asking children if they have ever been stung. Almost everyone has and very soon you will hear stories about "the thirty bees that stung me last summer". Of course, that was most probably yellow jackets, because they nest in the ground. It is common for children and their parents to confuse honey bees with hornets, wasps and especially yellow jackets. So, I bring pictures or (deceased) samples of all of them and we figure out who's who and where they live. I bring an empty bald-faced hornet's nest and a wasp's nest and we talk about where all the non-honey bees tend to live (and why yellow jackets are the most upset with us because we step on their doorways).

Then, we talk about the most common places to find honey bees, which are around managed hives or on a plant just minding their own foraging business (and having to defend themselves against an occasional big old human foot or hand). We talk about how when a honey bee stings, it dies (unlike its fellow stinging pollinators) and we practice with our thumbnails how to best remove a sting so that it doesn't hurt as much. None of this takes a long time, but it is important because the number of confusions about what honey bees are and especially what they aren't are legion. We don't avoid the truth about stinging – we go there first because it is usually burdened with misunderstandings that make appreciating honey bees harder.

Appreciation

Where else to start but food, glorious

In my classroom bee outfit reading student "bee mail"

food? We bring honey bee-dependent fruits and veggies (pictures or the real thing) that children care about. The conversation launches from (the obvious) honey to lots of other day-to-day foods that children like to eat. Their top favorites are usually apples and berries. And hamburgers are the other favorite. Even the teachers aren't always up on the connection between honey bees and hamburgers: American cattle are often fed on alfalfa and clover of which the seed production is dependent on honey bees and other pollinators.

And, spend some time shopping for apples before class. I hold up a round apple in one hand and a non-round one in the other (and you may have to shop for the latter at a farmer's market or look in someone's yard because stores favor round ones which sell better). I ask the class what the difference is between the two apples and rarely does anyone know that the shape of the apple is determined by how many visits a honey bee makes. That is a great way to begin to convey what pollination is about. (One teacher reports that she got so ignited about this one fact that she kept her husband up half the night raving about honey bees.)

Debra Roberts in her beeyard

Beekeepers sometimes bring observation hives. Even though I have access to one through my local club, I am too fussy to bring my own girls out of their yard. And I have never needed to. (But if you are inclined to bring one, the children will love it.) I bring a hive box, bottom board, inner cover, top, and hive tools. I put my suit on in front of them (to walk in already suited up and veiled can be a little scary for small children … better for them to meet you first). Children are also curious about trying any size suit on, so bring an extra if you can.

Before opening the hive, I tell the class that I have not brought any live bees with me that day (again, so they don't worry … some do). I ask them if they want to see inside where the bees live and at this point, it is always a Hallelujah Chorus of Yes. I bring ten frames in the hive body – a foundationless frame, one with plain foundation, and others in various stages all the way through to fully drawn (and fully drawn with capped honey, if available). We smell new wax. We talk about what the drawn cells house (brood and food) and where the wax comes from (and how cool it is that bees build their homes from what comes out of their bodies). We look at different colors of pollen. And we could be there all day with just this part of the lesson because children have a million great questions and perceptions about life in the hive.

We used to light a smoker if we were outside, but I don't recommend it anymore unless you keep it completely away from children until extinguished and cool again. One of our presenters, who is infinitely responsible, lit a smoker (one of the ones with a protective shield) and a quick-as-lightning future Olympian boy grabbed the smoker out of her hands. Fortunately, it was immediately reclaimed and the child only got a blister, but it was a distressing moment that influenced our decision to not light smokers around kindergarten through fourth grade children. And frankly, there are so many incredible things to share about honey bees that you don't have time for everything anyway.

I like to bring a picture of a swarm. (Beekeeping picture and informational sets such as the Dadant Study Prints are excellent.) There are also lots of good bee and beekeeping photos on the Internet that you can print out and laminate. Be sure to obtain permission from the photographer and/or website to do this, however. Children are fascinated by swarms and they are very empowered by knowing what one *really is* – that the bees are not out to "get them" and that they are full bellies with wings, looking to protect their queen until a new home can be found. Most children leave the session hoping to see one, so they can relax the adults around them and experience the miracle together.

Waggle and orientation dances are a very easy thing to talk about. Kindergarten through third graders have a blast imitating you shaking your thorax and abdomen. Fourth graders can begin to be more self-conscious and getting them to imitate a figure eight hand motion in front of the hive stays on cooler (even awesome) ground.

Time will fly as you keep weaving children's invited questions and input into your talk. Dialogue keeps everyone awake and ignites deeper interest and participation. The children are going to fall in love with you by the end of the session as you give them reasons to care about the honey bee.

How to Help the Honey Bees

Children love to help, so we end our time together by discussing how to be good bee stewards. We also leave a handout with them called "How You Can Be(e) a Good Friend to Honey Bees!" (or ten easy things that any child can do no matter where they live or how old they are). Children can learn to make a water source for bees and birds (that is shallow, has a slope, or has rocks in it, so the bees have somewhere to stand while they drink); they can invite their parents to buy honey harvested from someplace near where they live; and every time they eat an apple or another honey bee-dependent food, they can thank a bee! (And you'll think of more.)

One of my personal favorite things to do is to encourage children to write letters of appreciation (love letters) and make drawings for the bees. This reflects back some of the things they learned. The teacher mails them to us later.

Children Also Love …

A quick sampling of other popular things to do with children is:

- Bring honey for the children to taste (but clear it with the teacher ahead of time – on rare occasions, they will say no). Bring a jar of good local honey and a box of new coffee stirrers. You stick them into the honey and hand them out (which satisfies the school's hygienic standards).
- Give out free stickers. The National Honey Board will sell you a large roll of *I Love Honey* stickers for a very low price (honey.com). We also give away a lovely bright orange postcard with a gorgeous picture of a bee to each child, so they have a friendly beautiful image of a bee to take home.
- With younger children, I do a "bee symphony", teaching them three bee sounds (a contented humming, an irritated you-are-bothering-my-hive sound, and queen piping). Everyone learns every sound and then I divide the group into three and "conduct" them. We all have a blast. (Middle schoolers, however, find this very annoying.)
- If there is enough time, I show *The Hon-*

eybee Fly Around Song music video (it's only seven minutes). This upbeat song sets a fun honey bee-loving tone for children. We sometimes bring the written lyrics along, teach the refrain, or talk about a few of the honey bee facts afterwards. This piece is available on YouTube via our website, thehoneybeeproject.com. And be prepared for children to fall in love with Todd Elliott, the teenaged star, singer and beekeeper in the video who has been hailed by some as the Jimi Hendrix of the Bee Yard.

- Bring laminated cards with blown up pictures of pollen. Pollen is as varied as snowflakes are. The colors are amazing. And even more so, if you show a picture of a flower blossom beside a super-enlarged picture of one grain of that flower's pollen (which can look like anything from a small Faberge taco to a moonscape), children and teachers are endlessly fascinated.
- Order some paper on-line at a place like castpaperart.com. They have wild seed paper where seeds of honey bee-friendly plants are embedded in the paper. Children can write or draw about bees on the paper and then plant it later. The paper's seeds will sprout into plants long after you are gone.

So, take your beautiful bee-loving self and dive in. You will gladden the hearts of amazing children. And even if they never become beekeepers, just lessening their fears and confusions and giving them a few real things to appreciate about bees changes their world and changes the world. And, you will feel like a genius of the modern world. That you cared enough to come and spend an hour with children will also win you the deep appreciation of teachers (who are my heroes and in my perfect world are the ones earning rock star salaries).

One of my favorite thank you letters from last year's presentations came from a boy who wrote: "Thank you for coming Mrs. Roberts. My favorite thing was everything." I felt like I'd won the Nobel Bee Prize!

Go forth and pollinate, my friends, and enjoy this precious opportunity.

(Debra Roberts is a Master beekeeper, bee educator, writer, and is generally besotted. You can contact her at (828) 712-0880 or The Honey Bee Project at (828) 712-4818 / thehoneybeeproject.com.)

Beekeeping in Southeast Georgia Where Comb Honey Reigns

by CECIL HICKS

Way down in the state of Georgia amongst a large swamp named Okefenokee there's a wild plant named gallberry that is the main source of foraging nectar for regional honey bees.

According to commercial beekeeper Ben Bruce, who lives in Homerville (pop. 2,801), which is located in Clinch County, there's some 40 commercial beekeepers in his local area. They have bee yards in the slash pine forests surrounding the area near the Okefenokee Swamp and nearly all of these beekeepers produce and sell comb honey. He added that there are roughly 6,000 residents living in his rural county and there are probably also some 40,000 beehives.

The Okefenokee is also part of the national wildlife refuge system and its land mass covers some 402,000 acres (that's roughly 300,000 football fields in size) of cypress forest, southern longleaf pines, swamps, marshlands, grassy areas, lakes and islands. It is home to a wide variety of wildlife and waterfowl including alligators, water moccasins, and Sandhill cranes.

The name Okefenokee derives from the local Creek and Seminole Indians who lived in the area and called it "The Land of the Trembling Earth." The swamp is also the source and headwaters of the famed Suwannee River that flows south into Florida and eventually empties into the Gulf of Mexico.

Ben claims southeast Georgia is renowned for being the top comb honey production region in the entire United States with approximately 90 percent of our nation's supply of comb honey coming from the area. In a good year his 1,400 plus hives will produce some 100,000 pounds of honey, which he sells wholesale all over the United States.

Annually, he usually keeps only about five percent of the total amount of honey his bees make and cuts the comb honey into four inch square blocks, packages it, sticks his Bruce's Nut-N-Honey Farm label on it. He sells it from his local roadside (honor system) shop nicknamed the "Honey Shack" located off of Georgia Highway 441, three miles south of Homerville. Ben also sells honey through his website at www.brucenutnhoney.com and he also advertises in the Georgia Farmer's Market Bulletin for mail orders. Comb honey prices in his area usually ranges from $1.30 to $1.50 per pound wholesale in large quantities.

Ben noted that his family previously owned a pecan orchard, thus the name Nut-N-Honey Farm, but the pecan orchard business has since been sold.

While its not a large number of colonies, he does have some that he pulls supers and extracts honey from. This honey is poured into one pound, two pound and gallon containers. His bottled honey sells for $5, $7 and $24, respectively. As you drive the highways and byways of southeast Georgia, every few miles you'll see a sign advertising honey for sale from a roadside honey stand.

Ben was born and raised around Homerville, which is a region that offers, according to him, three main agriculture employment opportunities—logging (tree farms of slash pine for the paper industry and some private swamp logging operations), blueberry farming and beekeeping.

For more than 20 years Ben has been working bees. He grew up helping his dad with bees. His father, Winston Bruce, who

(l) Georgia beekeeper Ben Bruce is shown with his bee truck. (r) Ben sells both comb and extracted honey from his honor system sales shack off of Highway 441 near Homerville, Georgia.

(l) Ben only keeps about five percent of his honey crop to package for sale at his Honey Shack, website and mail order. (r) Pure South Georgia Honey—how sweet it is.

(l) Ben's bee shop is located in southeastern Georgia, a little west of the Okefenokee Swamp, near Homerville. The region is renowned for its comb honey. (r) Ben checks over a stack of recently assembled bee feeders. Each feeder holds two gallons of sugar water mixture.

In his bee shop where he stores supers, Ben Bruce holds two frames. The lower has new wax foundation and the upper is full of honey, which will be cut into squares for local sales.

is no longer keeping bees, started raising one beehive in 1980. At around seven or eight years-of-age he recalls assisting his dad with his hives on a regular basis. "My father was my mentor, who guided me and taught me about bees as a young beekeeper."

In high school he was involved with a vocational work study program, but instead of bagging groceries, or mowing yards like many of his fellow classmates, he opted to work honey bees instead.

"By the age of 18, I was a full-time beekeeper with 600 hives," he said.

Ben, age 34, his wife Janin, and their two children, Jenna Lee, 7, and Jake born in September 2009, reside on a rural farm which is next door to Janin's parents and grandparents, who live on a 300 acre farm where blueberries are grown. The Bruce's farm 15 acres of high bush blueberries, which are an early harvest variety and must be hand picked. The rest of their farm consists of timber land with a few fields which are used to grow hay and pasture for their horses.

Ben specializes in comb honey produced from the gallberry bushes (which have small white flowers and produce a small black berry about the size of a bb) that grow wild in the south Georgia swamps, timberlands and forests.

Although he has one full-time beekeeper on staff and a couple part-time helpers as needed, Ben calls his bee operation largely a one-man show as he also does his own bookkeeping.

At one time he used to haul, or have another beekeeper transport, some of his bees to Florida to produce honey in the orange groves, but he has since stopped doing this. Now he does pollination for local regional blueberry farms (including blueberry acreage owned by family members) during the months of February and March. Ben said in the past few years southeast Georgia has seen a large influx of blueberry farm startups to the benefit of local beekeepers. Blueberry pollination fees usually range from $20 to $40 per hive.

Each year Ben will order some 20,000 to 26,000 4 3/8 inch shallow-frame foundation wax sheets from Dadant & Sons bee equipment suppliers based out of High Springs, Florida, for his comb honey supers to place in his 10-frame boxes. Either he, or an employee's winter job is melting beeswax and then pouring and sealing the foundation onto a frame. In a work storage shed (his old bee shop) near his main bee shop, he stores his beeswax.

To help with this foundation wax sealing operation he designed a home-made board foundation tree. On it he built wooden

(l) One of Ben's winter projects is sealing wax foundations onto frames. Here he uses a baster filled with heated beeswax to seal the foundation to the frame. (r) Ben checks one of his bee yards located at a blueberry field. At the end of January 2010 the region had been cold and wet and blueberry blooms were just beginning to appear.

blocks to hold the frames in a slanted position so the hot wax will run down the entire length of the foundation while applying it with a baster.

After pulling his shallow supers at the end of the gallberry honey flow season (April to July), he sells his honey, box and all, to a regional wholesale honey packer. The nine pound weight of the box itself is subtracted from the agreed upon price per pound and he then gets his boxes returned in the fall.

Around the first of July he'll move bees into regional cotton fields where they'll remain for the rest of the year until it's again time to place them on blueberries and gallberries.

Ben is a member of the state-wide Georgia Beekeepers Association (GBA) that's been in existence for 85 years. According to the GBA statisics, the state has some 2,000 hobby, sideliner and commercial beekeepers. The beekeeping industry in the Peach State generates some $70 million dollars worth of business each year through sales of honey (comb and extracted), beeswax, queen bees and package bees. Last year Georgia placed 16th in the nation with some 3.5 million pounds of honey produced, according to National Honey Board figures.

According to the GBA's membership web site, there are 17 local beekeeper clubs and associations across the state. He is also a member, and current president, of the Southeastern Georgia Beekeepers Association. "Almost all of our members are commercial beekeepers and usually between 30 to 40 people attend our annual meetings," Ben explained.

Ben said the Georgia state bee industry is regulated by the state's department of agriculture. This agency has scheduled several meetings with beekeepers around the state in 2010 (the first was to take place on February 2nd at Ben's local bee club in Homerville) to explain a pending regulation that requires an inspection of commercial bee shops before beekeepers can sell honey to packers. Ben said that although this requirement has been on the books since 1996, the state is just now starting to implement it. He added that he's received a lot of concerned telephone calls about this inspection program from beekeepers from around the state.

In 2007 Ben lost about 90 percent of his normal honey crop to three major disasters. The first was an early spring frost that killed much of the new growth of gallberry plants in the area. The second was a huge wild fire in the month of June, due largely to the hot weather and extended drought conditions, in southeast Georgia. He said the fire started apparently when a tree fell across a power line. It burned around half a million acres of the Okefenokee Swamp and surrounding lands where he leased sites for his beeyards. Bruce said these figures convert into 781 square miles of land burned, which makes this the largest fire in the history of both Georgia and Florida.

Ben said he thanked God that fortunately all his bee yards, which included about 1,000 colonies, in the fire's path survived the flames, although a few hives were scorched.

Finally, the third disaster was the smoke itself from these fires that hung in the area like a giant bee smoker for an entire month disrupting everything and keeping his bees inside their hives instead of being outside foraging.

When in bloom, gallberry bushes (like this one) located in and around the Okefenokee Swamp will provide forage for southeastern Georgia bees.

Numerous slash pine forest plantations like these trees are planted largely on private land in southern Georgia. Tree farming and logging is one of the area's largest agriculture industries.

(l) Ben shows off his 600-gallon tank mounted on top a bee truck where he mixes sugar and water for feeding his bees at his yards. The unit also has a motor with a hundred foot hose. (r) In 2007 this burned over forested area near Homerville, Georgia, was part of a 500,000 acre wildfire. The fire devastated the region's bee industry that season and many commercial beekeepers claimed their bees only produced about ten percent of a normal production of honey.

Welcome to the Honey Shack. Quite a number of Honey For Sale signs are located along the byways and highways of southeast Georgia promoting local sales of pure honey.

Ben said that following these honey-loss disasters, commercial beekeepers from the area met with county extension personnel and U.S. Department of Agriculture officials about receiving emergency financial aid because of their extreme honey production losses due to the forest fires. Unfortunately, they were told there was no federal disaster relief money available for any lost comb honey production.

However, Ben is hopeful that in the future there will be some government help following the congressional passage the following year of a U.S. 2008 Farm Bill that included some programs to compensate beekeepers for losses due to major disasters such as wild fires and CCD. He added that hopefully by now Congress realizes how important bees are to agriculture in this country.

Ben reports that gallberries in the region are currently making a comeback after the disastrous 2007 season. He'd like to see it quickly return to where it was when his bees averaged some 40 to 50 pounds of comb honey per super.

Unfortunately, January of 2010 started out being cold and wet with record-breaking freezing weather for nearly a dozen straight nights. He said he was kept busy during this time in his blueberry fields frost protecting with overhead irrigation so the early blooms wouldn't freeze. Regional weather forecasters have said it was the coldest January for the past 25 years.

Until the bloom starts on flowering plants, he feeds a mixture of sugar water to his bees. He uses a two-gallon feeder inserted in place of two frames in his bee colonies. On a flatbed bee truck he has a 600 gallon water/bee feed tank set up with a motor and a 100 foot hose that allows him to drive to his beeyards and easily fill the feeders.

His beekeeping equipment includes a Gehl skid steer 3935, a Dodge 4500 4x4 bee truck and a Chevy 4500 bee truck. He has a 40 feet by 60 feet metal bee shop where he does extraction and wood working. He keeps approximately 5,000 honey supers stored in half of the building. There's also storage space in a lean-to off the front of the building. The shop also contains two Kelley 70-frame extractors, a Cowen uncapper/spinner, and a settling tank.

During the months of February and March his bees are pollinating blueberry fields. During this time of year his bees will produce honey from the titi, a wild swamp flower, that makes a bakery-grade honey. At about the same time he said the palmetto flower bloom also goes well with gallberries.

After he pulls his honey comb supers, he moves his hives into cotton fields around mid-July. They'll stay in the cotton fields until about the first of the year when he splits hives and adds new queens. He doesn't purchase nucs or packages, but does buy between 500 to 1,000 queens per year as needed.

Besides losses that resulted from the 2007 combination of cold weather, wildfire and smoke, other beekeeping problems facing Georgia beekeepers include on-going mite infestations and small hive beetles. Although, Ben said, small hive beetles aren't usually a problem if a beekeeper can maintain strong mite-free hives, or at least colonies with only a light number of mites. He explained that it has been his experience that if you can control mites, you don't usually have too many other problems. According to reports from the Georgia State Department of Agriculture, to date, no Africanized Honey Bees have crossed the border from Florida. As for CCD, "We're still learning about it."

Commercial beekeepers like Ben Bruce are kept busy adding comb supers and inspecting their hives when it's honey flow season in southeastern Georgia. As these beekeepers face the future, they can only hope that their beekeeping problems are manageable, the weather cooperates (not too hot, too wet, or too cold) and that the wild gallberries will remain plentiful in the neighboring Okefenokee Swamp as their bees forage for nectar.

Rafter Beekeeping in Borneo

By STEPHEN PETERSEN
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Introduction

Situated on the world's third largest island of Borneo, a group of rafter beekeepers continue a centuries-old tradition of managing *Apis dorsata* using artificial nesting sites called "*tikung*" along the flooded margins of the Kapuas Lake system in West Kalimantan on the Indonesian side of the border. Their beekeeping activities have evolved over the last couple of decades into a community-based, sustainable, natural-resource management system that is excellent model for others to follow. Wishing to experience the situation firsthand, I ventured deep into the heart of Borneo. It exceeded all of my expectations; meeting all of the criteria that I espouse as critical for a well-designed and implemented bee project.

Getting There

I felt as though I was living a scene from Joseph Conrad's novel, "Heart of Darkness"; "*Going up that river was like traveling back to the earliest beginnings of the world, when vegetation rioted on the earth and the big trees were kings. An empty stream, a great silence, an impenetrable forest. The air was warm, thick, heavy, sluggish.....The long stretches of the waterway ran on, deserted, into the gloom of over-shadowed distances….*"

A troop of proboscis monkeys fled at our approach, a romp of otters ignored us as we cruised by, birds called unseen from the flooded forest as our long canoe wound through unseen (to me) channels in the flooded forest. It was nearing the end of the rainy season. This year there had been more rain than in the last 25 years; water levels in the lake fluctuate 30-42 feet from rainy to dry season. This season 90% of the normal rafter locations were submerged; the beekeepers had relocated some rafters higher in the trees, but not all and they expected the honey crop to be curtailed. I was completely entranced; the black, tannin-stained water reflected the patches of blue sky glimpsed through breaks in the canopy – this was much better than the 16-hour all-night bus ride I had just finished. After six more hours of sitting in the boat, we pulled up to a series of floating logs that served as a dock for the Melayu village of Semangit. A narrow plank served as access to the steep stairs that led into the village — crossing my fingers for luck, I wobbled the plank which bowed under the water from my weight. "*Don't do that tonight*," I murmured to myself.

The Region – History, People and Geography

The original inhabitants of the region were the Iban (also called under a collective name of Dyaks), a forest-dwelling people who hunted and employed small scale agriculture in jungle gardens. In the late 1600's and early 1700's they were gradually displaced by an influx of Muslim-Malay fishermen and traders who established mini-sultanates along the rivers where fishing was the main activity. They probably carried some knowledge of *Apis dorsata* (or "*muanyik*" in the local parlance) with them as honey hunting throughout the

Getting there is half the fun!

House boats ply the Kapuas River, providing the slowest means of transport. A bit faster are the numerous long boats powered by small outboards.

Two main ethnic groups inhabit the area; the *Dayaks* (mainly *Iban*) who are primarily agriculturalists and do some honey hunting in the forest, and the *Melayu* who are fishermen and rafter beekeepers. The *Iban* live in longhouses on higher ground while the *Melayu* live in raised houses along the rivers and lakes.

Malay Archipelago is a common activity. It is not known how and when the transition to rafter beekeeping was made, but it probably resulted from astute observations. The area meets two important criteria for success of rafter beekeeping; superior bee forage during a portion of the year and, a lack of suitable natural nesting sites (large trees), so the bees may be induced to nest on man-made structures (rafters).

Today there are two main groups of people in the area; the fishermen/rafter beekeeping Melayu, who live in small villages afloat or in stilted houses and, the land-based Iban who live in longhouses in the surrounding jungle area of the Kapuas Lake drainage. The Iban beekeeping activities are primarily centered around ownership and care of individual bee trees (usually *Koompassia sp.*) where *dorsata* colonies habitually nest. The community rules and regulations concerning harvesting from these trees are based on a well developed system of customary laws (called "*adat*") that prescribe tenure, harvest times and penalties for transgressions.

The rafter-beekeeping communities are organized along community lines, loosely based on the old sultanate boundaries, but well defined today as boundaries for fishing and beekeeping activities. Beekeepers have organized themselves into village level groups called "*periaus*"; these in turn have grouped together in a broader association — *Asosiasi Periau Danau Sentarum* (APDS). In order to join a *periau,* an individual must have at least 25 rafters and abide by the rules of the *periau*. There are *periau*-implemented sanctions for activities that fall outside beekeeping activities — e.g. fishing or wood-cutting transgressions. Each village *periau* may join APDS if they agree to the bylaws of the Association; training is provided to the *periaus* by APDS so that all members are aware of, and abide by, the regulations necessary for organic certification.

