BEE NEWS & VIEWS

The Mississippi Beekeepers Association Newsletter

JEFF HARRIS, Editor
Phone: 662.325.2976

November-December 2014

Volunteers Needed for Demonstration Experiments

By Jeff Harris

As a researcher, I can sometimes speak until blue in the face about how to do a sophisticated technique for mite control, and very few beekeepers actually try the method. On the other hand, I have learned from doing workshops that if beekeepers are shown a technique – with me standing in the field with them and going through every step – many beekeepers will try and ultimately adopt the useful technique. Many beekeepers simply learn by an on-hands approach, rather than from hearing information at a seminar.

The primary purposes of these experiments are to involve beekeeper volunteers and to show the benefits of two methods of non-chemical control for *Varroa* mites. The two methods will be (1) use of a varroa-resistant stock of honey bees known as Varroa Sensitive Hygienic bees (or VSH bees) and (2) use of drone brood as a trap for mites. My goal is for the beekeepers to witness firsthand the benefits of non-chemical techniques to control the mites, and the information will likely be published as an extension document to be shared with other beekeepers in the state (and other states) as a testimonial to the utility of the methods.

In addition, beekeepers are not shy about talking amongst themselves about things that work well; thus, it seems likely that beekeeper volunteers could help recruit others to at least try non-chemical methods against the *Varroa* mite. The overall goal is to help beekeepers reduce the use of chemicals within their hives, which should help promote healthier colonies of bees.

Successful completion of these experiments should provide incentive for beekeepers to try non-chemical techniques within their normal repertoire of beekeeping skills. Contamination of beeswax combs by agro-chemicals and insecticides is an emerging problem in the beekeeping industry, and any methods that reduce the exposure of hives to toxins are important. For many beekeepers, the basis for the inertia against trying such methods is a healthy skepticism that some of the claims about the utility of these methods are hyperboles. My experience of the last 15 years suggests that the use of VSH bees and the use of drone trapping are effective means for reducing the growth of mite populations. Proving it to beekeepers will go a long way to encourage adoption of these techniques by small scale or hobbyists.

To keep the analysis simple, two different experiments will be conducted. A total of at least 12 beekeeper volunteers will each be asked to provide colonies of honey bees to be used. All queens will be replaced with new queens at the beginning of experiments and again after the first year. Young queens often produce better colonies of bees, and it will be important that all beekeepers have a chance at the same quality of queen at the start of each experiment.

Half of the volunteers will compare the growth of mite populations in untreated control colonies to colonies in which drone brood was used as a mite trap. Each volunteer will have equal numbers of control colonies and colonies utilizing drone traps. The other experiment will require the other half of volunteers to compare mite growth in colonies using a standard commercial stock versus similar colonies using VSH bees. Each volunteer will have equal numbers of VSH colonies and commercial Italian colonies.

Each volunteer will measure the total mite populations in all colonies at set intervals during the year. Miticides will be used when mite populations exceed critical threshold levels (these levels will be decided amongst the group of volunteers with some guidance from me before experiments begin). I will help everyone involved in executing the experiments, collecting the data, and summarizing the data for presentations and publications. I may ask some of the volunteers to speak on their experiences during the year to other beekeepers at workshops or at the annual MBA convention this next year.

If you are interested in participating in these experiments, please contact me before March 1, 2015. I would like to speak with all volunteers to develop a plan of attack that puts us all on the same schedule at the beginning of the season. My email is JHarris@ext.msstate.edu and my office phone is 662.325.2976.

2015 4-H Beekeeping Essay Contest Entries due January 20

By Lois Connington

Mississippi entries for the 2015 4-H Beekeeping Essay Contest, sponsored by The Foundation for the Preservation of Honey Bees, Inc., will be due by close of business on January 20, 2015. Please send your essay and brief biographical sketch (see below) to Dr. Jeff Harris at JHarris@ext.msstate.edu

(Subject: 4-H Beekeeping Essay). ONLY ESSAYS SUBMITTED ELECTRONICALLY WILL BE ACCEPTED. The first place essay from the Mississippi level of competition will be sent to the national contest.

In 2014, the second place winner in the national contest was Mississippi's Garrett Smith from Oktibbeha County! Start your essay now, and let's send another national award-winning essay from Mississippi this year.

AWARDS

State Winners • 1st Place—$100.00 (essay goes on to national competition) • 2nd Place—$75.00 •3rd Place—$50.00 (prizes provided by Mississippi Beekeepers Association)

National Winners • 1st Place—$750.00 • 2nd Place—$500.00 • 3rd Place—$250.00 (provided by The Foundation for the Preservation of Honey Bees). Each state winner, including the national winners, receives an appropriate book about honey bees, beekeeping, or honey from The Foundation for the Preservation of Honey Bees.

TOPIC

"Planting for Bees from Backyards and Up"

(*Hint: Make your essay pop by adding a catchy title rather than using the topic as your title.*)

Beekeeping has become difficult due to a lack of native plants for forage. In this essay, you will be required to discuss ways that habitats can be modified to become "bee friendly." Does your community allow roadsides and open land to grow wildflowers and encourage native planting of bee friendly plants?

Survey your community to see what is being done to help honey bees. Include your state in your survey to see if there is a wildflower planting program available or any other program that could aid the honey bee.

The scope of research is an essential judging criterion, accounting for 40% of your score. The number of sources consulted, the authority of sources, and the variety of the sources are all evaluated.