The Kapuas Lake region (now a National Park- Danau Sentarum) forms the headwaters of the Kapuas River (Indonesia's longest river 1143 km or 686 miles) acting as a giant sponge — absorbing rainfall from the surrounding mountains and slowly releasing it during the dry season (April to September). The higher elevations surrounding the Park are the home of the migrating *dorsata* bees during the dry season and are still within the park boundaries. This provides another important aspect of the sustainable management — the bee trees of the uplands are protected. As the bees migrate back and forth between the flooded forest of the lake and the surrounding mountains, they always have access to nesting sites and forage.

Specially shaped rafters or "*tikung*" are placed 3-4 meters above the normal high water level. Some families have as many as 1,000 *tikung* — typical occupancy rates are 25% - 40%.

Bees, Beekeeping and Activities

The single-comb, open-nesting giant Asian Honey Bee (*Apis dorsata*) is the predominate species in the area; although other species (*A. cerana, A. koschevnikovi*, and *A. florea*) exist, they are of no commercial value. *Dorsata* bees are migratory — moving seasonally from one area to the next in response to the floral calendar. This is not always as predictable as our "spring blooms" in temperate climates. Many rainforest trees, e.g. Dipterocarps, may bloom every 3 - 7 years; when several species' bloom times overlap, the event is called a "mass flowering". Migrating swarms of *dorsata* appear at the beginning of this event and for a while the area is saturated with colonies hanging from trees — the following season there may be none. The migrating colonies migrate from 100's of kilometers away — an unsolved mystery of the jungle is how the bees "know" the mass flowering event is taking place.

Most *dorsata* migrations are shorter, elevation-based events, but still in response to phenology (flowering times). Examples besides the Danau Sentarum region are; migration from Cardamom Mountains to the mangrove/*Melaleuca* coastal forests surrounding the Bay of Kampong Som in Cambodia; from the highlands of Phnom Kulen to the *Melaleuca* low forests near Siem Reap, Cambodia; and the movement between the coastal mangrove and the *Melaleuca* forests further inland in the U Minh forest of southern Vietnam. Most of the aforementioned migrations are less than 100 kms.

In each of the above locations rafter beekeeping is practiced, it is important to emphasize the two most important criteria for

Branches are trimmed to provide a flyway (*bagain muka*) for the bees. The *tikung* may be attached in a number of different ways; *tikungs* will last 30-40 years and are left in position year around.

In September the "*muanyik*" (the local name for *Apis dorsata*) begin to arrive in the lowlands and occupy the *tikung*.

rafter beekeeping to succeed:

- There must be adequate bee forage on a seasonal basis.
- There must be a lack of normal nesting sites (tall trees, cliffs), so the bees may be induced to nest on man-made structures.

These conditions also exist along the east coast of Peninsular Malaysia (Terengganu), in Cambodia's Tonlė Sap Lake, the delta of the Ayeyarwady (Irrawaddy) River in Myanmar (Burma), and the Sunderbunds in Bangladesh. The potential for implementing rafter beekeeping techniques is being explored only in Terengganu, Malaysia.

How and Whys of Rafter Construction

As previously mentioned, a lack of suitable nesting sites is one criteria for the implementation of rafter beekeeping; through astute observations people may have figured if they provided a man-made "branch" the bees may build their nests there — like the baseball movie clichė "Build it and they will come". When I first related rafter stories from other locations to the rafter beekeepers of the Siem Reap area in Cambodia, one of their first questions was, "Why do they go to all the trouble of shaping the rafter?" I was at a loss for an answer until my visit to Danau Sentarum when it struck me — it rains! The rafter beekeeping as practiced in Siem Reap is done during the dry season when water run-off is of no concern; but in Danau Sentarum and Vietnam's U Minh forest the rafters are concave on the top side (much like a rain gutter) to facilitate water run-off. More indigenous knowledge to build upon.

It takes 4-6 man hours to shape a rafter using hand tools in the Danau Sentarum area. The preferred wood for constructing a rafter is locally called "*tembesu*" (*Fragrea fragans*). It is easiest to work when green or has been soaking in water for sometime; care is taken in forming the rafter — they may last up to 40 years and be passed down from father to son.

Making and Installing a "*Tikung*"

(courtesy of Tuan Wazir of Semangit)

1. Select a 3-8 foot long log between 10-20 inches in diameter; preferred woods are #1 *Tembesu* (*Fagraea fragrans*), #2 *Medang* (*Litsea sp.*), and #3 *Kawi* (*Shorea belangeran*). Using an adze, plane, and rasp round off and smooth the bottom side of the plank in the fashion of a tree limb.
2. Using the adze, hew out a trough on the upper side of the plank in the fashion of a rain gutter to facilitate water run-off.

The rafters are concave on the upper side to facilitate rain water runoff; the underside is rounded and smooth duplicating the bees preferred nesting site (a tree branch). They are placed at about a 30° slope from the horizontal.

Simple hand tools are all that are available for *tikung* construction. Below from left to right — adze, plane, hand-axe, rasp, auger, and handsaw.

3. Using a hand saw and chisel cut a notch about 8-10” deep and 3-5” wide in both ends of the “tikung”.
4. Turning the “tikung” on its side use an auger to bore about a 1” hole through both sides of the notch.
5. Whittle a peg to fit snugly into the notch — this will be one method of securing the “tikung”.
6. The bottom side of the “*tikung*” may be coated with melted beeswax to enhance attractiveness.
7. Select a spot to install the “*tikung*” 10-12 feet above anticipated high water mark. There must be no red ants in the vicinity.
8. Using additional forked sticks to brace the “*tikung*”, install in a suspended tripod fashion at about a 30º angle from the horizontal.
9. Bind all contacts securely with heavy twine or lianas; drive the pegs through the ends securing the “*tikung*” to smaller branches.
10. You may want to secure a horizontal branch upon which to stand while harvesting honey 4-5 feet below the top of the rafter.
11. إن شاء الله (*Insha’Allah - Allah willing*) the bees will come.

Putat *(Barringtonia acutangula)* Some of the nectar sources bees often work: Ubah *(Syzygium ducifolium)*, Kawi *(Shorea belangeran)*, Leban *(Vitex pinnata)*, Ringin *(Dillenia beccariana)*, Akar Libang *(Connarua monocarpus)*

Harvesting honey from a “tikung”
(courtesy APDS)

1. Prepare and thoroughly clean the boat – no fish scales or slime. Have on hand several clean buckets with lids, rubber gloves, clean knife, and notebook. Harvesting must be done during the day to allow the bees to re-orient to their nest.
2. Before approaching the colony to be harvested, light a smoker made from natural materials (e.g. traditional smokers called “*tebauk*” are made from the bark of a liana locally called “*akar miadin*”). Do NOT use gasoline or any other material to get the smoker going (part of the organic certification regulations).
3. Using cool, white smoke with no flame, the bees are chased from the comb; one beekeeper scrambles the 10-12 feet from the boat up to the occupied rafter. He suspends a clean bucket under the “honey head” (the thick portion of the comb at the upper end) and, using rubber gloves and a clean knife, cuts away only the honey portion of the comb. He in turn passes the bucket to an assistant in the bow of the boat who covers it immediately to prevent leaves, bees and other detritus from contaminating the honey. A third man steadies and maneuvers the boat as needed.
4. After emerging from the tangle of vegetation, and again employing rubber gloves, beekeepers use another clean knife to separate any visible pollen cells from the honey head. The cleaned comb is gently placed in another clean covered bucket. Six to eight colonies may be harvested in this manner in one day. Typically, all the colonies harvested belong to one beekeeper — notes are kept as to the location and owner of that particular honey harvest. The honey is labeled with the producer’s name, so it may be tracked during processing and sales.
5. Back in the village in a clean area the combs are uncapped and also cut down the midrib (again with the rubber gloves and clean knife); this allows the honey to rapidly drain as if it were a bunch of straws open at each end. The honey drains through a white muslin filter cloth. The comb is not crushed or squeezed, thus reducing the chance of pollen contamination. If there are uncapped cells of honey, these are processed separately and the honey used in the village.
6. After draining and sieving, the honey is assigned a lot number to facilitate tracking and sealed to protect from ambient moisture. High moisture honey is a major problem in the tropics (especially during the rainy season). It is not unusual to have moisture contents above 25% — that, coupled with high ambient temperatures, can lead to rapid fermentation. The clean practices and care of the APDS honey reduces, but does not eliminate, chances for fer-

With an intimate knowledge of the phenology (bloom times) of the local flora, *periau* members can produce unifloral honeys; most often however, it is a blend of the season’s flowers.

Traditional smokers called *tebauk* are made from the bark of a liana locally called “*akar miadin*”.

Managing *dorsata* bees using rafter techniques (locally called *tikung*) to produce a high quality organic honey is the #2 activity and cash generator for the *Melayu.*

The question of sustainability can only be answered by monitoring, data collection, and processing over time.

mentation. A pressing need of APDS is a village-based method of moisture reduction without overheating the quality honey. Remember, electricity is available only from small portable generators and fuel is prohibitively expensive. Now it is a 400 mile ride to processing facilities in Pontianak where the honey is bottled and labeled.

A Model Project- What is Sustainable Beekeeping?

As mentioned in the introduction, I think the APDS-Danau Sentarum project is the poster child for a beekeeping development project. Let's examine some of my reasons why:

- It builds on indigenous knowledge. The rafter method was in place long before NGO's (Non governmental Organizations) were ever in the area. Formerly the beekeepers would harvest honey at night with torches — killing many of the bees and causing others to drop into the water at night. After an exchange visit in 1994 with rafter beekeepers of the U Minh forest in southern Vietnam, Melayu rafter beekeepers adopted the more sustainable daylight harvesting techniques, as well as taking only the honey head. Information and techniques were spread laterally among *beekeepers* instead of being directives from top-down institutions.
- There are clear boundaries for rafter beekeeping and locations. These boundaries are mapped, colonies have a unique designation and are mapped, and tenure (ownership) is established, respected and enforced by community values ("*adat*"). If you move to another *periau* district, you may no longer practice in your original location — you must bring your rafters and install them in new locations.
- In order to join the *periau* and enjoy the benefits, you must adhere to the *periau* guidelines — these extend outside the venue of beekeeping. For example, if a *periau* member is caught doing illegal fishing or wood cutting, his *periau* status may be revoked. These rules and regulations originate from within the community by consensus and are enforced by the community, not an outside entity. The local authorities are advised of the community regulations and, in extreme cases, may step in with criminal prosecutions.
- By harvesting only the honey head and leaving the brood intact, plus the fact that minimal honey hunting activities take place in the mountains, the APDS members are contributing to the long-term sustainability of the bee population. General levels of awareness and education allow local people to realize the importance of bees in their environment. A healthy forest surrounding the lake means adequate nutrients for the fish population — another resource they are dependent upon.
- By working together through *Asosiasi Periau Danau Sentarum* (APDS), the *periaus* have been able to speak with one voice when it comes to dealing with Government entities, NGO's, buyers, local officials, and certifying agencies such as BioCert (the Indonesian organic certification agency). They are currently working toward getting a village-based honey-drying facility — something an individual could never afford.
- Through efforts of APDS, Riak Bumi (a local NGO instrumental in building the organization), Dian Niaga (a Jakarta based honey marketing firm) and previous work by NGO's, the beekeepers of Danau Sentarum have pushed all of the right market buttons. They have an attractive label with the story value associated with a unique product (Dorsata Honey), they are organically certified, their place of origin (Borneo) itself evokes thoughts of pure wild jungle honey, and they have targeted the emerging middle class in Indonesia with discretionary money to afford a premium product.

The Way Forward

The most pressing need for APDS and the rafter beekeepers of Danau Sentarum (this is true for almost every Asian beekeeping project) is an economical method of reducing the moisture content of their honey to below at least 20%. I'm familiar with reverse osmosis dryers (very expensive, heat the honey too much and use a lot of power) and a method involving warm-dry air blowing over the honey as it flows over a series of baffles; again power requirements and the necessity of a sealed room to maintain low humidity limit their application in this situation. I know about aquarium bubble generators that have been used to reduce moisture in small lots of honey, but again ambient humidity is a dilemma. Ideas, especially low-cost, low-tech are welcome!

Transport to market is another dilemma, but with the opening of a new border post leading into Malaysia (at Batang Ai), it is only 50-60 kilometers to a good road system instead of 650 kilometers to Pontianak.

The beekeepers of Danau Sentarum have worked for a couple of decades to bring their beekeeping and organizational skills to the point where it can be noted as an excellent example of beekeeping development. Kudos to a sustainable economical activity that benefits the community and the surrounding environment — they are to be applauded for their efforts.

Acknowledgments

I am indebted to Riak Bumi, a Pontianak based NGO, and its director, Valentinus Heri, and staff for arranging the transportation and translation logistics. I give warm thanks to the villagers of Semangit for their wonderful hospitality and especially to Tuan Wazir, my rafter mentor in the village. *Ego apis ergo sum.*

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Pesticides Applied to Crops and Honey Bee Toxicity

by M.D. ELLIS*

Abstract

This article discusses the role that pesticides applied to crops may play in honey bee health. Although no one pesticide has been clearly associated with causing colony collapse disorder, there is evidence that the additive and synergistic effects of multiple pesticide exposures are harming bees. Pesticide use patterns have changed in the past decade, and this article reviews research on how crop pest control practices are affecting honey bee health. It then concludes with a discussion of the current risk assessment protocols to protect honey bees and how they are being amended to address current issues and concerns.

Pesticides applied to crops

The recent sequencing of the honey bee genome provides a possible explanation for the sensitivity of honey bees to pesticides; relative to other insect genomes, the honey bee genome is markedly deficient in the number of genes encoding detoxification enzymes (Claudianos et al., 2006). This notable difference renders honey bees more susceptible to pesticides than other insects, and beekeeping has been negatively impacted by pesticides applied to crops for as long as pesticides have been used.

Despite the dependence on honey bees for the pollination of crops in the USA, colony numbers have declined by 45% over the past 60 years (NAS, 2007). Most honey bee losses from 1966-1979 were attributable to organochlorine, organophosphorus, carbamate, and pyrethroid pesticide exposure. Efforts to restrict pesticide application during bloom provided some relief; however, the residual activity of some pesticides was never effectively addressed. Colony losses were especially severe from 1981 to 2005 with a drop from 4.2 million to 2.4 million, although some of the decrease is attributable to changes in how colony numbers were estimated. The introduction of parasitic honey bee mites, *Acarapis woodi* (1984) and *Varroa destructor* (1987), contributed to dramatic bee losses. At the same time, the control of crop pests in USA agriculture was rapidly changing. Genetically engineered (GE) crops were developed and extensively deployed, and two new classes of systemic pesticides, neonicotinoids and phenylpyrazoles, replaced many of the older pesticides. The rapid development and deployment of these two new insect control techniques distinguish USA agriculture from other regions of the world. In Europe a more cautious approach to the adoption of new agricultural practices has been taken.

GE plant varieties

GE plant varieties that have herbicide tolerance or insecticidal properties were first introduced into the USA in 1996. Soybeans and cotton are genetically engineered with herbicide-tolerant traits and have been the most widely and rapidly adopted GE crops in the USA, followed by insect-resistant cotton and corn. In 2007 these GE crops were planted on more than 113 million hectares worldwide, and the United States leads the world in acres planted with GE crops with most of the plantings on large farms (Lemaux, 2008). Insect resistance is conferred by incorporating genes coding for insecticidal proteins produced by *Bacillus thuringensis* (Bt), a common soil bacterium. While Bt can also be delivered by spray application, GE plants benefit from continuous production of Bt toxins. Bt endotoxins are activated in the insect gut where they form pores that allow gut contents to leak out of the lumen leading to the death of the insect. To date, Bt genes have been incorporated into corn (*Zea mays*), cotton (*Gossypium hirsutum*), potato (*Solanum tuberosum*) and tomato (*Lycopersicon esculentum*), and GE seeds of these crops are available to producers. Precommercial field tests of 30 different plant species with Bt genes were conducted in 2008 including apples, cranberries, grapes, peanuts, poplar, rice, soybeans, sunflowers and walnuts (ISB, 2007).

Numerous studies have been conducted to determine the impact of GE crops on honey bees (Lemaux, 2008). Canadian scientists found no evidence that Bt sweet corn affected honey bee mortality. Studies conducted in France found that feeding Cry1ab protein in syrup did not affect honey bee colonies. Likewise, exposing honey bees colonies to food containing Cry3b at concentrations 1000 times that found in pollen resulted in no effect on larval or pupal weights. Feeding honey bees pollen from Cry1ab maize did not affect larval survival, gut flora, or hypopharyngeal gland development. A 2008 analysis of 25 independent studies concluded that the Bt proteins used in GE crops to control lepidopteran and coleopteran pests do not negatively impact the survival of larval or adult honey bees (Duan et al., 2008).

There is no evidence that the switch to Bt crops has injured honey bee colonies. To the contrary, it has benefited beekeeping by reducing the frequency of pesticide applications on crops protected by Bt, especially corn and cotton. On the other hand, the switch to GE crops with herbicide resistance has eliminated many blooming plants from field borders and irrigation ditches, as well as from the crop fields themselves. The reduction in floral diversity and abundance that has occurred due to the application of Round-UP® Herbicide (glyphosate) to GE crops with herbicide resistance is difficult to quantify. However, there is a growing body of evidence that poor nutrition is a factor in honey bee health. Eischen and Graham (2008) demonstrated that well-nourished

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A detailed review of the literature on Pesticides and Honey Bee Toxicity by R. Johnson, M. Ellis, C. Mullin and M. Fraizer can be found in the May 2010 Special Issue of *Apidologie* on Honey Bee Health.

honey bees are less susceptible to *Nosema ceranae* than poorly nourished bees. The adoption of agricultural practices that provide greater pollen diversity has been advocated, including the cultivation of small areas of other crops near monocultures or permitting weedy areas to grow along the edges of fields (Schmidt et al., 1995).

Neonicotinoid and phenylpyrazole pesticides

Another major shift in agriculture has been the development and extensive deployment of neonicotinoid and phenylpyrazole pesticides. These pesticides are extensively used in the USA on field, vegetable, turf, and ornamental crops, some of which are pollinated by bees. They can be applied as seed treatments, soil treatments and directly to plant foliage. Neonicotinoids cause persistent activation of cholinergic receptors which leads to hyperexcitation and death. One neonicotinoid, imidacloprid, was applied to 788,254 acres in California in 2005, making it the 6th most commonly used insecticide in a state that grows many bee-pollinated crops. The phenylpyrazoles, including fipronil, bind to γ-amino butyric acid (GABA)-gated chloride ion channels and block their activation by endogenous GABA, leading to hyperexcitation and death.

Neonicotinoid and phenylpyrazole insecticides differ from classic insecticides in that they become systemic in the plant, and can be detected in pollen and nectar throughout the blooming period. As a consequence, bees can experience chronic exposure to them over long periods of time. While some studies have shown no negative effects from seed-treated crops, acute mortality was the only response measured. Desneux and colleagues (2007) reviewed methods that could be used to more accurately assess the risk of neonicotinoid and phenylpyrazole insecticides including a test on honey bee larvae reared *in vitro*, test for larval effects, a proboscis extension response assay to access associative learning disruption, various behavioral effects, and chronic exposure toxicity beyond a single acute dose exposure. Pesticide exposure may also interact with pathogens to harm honey bee health. Honey bees that were both treated with imidacoprid and fed *Nosema* spp. spores suffered reduced longevity and reduced glucose oxidase activity (Alaux et al., 2010).

Registration procedures and risk assessment

In the USA risk assessment related to agrochemical use and registration follow specific guidelines mandated by the Federal Insecticide Fungicide and Rodenticide Act. Despite the importance of honey bees, the effect of pesticide exposure on colony health has not been systematically monitored, and the Environmental Protection Agency (EPA) does not require data on sublethal effects for pesticide registration.

For many years, the standard laboratory method for assessing pesticide risk was to determine the median lethal dose (LD_{50}) of the pest insect. In a second step, the effects of pesticides on beneficial arthropods were examined by running LD_{50} tests on the beneficial species to identify products with the lowest non target activity. In the USA this protocol remains the primary basis for risk assessment in pesticide registration. However, this approach to risk assessment only takes into account the survival of adult honey bees exposed to pesticides over a relatively short time frame. In Europe, when the standard procedures do not provide clear conclusions on the harmlessness of a pesticide, additional studies are recommended; however, no specific protocols are established. Acute toxicity tests on adult honey bees may be particularly ill-suited for the testing of systemic pesticides because of the frequency of exposure bees are likely to experience in field applications. Chronic feeding tests using whole colonies may provide a better way to quantify the effects of systemics.

Registration review is replacing the EPA's pesticide re-registration and tolerance reassessment programs. Unlike earlier review programs, registration review operates continuously, encompassing all registered pesticides. The registration review docket for imidacloprid opened in December 2008. To better ensure a "level playing field" for the neonicotinoid class as a whole and to best take advantage of new research as it becomes available, the EPA has moved the docket openings for the remaining neonicotinoids on the registration review schedule (acetamiprid, clothianidin, dinotefuran, thiacloprid, and thiamethoxam) to fiscal year 2012. The EPA's registration review document states that "some uncertainties have been identified since their initial registration regarding the potential environmental fate and effects of neonicotinoid pesticides, particularly as they relate to pollinators (EPA, 2009)." Studies conducted in Europe in the late 1990s have suggested that neonicotinoid residues can accumulate in pollen and nectar of treated plants and represent a potential risk to honey bees. Recently published data from studies conducted in Europe support concerns regarding the persistence of neonicotinoids. While the translocation of neonicotinoids into pollen and nectar of treated plants has been demonstrated, the potential effect that levels of neonicotinoids found in pollen and nectar can have on bees remains less clear. Girolami and colleagues (2009) report high levels of neonicotinoids from coated seeds in leaf guttation water and high mortality in bees that consume it. While the frequency of guttation drop collection by bees under field conditions is not documented, the authors describe the prolonged availability of high concentrations of neonicotinoids in guttation water as "a threatening scenario that does not comply with an ecologically acceptable situation." The pending EPA review will consider the potential effects of the neonicotinoids on honey bees and other pollinating insects, evaluating both acute risk at the time of application and the longer-term exposure to translocated neonicotinoids (EPA, 2009).

The use of newer systemic pesticides, including the neonicotinoids (e.g. imidacloprid) and phenylpyrazoles (e.g. fipronil), has become prevalent in the USA. As systemics, these pesticides are present in all plant tissues, including the nectar, pollen and other plant exudates. Honey bees' exposure to these compounds is very different from that of traditional pesticides, where acute toxicity was a primary concern. Instead, honey bees at all stages of development may be chronically exposed to sublethal doses of these compounds. The consequences of this new mode of exposure have not been extensively considered in regard to pesticide regulation in the USA, although the EPA is currently reviewing the status of these compounds. Beekeepers should watch these deliberations closely. Restricting new compounds may result in a reversion to older chemistries that clearly harm bees. Beekeepers should weigh the evidence and the risks carefully before taking a position.

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Mite-Away Quick Strip™ Mid Honey Flow Efficacy Trial

by DWAYNE MITCHELL,[1] DAVID VANDERDUSSEN[2]

Monitoring phoretic Varroa destructor levels after the application of a strip formulated acaricide (Mite-Away Quick Strip™[3]), targeting the male varroa. Formic acid, in a saccharide gel matrix, is the active ingredient.

Abstract

Traditional approaches to controlling the parasitic mite *Varroa destructor* in honeybee colonies have focused on targeting the female mite when phoretic (outside the brood cells, on the adult bees). NOD Apiary Products Ltd. (NOD) decided to shift its focus to killing the male varroa. The hypothesis is that, if the males are killed prior to mating, the female varroa population will remain low for an extended period of time.

Working with formic acid as the active ingredient, NOD developed a single application, strip formulated, "sticky" formic acid vapour release product (Mite-Away Quick Strips™), using saccharides. Mite-Away Quick Strips™ are inserted into the brood rearing area of the colony. The air movement response of the honeybee colony to formic acid vapours is utilized to drive the molecule under the cap, to kill the male varroa.

Determining the overall efficacy is a challenge in this model of varroa control. The traditional methods of determining efficacy (positive control comparison of phoretic female varroa kill) will not give a fully accurate efficacy picture. Mite-Away Quick Strips™ are designed for kill under the cap, so looking under the cap was on option. An alternative is an extended trial that monitors the trend of phoretic varroa mites using alcohol wash or a similar method. In 2009, NOD worked with researchers using all three methods. The study presented is a summertime, seven-week post-application, phoretic mite population trend study. Colony health, queen health, and the formic acid levels in the honey in honey supers, were also tracked.

Key words: varroa, male varroa, formic acid, Mite-Away Quick Strip™

The Male Varroa as a Target

The male varroa only live within the capped brood cell. Unlike the females, this makes them a non-moving target in a known location. The male varroa do not develop the hard outer shell of the females, so they should be more susceptible to formic acid vapours.

Varroa Sex

The foundress *Varroa destructor* mite lays her first egg 60-72 hours after the cell is capped (2.5 days at the earliest) and it is a male. The first female egg is laid 30 hours after that (3.75+ days after capping). It takes 5-6 days for the female to become sexually mature (9+ days after the cell is capped). The male produces sperm packets, which he takes into his mouth and places in the vagina of the most recently sexually mature female. Multiple matings are required over 30 hours to ensure full fertility (10 + days after the cell is sealed). In the reproduction of varroa, the second female varroa egg laid has a very low mating success rate in worker brood, high success rate in drone brood.

If the male varroa is killed at any time within 10 to 11 days of the cell being capped over, their reproductive capability has been impaired, even if the female sisters survive.

The Mite-Away Quick Strip™ is applied in the brood rearing area of the hive. An element of the Mite-Away Quick Strip™ treatment is the bee's natural ventilation response to the relatively high levels of formic acid vapours present immediately upon application. Enough formic acid vapours are able to penetrate the brood cell cappings if there is adequate air movement created in the brood area to drive the vapours through the brood cappings, into the cells. Therefore, a minimum colony size is a consideration.

Mite-Away Quick Strip™ Development.

NOD has been working with formic acid, as an acaricide, since 1997. Unlike conventional chemicals, no resistance is expected to develop to formic acid, and it is naturally occurring in honey.

To produce a biopesticide, to support the organic nature of formic acid, various saccharide based gel formulations were developed in NOD's laboratory. The goal was to have an effective rate of vapour release spanning three days. Unlike conventional pesticides, this product is designed to work with the bees; the colonies are not "passive recipients": The colony's drive to maintain temperature and humidity (homeostasis) in the brood rearing area is a factor in the product's effectiveness. The strip product was designed to fit in the bee-space, laid flat on frame top-bars.

After achieving success in incubator trials, field trials were conducted in 2009.

Materials and Methods

Apiary and Colony Selection

On July 6, 2009 (Day -4), in 2 bee yards, managed by David VanderDussen[4] to be "varroa farms", 21 colonies were identified as being queen-right, having healthy brood patterns, good size clusters for honey production, and having phoretic varroa loads at least double the recommended levels for the end of June Economic Threshold Level (ETL)[5]. Phoretic varroa loads were determined by using the alcohol wash method (approximately 300 adult bees per sample, taken from the brood rearing area). These colonies were allocated into three groups of seven; by location, brood chamber size, and mite loads. In the Control group, 6 of the 7 colonies were 2-brood chambers; each treatment group was 3 single brood chamber hives and 4 two-brood chamber hives. Other colonies in the yards were left untreated, providing additional varroa pressure, as most, if not all of the feral colonies in the area are gone.

The hives had been supered for the honey flow in June. Supers were left on during the treatment, and were added to as needed through the trial period.

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3 Product of NOD Apiary Products Ltd, ibid.

4 Owner, River Valley Apiaries, 231 Frankford Road, Stirling, Ontario, Canada. KOK 3E0

5 July 1st varroa threshold is 1%. September 1st varroa threshold is 3% (Currie, R., University of Manitoba, Canadian Association of Professional Apiculturists published recommendations, Updated May 26, 2008) http://www.capabees.com/main/files/pdf/varroathreshold.pdf

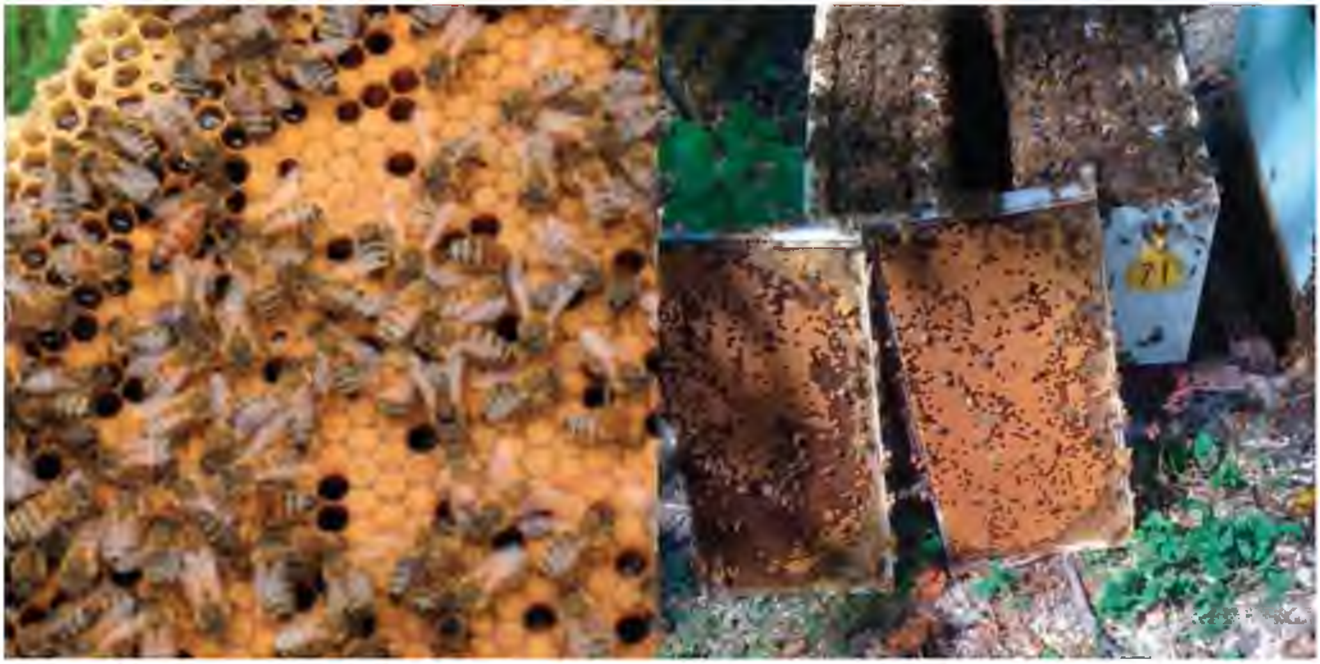


Figure 1. (l) Queen just after MAQS treatment, (r) brood combs 6-weeks after treatment.

Formic acid levels were monitored in 10 hives in the first 22 days of the trial. From each hive 5 samples were taken: At time of treatment (Day 0), Day+3, Day+7, Day+14, and Day+21. The honey samples were taken from the honey supers, each sample a composite from 5 points in the nearest super to the product application. Analysis was performed by Chemisar Laboratories Inc.[6]

Mite-Away Quick Strip™ Application

On July 10, 2009 (Day 0) Mite-Away Quick Strips™ were applied to the treatment groups. Group-1, as the Control, did not receive any treatment, but hives were opened and had honey samples taken, following the same process as the treated groups. Group-2 colonies each received a 200-gram dose, Group-3 colonies received 300-gram doses. For single brood chamber colonies, the strips were laid across the width of the hive body, on the top bars, spacing them apart for easy bee movement and air circulation around them. The queen excluder was replaced, set on above the strips. In 2-story colonies the strips were placed between the brood chambers, laid across the frames in the same manner.

Temperatures

Ambient temperatures in the first three days, the critical time of the treatment, are illustrated in Chart 3. Highs and lows ranged from 26.7° C (80°F) to 11.4° C (52.5°F).

<u>Results</u>

Efficacy

At the Day+3, the Day+14, and the Day+21 marks, in the treated colonies, the colonies treated at 200-gram doses had phoretic varroa load reductions of 64.4%, 75.7%, and 76.2%; the ones treated at 300-gram doses showed a reduction of 95.5% at both the Day +3 and the Day+ 14 marks, 96.2% at the Day+21 mark. See Chart 1.

The phoretic varroa to bee ratio trends, over the full 7-weeks of the trial, are illustrated in Chart 2.

Queen health

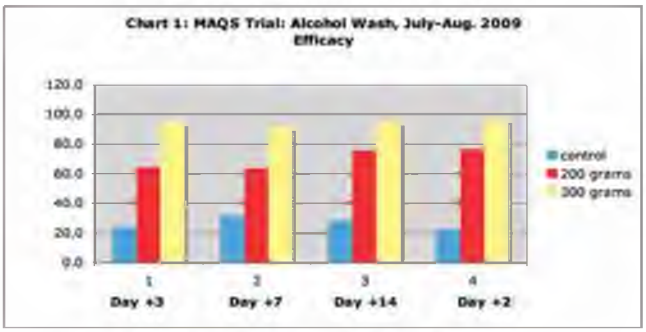
There was no sign of negative effects on the queens due to treatment. Egg laying continued throughout the 7-Day treatment period. In treated colonies, some damage to brood was observed at the Day+3 mark, but colonies recovered quickly. After Day+3 no additional damage was observed. Brood patterns were exceptionally solid and healthy in the treated colonies (see Figure 1); they became spotty, with signs of parasitic mite syndrome (PMS), in the Control colonies.

Colony health

Overall, colony health remained in good shape in all groups throughout the trial period. One Control colony became queenless just after the trial started and did not become queen-right by the end of the trial. Its varroa load level data was culled from the efficacy data set. One colony in the 300-gram group became a drone layer at some point after the Day+21 colony exam, so the Weeks 6 and 7 data on that hive was culled.

Formic acid levels in honey

Over the 22 days that the formic acid levels were monitored, formic acid levels in untreated colonies ranged from a low of 402 parts per



[6] **Chemisar Laboaratories Inc., 24 Corporate Court, Guelph, Ontario, Canada N1G 5G5 www.chemisar.com**

million (ppm) to a high of 2,097 ppm. In treated colonies the formic acid levels ranged from a low of 585 ppm to a high of 1,851 ppm. See Chart 4.

Discussion

The trend over the 7-weeks of the trial was an initial drop in phoretic varroa loads in all groups, with significant variation between groups by Day+3. The control colonies did exhibit the expected reduction in varroa-to-bee ratios that can occur in early summer, as the adult bee population growth rate exceeds the varroa growth rate. This is reversed in August. A similar pattern was observed in the 200-gram treatment group.

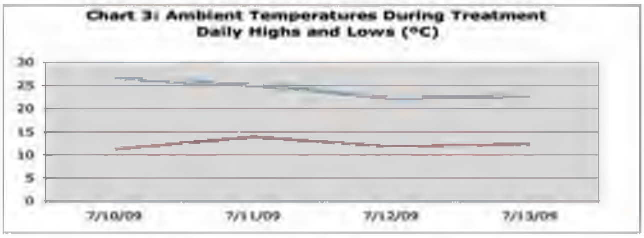
In the 300-gram treatment group varroa levels dropped to near zero, and remained low, even with high environmental varroa pressure present. This indicates that the treatment impacted the varroa population's reproductive capability.

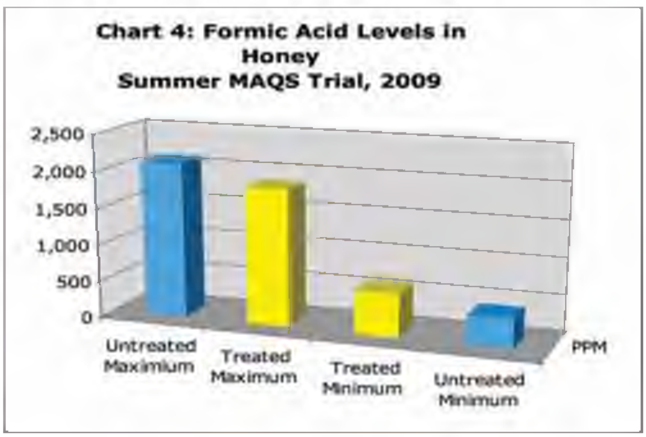
It should be noted that all the colonies in the trial were at least double the recommended varroa loads prior to the Mite-Away Quick Strip™ application, so the colonies were already under parasitic mite stress at the time of acaricide application. Environmental varroa pressure was maintained throughout the trial, making it similar to the migratory mingling, or "poor neighbor practices", re-infestation situations that can occur. Even under these stresses, the three-day treatment, at the 300-gram dose, was effective in bringing and keeping varroa loads under control for an extended period of time during a honey flow with supers on.

From an Integrated Pest Management (IPM) perspective, in the Control group, varroa loads stayed above threshold throughout the trial period, in the 200-gram colonies the loads had dropped to threshold but were again above threshold by the end of the trial. In the 300-gram treatment group, the drop in the phoretic mite load, especially for a vapour release product applied with supers on, was exceptional. A follow-up treatment in the early fall was unlikely to be required, especially if all colonies in the yards had received the 300-gram treatment, which would have greatly reduced environmental pressure. However, varroa levels should be monitored in late summer to ensure the winter cluster bees are adequately protected.

Colony health and queen health did not appear to be negatively affected by the treatment. Queens continued to lay well through the treatment period and to the end of the trial.

Formic acid is a component of honey, not an impurity. Therefore, the concern is not residues, but levels. The formic acid levels in the honey in the treated hives remained within what was determined to be naturally occurring. No withdrawal period is required.





Conclusion

One treatment, applied early summer on all colonies in a location, at the 300-gram dose application rate, was highly effective in knocking down varroa mite populations, and keeping them down, through the key harvestable honey production period. Indeed, in Northern climates, one treatment may provide sufficient control to keep varroa mite loads below treatment thresholds for one year, under the conditions tested. Two 300-gram treatments annually, one applied early summer and one applied later in the summer or early fall, should provide excellent control of varroa. Following an IPM program is recommended, to determine if an early-fall follow-up treatment is required.

Overall, neither queen nor colony health appears to be negatively impacted by the treatment. Formic acid levels tracked in the honey supers remained within what was naturally occurring, so no withdrawal period is required. Along with there being no chemical residues risk to the honey crop or wax, Mite-Away Quick Strips™ are an excellent new tool for controlling *Varroa destructor*, during honey flows.

Acknowledgements

Our thanks to Jerry Hayes of the Florida Department of Agriculture, Dr. James Ellis of the University of Florida, Dennis van Engelsdorp of Penn State University, Dr. Frank Eischen of the USDA-ARS Bee Research Lab in Weslaco, Texas, and Dr. Jeffery Pettis of the USDA-ARS, for their interest, support, and guidance. Ongoing support from Dr. Ethel Villalobos and the University of Hawaii is greatly appreciated.

Financial Support: A special thanks to the people at BASF. SE Crop Protection Division, 67056 Ludwigshafen, Germany, who supported this research, to help find ways to protect the world's honey bees.

Figure 2. MAQS inserted between brood chambers during honey flow. When packed commercially, application will be two strips. Applicators must wear chemical gloves. Note the alcohol wash collection jars on the hives behind.

The Other Side of BEEKEEPING

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Soybeans Continued

In the April column I discussed the slow historical acceptance that soybeans can sometimes provide a honey crop, sometimes even a good honey crop. It is clear from the data that was provided that there is a wide range of innate *honey potentials* within different soybean lines. That's not the end of the story, however. It *may* not even be the most important part of the story. The local environment is also very important in determining the honey potentials of the soybeans grown in a particular area.

Environmental effects on soybean honey production

In 1979 Erickson and Robins[10] undertook what I consider one of the first steps in a string of important studies to definitively identify the environmental factors that lead to high soybean honey production. In this early study they set out to test the hypothesis that historic soybean production records, *as well as* soil type based on existing soil maps would be correlated with honey production. If that were true, soybean production records and/or soil maps could be used to locate apiaries that were likely to provide good honey production. The study was done in the Mississippi delta areas of Missouri and Arkansas where the Ohio and Mississippi Rivers, as well as several smaller tributaries, have changed courses several times in recent geological history, leaving a variety of soil types that made it possible to test this hypothesis. In general, the study confirmed the original hypotheses, but honey production was more highly correlated with soybean production than with soil type. The soil characteristics that correlated with good honey production were deep, heavier, highly fertile soils (including potassium), with a pH between 6.0 and 6.4[1]. As final proof, in the authors' words, "Relocation of apiaries short distances (up to 10 miles) to heavier soil and class sites invariably improved the productivity of the colonies involved." Their conclusion was, "Whether or not the nectar source is soybeans, beekeepers seeking productive apiary sites should, in lieu of more definitive information, do best by locating on those farm lands with the best records for crop productivity (yield/acre)."

The Erickson and Robins study confirmed the more casual observations of earlier authors. Pellett[20] reports from a 1922 letter sent to him by a Mr. J. R. Pinkham of Washington NC (Coastal area) that soybeans do not seem to yield as heavily on uplands as on the black swamp or Pocosin silt. Davis[3] stated, "The best soybean nectar-producing areas of Arkansas are the river bottoms where the soil is deep and fertile." Harvey Lovell[17] reported that a beekeeper near Geneva, NY found that bees worked soybeans heavily and made some honey from soybeans growing on light gravelly soils, but made no honey when grown on clay.

With the above study as a background, the research group (Robacker et al.[22]) went on to study the effects of other environmental factors on soybean honey production in a more controlled way in the University of Wisconsin's Biotron where factors such as day and night air and soil temperatures, nitrogen, phosphorous, potassium and other soil nutrients, light intensity, soil moisture, etc. could be managed alone or in various combinations [22]. Over 50 combinations were used and their effects on the soybean recorded. They looked at plant size, flowering date, number of flowers produced, flower color intensity, degree of flower openness, nectary development, nectar secretion, plant aroma, and attractiveness to bees. It was easy to optimize one parameter at a time, daytime tempera-

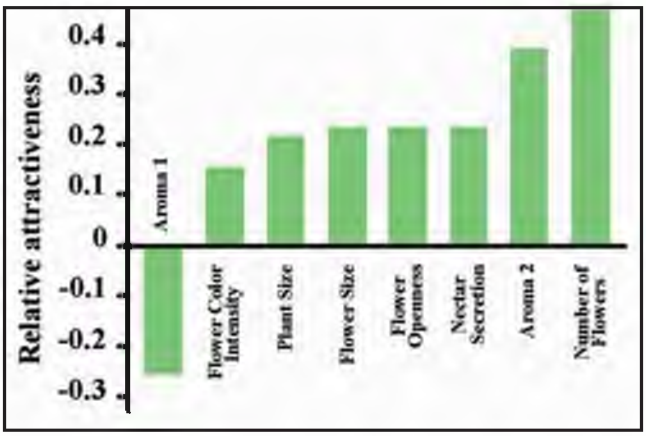

Fig. 1. Relative attractiveness of different soybean plant and flower attributes. Positive values represent the relative *attraction of honey bees to* soybean flowers; negative values represent attributes that have the opposite effect. The authors seem to feel that the most important features leading to attraction were nectar secretion and number of flowers. They seemed to view the other features that showed a positive correlation with attractiveness as simply "coming along for the ride" as those two features evolved. Adapted from Robacker et al.[22]

[1] **Both low potassium and low pH (pH optimum:6.0 to 6.5) adversely affect the nodulation process that allows the *Rhizobium* bacteria to supply fixed nitrogen to the plant in later life (after 3 months post planting) [28].**

tures, for example, where all the other variables were held constant. It soon became apparent, however, that this daytime optimum temperature held only for that particular set of other conditions. For example, using primary plant characteristic such as growth, relatively warm *nighttime* temperatures could offset the effect of what had originally appeared to be nonoptimum daytime temperatures. As another example, soil nitrogen levels affected optimum day/nighttime temperature regimes. They, in fact, found that soil nitrogen and phosphorous levels affected almost everything else including themselves. These interrelationships are called *interactions*. They sound messy, and they are, but this is the way the world works. One of the prime axioms of System Science is that you can't optimize all the variables of a complex system at the same time. As messy as I just made it sound, a lot of good information and some very interesting questions and theories grew out of this study. First it began to make clear why the observations made by beekeepers often differed. It also began to clarify which plant characteristics were important in attracting bees and which environmental elements affected these characteristics. Fig. 1 represents the authors' attempt at identifying and assigning relative values to the soybean characteristics that affect the attractiveness of soybeans to honey bees. Some of these are quite obvious, for example flower openness—if a flower doesn't open, it probably won't be attractive to bees. Notice that this list is also not without its obvious interactions. If, for example, flowers don't open, the number of flowers probably isn't going to greatly affect the attractiveness to bees.[2]

Effect of temperature

The researchers found that warm day temperatures (about 83˚F) provided the best results. Warm nighttime temperatures also seemed to contribute to attractiveness. This study also confirmed the earlier more casual observations of others. The heavy soybean flows of both Johnson[14] and Milum[19] (see 'Honey Potential, April Column) occurred after rains that were followed by warm temperatures that reached 100°F in the Johnson situation, and temperatures, while warm in the Milum situation, were a little cooler than those experienced by Johnson[3]. Milum also tells of communication with a Mr. Kirk from Farmersville, IL (ca. 90 miles southwest of Urbana) who had also experienced a soybean honey flow during the same hot, dry weather system. Milum concluded that adequate moisture coupled with hot, dry weather may be one of the factors controlling soybean honey production. Jaycox[13] states, "I have found that our scale colonies usually gain more weight during soybean bloom if the temperatures are consistently in the 80's or above." Erickson had also previously reported adverse effects of cold weather on soybean honey production. In a three-year study [6 & 7][4] using many varieties, he noted great variation in the effect of temperature on flower openness and nectar secretion between those varieties. Many of the varieties didn't secrete any nectar. He found that one variety, 'Hark', which was less adversely affected by cool temperature than most varieties, ceased producing nectar and the flowers remained closed (cleistogamy) at mean daily temperatures below 70°F (21°C), and one to four days of warmer temperatures were necessary to again stimulate nectar secretion. Interestingly the nectar sugar concentration of those flowers *that produced nectar* seemed to remain relatively constant, between 33 and 36%[5] during these up and down nectar production periods.

Soil fertility

In the Robacker et al. Biotron study[22], high nitrogen and low phosphorous situations also led to high levels of attractiveness to bees. Soil temperatures, and surprisingly, the two factors, potassium, and soil moisture had little effect on attractiveness. The authors point out, however, that soil moisture levels were the hardest condition to maintain in the Biotron.

The Aromas

In a 1982 Robacker et al. article[22] the authors describe two aromas. This was expanded to three in another article by Roebacker et al.[23]. Here I use the three-aroma version, and because there are several things going on at once, the reader is encouraged to follow the associated graphic as they read what is provided in the text. A soybean flower is open for only a day. Early in that day, at a time when the flowers were not yet open, they released a mixture of aromas where component (1) predominated. As the flowers opened, nectar secretion started and reached a maximum at about 3.5 hours into the light cycle, the same time aroma (3) reached its maximum, and aroma (1) and (2) reached their low points. A little later as the nectar secretion diminished, the concentration of component 3 dropped, and by the time nectar secretion ceased at 8 hrs, aroma (1) had again become the major component. Thereafter, as the flower closed, the concentration of all aroma components diminished, with component (1) still predominating. Notice that the bee foraging population reached its peak as component (3) reached its peak. Through hours 5.0 and 6.5 the foraging population remained high because there was still some nectar and probably also pollen that could be collected. Then, as nectar secretion continued to diminish, component (1) regained its original prominence and the foraging populations declined. Recalling that bees have a memory and can associate "cues" with recurring events, in this case, associating aromas with nectar production, it is almost as though the plant were telling the bees "not yet" then a little later "we're ready for you now" and still later "it's too late now, look for another flower". While that's interesting, plants aren't altruistic; they wouldn't be trying to help the bees for the bees' sake. The researchers speculated that this seemingly altruistic behavior ensures that both self and cross-pollination will occur. Using what seems like a reasonable train of logic, they estimated that it would take about 20 pollen grains to fully fertilize the average soybean flower. The top graph of the associated figure represents, over time, the percentage of stigmas that would have 20 or more pollen grains (full self-pollination) in a bee-free environment. Up until about the time that the bees are receiving some nectar and their foraging populations begin to increase, mainly self-fertilization would occur. As the foraging bee population increases, the process of cross-pollination would be initiated and increase as the foraging population increases. Notice that the foraging population reaches its maximum at a time when there would be, without bees, only about 33% of the stigmas fully self-pollinated (have at least 20 pollen grains). Some self-pollination would also be occurring at this time as a result of the bees cavorting around on the flower. The strategy seems designed to enforce a balance between self and cross-pollination.

Interesting questions

The Robacker et al. article[22] described above addresses some very interesting theoretical questions. Why would a plant species known to frequently self-pollinate before it opens "be interested" in attracting bees with contrasting coloration, nectar guides, and nectar production etc. (see April column). The researchers provide an interesting answer. First, they explain that being either totally cross-pollinated or totally self-pollinated probably isn't good, and plants evolve striking a happy medium between the two strategies that fits the environment in which they find themselves. Then, they propose the hypothesis that the progenitor of the current soybean was originally a largely cross-pollinating species, but when it was moved to many parts of the world as an agricultural crop, it experienced environments devoid of its original pollinators and the "tug of war" between self-pollination and cross-pollination slid the soybean toward self-pollination. In this view, many of the attributes of a cross-pollinating plant have not yet been lost (the showy floral display, nectar, nectar guides, the opening to the tongue channel and the associated tongue guides, attractive aromas, etc.[6]). Whatever the explanation, it will be important to get around the current strong self-pollination aspect of the species if hybrid soybeans are to be developed.

2 Only one variety, Mitchell was used in the study. Apparently under some conditions the flowers of this variety opened and under other conditions they didn't. There are probably other varieties that are either more or less prone to opening.

3 Milum describes the weather during the honey flow as "hot dry weather".

4 These two references cover the same 3-year study. One is intended for the beekeeping community, the other more for the scientific community.

5 This seems to be reported as 33-39.7% in the second Erickson reference.

6 Most of these attributes are discussed in the April column.

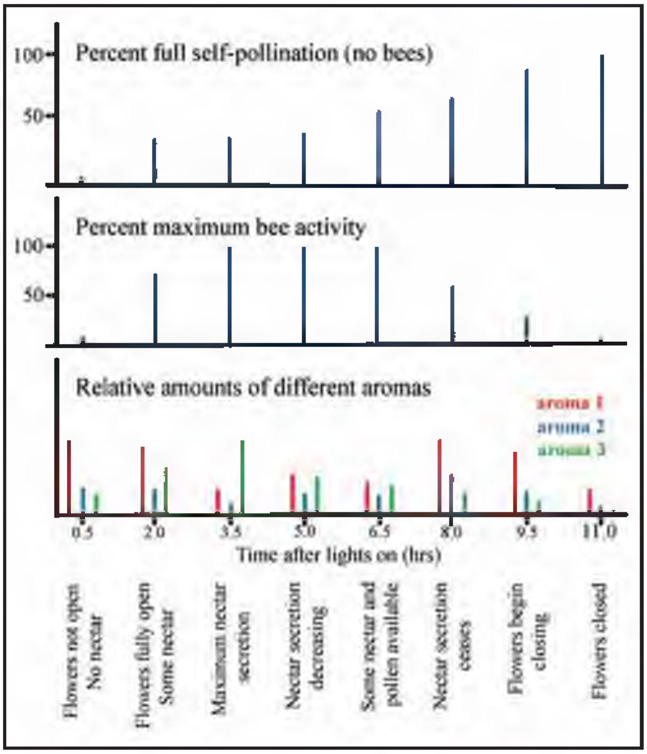

Fig 2. The effect of different soybean floral aromas on honey bee behavior and cross-pollination. The distance between the aroma bars within an individual set of three is *not* meant to indicate that the three aromas are present at slightly different times. Within a group, all three are present at the time above which they are centered. Follow along in the text. Adapted from Robacker et al.[23].

Effect of bees on soybean production and cross pollination

Just as historically there was originally skepticism and confusion concerning soybean honey production, this has also been the situation with the topics: (1) how much cross pollination do honey bees accomplish? and (2) do honeybees increase soybean yield?

Cross-pollination

Originally it was dogma that soybeans were nearly totally self-fertilized. In the words of C. M. Woodworth (1922) [27], "When the stigma is receptive, the anthers burst open covering the stigma with an abundance of pollen grains." This statement was based on two experiments, each using a different genetic marker where the two lines to be crossed were systematically and intimately intermingled. In both experiments the crossing rate was only 0.16%. Piper and Morse (1923) in their book 'The Soybean'[21] make similar claims, "The flowers are completely self-fertile, as bagged or screened plants set pods and seeds as perfectly as those in the open." As an indication of this, they cite two studies, one in Virginia (1909) where ten varieties were tested and a similar study in India (1913) that gave results identical to what they had just described. Milum (1940), at the University of Illinois, set wire cages over soybean plants at different distances from honeybee hives and found, ".....there were just as many seeds per pod beneath the cages as on the plants outside the cages." He concluded that "Since soybeans are self-fertile.....there should be little, if any, nectar available to attract the bees for the service needed for seed formation". Jaycox[13] in a review of the early soybean crossing literature, cites (without references) a work of Dr. Hadley in the Department of Agronomy at the University of Illinois who had done crossing experiments to assess the potential for cross-pollination. In what was apparently an open field test[7], there were no differences in the crossing percentages between flowers in the upper and lower portions of the plant and overall, there had been only 0.39% crossing. In caged experiments, the cages with bees produced a crossing rate of 0.69%, while in the cages without bees no hybrid seeds were produced. Where Hadley conducted uncaged experiments near honey bee colonies, he found crossing rates between 0.21 and 0.47%. Jaycox (again without references) also provides data from experiments by Dr. Richard Bernard of the USDA Regional Soybean Laboratory at the University of Illinois, who had done experiments with an unusual noncommercial variety of soybean known for its ability to cross. Bernard found the crossing rate in this noncommercial variety was 15.5% when it was caged with bees and standard soybean varieties as sources of pollen. He also found the crossing rate was 11.6% in open field conditions when honey bee colonies were close by, but this percentage slipped to 6.6% when the colonies were farther away. Jaycox ends his review with the statement, "Standard soybean varieties grown in the Midwest, such as Clark and Harosoy do not benefit from visitation by honey bees. This is probably true also of all other commercial varieties."

As I reviewed the literature, I encountered a translation of a Russian paper[11] which provided an interesting insight into how difficult it is for plant breeders to make soybean crosses. The author, V. A. Gordienko, was interested in developing an *easy and quick* method for making soybean crosses using bees. If these crosses are made by a plant breeder in the field, they sometimes must lie on the ground, and then work under magnification with thin needles and forceps in order to remove the small and delicate stamens before pollen is released. This delicate operation must be done without adversely affecting the pistil, which at this time is pretty much surrounded by and in close contact with the staminal sheath (see the April column). Under these circumstances, the rate of stamen removal and subsequent pollen transfer was claimed to be about 30 flowers in an eight-hour day and the success rate of hybrid seed formation was only about 0.2%. When Gordienko[11] performed caged studies similar to those cited above, he claimed a crossing rate of between 28.6 and 44.1% in cages with bees. These were unexpected results and he suggested the unexpectedly high cross-pollination rate had resulted from either rapid changes in temperature and/or humidity within the cage, which weakened the corolla and caused it to split open prematurely before the pollen was released. He also provided another explanation that is unintelligible to me, perhaps because of a clumsy English translation.

More recently, Abrams et al.[1] conducted an experiment designed to study the comparative effectiveness of honey bees vs. alfalfa leaf cutter bees (*Megachile pacifica*, now *M. rotundata*) for cross pollination and increased soybean yield. Six fields of *purple flowered* soybeans were used. In each field, perpendicular transects that intersected in the fields' centers were laid out, and small plantings of white flowering cultivars were planted at varying distances from the intersections of the transects. A honey bee hive was placed at the intersection of the transects in three fields and a commercial alfalfa leafcutter bee board was placed in a similar location in the other three fields. At the ends of the fields white flowered plants were also planted among the purple flowered plants. These plots were sprayed with insecticides and were used as control plots. Purple flower color is dominant to white flower color so that purple flowered progeny of white flowering plants would be the result of cross pollination. The honey bees were observed foraging actively within their fields and the colonies faired well, doubling in size and storing sufficient honey for winter maintenance. The leafcutter bees faired poorly and did not work the soybeans, but were observed actively flying from the field. At maturity both the white and purple flowering plants were harvested in all plots. Bean yields of the purple flowering plants were determined and the seeds from the white flowering plants were planted in a greenhouse to determine the rate of cross pollination. Soybean yields of the purple flowered plants were not significantly increased by either bee species. The cross pollination in the honey bee fields ranged from 2.95% to 7.26% compared to only 1.15% in the insecticide treated control plots at the ends of the fields. There was no generally diminishing trend of cross-pollination

7 **That this was an open field test is not absolutely certain and Jaycox provided no references to these studies.**

at the different distances from the hives, but I felt the data *might* be interpreted as having two peaks. There was, however, not an abundance of data points. In addition, the cross pollination in the alfalfa leafcutter fields, which appeared to not be worked by the leafcutters, ranged from 1.61% to 7.74% compared to 6.59% in the insecticide treated control plots. These last facts led the researchers to speculate on the presence of a third, but unknown pollinator.

Increasing production

Erickson, perhaps spurred on by his recognition that the soybean flower appears to be designed to accommodate insect pollinators, has almost doggedly investigated not only soybean honey production covered partly in the April column and continued above, but also the effect of bees on soybean yield. During a three-year study in *southern Wisconsin* (1971-1973)[5] he investigated this topic using several varieties of soybean in cages with and without bees and also cages "without insects" where the soybeans within the cages were treated with an insecticide. Plots without cages served as control plots. Seed yield differences varied between both cultivars and years and appeared to result from differential attractiveness based on whether or not the flowers opened and probably also on differences in available nectar sugar. In the 1971 study the cultivar 'Chippewa 64' never opened (*cleisto*gamous) and produced no significant yield differences and was apparently totally self-pollinated. The cultivar 'Carsoy' caged with honey bees yielded 13.9% more soybeans than those caged without bees. The insecticide treated vs. the control open, untreated plots showed no significant differences, but the plants caged with bees produced 14.9% more soybeans than the caged plants treated with insecticides. Both the 1972 and 1973 studies utilized 'Hark' a relatively *chasto*gamous[8] cultivar. The 1972 study produced no significant differences between plants caged with and without bees. In the 1973 study the plants caged with bees produced 16.3 % more beans than the plants caged without bees. The difference between the insecticide treated plots and the open, untreated plots were apparently not significant, but the plants caged with bees produced 11.6% more beans than the insecticide-treated plots. Statistical significance in the 1973 trials was dependent on the statistical test used.

Wisconsin is approaching the northern limit of soybean production. To see how similar experiments as described above would play out farther south, Erickson et al.[9] in 1975 performed both "caged with and without bees studies" as well as "distance from hives" studies in both Missouri and Arkansas. The "caged with and without bees" studies were performed near Bragg City, MO and Jonesboro, AR using "Pickett 71' and 'Pickett', respectively, in those locations. In combined results of the two locations, the caged plants with bees produced 21.6% more beans than the caged plants without bees and there was a 20.4 % increase in the total number of pods filled. Interestingly, open field plots, intended to serve as controls produced better than the caged plots with bees, which the authors believed resulted from the cages having a detrimental effect on the plants. Because they had not seen similar results in their Wisconsin studies, they suggested that caged studies should not be used in southern production trials. Their "distance from hives" studies were carried out near Wardell, MO using the cultivar 'Forrest' and near Blytheville, AR using the cultivar 'Lee 68'. In these experiments there was not a steady decline in soybean production with distance from the hives. Instead, production generally declined and then went through a secondary peak at about 250 meters and then again declined. The fields were not large uniform areas, but had significant landmarks (field edges and roads) and the authors felt that their data was consistent with the known foraging behavior of honey bees, which have been shown to forage heavily near landmarks, and they seemed to feel that they had demonstrated that there had been a decline in soybean production correlated with distance from the hives.

Kettle and Taylor (1979) [15] working in northeast KS found the "highly attractive" cultivar 'Forrest' with a mean nectar solids[9] concentration of 39.5% produced significantly greater seed yields of approximately 20% under cages with bees than under cages without bees.

Sheppard et al. (1979)[25] from their studies, presumably in Illinois, concluded that there was no relationship between soybean yield and distance from hives. As I look at their data, while there were not many data points, the pattern seems somewhat reminiscent of the "*possible* double peak" pattern found by Erickson et al.[9] and Abrams et al.[1], and I wonder if we are missing something. The Sheppard et al. paper provided the interesting bit of information that the Italian bee breeds seemed to forage over greater distances than the Caucasian or Carniolan breeds, suggesting that Italian bee strains may be more likely to forage flora outside of the soybean fields that is more attractive than soybeans.

Koelling et al.[16] (1981) examined the potential of honey bees vs. alfalfa leaf cutter bees for making hybrid soybeans using a male-sterile 'Williams' line[10] and a male-fertile 'Calland' line. In these experiments they used cages with and without bees (the two bee species segregated into different cages) and as controls they used caged plots without either bees species and also plots that were caged, but with the cage sides rolled up to 60 cm (about two feet). Only the beans from the male-sterile plants were harvested. No bees of either species were added to the field in which the experiment was performed. The researchers found no *significant* differences in soybean seed production between honey bees and alfalfa bees. They also found no significant differences between closed cages and open cages. They did, however, find significant increases in seeds/plant (39.6 vs. 8.5) and pods per plant (19.1 vs.1.7) in cages with bees vs. those without bees. There was no significant increase in seeds/pod, indicating that the increase came from the number of pods that were set. Unlike the Abrams et al. study[1], they found the alfalfa leaf cutting bees more suitable, or at least easier to deal with, than the honey bees.

Sheppard et al. (1979) [25] seem to suggest that indeterminate growth[11] plants used in their study might not produce as much nectar as determinate plants commonly grown farther south than the indeterminate types. As a result, indeterminate plants would be less attractive to bees than determinate types, and bees would not, therefore, be expected to produce the benefits that they sometimes seem to farther south. Erickson[8] clearly disagrees with this assessment, stating, "I have yet to discern differences in foraging by bees or yield responses resulting from bee pollination that can be explained based upon level of determinancy at flowering." Instead, his work that demonstrated that cleistogamy is sometimes related to cool temperatures suggests *to me at least* that higher honey and seed productions in southern climates may be the result of warmer temperatures.

Recommended number of colonies per acre of soybean

If bees can increase soybean yields, it is not well reflected in the pollination recommendations for the crop. McGregor[18] states "There are no recommendations for the use of bees in pollination of soybeans." He adds that he reviewed the literature primarily because of the interest in the production of hybrid soybeans. Delaplane and Mayer [4] state, "Supplemental bees are rarely, if ever used for pollinating soybean in the field. This could change if production of hybrids becomes practical, in which case bees will be needed to transfer pollen between parent lines." Scott-Dupree et

[8] **Be aware that the two terms that look much alike (*chasto*gamous and *cleisto*gamous) have opposite meanings. The first refers to flowers that open before fertilization and are generally cross-pollinated. The second refers to flowers that do not open and are self-pollinated.**

[9] **Most data that is reported as nectar sugar concentrations is acquired with a refractometer. Technically this instrument provides an *estimate* of total dissolved material in the nectar, much of which is usually, and perhaps always, mainly sugars.**

[10] **The male sterile line was created by analyzing the pollen of the first flower to open of all the 'Williams' plants to identify all male fertile plants. These were then removed from the plots leaving only the male sterile plants.**

[11] **Determinant and indeterminate growth: Determinant type plants stop growing when reproductive development starts whereas indeterminate type plants continue to grow after reproductive growth begins.**

al. [24] make a recommendation of "0" hives per hectare, but they do provide an estimate of soybean production being 5% dependent on honey bees and 10% dependent on insects as a whole.

Jaycox[12] (1970) claims to have heard numerous stories of soybean growers in Illinois and other places wanting bees near their plantings, but was never able to collect hard evidence that this was true. Erickson[8] (1984), however states "Regardless of opinions to the contrary, many soybean growers continue to encourage beekeepers to locate apiaries near their fields and report increased yields with bees present." Ayers and Harman[2] reported some of the respondents to their questionnaires indicated that there was some commercial pollination of soybeans within the area for which they were reporting. In some cases, however, it was unclear exactly what was meant by "commercial pollination".

Prospects for hybrid soybean production

Soybeans have become a very important crop, and there has been much interest in the production of hybrid soybeans. Like many of the other topics associated with soybeans, there is disagreement about whether soybean hybrids will become a reality. There are those who think they will be developed very soon, and there are those who think that it will never happen. From my perspective, the self-fertile nature of soybeans, the way that this is enforced by the flowers of some cultivars not opening, and the effects of the weather on floral opening all seem to be large problems that need to be overcome if hybrid soybeans are to become a reality. On top of that there are the more usual problems of developing satisfactory male-sterile plants, restorer lines, creating lines that the pollinators will move freely between, etc. Hybrid soybean seed has been created, but the yields have been disappointing and/or the process has been too expensive to compete with nonhybrid soybean seed production.

In 2003 a group of Chinese researchers claimed to have produced the first practical hybrid soybean cultivar[28]. These crosses were apparently done with an insect other than the honey bee. My discussions with a U.S. soybean breeder indicates that the reported Chinese hybrid production system is very expensive and not economically competitive and that the hybrids do not produce as well as the best inbred lines. If this is true, it looks to me as though in the area of hybrid soybeans, we haven't yet arrived.

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Correction: The middle and last photos on the bottom half of page 400 of the April 2010 issue are transposed.

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Proceedings of the American Bee Research Conference

The 2010 American Bee Research Conference was held January 14-15 at the Wyndham Orlando Resort in Orlando, Florida. This was a special joint conference between the American Association of Professional Apiculturists and the Canadian Association of Professional Apiculturists. The twenty-fourth American Bee Research Conference will be held in conjunction with a joint meeting of the American Beekeeping Federation and the American Honey Producers Association in Galveston, TX on January 4-8, 2011. The following are abstracts from the 2010 Conference.

1. Afik[a], O., W.B. Hunter[b] & K.S. Delaplane[a] – EFFECTS OF VARROA MITES AND BEE DISEASES ON POLLINATION EFFICACY OF HONEY BEES – Varroa mites and viral diseases are known to affect the efficiency of crop pollination by honey bees through the elimination of colonies, but only limited information exists on their influence on pollination at sub-lethal levels on the individual bee (Ellis & Delaplane, *2008 Agr. Ecosyst. Environ. 127:201-206*). The purpose of this study was to learn about effects that varroa mites and bee diseases may be having on the foraging behavior of adult bees and the consequences of these effects on successful fruit pollination.

For the first season of the experiment, four honey bee colonies of about 4,500 bees each were established. Two of these colonies were each infested with 1,000 varroa mites collected from other hives by sugar powdering. Two other colonies were used as non-infested control colonies. In order to force mites to attach to the adult bees, brood combs from both treatments were replaced with empty combs before brood was sealed. Each colony was caged in a separate enclosure containing one blueberry target plant and two potted pollen source plants. Pollination efficacy was tested by measuring percent of fruit-set and pollen deposition at flowers exposed to a single visit by an individual bee. Each visiting bee was collected at the end of the flower visit and preserved for later pathogen analysis.

The results indicated that bees from mite-infested colonies achieved a lower percent of fruit set and tended to deposit fewer pollen grains on the flower stigma. Bees from infested colonies performed shorter flower visits and a lower percentage of them were pollen foragers. These two behavioral differences may contribute to lower rate of fruit-set since the duration of flower visit was positively correlated with pollen deposition and pollen foragers were found to be more efficient pollinators of blueberry flowers than nectar foragers. More than 75% of the bees from both treatments were determined to be naturally infected with the viruses DWV and BQCV, but no bee was positive for *Nosema* spp., ABPV, IAPV or KBV. The results suggest that bees from colonies highly infested with mites are less efficient pollinators, possibly due to shorter visits to the flowers and lower tendency to collect pollen. The effects of mite infestation combined with high virus infections have not yet been determined. Further research will focus on how to limit the effects of varroa mites on the foraging behavior and pollination success of honey bees.

2. Alaux[c], C., J.-L. Brunet[d], C. Dussaubat[c], F. Mondet[d], S. Tchamitchan[d], M. Cousin[d], J. Brillard[e], A. Baldy[c], L.P. Belzunces[d] & Y. Le Conte[c] - INTERACTIONS BETWEEN *NOSEMA* MICROSPORES AND A NEONICOTINOID IN HONEY BEES - Massive honey bee losses have been reported in the world, but the specific causes are still unknown. Single factors, like pesticide impact, or a disease or parasite have not explained this global decline, leading to the hypothesis of a multifactorial syndrome (van Engelsdorp *et al., 2009 PLoS One 4:e6481*). Consequently, we tested the integrative effects of an infectious organism (*Nosema sp*) and an insecticide (imidacloprid) on honeybee health. We demonstrated, for the first time, that a synergistic effect between both agents, at concentrations encountered in nature, significantly weakened honey bees. The combination of *Nosema*, a pathogen whose importance is emerging, with imidacloprid caused a significantly higher rate of individual mortality and energetic stress in the short term than either agent alone. We then quantified the strength of immunity of honey bees. While the single or combined treatments showed no effect on individual immunity (haemocyte number and phenoloxidase activity), a measure of colony level immunity, glucose oxidase activity, was significantly decreased only by the combined treatments, emphasizing their synergistic effects. Glucose oxidase activity enables bees to secrete antiseptics in honey and brood food. This suggests a higher susceptibility of the hive to pathogens. We, thus, provide evidence for integrative effects of different agents on honey bee health, both in the short and long term. By focusing either on the effects of pesticides or parasites alone, previously established synergy has been ignored, despite clear evidence from integrated pest management that entomogenous fungi act synergistically with sub-lethal doses of pesticides to kill insect pests (Alaux *et al., 2009 Environ. Microb. doi:10.1111/j.1462-2920.2009.02123.x*).

3. Andino[f], G.K. & G.J. Hunt[f] - A NEW ASSAY TO MEASURE MITE GROOMING BEHAVIOR - Grooming behavior is one of the known mechanisms of defense for honey bees against parasitic mites. *Varroa destructor* is often considered the biggest beekeeping problem within the U.S. and around the world. Mite-grooming behavior has been described as the ability of the adult bees to remove *Varroa* mites during grooming and has been associated with mites that have been chewed by the bees' mandibles, but the proportion of chewed mites is extremely tedious to measure.

We developed an easier assay to measure mite-grooming behavior that can be used for selection in breeding programs. Wood cages with screened tops and bottoms were used to hold a frame of bees collected from the brood nest. Bees were transferred to comb containing pollen and nectar but without brood. The mites removed during grooming were collected in sticky boards for three days at room temperature (22-25 °C) and then counted. The remaining mites on the adult bees were collected and counted using carbon dioxide (CO_2) to anesthetize the bees and powdered sugar to remove the mites. The percentage of the mites removed was calculated.

A significant relationship ($p = 0.0285$) was found between the proportion of mites removed in the lab assay and the proportion of chewed mites on sticky boards from the source colonies. This relationship indicates that the colonies that removed the highest percentage of mites in the caged adult bees were also the colonies that had the highest percentage of chewed mites (Figure). These results suggest that the method used to measure mite-grooming behavior is effective. In addition, we also found a negative relationship ($p = 0.0072$) between the percentage of mites removed and mite infestation of adult bees, which indicates that the colonies with the highest percentage of mites removed in the cage assay, had the lowest population of mites on adult bees. These results suggest that the low population of mites present on the adult bees is due to grooming.

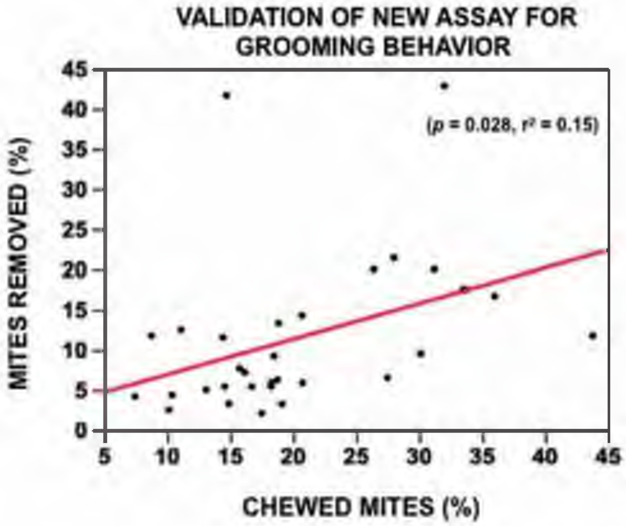


Figure. Relationship between the % of mites removed and the % chewed

4. Bahreini[g], R. & R.W. Currie[g] – INCREASING THE ECONOMIC THRESHOLD FOR FALL TREATMENT OF VARROA MITE (*VARROA DESTRUCTOR* A.&T.) IN HONEY BEES BY USING MITE-TOLERANT STOCKS IN NORTHERN CLIMATES - The objective of this research was to develop effective and economical methods to reduce the impact of varroa mites on honey bees under winter management systems. Fall economic thresholds for varroa mite control in the prairie region of Canada suggest producers should treat honey bee stock when the mite level is greater than 4 mites per 100 bees (in late August to early September) to prevent fall or winter colony loss (Currie & Gatien, *2006 Can. Entomol. 138:238-252*). However, it is not known how the use of mite tolerant stock or late season acaricide application would affect these thresholds. An experiment to assess these factors was carried out at University of Manitoba in fall 2007 to spring 2008. Thirty-nine colonies from mite-susceptible (n=23) and mite-tolerant (n=16) stocks with mite levels (16±3 mites per 100 bees) above the fall economic threshold were chosen and within each type of stock were randomly assigned into two groups that would either receive a late fall (November 2007) treatment with 1 g of oxalic acid crystals or were left untreated. Colonies were randomly arranged in two small rooms in a wintering building maintained at 5°C. Colony worker population and mean abundance of varroa mites were assessed before and after wintering colonies, and varroa mite and worker mortality rates were determined.

As expected, late fall treatment with oxalic acid reduced the mean abundance of varroa mites over winter (to 3.5%), relative to that found in untreated colonies (12%) in both susceptible and tolerant stock as indicated by a significant acaricide treatment × season interaction ($P<0.01$). However, under high fall mite load, reductions in mite levels associated with late-season oxalic acid treatment did not improve colony survival relative to untreated colonies. The use of mite-tolerant stock improved colony survival. In the mite-tolerant stock winter survival of colonies was much higher (75%) than in mite-susceptible stock (43%). The populations of worker bees in mite-tolerant and mite-susceptible stock were similar in colonies that survived winter. Bee populations in tolerant stock tended to be slightly higher than in susceptible stock, whether colonies were treated with acaricide or not. Untreated colonies with tolerant and susceptible stocks had similar mite mortality rates over winter, but tolerant stock had slightly a lower mean abundance of mites at the end of winter, compared to susceptible stock. Overall, this study demonstrates that when late fall mite levels are well above the fall economic threshold, tolerant stock could be used by beekeepers to help minimize colony loss in the Canadian prairies and under these conditions late fall oxalic treatments may not improve colony survival.

5. Cobey[h], S., J. Pollard[i], C. Plante[i], M. Flenniken[h] & W.S. Sheppard[j] - DEVELOPMENT OF A PROTOCOL FOR THE INTERNATIONAL EXCHANGE OF HONEY BEE GERMPLASM - The development of protocol for the safe, well regulated international exchange of honey bee genetics is needed. The current ban on importation is inconsistent and has failed to prevent the spread of pests, parasites and pathogens. The initial limited gene pool introduced into the U.S. before the 1922 ban and the alarmingly high loss of colonies due to Colony Collapse Disorder is an increasing concern. Genetic diversity has been demonstrated to increase colony fitness and reduce the impact of pests and diseases. Our project is designed to develop technologies to safely import honey bee germplasm, semen and eggs, and to import stocks selected for resistance to enhance our domestic honey bee gene pool.

An improved bee semen extender with an antibiotic mixture, containing gentamicin, amoxicillin, lincomycin and tylosin, specifically designed to control bacterial pathogens was developed and tested to facilitate the transport of semen. Extended semen was examined for viability and motility after storage for 7 days, and inseminated to virgin queens. Results demonstrated high sperm viability, normal spermathecal sperm counts and normal brood patterns of inseminated queens.

USDA-APHIS (Animal Plant Health Inspection Service) permits were obtained and honey bee semen imported. *Apis mellifera ligustica* from survivor stock in Italy and *A. m. carnica* from the Germany Carnica Association were imported in 2008 and 2009 and crossed with domestic stocks. The semen was tested for viruses and resulting colonies established in an approved quarantine area at Washington State University. Progeny of these colonies were also examined and tested for pathogens. The 2008 imports released were backcrossed to the 2009 imports to create more pure stocks and also were incorporated into proven commercial U.S. stocks.

The New World Carniolan × German *A.m. carnica* colonies expressed increased fitness and increased expression of hygienic behavior. The Italian stock is still undergoing testing. Future plans are to import *A.m. caucasica,* as this subspecies is detectable but largely unrecognizable in the U.S.

Honey bee eggs represent a complete genetic package and are available in large quantities. Therefore, we developed reproductive technologies to manipulate honey bee eggs to allow for their isolation, pathogen testing and transport. A method to manipulate embryos was developed using fine forceps modified by the application of micro-bore tubing. The transferred eggs were hatched *in vitro* and the larva were grafted into queen cell cups, reared into queens and instrumentally inseminated with a high rate of success.

6. Delaplane[a], K.S. & J.A. Berry[k] - TEST FOR SUB-LETHAL EFFECTS OF SOME COMMONLY USED HIVE CHEMICALS, YEAR TWO - We are involved in a two-year, two-state (GA, SC) experiment examining sub-lethal effects of selected bee hive chemicals; the list includes registered products at label rates, as well as two off-label formulations. The reason we are doing this is that there is evidence that some of the chemicals used in beekeeping are hazardous to bees and contribute to bee decline (Frazier *et al., 2008 Am. Bee J. 148(6):521-523*; Desneux *et al., 2007 Ann. Rev. Entomol. 52:81-106*). Understanding this piece of the CCD puzzle will help beekeepers move toward more chemical-independent management. Here are results for two years from Georgia. Varroa levels (mites/100 bees) were significantly higher in CheckMite (coumaphos)-treated colonies than in colonies treated with Taktic (amitraz); mite levels were intermediate in all other treatments. Bees in the non-treated control colonies exhibited numerically highest brood viability, homing ability, and foraging rate and numerically lowest incidence of queen supersedure cells. Information like this is important for evaluating the cost:benefit ratio of using exotic chemicals in honey bee management.

Table - Comparison of sublethal effects of various chemicals commonly used in hives.

Chemical	Mites per 100 adult bees	Brood viability (% open brood alive after 3 d)	Supersedure cells	Homing ability[1]	Foraging rate[2]
Non-treated	11±2 (22)ab	96.6±0.9(33)	0.5±0 3(35)	17±2.5(8)	57±9(32)
Cu naphthenate[3]	13±2(19)ab	89.2±2.7(30)	2.2±0.7(32)	10.4±2(7)	54±8(29)
Apistan (fluvalinate)	7±1.4(21)ab	92.8±1.4(31)	3±1(33)	16±2(6)	52±8(30)
CheckMite (coumaphos)	14±2.6(20)a	90.1±2.4(30)	3.3±1(32)	9.5±2(6)	51±7(29)
Maverik (fluvalinate)	5±1.3(19)ab	90.5±2.2(29)	1.4±0.6(30)	13.9±3(7)	53±7(29)
Taktic (amitraz)	3±1(22)b	91.3±2.1(29)	2.1±0.5(34)	15±7(7)	50±7(31)

1 Reported as % of bees (of 30 marked) returning to colony entrance within 15 min after being released 1 km distant.

2 Reported as number of foraging bees returning to colony entrance per min in observation period of 15 min.

3 Copper naphthenate wood preservative was applied as a 2% water-soluble solution on a plywood panel which was allowed to air-dry and placed on hive floor.

7. Desai[g], S. & R.W. Currie[g] - INHIBITION OF DEFORMED WING VIRUS (DWV) MULTIPLICATION IN HONEY BEES BY RNA INTERFERENCE - DWV plays a major role in affecting honey bee health. High proportions of colonies are infected by this virus, and it can be detected in worker honey bees, queens, pupae, larvae, drones and also in varroa mites. DWV and its interactions with the ectoparasitic varroa mite and other diseases have caused significant mortality of honey bee colonies on a world-wide basis (Miranda & Genersch, *2009 J. Invertbre. Pathol.103:S48-S61*).

RNAi is a comparatively "simple", rapid and specific method for silencing gene function and can be developed to be specific to an individual virus**.** RNAi has recently been utilized in a number of species including human beings, plants, animals and insects (*Drosophila*) and recently in bees to suppress viruses. For example, successful silencing of Israeli Acute Paralysis Virus (IAPV) in honey bees by feeding specific dsRNA to bees dramatically improved bee-to-brood ratio and honey yield (Maori *et al., 2009 Insect Mol. Biol. 18:55-60)*.

RNAi reduces virus replication by causing degradation of the target mRNA. In this experiment, we assessed the effects of feeding dsRNA constructs against DWV to larvae that were infected with DWV and the potential lethal and sub-lethal effects on developing worker bees.

In DWV-infected larvae fed dsRNA survival (45%) was greater than the survival of larvae fed unrelated dsRNA (GFP) (31%) or DWV-infected larvae that were not treated with dsRNA. The dsRNA did not affect larval survival as DWV-"free" larvae fed our dsRNA construct had similar survival to that of untreated controls (Figure). Our dsRNA-fed larvae that were infected with DWV had significantly lower levels of wing deformity compared to larvae infected DWV or to larvae infected with DWV and an unspecific form of RNAi (GFP). Our experiment also demonstrated for the first time that feeding DWV orally in the absence of mites causes wing deformity in *in-vitro* reared larvae. We hypothesize that application of dsRNA into the honeybees fed DWV should result in a reduction in DWV titer over time with no effect on bee longevity. If proven effective, this mechanism can be used to block DWV and could improve winter survival of honeybee colonies.

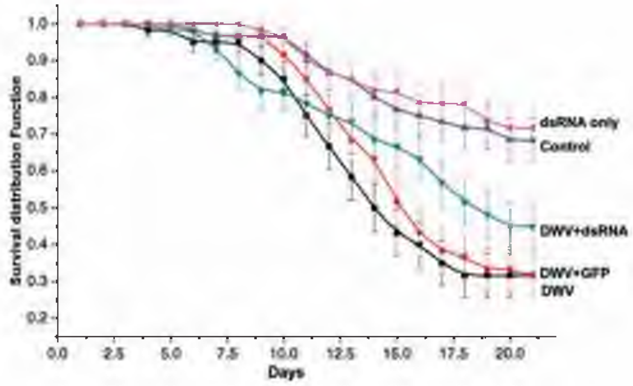


Figure. Effect of dsRNA on survival in DWV infected larvae.

8. Eischen[1], F.A., R.H. Graham[1] & R. Rivera[1] - MOUNTAINSIDE WINTERING IMPROVES COLONY STRENGTH AND SURVIVAL OF HONEY BEES IN SOUTHERN CALIFORNIA - We examined the interaction of a feeding program and cold-windy conditions on honey bee colonies near Santa Ysabel, California (elev. 914 m). An equal number of colonies located near Fallbrook, California (elev. 219 m) served as controls. The trial began 7 September 2008 near Holtville, California (Imperial Valley). Colonies were randomly assigned to four treatment groups (n = 50), i.e., 1) Highland, fed continuously, 2) Highland, fed discontinuously, 3) Lowland, fed continuously, and 4) Lowland, fed discontinuously. On 20 November, lowland-designated colonies were moved to their normal winter locations near Valley Center, CA, and highland colonies to a mountainside near Santa Ysabel, CA. Groups 1) and 3) were fed continuously throughout the trial. Groups 2) and 4) were not fed during the period 6 Dec. 2008 – 13 Jan. 2009. Colonies were evaluated for strength and broodnest size on 26 January 2009, i.e., near the time of almond pollination evaluation.

Regardless of feeding treatment, highland colonies at the end of the trial were stronger by about 1.5 frames of bees than colonies of either lowland group. Brood nests of highland colonies were smaller, however by about 1.0 frames of brood. Stored pollen declined in the highland colonies, but stayed about the same in the lowland colonies; indicating that pollen foraging occurred in the lowland colonies. Highland colonies had a slight, but significantly higher survival rate than did lowland colonies.

To determine if the highland colonies would lose strength on return to lowland conditions, colonies from each treatment group (n = 25) were moved to an almond orchard near Shafter, CA and examined on February 15. Highland colonies were nominally larger than lowland colonies. Broodnest sizes were about the same for both highland and lowland colonies. Highland colonies had significantly more stored pollen than lowland colonies, indicating that their larger size caused increased pollen foraging. A simplified cost/benefit analysis indicates that it was economical to place colonies in a climate that limits unproductive flight during winter.

9. Eischen[l], F.A., R.H. Graham[l] & R. Rivera[l] - ALMOND POLLEN COLLECTION BY HONEY BEE COLONIES HEAVILY INFECTED WITH *NOSEMA CERANAE* - In 2007 apiculturists became aware that the microsporidian, *Nosema ceranae*, had become established in the United States. A related species, *N. apis* is a well known honey bee pathogen. There was concern within the beekeeping industry that this "new" pathogen is part of the Colony Collapse Disorder (CCD) phenomenon.

A commercial beekeeper, based in Louisiana and New York, was found to have high levels of this pathogen in colonies used to pollinate almonds, blueberries and cranberries. We examined the impact of four *N. ceranae* levels on honey bee colonies including pollen collection during almond bloom in the Central Valley of California during February – March 2009.

N. ceranae levels in October 2008 were on average 1.0 – 2.9 million spores/bee (MSPB). By January 2009, levels increased to, on average, 1.6 MSPB in the lightest infection group to 49.5 MSPB in the heaviest. After transport from Louisiana to California during 31 Jan.-2 Feb, colonies in the two heaviest-infected groups had striking declines in their spore levels. We suspect the rigors of travel caused many severely infected bees to die.

Pollen collection by the lightest-infected colonies (Group I) was about twice that of Group II (159.8 vs. 74.0 g/day). Both Group I (0-4.5 MSPB) and Group II (5-15 MSPB) colonies collected significantly more pollen than Groups III (16-34 MSPB) and IV (35-49 MSPB) 16-34. When pollen collection was based on grams of pollen per frame of adult bees, we found that Group I colonies collected significantly more pollen. This suggests that foragers with heavy infections either make fewer collecting trips or pack smaller loads or both.

Colonies of all four groups lost significant adult bee strength during almond bloom, but losses were more severe in Groups II, III, and IV. At the end of pollination, no significant differences in *N. ceranae* spore levels were found among treatment groups, but levels rose in Groups I and II, while remaining about the same in Groups III and IV.

We suspect that these colonies, especially those with high spore levels, had large spore reservoirs on their honeycombs. We recommend including this factor when determining economic thresholds.

10. Eitzer[m], B., F. Drummond[n], J.D. Ellis[o], N. Ostiguy[p], M. Spivak[q], K. Aronstein[l], W.S. Sheppard[j], K. Visscher[r], D. Cox-Foster[s] & A. Averill[t] - PESTICIDE ANALYSIS AT THE STATIONARY APIARIES - One facet of the stationary apiary project within the "Sustainable Solutions to Problems Affecting the Health of Managed Bees Coordinated Agricultural Program" is a monitoring of the honey bee's exposure to pesticides. This is being done by determining pesticide residues in the pollen that is brought back to the hive by foraging honey bees. At five hives from each of the stationary apiaries, pollen is sampled with traps one day per week. Pollen samples are frozen after collection. Aliquots from all samples taken from an apiary during a calendar month are combined to generate a monthly composite sample for each apiary. Five grams of this composite sample are analyzed by a multi-pesticide residue procedure. In brief, the samples are extracted with acetonitrile using a dispersive solid phase technique known as QuEChERS (for Quick, Easy, Cheap, Effective, Rugged and Safe) and analyzed using high performance liquid chromatography/mass spectrometry/mass spectrometry. Using this technique allows over 140 different pesticides to be analyzed in the parts per billion (PPB) concentration range.

To date 29 of the monthly composite samples have been analyzed. Within these 29 samples, residues of 32 different pesticides or pesticide metabolites have been observed including: 14 insecticides plus one insecticide metabolite, 9 fungicides and 8 herbicides. The average composite pollen sample had an average of 4.1 pesticide residues detected. The concentration of residues when detected are mostly in the low PPB range (1< to 30 ppb), but some residues were substantially higher. The results indicate that honey bees at the stationary apiaries are being exposed to varying amounts of pesticides. As might be expected, this exposure amount varies with the location of the apiary (i.e. honey bees in Washington are exposed to different pesticides than those in Florida) and time of year. In addition, analysis of non-composited samples taken from five different hives within the same apiary on the same day also shows different pesticide amounts. This indicates that the honey bees from these hives are clearly foraging from different fields that have had different amounts of pesticides applied. This variability of pesticide exposure will be further examined as we continue to monitor these hives over the next several years.

11. Esaias[u], W. – RELATIONSHIPS BETWEEN VEGETATION COVER, NECTAR AVAILABILITY, AND THE AFRICANIZED HONEY BEE - Collections of scale hive records of the Honey Bee Nectar Flow reveal dramatic regional variations related to honey bee forage and its phenology, and are used to quantify inter-annual variations that are related to changes in land cover type (nectar sources) and natural climate change. Temporal trends in the nectar flow dates correlate well with trends in vegetation parameters observed with the Moderate Resolution Imaging Spectroradiometer on the Terra and Aqua satellites. Nectar flows are generally occurring earlier in the Northeast U.S., and later in the Southeast U.S., in conjunction with regional increases in winter minimum temperatures. Numbers of volunteer beekeepers who provide records of daily weight changes has been doubling for the past several years and is now approaching 100 locations throughout the U.S. Further insight into climate and land cover change impacts on the timing of nectar flows will be possible as the number of volunteer locations increases, especially in the central and western U.S. Maps of site locations coverage, and scale hive data itself, are available at http://honeybeenet.gsfc.nasa.gov. Research programs establishing longer term monitoring apiaries are encouraged to consider monitoring hive weight changes to evaluate the impact of inter-annual nectar flow variations on colony health and behavior.

Jointly with the USGS National Institute of Invasive Species at Ft. Collins (C. Jarnevich, J. Morisette, T. Stohgren), climate and satellite vegetation data and species distribution models (SDMs) are used to better understand the areas at risk from further advance of the Africanized Honey Bee, and to shed light on why its movement into eastern Gulf of Mexico states has been slow compared to movement to the north and west. A key limitation to these studies, based on presence of an invasion still in progress, is the relatively poor knowledge of exact AHB locations throughout the range, although some states are very well sampled. Additionally, the sampling is biased spatially, makes no distinction between overwintered versus incidental/transient transport, and sampling effort is not uniform or recurrent over time. With 1-5 km scale resolution, model depictions of areas having similar climate and vegetation to the AHB presence locations appear to be very robust in the Southwest U.S. (west of 190 W) using the Maxent model. Winter and summer temperatures and vegetation parameters were critical variables. Maxent does not give satisfactory results for the Southeast U.S. yet. There, sampling biases are extreme due to presence data only in the western portion and extreme southeastern (S. FL) portion of the region. However, initial software test runs using an ensemble approach with 5 different SDMs appear to provide very useful maps of suitable AHB regions for the U.S., with further refinement required. Based on those very preliminary results and the small number of historic and current nectar flow records available, there is complete correspondence between areas of AHB presence/absence and abundance/dearth of nectar in the late summer and fall. This suggests that the combination of physical climate and the bulk vegetation phenology data from satellite observations can provide useful insight into local nectar flow phenology, at national scales.

Contributors to this project are R. Wolfe, P. Ma, J. Nightingale, and J. Nickeson at GSFC, C. Jarnevich, T. Stohlgren, J. Morisette at USGS Ft. Collins, J. Pettis at ARS/USDA Beltsville, J. Harrison at Arizona State Univ, J. Hayes at FL DACS, D. Downey at UT DAF, and the HoneyBeeNet Volunteers. Funding is from the NASA Earth Sciences Applications – Decisions Program.

12. Fell[v], R., C. Brewster[v], & A. Mullins[v] - THE SPATIAL DISTRIBUTION OF VARROA MITES IN HONEY BEE HIVES - Studies on the intra-hive distribution of Varroa mites were designed

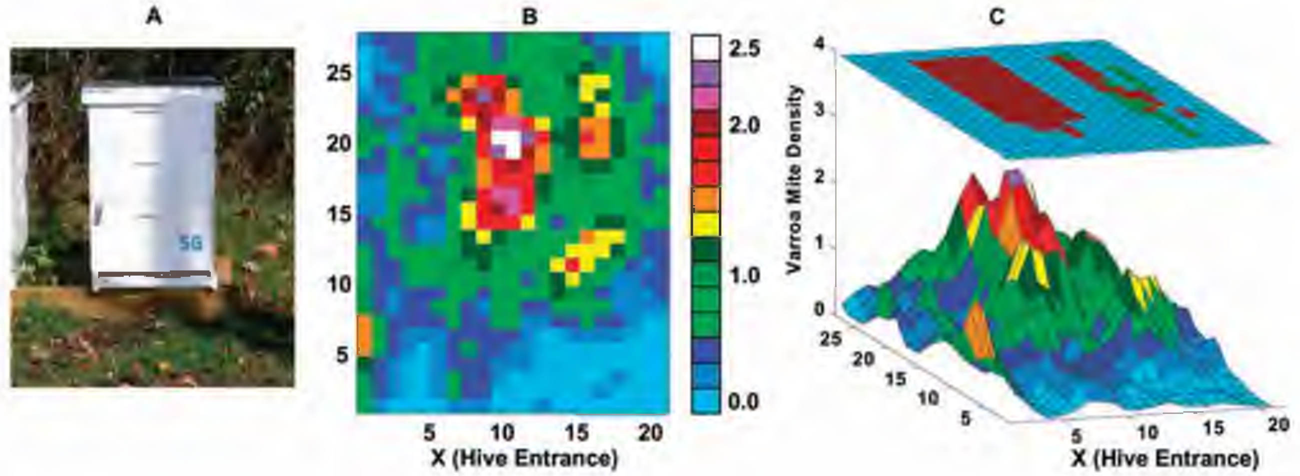


Figure. Varroa mite distribution in Hive 56 (A) in relation to capped and uncapped worker brood. (B) 2-D surface map and legend of mite numbers per cell and (C) 3-D map of mite density with a 2-D map overlay of the occurrences of brood (capped worker cells - red, uncapped worker cells - green) with respect to mite density.

to obtain a better understanding of the spatial distribution of mites, how these patterns change over time, and how this information might be used to improve sampling and treatment decisions. Mite populations were sampled in a group of eight experimental hives (consisting of 1 full-depth hive body or 1 full-depth and 1 medium depth) three times at two-week intervals from mid-August to early October. PSU/IPM sticky boards were used for sampling, but were modified to cover the entire bottom board of a hive. Sticky boards were left in hives for 3 days. After removal, mite numbers were counted in each grid square (1.8 x 1.8 cm) and used to establish a distribution matrix. A geostatistical approach utilizing GS+ and Matlab® (MathWorks Inc., Natick, MA) software was used to analyze the mite sampling data and to build spatial models of mite distributions that can be displayed as surface density maps (Figure). Brood distribution in each hive was also measured after mite sampling using digital images. Frames were removed and photographed on each side with respect to their position in the hive and then divided into a set of data cells that corresponded with the sticky board grid. Frame contents were categorized as brood (worker, drone, capped, uncapped) or non-brood. Mite and brood sample distributions were further analyzed using spatial analysis by distance indices (SADIE).

The results show mite distributions were aggregated or clumped, and significantly associated with brood distributions (Index of association [I_m] values varied from 0.23 – 0.58, $P_m < 0.0001$). Surface density maps indicate that bee collection for mite sampling using techniques such as the powdered sugar roll should be made in or near the brood nest. The results of this study also indicate that mite-sampling data can be highly variable. Mite numbers from sticky board samples were found to vary by as much as 250% in as little as two weeks. These data make it difficult to set mite number thresholds for beekeepers to use when making management decisions for colony treatment. Colonies deemed below a treatment threshold may show mite populations significantly above the threshold two weeks later when sampled in late summer and early fall. The association between brood and mite distribution also suggests that brood frame manipulation might provide an effective management tool for altering mite distributions for targeted treatment approaches.

13. Frost[w], E.H., D. Shutler[w] & K. Hillier[w] - EFFECTS OF A MITICIDE ON HONEYBEE MEMORY: IS THE CURE WORSE THAN THE DISEASE? - Significant mortality from *Varroa destructor* has occurred in wild and managed honeybee populations. Although mortality is the clearest indicator of negative consequences, *Varroa* may have other subtle effects. For example, chemical treatments used to eliminate *Varroa* may interfere with the honey bees' ability to properly integrate stimuli that elicit feeding, mating, colony defense, and communication behaviors.

We assessed learning and memory of honey bees exposed to tau-fluvalinate, the active ingredient in Apistan®, using a standardized Pavlovian insect-learning paradigm (proboscis extension reflex [PER]), that mimics learning in the natural environment. Honey bees are presented with a neutral stimulus, usually an odor, followed by a positive reward such as sugar water. Honey bees learn to extend their proboscis when exposed to the odor, in the absence of a reward, because the odor predicts the presence of food. Stressors, such as pesticides may reduce the frequency of PER, suggesting impaired learning (e.g., Abramson *et al., 2004 Environ. Entomol. 33:378-388*; Decourtye *et al., 2005 Arch. Environ. Contam. Toxicol. 48:242-250*).

Forager honey bees were collected in Nova Scotia, Canada in August/September 2009 and immobilized with only their antennae and mouthparts free. Tau-fluvalinate, dissolved in 1.25 µL of acetone, was applied dermally (thorax) or orally (proboscis) at concentrations of 0.125 µg (estimated to be daily exposure per bee in treated hives [Johnson *et al., 2009 J. Econ. Entomol. 102:474-479*]) or 1.25 µg. Controls were treated with 1.25 µL of acetone. Bees were trained to perform PER (training trials), and then tested for retention of odor memory 24 hours later (extinction trials).

Lower dose treatments had no significant effect on mortality or PER during training or extinction. At the 1.25 µg dermal dose, mortality was significantly higher in treated honey bees than controls at both 3 and 24 hours post treatment ($p = 0.001$ and $p < 0.0001$, respectively). Controls had a significantly higher average number of PER responses to odor cues during training ($p = 0.05$); there was no significant effect during extinction trials ($p = 0.08$).

We are also quantifying how tau-fluvalinate is partitioned within the honey bee body, and the relative concentrations. Chemical residues are evaluated using gas chromatography mass spectrophotometry by isolating the head and thorax and placing them in hexane to extract tau-fluvalinate. Quantities of tau-fluvalinate are measured by the size of the peaks on the chromatography output relative to a standard curve. Preliminary results suggest tau-fluvalinate enters the honey bee circulatory system after dermal contact. Honey bees with a dermal application (thorax) of tau-fluvalinate also have traces of the chemical in their head. Detoxification may also occur over time, with decreasing levels of tau-fluvalinate present in honey bee tissues over a 24 hour period.

Ultimately, this research will lead to standardized methods to evaluate suitability of mite treatment programs and potential sublethal effects of chemicals on honey bees. Bees worldwide are exposed to both mite and acaricide stressors, so results of this research will be applicable globally.

14. Guarna[x], M.M., A. Methalopoulus[y], S. Pernal[y] & L.J. Foster[x]- ANTENNAE PROTEINS AS MARKERS OF DISEASE RESISTANCE - A main goal of our APIS project (*Apis mellifera* Proteomics of Innate reSistance) is to develop tools to facilitate selective breeding of stocks resistant to disease. These tools will be based on the discovery of proteins with levels that correlate with the ability of honey bees to resist or tolerate disease. In a collaborative effort of the proteomics team at UBC in Vancouver, BC and the AAFC Research Station in Beaverlodge, AB, we have analyzed protein expression in honey bees with different levels of resistance to American foulbrood (AFB). In particular, we investigated whether the relative quantity of proteins isolated from honey bee antennae was associated with field traits. Preliminary analysis of the data showed that the quantity of selected proteins was indeed related with at least one of the field traits, hygienic behavior. These proteins are our first potential markers of disease resistance and we are now performing follow up experiments to confirm these markers and investigate their heritability.

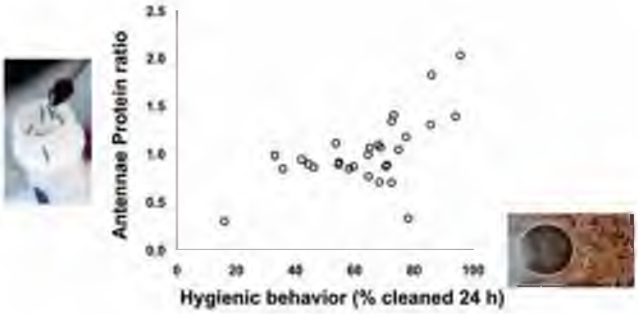


Figure. Protein XP-392111.2 in the antennae was observed to be related to, and thus may indicate, the hygienic behavior of the honey bees sampled.

15. Hood[z], W.M. & B. Tate[z] –FREEMAN SMALL HIVE BEETLE TRAP INVESTIGATIONS – The Freeman Beetle Trap was field tested at Clemson University, South Carolina in 2009. The trap consists of a hive bottom made of wood and screen that allows beetles to freely enter a removable plastic tray (partially filled with vegetable oil) below.

The primary objective of this research project was to compare the number of adult beetles killed in the Freeman Trap versus the Hood Trap (Nolan & Hood, *2008 J. Apic. Res. 47(3):229-233*) during one full season. The Hood trap was secured into a shallow frame with trap-top flush with frame top bar and placed in the top honey super to allow convenient beekeeper access. The other objective was to measure and compare other colony parameters including adult bees, capped brood, honey, and varroa mites during the season.

Four apiaries were setup in the CU Experimental Forest. Six test colonies were established in each apiary with two-pounds package bees (Wilbanks Apiaries Inc., Claxton, Georgia) each on 6 April. On 12 May, colonies were randomly selected to receive one of three treatments: Freeman Trap, Hood Trap, or no trap (control). Treatments were replicated twice in each apiary. All 24 test colonies were fitted with Freeman Trap hive bottoms.

Freeman and Hood traps were serviced at 2-week intervals through 28 October by removing and counting dead beetles and replenishing traps with vegetable oil (Freeman Traps) or cider vinegar/mineral oil (Hood Traps). Each test colony received a 3-day survey for beetles and mites at 6-weeks intervals through 9 November by placement of a clean Freeman Trap tray with fresh vegetable oil and a varroa mite sticky board. Colony parameters including bees, capped brood, and honey were measured at 8-week intervals through 8 November. An end of season total "colony shakeout" of beetles on a white plastic table was conducted on all colonies on 16 November to count adult beetles remaining in colonies.

Four summations of beetles killed in the Freeman and Hood Traps (2 Jul, 14 Aug, 22 Sep, and 28 Oct) were compared. Significantly more ($P<0.05$) beetles were killed in the Freeman Trap on the first and second summation dates, and significantly more ($P<0.05$) were killed in the Hood trap on the final summation date. The Freeman Trap survey 2 on 20 Aug yielded a significant ($P<0.05$) increase in beetles killed in the Hood trapped colonies and the control colonies compared to the Freeman Trap colonies. There was a significant ($P<0.05$) increase in beetles killed in the control colonies versus the Freeman Trap colonies on the 3rd survey date, 28 Sep. There was no significant difference ($P=0.06$) in the mean number of beetles counted during the total colony shakeout of beetles (Freeman/50, Hood/71, and control/80). There were no overall treatment differences in colony parameters: adult bees, capped brood, honey, or varroa mites.

These preliminary investigations suggest that the Freeman Trap proved to be a more efficient trap based upon the number of beetles removed from the colonies. The low mean number of beetles (80) remaining in the control colonies at the end these investigations suggests that traps may have provided "trapping sinks" in test apiaries, thereby reducing the overall beetle numbers in all test apiaries, including control colonies.

16. Huang[aa], Z.Y., K. Ahn[aa], J. Riddle[aa] & J. Pettis[bb] - EFFECT OF TRANSPORTATION ON HONEY BEE PHYSIOLOGY - Despite the requirement of long distance transportation of colonies for almond pollination, we understand little of the effects of the long distance transportation on bees. We conducted three trials to study the effects of transportation on honey bee physiology. For each trial, newly emerged bees from one colony were split into two groups and introduced into a M (migratory) or S (stationary) group – these M and S colonies form a **colony pair (CP)** with similar genetics, but different experience in transportation. One trial was conducted in CA/FL, whereby S bees stayed in Bakersfield, CA but M bees were moved to FL (4,000 km, n=12 colonies / group). One trial was done in Boston, GA, where the M group were transported to MI, then back to GA (3,250 km, n=12 colonies / group). In both trials, bees were about one week old and experienced transportation 3-5 days old. A third trial was in E. Lansing, MI, where the M group was transported for 900 km per day for 3 days (n= 6 colonies / group). In the first 2 trials, only one cohort of bees were age marked before transportation, but in the 3rd trial, bees were sampled at 7 and 17 day olds (they experienced transportation when they were 3-6 and 13-16 days old, respectively).

We measured the following parameters: juvenile hormone titers (JH) in hemolymph, lipid content in the abdomen, total protein in head or thorax, and sizes of hypopharyngeal gland (HPG) acini. HPG sizes were significantly smaller in migratory colonies. These were true for all three locations, and also for young and old bees in the Michigan trial (Table). This might be due to workers unable to consume pollen normally while being transported, which affected their gland sizes adversely. All other parameters (JH, lipids and total

CA			
JH	**lipids**	**Head/thorax protein**	**HPG sizes**
2 out of 11 CP significant. ANOVA: NS	2 out of 4 CP with higher lipids in S, the other 2 reversed. ANOVA: NS	Not measured	7 out of 9 CP showed larger glands in S group. ANOVA: P<0.01
GA			
2 out of 12 CP significant. ANOVA: NS	1 out of 4 CP with higher lipids in S. ANOVA: NS	9 CP analyzed. ANOVA: NS for thorax protein, but P<0.01 for head protein.	4 out of 4 CP showed larger glands in S group. ANOVA: P<0.01
MI (Young cohort, 7 days old)			
2 out of 6 CP had higher JH in M. ANOVA: NS	5 out of 6 CP with higher lipids in S. ANOVA: P<0.01	6 CP analyzed. ANOVA: NS	4 out of 6 CP showed larger glands in S group. ANOVA: P<0.01
MI (older cohort, 17 days old)			
2 out of 6 CP had higher JH in M. ANOVA: NS	ANOVA: NS	6 CP analyzed. O ANOVA: NS	3 out of 6 CP showed larger glands in S group. ANOVA: P<0.01

Table - Brief summary of analysis of variance (ANOVA) and analyses by individual colony pairs (CP). NS=no significant, with P>0.05.

protein in heads or thorax) were either not as sensitive, or inconsistent. We were surprised to find that 1) JH titer was not significantly higher in the M group, and 2) that 17-day-old bees were still affected by migration, even though their HPG should have attained maximum sizes around day 8-12.

17. Johnson[cc], R., L. Peters[cc], B. Siegfried[dd] & M.D. Ellis[cc] – DRUG INTERACTIONS BETWEEN IN-HIVE MITICIDES AND FUNGICIDES IN HONEY BEES - Beekeepers must often resort to using varroacides to reduce parasitic varroa mite populations in honey bee colonies. The utility of varroacides depends on honey bee tolerance of these pesticides at dosages that kill varroa mites. Honey bee tolerance of three commonly used varroacides – coumaphos (Checkmite+™), fenpyroximate (Hivastan™) and tau-fluvalinate (Apistan™) – appears to be due to bees' capacity to detoxify these pesticides through cytochrome P450 monooxygenase activity.

However, a bee's capacity for detoxification appears to be compromised when exposed to multiple varroacides simultaneously – a likely situation given the high levels of varroacide contamination reported in beeswax. Bees treated with a sublethal dose of coumaphos were 14 times more susceptible to tau-fluvalinate, as measured by the change in LD_{50}. Similarly, bees exposed to sublethal doses of fenpyroximate were 7.6 and 5.6 times more susceptible to coumaphos and tau-fluvalinate, respectively. Bees are also frequently exposed to fungicides applied to crops since fungicides are commonly considered safe for bees and there are few restrictions on their application during bloom. However, some fungicides may affect a bee's ability to tolerate other pesticides, including varroacides. Honey bees pre-treated with pyraclostrobin and boscalid (both components of Pristine™) or chlorothalonil (Bravo™) were not more susceptible to any varroacides tested. Pre-treatment of bees with the fungicide prochloraz, however, increased the toxicity of coumaphos (72 times), fenpyroximate (23 times) and tau-fluvalinate (1118 times). These results confirm earlier work demonstrating that ergosterol biosynthesis inhibiting fungicides, a class of fungicides that includes prochloraz, can inhibit cytochrome P450-mediated detoxification of pesticides in honey bees. Based on these laboratory findings, it may be prudent for beekeepers to avoid repeated use of P450-interacting varroacides – tau-fluvalinate, coumaphos and fenpyroximate – and to avoid using these varroacides when bees are likely to come into contact with P450-inhibiting ergosterol biosynthesis inhibiting fungicides.

18. Kather[ee], R. & S.J. Martin[ee] – FRIEND OR FOE? NESTMATE RECOGNITION IN THE HONEY BEE *APIS MELLIFERA* - Honey bees can tell nestmates from non-nestmates and chase away any intruder trying to enter their hive. Despite this, one of the honey bee's major and most lethal parasites, the *Varroa* mite, frequently enters and travels between hives. To determine how *Varroa* is able to overcome the bees' detection system we need to better understand how bees recognize each other. Insects use their sense of smell to identify other insects. Every insect produces a set of chemicals on their 'skin', so-called cuticular chemicals, and usually

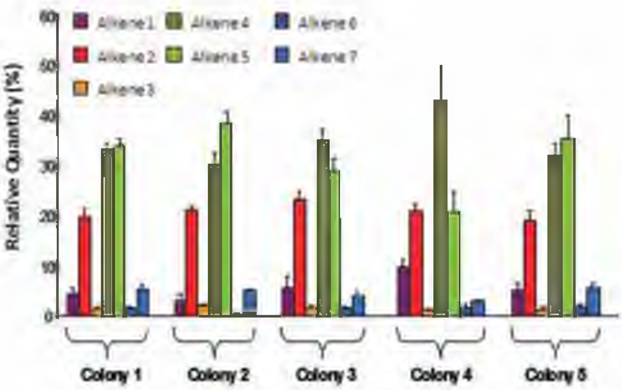


Figure. Alkene profiles identify workers originating from specific colonies.

insect species differ in the type of chemicals they produce (Howard & Blomquist, *1982 Ann. Rev. Entomol. 27:149-172*). In the social insects such as wasps, hornets and bees, colonies of the same species produce the same types of chemicals, but chemical quantities vary between colonies forming a colony-specific odor. This way, one insect can identify another insect, i.e. which species or colony it belongs to, by 'reading' the chemicals on that insect's skin. Chemically, *Varroa* 'looks' like a honey bee, which partly explains why it remains undetected in the hive, but how does it overcome the bees' colony recognition when it moves between hives? To answer this question we need to identify the compounds bees use to identify nestmates.

Previous studies have suggested two candidate classes: the fatty acids and the alkenes (Breed & Stiller, *1992 Anim. Behav. 43:875-883*, Dani *et al., 2005 Chem. Senses 30:477-489*). But chemical evidence to support this is still missing. Our research was the first to see whether nestmates had similar quantities of fatty acids/alkenes and whether colonies varied in these quantities, which we would expect from colony recognition compounds. Our data suggests that this is indeed the case for the alkenes, but not for the fatty acids. Fatty acid quantities varied considerably between nestmates and thus cannot function in nestmate recognition. Every colony had its own alkene profile (Figure).

The next step of our research will be to investigate whether and how *Varroa* mimics these recognition compounds to stay undetected in the colony. Only by better understanding the *Varroa*-honey bee system can we begin to disrupt this system of manipulation and design new and more effective treatments to combat this enemy common to bee and man.

19. Melathopoulos[y], A.P., S.F. Pernal[y], A. van Haga[ff] & L.J. Foster[x] - VARIABILITY AND CORRELATIONS AMONG FIVE TRAITS ASSOCIATED WITH AMERICAN FOULBROOD (AFB) RESISTANCE IN A CANADIAN BREEDING POPULATION – The demonstration of AFB resistance in the 1930s lead to the discovery of several resistance traits (Spivak & Gilliam, *1998 Bee World 79:124-134, 169-186*). The heritability of these traits in commercial breeding populations, their correlation and their relative contribution to overall resistance, however, remains poorly understood. For this reason we compared the distribution of AFB traits within a breeding population.

We assembled colonies in a common apiary headed by queens from eight different regions (New Zealand, Chile, Hawaii, California, British Columbia, Alberta, Saskatchewan, and Ontario). These were tested for 1) *Hyg Beh:* hygienic behavior, 2) *Larval AFB:* the percentage of *in vitro* reared larva with AFB after being fed *Paeni-*

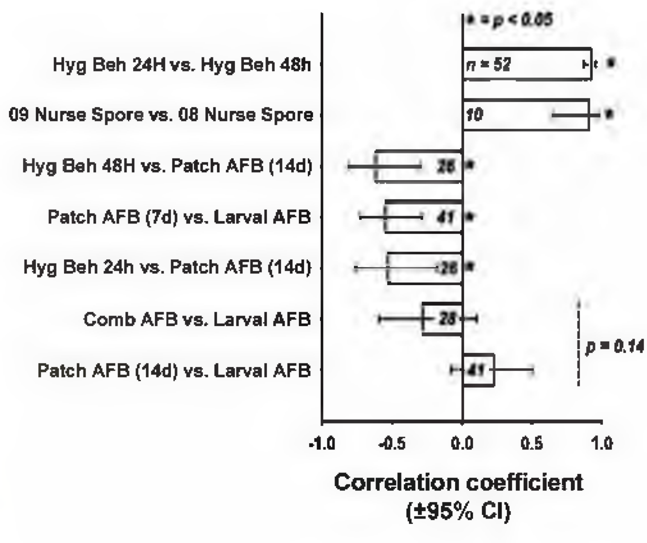


Figure. Significant Pearson product-moment correlations among five AFB resistance traits (see text for description).

bacillus larva spores, 3) *Nurse Spore:* the retention of spores by nurse bees fed spore-containing syrup, 4) *Patch AFB:* the percentage of first-instar larvae in comb developing AFB *in situ* after inoculation and 5) *Comb AFB:* the number of AFB cells in colonies following inoculation with AFB-infected comb.

There were five significant correlations among the traits (Figure), the strongest being between four related traits; *Hyg Beh* measured at 24h versus 48h, and *Nurse Spore* from whole colony tests in 2008 versus cage tests in 2009. More notable, however, were correlations among a number of seemingly unrelated traits. Principal component analysis revealed that among these later traits *Hyg Beh* and *Patch AFB* (14d after infection) loaded diagonally on the first component, while *Larval AFB* loaded diagonally to *Patch AFB* (7d after infection) on the second component. This suggests that *Hyg Beh* and *Larval AFB* may work synergistically, but at different stages of disease's development. *Nurse Spore* loaded strongly on the third component suggesting the trait is unrelated to the other traits.

Our next step will be to estimate quantitative genetic parameters for each trait by assessing them among an F_1 generation produced through a partial diallele cross of selected colonies.

20. Nasr[gg], M.E. & A.J. Williamson[gg] - VARROA HAND SHAKER: A SIMPLE FIELD METHOD FOR MONITORING VARROA MITE INFESTATIONS - Determining varroa mite's infestation levels is critical when making decisions to implement integrated pest management practices for varroa control. Current methods are time consuming and expensive. A simple fast reliable method to monitor the population of varroa mites in honey bee samples in the field was developed. Two 500 ml transparent plastic spice jars were modified to make the "Varroa Hand Shaker". The centers of two closure lids of the plastic jars were removed to accommodate a 7 cm diameter circle made of 8 mesh-screen. The screen was placed in between the two closure lids, and then lids were glued back together to form a strainer-closure that can keep the two jars connected mouth to mouth.

A sample of 300-400 bees from brood combs was collected in one of the varroa hand shaker jars that contained 250 ml of 70% alcohol. This sample of bees filled about 2.25 cm in the jar. Then, the second jar with the strainer-closure was screwed back on the jar containing bees. The varroa hand shaker was vigorously shaken up and down for 40-60 sec. To determine varroa infestation levels, the varroa hand shaker was flipped upside down to keep the bees on the top of the screen and allow the mites and alcohol to pass through the screen into the bottom jar. The number of mites collected in the bottom jar was counted. The same sample was shaken using an orbital lab shaker at 175 rpm for 15 min to compare results. Bees and mites were washed using a strainer and collected mites were counted. The percentage of infestation based on the number of bees/sample was calculated for each of the tested methods. The percentages of infestation were determined in 1,590 bee samples. The two methods were significantly correlated (r=, $P<0.0001$) (Figure). A

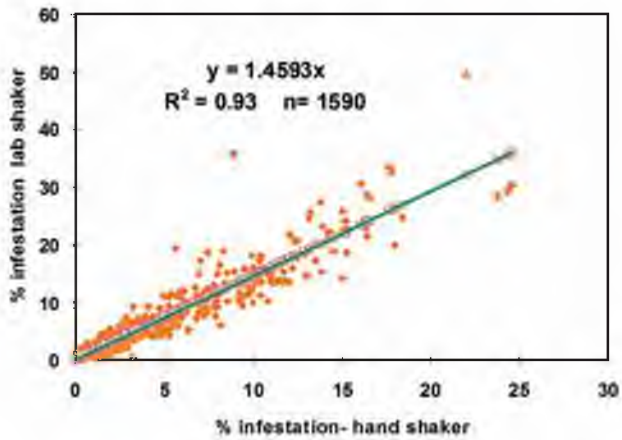


Figure. Association of the percentages of varroa infestation determined by the standard orbital lab shaker method and the varroa hand shaker method.

correction factor as indicated in the Figure can be used to correct the percent infestation relative to the standard orbital shaker method. The developed varroa shaker method is currently widely used in Alberta, Canada by commercial beekeepers to determine the infestation of varroa mites because it is simple, accurate, and inexpensive. It also requires very little time.

Financial support by Alberta Beekeepers, Agriculture Crop Industry Development Fund Ltd. (ACIDF), Poelman apiaries, Bayer Cropsciences Canada , Pioneer Hi-Bred, Hy-tech, Monsanto, Sothern Alberta Beekeepers Association, and Agriculture and Agri-Canada; Growing Forward.

21. Nasr[gg], M.E., S. Muirhead[gg], R. Panasiuk[gg] & L. Vandervalk[gg] - HONEY BEE WINTER KILL FROM 2007-2009 IN ALBERTA, CANADA: ARE OUR BEES HEALTHY? - In Alberta, Canada, beekeepers reported higher than average winterkill in overwintered bee colonies in spring 2007-2009. To determine the extent of winterkill, Alberta Agriculture and Rural Development conducted an annual survey of 100-112 commercial beekeepers with 400 or more colonies in the past three years. The percentages of beekeepers who responded to the surveys were over 75%. Survey results show that the beekeepers reported 30% loss per year in 2007, 2008, and 2009. The surveys also revealed that 15% the surviving colonies were weak with less than 3 frames covered with bees. The average percentage winterkill plus weak colonies was 45%. The reported winterkill and weak colonies were the lowest in southern Alberta region and the highest in the Peace River region.

The beekeepers' responses in these surveys indicated that overwinter losses in Alberta during the past three years may be attributed to a combination of several potential causes: 1) Varroa mites unexpectedly developed resistance to applied miticides; consequently, mite populations were higher than normal in bee colonies and damaged winter bees, 2) beekeepers reported higher than normal incidence of *Nosema*-like symptoms which was shown to be positively correlated with winterkill and winterkill plus weak colonies, and 3) unusual weather conditions in fall and winter reduced the production of winter bees and increased the stress through winter months on wintering bees. Disappearance or starvation of honey bees were not major factors in reported high overwinter losses in Alberta. The data also showed that colony losses cannot be attributed the Colony Collapse Disorder currently described in the United States.

Honey bee colonies (12-60/beekeeping operation) were examined in fall of 2007, 2008 after treatment of colonies for varroa and *Nosema*. The percentage of varroa infestation was determined in 300-400 bee samples/colony that were collected from the brood area. The abundance of *Nosema* spores in a sample (30 bees/colony) collected from honey combs was calculated. Based on these two criteria in 2007, it was estimated that 10% of the beekeeping operations were healthy. These operations had varroa and *Nosema* below the economic threshold (1% varroa infestation and 1 million *Nosema* spores/bee). The rest of the colonies had varroa, *Nosema*, tracheal mites or varroa and *Nosema* above the thresholds. Similar results were found in 2008.

In fall 2009 results of examining 24-60 colonies/commercial beekeeping operation showed that 79% of beekeeping operations had varroa and *Nosema* below the economic thresholds. The reported improved bee conditions were due to successful use of Apivar, a newly registered miticide for varroa control, as well as using fumagillin for *Nosema* treatment. Results showed that the percentages of varroa infestation and abundance of *Nosema* were significantly correlated to colony mortality. These results confirm previously reported possible causes of high winterkill in beekeepers' surveys. Attention to disease prevention and surveillance for early detection were critical points for colony survival and improving bee health.

Research sponsored by Alberta Beekeepers, Agriculture Crop Industry Development Fund Ltd. (ACIDF), Poelman apiaries, Bayer Cropsciences Canada , Pioneer Hi-Bred, Hy-tech, Monsanto, Sothern Alberta Beekeepers Association, and Agriculture and Agri-Canada; Growing Forward.

22. Ostiguy[p], N. – A PEEK AT THE DISTRIBUTION OF

VIRUSES IN STATIONARY HONEY BEE COLONIES IN THE U.S. - A seven state (CA, FL, ME, MN, PA, TX and WA) long-term study of 30 stationary colonies per location began in spring 2009 to track colony health and longevity using queens from the same source to control for genetic variation. This study will provide epidemiological data to characterize the similarities and differences in colony health across the U.S. through time. This is a report on the preliminary virus results for six of the seven locations (no data on CA available).

It was not practical to establish colonies at the same time of year due to differences in climate. Package installation matched forage availability – February/March in the southern locations and April/May in the northern locations. Packages were not obtained from the same source as virus incidence and prevalence from a single package supplier varies among packages obtained at the same time (unpublished, PSU). Two pairs of apiaries, CA–MN and ME–PA, obtained bee packages from the same supplier.

The viruses obtained from the bees initial package samples varied significantly by location (Table). A significantly higher prevalence of Black queen cell virus was observed in the Minnesota packages (p=0.00000001), while DWV and SBV were significantly higher in Texas (p=0.00000001) and Washington (p=0.00000001), respectively. The prevalence of Israeli acute paralysis virus was low, but prevalence in Washington was the highest (p=0.00000001). The bees in the packages received by Pennsylvania, even though the supplier was the same as those bees received by Maine, had a higher prevalence of BQCV and DWV, but SBV prevalence was lower; the differences were 38%, 19% and 14%, respectively.

Seasonal changes occurred in virus prevalence. Deformed wing virus prevalence increased from 55% to 96% of bees tested from Maine. The bees in Maine began with the lowest prevalence of DWV (55%), but by August the prevalence of DWV was the highest (96%). In our preliminary data, Maine also was experiencing the highest level of Israeli acute paralysis virus (12%). This preliminary data indicates that virus prevalence varies by region and in time. We also have evidence that the viruses found in packages from the same source are not similar.

Table - Regional Prevalence of Honey Bee Viruses*

	Black queen cell	Deformed Wing	Israeli acute paralysis	Sacbrood
Florida	20%**	83%	0%	20%
Maine	29%	55%	0%	24%
Minnesota	87%	56%	2%	16%
Pennsylvania	67%	74%	1%	10%
Texas	24%	96%	0%	0%
Washington	58%	61%	7%	77%

*n = 521
** Percent of positive samples

23. Parker R.[x], M.M. Guarna[x], S. Pernal[y] & L.J. Foster[x]- *APIS MELLIFERA* PROTEOMICS OF INNATE RESISTANCE (APIS) - The APIS project focuses on two diseases affecting honey bees in North America, American foulbrood (AFB) and *Varroa* mites. Although treatments are available, increased resistance and the concern of chemical residues makes selective breeding of resistant bee stock the most desirable solution. Our goal is to develop tools for accelerating and strengthening the selection process. These tools will be based on protein markers that indicate resistance and can predict whether a honey bee stock will be more likely to resist or tolerate disease. In our first year, we sampled diverse stocks (Figure), tested behavioral and physiological field traits, and are using Mass Spectrometry-based proteomics to compare protein expression. Analysis of *ca.* 500 quantified proteins in each tissue showed significant protein differences that were related to the characteristics of the bees sampled. For the 2009-2010 experiments, we acquired additional queens and have implemented a mating design to study heritability of the field traits and the protein markers associated with them. We are also collaborating with Jeff Pettis, USDA, to investigate the economic impact of disease on the beekeeping industry. Our recent progress will be presented.

Figure. Eight stocks sourced from international queen breeder were established and sampled in 2008 at the Beaverlodge Research Farm, AB, Canada. Both protein expression and field data related to disease resistance were investigated.

24. Pernal[y], S.F., A. Ibrahim[y] & A.P. Melathopoulos[y] - DISINFECTION OF *NOSEMA CERANAE*-CONTAMINATED COMB BY IRRADIATION, ACETIC ACID FUMIGATION AND HEAT - *Nosema ceranae* is an endoparasite first described from *Apis cerana* (Fries *et al., 2006 Eur. J. Protistol. 32:356-365)* that has subsequently spread to populations of *Apis mellifera* in Europe and throughout the world (Higes *et al., 2006 J. Invertebr. Pathol. 92:93-95*; Klee *et al., 2007 J. Invertebr. Pathol. 96:1-10*). In North America, the parasite has been associated with Colony Collapse Disorder in the U.S. (van Engelsdorp *et al., 2009 PLoS ONE 4(8):e6481*) and implicated in heavy wintering losses in Canada (Currie *et al., 2010 J. Apic. Res. 49:104-106*).

Though mechanisms of transmission for *N. ceranae* are not well understood, we hypothesized that decontamination of comb could be an important non-chemotherapeutic technique for managing this organism. We undertook an examination of new techniques of comb sterilization in addition to those previously demonstrated to be effective at suppressing *Nosema apis* (Bailey, *1957 Am. Bee J. 97:24-26*; Cantwell & Shimanuki, *1969 Am. Bee. J. 109:52-54*).

Frames containing honey comb were sprayed with an aqueous suspension of *N. ceranae,* so that each colony received a dose of 4.51×10^8 spores. Inoculated brood chambers were allocated to four groups, each with 12 replicates, receiving one of the following treatments: 1. Irradiation - 10 kGy of electron beam radiation. 2. Acetic Acid Fumigation - 480 mL of 80% (v/v) acetic acid. 3. Heat - 24 h at 49 ± 0.1°C. 4. Inoculated - no disinfection. A fifth, non-inoculated, treatment consisted of brood chambers receiving neither inoculation nor disinfection. Sixty 1-kg New Zealand packages were hived in the brood chambers on 2 May 2009.

Colonies were sampled for *N. ceranae* spores by collecting a minimum of 30 adult bees on a weekly basis from 2 May to 4 June 09, after which time sampling occurred biweekly, then monthly during winter. Colony growth was evaluated by measuring adult worker population and sealed brood on 30 July and 30 August; honey production was weighed.

Thirteen days after hiving packages, spore levels within inoculated, untreated colonies rapidly proliferated to $2.4 \pm 0.4 \times 10^6$ spores per bee, while spore levels in irradiation, acetic acid fumigation and heat treatments remained below 167,000 spores. Nonetheless, by 21 May the acetic acid fumigation and heat treatments appeared less effective at suppressing spores than the irradiation treatment which remained similar to non-inoculated colonies. Separation among treatments diminished until 16 July when spore levels among all treatments, including those untreated, remained below 100,000 spores per bee. Considerable variability and increases in spore levels for the acetic acid fumigation and heat treatments, were observed during the fall and early winter months.

Significantly more adult bees (F=4.52; df=4,52; P= 0.0033) were found on the 3 July assessment in the irradiation versus heat treatment, with the fumigation, non-inoculated and inoculated treatments being intermediate in number. No significant differences among treatments were found for the area of sealed brood on this date, or for both parameters on 30 August. Honey production did not vary significantly among treatments.

In general, the acetic acid fumigation, heat and irradiation treatments all showed some suppression of the spring peak of *N. ceranae* spore development in bees, though suppression was more immediate and complete for irradiated comb. Only the irradiated treatment maintained spores at levels similar to non-inoculated colonies during the entire study.

25. Peters[cc], L.A., R.M. Johnson[cc], M.D. Ellis[cc] & B. Siegfried[dd] – EFFECTS OF IN-HIVE MITICIDES ON HONEY BEE DRONE SURVIVAL AND SPERM VIABILITY - Miticidal drugs are commonly used by beekeepers to control infestations of the devastating honey bee (*Apis mellifera*) pest *Varroa destructor*. One of these compounds, coumaphos, has been documented to affect the sperm viability of drone honey bees in a test based on prolonged exposure to Checkmite+ strips. In our study, newly emerged drones were treated topically with varying concentrations of six miticides: tau-fluvalinate, coumaphos, amitraz, fenpyroximate, oxalic acid and thymol. Drones were marked with paint and reintroduced to free-flying hives where they were allowed to become sexually mature. After two to three weeks drones were recaptured, semen was collected and sperm viability tested with a SYBR14 / propidium iodide fluorescent assay. No differences in sperm viability were noted in the semen of drones receiving any of the miticide treatments; however, thymol treatments positively affected drone recapture, and fenpyroximate treatments negatively affected the likelihood of drone recapture. While our tests found no effect on sperm viability for a single dose exposure, 5 of the 6 treatments are applied by beekeepers in delivery systems that expose bees over an extended time period, and prolonged exposure to miticides may reduce sperm viability where single dose exposures did not. The effects of thymol and fenpyroximate on drone recovery (survival) have not been previously reported.

26. Rogers[hh], R.E.L., G.R. Williams[ii], C. Lam[jj], D.L. Fischer[hh], & D.E. Hackenberg[kk] - MOVENTO®, CITRUS AND HONEY BEES: REPORT ON A SUCCESSFUL COOPERATIVE STUDY - The Asian citrus psyllid (*Diaphorina citri*) is the single greatest insect pest to the global citrus industry. Infestation typically results in withdrawal of large quantities of foliage sap and transmission of bacteria responsible for greening disease. If untreated, infestation will result in premature defoliation, poor fruit production, and eventual death of trees. Citrus growers have numerous options for controlling the Asian citrus psyllid, however, many are not bee-safe and must be used before or after bloom, which is not optimal for psyllid control. A new promising candidate for the job is Movento®, a.i. spirotetramat. Movento® is a unique two-way systemic foliar insecticide that is effective on psyllid, and is not believed to produce harmful effects to non-target species such as honey bees. In collaboration with Bayer CropScience, the National Honey Bee Advisory Board, the US EPA, Florida Department of Agriculture and Consumer Services and the USDA, we investigated the potential effects of Movento® on western honey bee (*Apis mellifera*) colonies when applied to citrus during bloom using our jointly developed protocol for western honey bee colony effects studies. Twelve colonies were placed at the edge of each of two citrus groves at the start of bloom and removed after bloom finished; one grove received a single application of Movento® at full label rate of 10 oz/ac (730 ml/ha) and the other received no treatments. Colonies were assessed for strength and health (i.e., adult and brood populations, food stores, pests, and diseases), and pollen, honey and wax samples were collected and analyzed for presence of residues of spirotetramat and other pesticides. After the conclusion of field work in Florida, the colonies were returned to commercial beekeeping operation and transported to northern states for use in pollination of several crops. Follow-up assessments of the health of these colonies were performed in May in Pennsylvania after apple pollination, in June in Maine after blueberry pollination, and in October in Pennsylvania after late summer pumpkin pollination. There were no significant differences between the control and treatment groups of hives during the in-citrus phase of the study. Both groups of hives started experiencing high losses of colonies between the blueberry and fall colony assessments. Varroa mite and *Nosema* counts were high in both groups of hives throughout most of the study period, and deformed-wing condition accounted for almost one-third of intra-hive mortality before leaving citrus. Residues of spirotetramat in bee-relevant matrices were detected in small amounts for only a few days post-application and were not-detectable in later samples. It appears there is a high degree of safety with Movento® use during citrus bloom. It appears likely that the primary causes of the high colony losses by fall, in both groups of hives, were *Varroa destructor*, *Nosema* spp., deformed-wing virus, queen issues, and multiple and various other pathogens to a lesser degree.

27. Sagili[ll], R.R. & C. Breece[ll] - EFFECTS OF POLLEN QUALITY ON HONEY BEE NUTRITIONAL STATUS AND COLONY GROWTH - Nutritional stress is one among several potential factors attributed for colony collapse disorder. In the wake of deteriorating honey bee health, honey bee nutrition has attained greater importance. Pollen is the sole source of protein for honey bees and is vital for their development and survival. Large monoculture and specialized greenhouse farming systems result in restricted choice of pollen diet in honey bees (Schmidt *et al.*, *1995 J. Econ. Entomol. 88:1591-1595*). Each year large numbers of colonies from all around the country are shipped to California for almond pollination, where bees predominantly rely on almond pollen to fulfill their protein requirement. Little is known about effects of single source pollen consumption for extended periods on honey bees. Here we examined and compared the effects of single-source pollen consumption versus multi-source pollen on honey bee nutritional status and colony growth.

Six-frame nucleus colonies were used for this experiment. A pair of colonies was derived by dividing a single colony and were headed by naturally mated sister queens. A large flight cage partitioned in segments was used for this experiment. Colonies were equalized before start of the experiment and all existing pollen was removed. There were two treatments: 1) single-source pollen and 2) multi-source pollen. Powdered pollen was packed into the comb cells and surface sprayed with 50 % sugar syrup (Dreller & Tarpy, *2000 Anim. Behav. 59:91-96*). Each week 100 newly emerged paint marked bees were introduced into each experimental colony. Each week 20 nurse bees were obtained from each colony for hypopharyngeal gland protein estimation and comb area occupied by eggs, larvae, pupae, pollen, honey and empty space were measured. Lipid content and emergence weights of newly emerged bees were also measured.

Preliminary results indicate that nurse bee hypopharyngeal gland protein content and colony growth in single source pollen treatments were significantly low compared to multi-source pollen treatments ($P < 0.01$ and $P < 0.05$ respectively) (Figure).

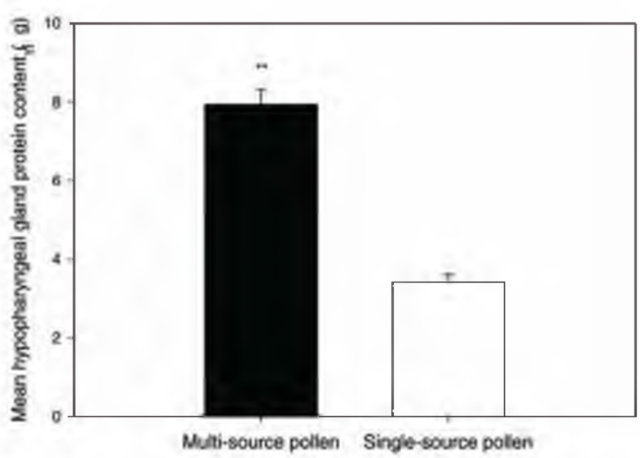
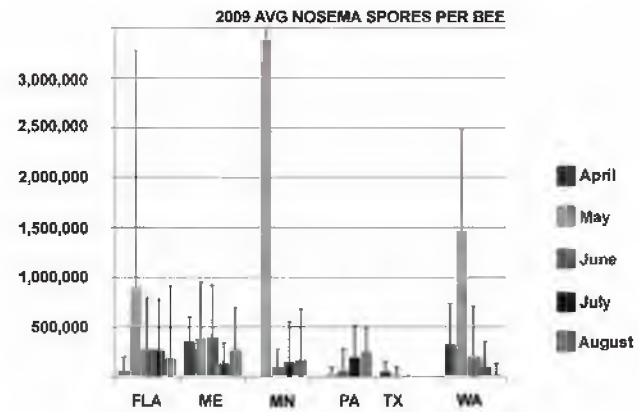


Figure. Mean hypopharyngeal gland protein content in micro grams (± SE).

28. Sheppard[J], W.S., B.A. Kahkonen[J], & K.E. Northfield[J] - SEASONAL ABUNDANCE OF *NOSEMA* AND TRACHEAL MITES IN CAP STATIONARY APIARIES - As part of a larger Coordinated Agricultural Project on honey bee colony health, we established 7 stationary apiaries across the United States. The locations were chosen to represent a diverse set of ecological conditions across the country and sites were selected in California, Washington, Maine, Minnesota, Florida, Texas and Pennsylvania. The apiaries of 30 colonies each were established in Spring 2009 with new woodenware, plastic foundation and package bees. As soon as practicable, sister queens of an Italian strain from a California queen producer were obtained and all colonies were requeened, to provide a common genetic foundation for all apiaries. Colonies were maintained using standard beekeeping practices appropriate for each location, but without chemical or antibiotic treatments.

I report here the preliminary results for *Nosema* and tracheal mite levels found in the stationary apiaries in 2009 based on monthly sampling. The samples were collected in ethanol and shipped to the Washington State Honey Bee Diagnostic Laboratory. Tracheal mites were determined through dissection and microscopic examination of tracheae from 20-30 bees from each colony and reported as percent infestation (# infested bees / # bees in sample). *Nosema* spore counts were determined by homogenization of abdomens from 50 workers and a standard protocol that involved serial dilution and microscopic examination of diluted material using a hemocytometer. Spore levels are reported as mean # spores per bee. *Nosema* species determinations were made on a subset of samples from each location using a standard PCR-based protocol, restriction enzyme digestion and gel electrophoresis.

Tracheal mite levels varied across locations and month sampled, and preliminary data are reported from samples taken from April to August (Figure). Tracheal mite levels in the three northern locations were highest in July, with the highest mean % infestation of bees reaching around 26% in Maine.



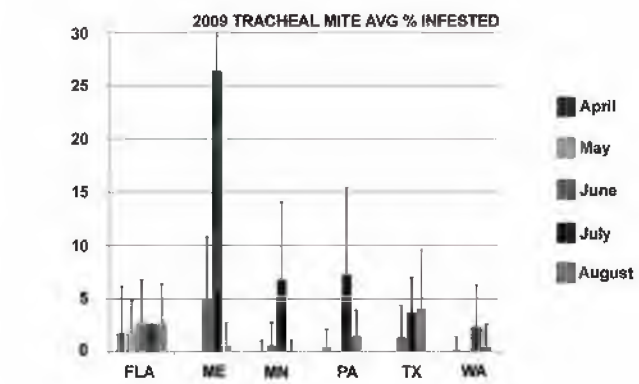


Figure – Incidence of *Nosema* and tracheal mites from stationary apiaries sampled monthly during the spring-summer 2009.

Molecular analysis of representative *Nosema* samples revealed that only *Nosema ceranae* occurred. *Nosema* spore levels also varied by location and month, but were generally highest in May and quite low in July and August (Figure). Overall, the highest mean spores/bee levels were found in the Minnesota (3.4 million spores/bee) and Washington (1.4 million spores/bee) stationary apiaries sampled in May.

The samples taken early in 2009 likely reflected the starting infestation levels of the package bees, while subsequent samples reflect infestation levels that became established in the replacement bee populations produced by the genetically similar queens used at all sites. Additional data from samples collected in Fall 2009 and Spring 2010 will provide a more accurate picture of the seasonality of *Nosema* and tracheal mite levels occurring at these stationary sites. Sampling and monthly pathogen/parasite evaluations of surviving colonies will continue through 2010, to better assess seasonal variation and potential geographic differences among stationary apiary locations.

29. Smart[J], M.D. & W.S. Sheppard[J] – DISTRIBUTIONS OF *NOSEMA CERANAE* AND PARASITE INTERACTIONS IN PACIFIC NORTHWEST HONEY BEES – *Nosema ceranae* is a microsporidian parasite that infects the midgut of honey bees. Its pathogenic effects on bees include decreased longevity, younger foraging age, greater hunger, and a suppressed immune system. Recent evidence suggests that this relatively newly recognized species is becoming more widespread throughout much of the world (Higes *et al.*, *2006 J. Invertebr. Pathol. 92:93-95*, Klee *et al.*, *2007 J. Invertebr. Pathol. 96:1-10*, Martin-Hernandez *et al.*, *2007 Appl. and Env. Microbiol. 73(20):6331-6338*, Williams *et al.*, *2007 J. Invertebr. Pathol. 97(2):189-192*).

N. ceranae may be more virulent than its better-known cousin, *Nosema apis* (Higes *et al.*, *2007 J. Invertebr. Pathol. 94:211-217*), and may have the ability to persist at higher levels throughout the year (Martin-Hernandez, *2007 Appl. and Env. Microbiol. 73(20):6331-6338*). Another recent study, in which researchers fed honey bees both *N. ceranae* and *N. apis* spores, found that while exposure to *N. apis* induced a honey bee's immune system to respond and fight the infection, *N. ceranae* had an immunosuppressive effect on honey bees (Antunez *et al.*, *2009 Environ. Microbiol.doi: 10.1111/j.1462-2920.2009.01953.x*). This underscores the importance of studying the interactions between *N. ceranae* and other pests and pathogens that may come together to cause greater weakening and collapsing of honey bee colonies.

There were three main objectives of this research. First, we sought to examine the basic regional and seasonal distributions of *Nosema apis* and *Nosema ceranae* in the northwestern U.S. by surveying migratory and sedentary beekeeping operations. Second, to identify age trends in *N. ceranae* infection, we individually processed bees and quantified the *N ceranae* infection levels of age cohorts of bees. Finally, we examined the interactions and deleterious effects between *N. ceranae* and the parasitic mite, *Varroa destructor* in the field.

Migratory and stationary apiaries were sampled between February 2008 and September 2009 to quantify *Nosema* spp. infection levels. DNA was subsequently extracted from samples testing positive for high levels of *Nosema* spp. infection, and the species present was determined. Preliminary results indicate that *Nosema ceranae* is the predominant species present, being distributed widely in the PNW and detected in all months sampled. *Nosema apis* was also detected, but at a low rate.

Age cohorts (groups of bees emerging around the same time) were followed in five colonies to track *Nosema ceranae* infection as individual bee's age. Forager bees (22-25 days old) had the greatest proportion of infected individuals and the highest levels of infection. This suggests that susceptible forager bees are most responsible for harboring the parasite; however it is still unclear how *N. ceranae* is transmitted in the hive environment.

Interactions between *Nosema ceranae* and the serious mite pest, *Varroa destructor,* were examined to better understand how these two important stressors might interact in the field. Additionally, a goal of this study was to determine if high *N. ceranae* infection levels could be maintained in colonies receiving weekly inoculations of *N. ceranae* spores.

Forty colonies, each undergoing one of four treatments, were sampled weekly for *N. ceranae* and *Varroa destructor*, and measures of strength and production were taken. As expected, colonies with low levels of *N. ceranae* and mites were significantly stronger at the end of the experiment than colonies with high levels of the two parasites. Colonies inoculated with *N. ceranae* weekly did contain bees with significantly higher infection levels. This method of artificially inoculating colonies with *N. ceranae* is potentially useful in future studies on colony level dynamics of *N. ceranae* and other various pathogens and parasites.

30. Stoner[mm], K.A. & B.D. Eitzer[m] – PESTICIDE IN POLLEN TRAPPED FROM HONEY BEE HIVES IN CONNECTICUT – TWO YEARS OF RESULTS IN RELATION TO ACUTE TOXICITY DATA - In two years of measuring pesticides in trapped pollen from healthy hives in 3-4 locations around Connecticut, the authors found residues of 44 pesticides and pesticide metabolites. As a very rough first step in evaluating the significance of the concentrations of these pesticides in pollen, we gathered the available data on the contact and oral lethal doses that would kill 50 % of the tested population (LD_{50}) of these pesticides from the U.S. Environmental Protection Agency and Agritox (France[1]) databases. Note that LD_{50} is typically measured with a single dose, evaluated over 24 -48 hours (U.S. EPA 1996[2]). Not all of the pesticides found have acute toxicity data in these databases, including the most commonly detected pesticide, coumaphos.

In order to calculate a dose in micrograms per bee from the concentration data, we used the calculation of Rortais *et al.* (*2005 Apidologie 36:71-83*) that an adult worker bee would consume 65 mg of pollen, on average, during a period of 10 days as a nurse bee.

Using this calculation for the concentration of each pesticide found in a trapped pollen sample (mixed pollen collected over 3-4 days), we found only one sample in 2007 where the dose of pesticide was calculated to be over the oral LD_{50} – a sample with imidacloprid measured at 70 ppb, which calculates to 123% the oral LD_{50} from the Agritox database. Pesticides with residues over 10% of the contact or oral LD_{50} are given in the Table.

[1]Agence Française de Securite Sanitaire des Aliments (AFSSA). 2009. Agritox database. Base de donnees sur les substances actives phytopharmaceutiques. http://www.dive.afssa.fr/agritox/php/fiches.php

[2] Ecological Effects Test Guidelines. OPPTS 850.3020. Honey Bee Acute Contact Toxicity. http://www.epa.gov/opptsfrs/publications/OPPTS_Harmonized/850_Ecological_Effects_TestGuidelines/Drafts/850-3030.pdf

Pesticide	Maximum residue in a sample (ppb)	Calculated dose to a nurse bee (µg/bee)	% of contact LD_{50}	% of oral LD_{50}
Imidacloprid (2007)	70	0.0046	10%	123%
Imidacloprid (2008)	23	0.0015	3.4%	40%
Chlorpyrifos	25	0.0016	16%	1.5%
Phosmet	3720	0.242	23%	No LD_{50}

Table – Pesticide residues found in pollen that met or exceeded the contact or oral LD_{50}.

31. Szalanski[nn], A., J. Whitaker[nn] & P. Cappy[oo] – MOLECULAR DIAGNOSTICS OF *NOSEMA CERANAE* AND *N. APIS* FROM HONEY BEES IN NEW YORK - Molecular diagnostics of the invasive honey bee pathogens, *Nosema ceranae* and *N. apis*, were conducted on honey bees from New York. A total of 1200 honey bee samples were collected by NYSDAM bee inspectors, of which, 528 (44%), from 49 counties had a positive *Nosema* spore count. Spore counts were the highest in the spring and decreased into the Fall. PCR genetic analysis on 371 spore-positive samples revealed that 96% were *N. ceranae*, 3% had both *N. ceranae* and *N. apis*, and 1% had *N. apis*. *Nosema ceranae* was more common in commercial operations relative to sideliner and hobbyist beekeepers. A preliminary molecular phylogenetic analysis of *N. ceranae* from New York revealed that it is identical to *N. ceranae* from Nebraska, South Dakota, Wisconsin, Europe and Australia.

32. Traver[v], B.E. & R. Fell[v] – STATEWIDE SURVEY OF *NOSEMA* IN VIRGINIA HONEY BEE COLONIES - Virginia beekeepers have reported average colony losses of 30% over the past five years. The recent discovery of *Nosema ceranae* in the U.S. has raised concerns among beekeepers as to whether this new pathogen could be contributing to these losses. Since *N. ceranae* is thought to be more pathogenic and has been linked to colony collapse disorder in Spain (Higes *et al.*, *2008 Environ. Micro 10:2659-2669*; Higes *et al.*, *2009 Environ. Micro Reports 1:110-113*), we initiated a statewide survey of honey bee colonies in Virginia to determine the incidence of *N. apis* and *N. ceranae*. Samples were collected from 305 colonies around the state and included samples from Virginia Tech apiaries, as well as samples sent in by Virginia beekeepers and apiary inspectors. Samples were analyzed for *Nosema* using both spore counts and molecular techniques. Spore counts were made by crushing the abdomens of 10 bees in water and counting spores with a hemacytometer. Genomic DNA was extracted from worker abdomens (5) and analyzed by real-time PCR for the presence of *Nosema*. All samples were run in triplicate, using a multiplex real-time PCR assay developed in our laboratory that uses primers and probes specific to either *N. apis* or *N. ceranae* 16S rRNA small subunit. The assay was validated using known *N. apis* and *N. ceranae* DNA samples provided by the USDA. This PCR assay allows for both the identification of the *Nosema* species and an estimate of the level of infection.

The results of the spore count studies indicate that 37.5% of the hives in Virginia are infected with *Nosema* spores, and real-time PCR analysis of positive samples indicated that *N. ceranae* is the dominant species present. *N. apis* infections were observed at very low levels (3.6%) and occurred only as a co-infection with *N. ceranae*. Our data also indicate that traditional diagnoses based on spore counts alone do not provide an accurate indication of colony infections. We estimate that 55% of colonies determined negative by spore counts are infected with *N. ceranae* when analyzed by real-time PCR. The actual infection level of colonies in Virginia, based on molecular diagnosis for *N. ceranae*, was 72%.

Infection levels in hives were estimated using a cycle threshold value (C_T). C_T values are used as a relative indicator of the concentration of target DNA in a reaction. In hives that tested positive for *N. ceranae*, average C_T values were used to diagnose a hive as having a low (C_T above 32), moderate (C_T 24-31), or heavy (C_T less than 23) level of infection. Of the hives analyzed, 11% of hives were classified as a heavy infection, 16% as a moderate infection, and 73% as a low level of infection. Based on these results, we were able to provide beekeepers with advice on treating their hives, suggesting that beekeepers with colonies having a moderate to high level infection consider treating with Fumagillin B.

33. Traynor[pp], K.S., R. Page[pp] & G. Amdam[pp] – EARLY ENVIRONMENT INFLUENCES THE BEHAVIORAL RESPONSE OF *APIS MELLIFERA* TO BROOD PHEROMONE – Brood pheromone (BP), a mixture of ten fatty acid esters given off by developing larvae, has previously been shown to both increase pollen foraging and prolong nursing behavior. Mutually exclusive effects of delayed foraging or precocious foraging have been ascribed to varying doses of BP. Why does the behavioral response of bees to the same pheromone differ at times?

New research indicates that prior experience can modulate the response to queen mandibular pheromone (QMP). Young bees are normally attracted to the queen and her pheromone, but if they have never previously experienced QMP, they are instead repelled by it just like foragers (Vergoz *et al.*, *2009 PNAS 106:20930-20935*).

Previous brood pheromone research has been conducted in small cages, nucleus colonies and full size hives. Our research using synthetic BP indicates that newly emerged (NE) bees placed directly into cages in an incubator respond to BP in the opposite direction than bees that have previously moved freely in a nucleus colony for two days (MA). This may help explain why previous BP results have often been contradictory.

Gustatory response scores (GRS) in the proboscis extension reflex (PER) test provide a window into future foraging choices. Pollen foragers typically have high scores, while nectar foragers typically have low scores. In response to both a high and low BP treatment, NE bees significantly increased their gustatory response scores (GRS) (Kruskal-Wallis: $\chi^2 = 6.576$, $n = 2$, $P = 0.037$). BP treatment did not significantly affect the GRS scores of MA bees, although the trend was in the opposite direction from the NE bees. Thus overall, there was a significant effect of bees (NE vs. MA) (Kruskal-Wallis: $\chi^2 = 6.445$, $n = 1$, $P = 0.011$).

MA bees consumed significantly more of the 30% sucrose solution compared to NE bees (ANOVA: Bees $F_{(1,76)}$= 65.618, P<0.001) and significantly less pollen (ANOVA: Bees $F_{(1,72)}$= 5.716, P=0.019). There were no significant differences in mortality or water consumption.

Our results suggest the initial exposure to the hive environment primes bees to perceive BP differently than bees that have never previously encountered BP. The MA bees that have the opportunity of experiencing a hive environment must gorge on protein during those first two days of life. They have significantly heavier rectums than the NE bees, although they consume less pollen in the cages (Rectum weights ANOVA: Bees: $F_{1,116}$ = 4.278, P= 0.041; Treatment: $F_{1,116}$ = 2.065, P= 0.131; Interaction: $F_{2,116}$ = 3.623, P= 0.03) Interestingly, there is an interaction of BP treatment and bees: the high dose of BP causes the MA bees to consume much less pollen in the cages and have significantly lower rectum weights than the MA control and MA bees exposed to a low BP dose. The MA high dose BP treated bees also have much less vitellogenin, an important egg-yolk precursor protein, in their hemolymph. This suggests that bees that have been primed to BP by experiencing a natural hive environment may be sensitized to the BP odor and thus require larger doses of BP to modify their behavior.

34. Villa[qq], J.D. – SELECTION FOR AN EFFECT OF HONEY BEE BROOD ON THE REPRODUCTION OF *VARROA* MITES – Brood from some genetic sources reduces *Varroa* mite fecundity (e.g. Africanized bees: Camazine, *1986 Ann. Ent. Soc. Amer* 79: 801-803); SMR/VSH bees: Ibrahim & Spivak, *2006 Apidologie* 37: 31-40). This suggests a genetic component to mite fecundity which may be enhanced through selection.

Mite reproduction was measured in tests of 6-12 colonies each. Each queen was caged on an empty comb for 48 h. Three days later, combs with eggs and newly emerged larvae from each source colony were moved to a common nurse colony. When the oldest larvae were one day from capping, combs were placed in an infested colony (> 0.1 mite/adult bee). Five days after, brood was moved to an incubator to develop without interference from hygienic bees for four to five days. Pupae were then examined for foundress females, progeny mites, developmental stage of pupae and anomalies in mite development. Only colonies with more than 28 infested cells were used in analyses.

Generation	L Colonies	H Colonies	P>F
Selected Parental (natural matings)	2.21 [2.04 - 2.49] (3)	3.44 [3.42 - 3.46] (2)	
First Generation (multiple drone I.I.)	2.70 [2.30 - 3.27] (9)	3.08 [2.65 - 3.39] (4)	0.0003
Second Generation (single drone I.I.)	2.13 [1.73 - 2.49] (4)	2.98 [2.70 - 3.36] (3)	<0.0001

Table – Mean [range] (n colonies) for the number of progeny per foundress female in infested pupal cells from L and H colonies selected as parents and representing two generations of selection. Probability of differences between H and L colonies derived from analyses of variance in each generation are indicated.

In 2008, 23 colonies from five genetic sources were screened to select potential parents. In 2009, two sequential generations of colonies were propagated from colonies in the previous generations identified as having high (H) or low (L) mite reproduction. The colonies of different origins screened in 2008 varied in mite reproduction (1.97-3.46 progeny per foundress female) allowing the selection of L and H parents (Table). In 2009, L and H colonies from the first selected generation (produced using queens instrumentally inseminated with mixed semen) and also from the second selected generation (produced with single drone inseminations) differed in mean mite fecundity. These results indicate progress in selection towards a trait that may be economically useful.

35. Webster[rr], T.C., F.E. Dowell[ss], E.B. Maghirang[ss]& E.M. Thacker[rr]- DOES VISIBLE/NEAR-INFRARED SPECTROSCOPY DETECT HONEY BEE CHARACTERISTICS? - Studies of insect tissue have shown near-infrared spectroscopy to be effective in determining the sex, species, or parasitism of insects (e.g. Dowell *et al., 2005 Bull. Entomol. Res. 95:249-257*). Application of this method for honey bee tissues might allow rapid and non-invasive evaluations of selected organs and tissues. The scan takes only several seconds and requires that a bee is briefly immobilized by chilling or carbon dioxide. We analyzed the abdomens of honey bee queens, semen from drone bees, the heads of worker bees, and the midguts of worker bees by visible and near-infrared spectroscopy. Mated honey bee queens could be distinguished from virgin queens by their absorption spectra with 100% accuracy (Webster *et al., 2009 Apidologie 40:565-569*). Spectra of semen contained in glass microcapillary tubes were compared to spectra of the queens. This comparison showed that classifications of queens were likely influenced by the presence or absence of semen in the queen spermathecum. However, physiological or morphological changes that occur in the queens after mating probably influenced the classifications also.

The heads of worker bees taken from the brood nest of a hive had absorption spectra that differed from those of flying workers taken from the hive entrance. These spectra could be used to predict whether bees were from the brood nest or were collected as flying bees with 85% accuracy. However, the weights of hypopharyngeal glands taken from those worker bees were not correlated with the spectra. Apparently, physiological changes in the heads of worker bees as they transition from brood nest to flight behavior contribute to the visible/near-infrared spectra. *Nosema apis* infection in worker bee midguts was not correlated with the absorption spectra of those midguts compared to uninfected midguts. Continuing work will include *Nosema ceranae*-infected midguts. Improvements in techniques may allow this and related techniques to be more useful for analyses of these honey bee organs.

36. Williams[w,ii], G.R., D. Shutler[w], C.M. Little[w], K.L. Burgher-MacLellan[tt] & R.E.L. Rogers[w,uu] – *NOSEMA CERANAE* IN NORTH AMERICA: NASTY, NICE, OR NEITHER? - A variety of emerging pathogens threaten western honey bees (*Apis mellifera*), including the microsporidian *Nosema ceranae*. Since jumping from the Asian (*Apis cerana*) to the western honey bee in the latter half of the 20th century (Chen *et al.*, *2008 J. Invertebr. Pathol. 97:186-188*), *N. ceranae* has become distributed nearly globally and has displaced western honey bees' historical *Nosema* parasite, *Nosema apis*, in many regions (Klee *et al.*, *2007 J. Invertebr. Pathol. 96:1-10*).

Very little is known about the epizootiology and control of *N. ceranae* in western honey bees because of its recent detection. Infection resulted in sudden collapse of apparently asymptomatic colonies in Spain (Higes *et al.*, *2008 Environ. Microbiol. 10:2659-2669*), whereas multiple stressors, rather than *N. ceranae* alone, are implicated as the cause of Colony Collapse Disorder in the United States (van Engelsdorp *et al.*, *2009 PLoS One 4: e6481-e6497*). Numerous control methods exist for *N. apis* in western honey bees, including fumigation, heat treatment, and replacement of aging equipment (Fries, *1992 Bee World 74:5-19*); however, most common in North America is oral administration of the antibiotic Fumagilin-B® with sugar syrup in fall and spring. In our preliminary investigation (Williams *et al., 2008 J. Invertebr. Pathol. 99:342-344*), Fumagilin-B® applied in the fall at the recommended dosage for *N. apis* controlled *N. ceranae* for at least 6 months; however, we did not account for potential variation among beekeeping operations.

Here we investigated effects of Fumagilin-B® on *N. ceranae* and on western honey bee colony strength (i.e., size of adult worker population, and amount of capped and uncapped brood, honey, and pollen) using colonies over-wintered in a single apiary, as well as investigated effects of *N. ceranae* on colony mortality. We also repeated our previous study using colonies over-wintered by seven different beekeepers to incorporate variation arising from beekeeping practices.

N. ceranae did not affect colony winter mortality (all $P > 0.56$) or any colony strength measure (all Ps > 0.17). There are a number of possible explanations for this, including false recovery of colonies (Higes *et al., 2008 Environ. Microbiol. 10:2659-2669*), sub-damaging *N. ceranae* intensities, or non-significant differences in *N. ceranae* intensity between treatment groups for colonies whose strength was measured (i.e., $P = 0.07$). Similar to our previous study, fall Fumagilin-B® treatment generally lowered *N. ceranae* the following spring (all Ps ≤ 0.05), although results were highly variable both within and among beekeepers. Differences in *N. ceranae* intensities and fumagillin effectiveness among beekeeping operations could be due to a number of factors, including beekeeper management and weather.

Understanding factors influencing colony-level pathology of *N. ceranae* is crucial, particularly due to conflicting data on pathogenicity of the parasite. Significant recent increases in honey bee colony losses globally are likely caused by multiple factors, including recently-introduced parasites, nutritional deficiencies, and exposure to pesticides intrinsic and extrinsic to beekeeping. Until influences of all important stressors are known, both singly and in combination, it may be difficult to understand differences in strength and mortality among western honey bee colonies.

37. Wilson[vv], M.E., J. Skinner[vv], K.S. Delaplane[a] & J. Pettis[bb] – BEE HEALTH @ EXTENSION.ORG: A WEB PLATFORM FOR THTE CREATION AND DISSEMINATION OF SCIENCE-BASED RECOMMENDATIONS – Members of the bee research and extension community are using a new toolkit and strategy in the outreach component of research and extension projects, which includes a website at www.extension.org/bee_health. This website is part of the larger eXtension.org non-profit organization, created out of the desire to transform the Cooperative Extension System through information technology.

Bee research and extension personnel became involved with this initiative out of the need to deliver objective, research-based, and credible information to the general public. Two grant programs are responsible to create a "Community of Practice" and deliver specific objective outcomes from their research programs. The USDA-ARS Areawide Program and the Managed Pollinator CAP have pooled resources to create the "Bee Health" community, while many other research and extension professionals have joined the initiative. Currently there are 65 members who specialize in honey bees and native bees. Members from state and federal programs are encouraged to integrate eXtension.org into future grant programs to make this effort sustainable and to build a long lasting knowledge base about bees.

Organizational structures such as the American Association of Professional Apiculturists, USDA-ARS bee labs, the NC1173 (formerly NC508), and the Apiary Inspectors of America have been integral in conducting research around bee decline. Organizing outreach programs under the umbrella of eXtension.org continues this efficient, collaborative strategy into knowledge delivery.

Numerous tools are offered by eXtension.org to their communities, including integration of the site within Google Analytics. This offers the ability to track which pages are the most successful and better focus our efforts to increase access to our information. Tools outside of eXtension.org are used by the community to make sure content is more accessible by the public, such as the new YouTube Channel for Bee Health at www.youtube.com/BeeHealth. Other features on the main site include news, events, and over 114 articles such as: monthly updates from the Managed Pollinator CAP, other research updates, and topics in honey bee anatomy, biology, and disease. FAQs address 120 common questions about bees. These products are an excellent start to the initiative and speak well for the potential that this project has for making accurate knowledge more accessible and sustainable practices for bee management more feasible.

38. Wu[J], J.Y., C. Anelli[ww] & W.S. Sheppard[J] – SUB-LETHAL EFFECTS OF PESTICIDE RESIDUES IN BROOD COMB ON WORKER HONEY BEES - The European honey bee, *Apis mellifera* L., is an important pollinator for many agricultural crops. The United States Department of Agriculture estimates one-third of our diet comes from insect-pollinated plants. Of that, 80% are pollinated by honey bees (Thapa, *2006 J. Inst. Agric. Anim. Sci. 27:1-23*). Unfortunately, honey bees are faced with many challenges including mites, microsporidia, viruses, poor nutrition and exposure to pesticides from in-hive and external sources.

Various miticides have been used since the late 1980's in the U.S. to treat the external parasitic mite *Varroa destructor* Anderson & Trueman (Varroidae) in honey bee colonies. Honey bees are often exposed to high and frequent doses of miticides as beekeepers seek to counter the mite's rapidly developing resistance to chemical treatments (Elzen *et al., 1999 Apidologie 30:17-19*; Elzen *et al., 2000 Apidologie 31:437-441*; Pettis, *2004 Apidologie 35:91-92*). Exposure to multiple pesticides is likely to occur during flight and foraging activities (Rortais *et al., 2005 Apidologie 36:71-83*). Returning foragers may further contaminate nest-mates, comb, and food resources. Current risk assessments for pesticides typically examine lethality of adult bees to a single active ingredient in a laboratory setting 24 or 48 hours after exposure. However, sub-lethal effects of pesticide residues on immature bees and effects from pesticide mixtures are not routinely used to assess the toxicity of pesticides during the registration process.

This study investigates pesticide exposure that honey bees face by exposure to the pesticide load or concentration of residues found in brood comb. We further investigated sub-lethal effects of pesticide residues in brood comb on larval survivability, adult longevity, and susceptibility to other pests and pathogens, such as *Varroa destructor* mites and *Nosema ceranae (*Nosematidae) spores. Worker bees were reared in either contaminated comb, containing high levels of pesticide residues, or in relatively uncontaminated "clean" comb within the same colony. Comparisons of survivability from egg to adult emergence and larval development rates yielded lower survivability and evidence of delayed development for bees reared in highly contaminated combs. Newly emerged adult bees reared from contaminated combs lived, on average, four days less than control bees in cage longevity tests. Preliminary results indicate no difference in susceptibility to *Varroa* mites. However, in a separate field experiment, a significantly higher proportion of bees reared in contaminated comb were infected with *Nosema ceranae* spores at a younger age and with higher infection levels than bees reared in clean comb. This suggests early exposure to pesticide residues during development can have serious effects on larval survivability and subtle delayed effects in the adult stage.

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[ww] Honors College, Washington State University, Pullman, WA 99164-6382; Ph. 509-335-1432, email: carol_anelli@wsu.edu

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This ships in 4 pkgs.		
1 pkg @ 47#	2 pkgs @ 35#	1 pkg @ 8#

The best built extractors on the market!

Little Wonder Hand-Extractor Kits

Power style also available

Little Wonder Extractor Kits—A step up in size from the Junior Bench. The little wonder extracting kit is perfect for the hobby beekeeper. It is available in both hand and power styles. This four frame extractor comes complete with extractor and stand, 1 bottling bucket kit, 1 speed king electric knife, plastic uncapping tub and 1 capping scratcher.

M00396KIT LW Hand Extractor Kit **$549.00**

This ships in 4 pkgs.		
1 pkg @ 78#	2 pkgs @ 35#	1 pkg @ 8#

M00403KIT LW Power Extractor Kit **$839.00**

This ships in 5 pkgs.			
1 pkg @ 78#	2 pkgs @ 35#	1 pkg @ 13#	1 pkg @ 8#

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Ranger Power Extractor Kit

Hand style also available

Ranger Extractor Kits—For those who prefer a radial extractor this is for you. The Ranger extracting kit is available in both the power and hand styles. It is capable of extracting 6 - 6 1/4" frames or shallow frames radially or three deep frames tangentially by using the optional baskets. The 6 frame radial extractor comes complete with extractor and stand, 1 bottling bucket kit, 1 speed king electric knife, plastic uncapping tub and 1 capping scratcher.
Optional baskets for deep frames sold separately.

M00400KIT Ranger Hand Extractor Kit. **$629.00**

This ships in 4 pkgs.		
1 pkg @ 78#	2 pkgs @ 35#	1 pkg @ 8#

M00401KIT Ranger Power Extractor Kit **$915.00**

This ships in 5 pkgs.			
1 pkg @ 78#	2 pkgs @ 35#	1 pkg @ 13#	1 pkg @ 8#

M00402 Optional Baskets, for Deep Frames, Ship Wt. 8 lbs. **$79.95**