Personal interviews with beekeepers and others familiar with the subject are valued sources of information and should be documented. Sources that are not cited in the endnotes should be listed in a "Resources" or "Bibliography" list.

(*Hint: Notice that "honey bee" is properly spelled as two words, even though many otherwise authoritative references spell it as one word.*)

Note: The essay must be your work, in your own words. An important consideration in writing an essay is to avoid plagiarism (the act of repeating information from a source word for word; failing to cite a source, even though you paraphrased the information; or using someone else's idea without giving them credit). It may be helpful to write a summary of each source you review, without quoting it and from memory, then outline your essay by pulling ideas from your summaries. Writing your essay from your outline will ensure your entry is your own work.

RULES

1. Contest is open to active 4-H Club members only. 4-H'ers who have previously placed first, second, or third at the national level are not eligible; but other state winners are eligible to re-enter.

2. Requirements (failure to meet any one requirement disqualifies the essay):

    - Write on the designated subject only.
    - All factual statements must be referenced with bibliographical-style endnotes.
    - A brief biographical sketch of the essayist, including date of birth, gender, complete mailing address, and telephone number, must accompany the essay.
    - Length—the essay proper: 750 to 1,000 words. The word count does not include the endnotes, the bibliography or

references, nor the essayist's biographical sketch—which should be on a separate page.

- Preparation for National Judging: ELECTRONIC SUBMISSIONS ONLY. Prepare your essays double-spaced, 12-pt. Times or similar type style, following standard manuscript format. Submit as a Microsoft Word compatible document.

3. Essays will be judged on:

- scope of research—40%
- accuracy—30%
- creativity—10%
- conciseness—10%
- logical development of the topic—10%

HopGuard® II for Varroa Control

By Jeff Harris

HopGuard® is a miticide derived from beta acids that are extracted from the hop plant *Humulus lupulus*. There are also alpha acids extracted from the plant, but the beta acids have the highest activity against the mites. The product is made by BetaTec Hop Products. It has been approved for Section 18 use in many states, including Mississippi.

The original formulation was not liked by many people because of the mess and sticky nature of the material when handled by the beekeeper. HopGuard® II is an improved version in which the sticky brown residue on the strips is greatly reduced, and it is more appealing than the original material.

I have read the research conducted on this material in Arizona, Canada and now in Europe. The Europeans are seeking approval of the material to help them have a greater arsenal for use against the mites. They currently use formic, oxalic and lactic acids as legal miticides in various countries. HopGuard® II has the advantage of low bee mortality, high mite mortality and low residues in beeswax and honey over some of the synthetic neurotoxins that have been used to control mites.

HopGuard® II has a >90% efficacy in killing mites in broodless clusters of bees (late fall or winter treatment). It appears that most of the mortality of mites occurs within the initial 24-30 hours of inserting the material into the hive. The efficacy for killing mites becomes less when brood is present, but this is true for many chemicals. About 65-80% of the mites will be within capped brood cells when the queen is actively laying, and these mites are shielded from exposure to the miticides.

There are detectable residues of the beta acids within 14 days of the initial use of HopGuard® II, but there are no detectable residues of the material within 3 months of treatment. This is certainly much more desirable than the 5-year half-life for miticides like Apistan® and CheckMite®. These chemicals can stay in beeswax for more than a decade!

Beekeepers who use HopGuard® II should report any negative issues with the material to the Mississippi Department of Ag & Commerce. This is one of the requirements for Section 18 registration, and it is the only way that problems associated with the material can be addressed by the manufacturer.

I have not used the material myself, but I plan to use it when necessary next year. I am trying to shift from using the synthetic neurotoxins to compounds that have less residue time in hives, and I recommend that all beekeepers do the same.

Along this same line of thought, formic acid in the form of Mite-Away Quick Strips (MAQS™) is another useful miticide that has low residue in beeswax. MAQS™ can also be used during a honey flow, while most other miticides cannot be used during honey production. The major problem with MAQS™ is that it can only be used in the temperature range of 50-92^{o}F. This can make it difficult to use during late spring or early summer in Mississippi. It can be most effectively used in the autumn, and perhaps during broodless periods during the winter.

Finally, it appears that the EPA will approve oxalic acid dehydrate for use as a miticide in bee colonies in the upcoming spring 2015. The material is most likely going to be used as a direct dribble (active ingredient in a syrup that is sprayed or poured over the bee cluster) onto the bees. As with the other miticides, it is likely to be most effective during broodless periods.

Please read and follow all directions on the labels for all of these miticides. These organic acids can have significant health effects on bees if used improperly. However, the prescribed methods of treatment should provide adequate mite control with little or no bee mortality. Additionally, the low residues of these materials in combs should help avoid the build-up of chemical contaminants in your beeswax.

Candy Boards for Winter Feed

By Roger Hoopingarner, Michigan State University

During cold days of winter when the bees cannot move any great distance for honey, candy boards placed over the upper combs have saved bees from starvation. Bees normally move upward during the winter as the heat from the cluster allows this movement more readily than laterally. If the bees reach the top of the hive before spring weather allows them to move or expand sideways they can starve with honey on the outside frames.

The use of candy boards will allow bees to survive this period when the temperature is too cold for lateral movement. Thus these boards are in some sense a temporary measure, or to some beekeepers as an "insurance" because they may have taken away too much honey, or have the colony organized with the honey poorly placed. The boards can be placed on the colonies in just a few seconds and thus save a colony that would otherwise die.

The making of these candy boards is relatively easy, and once the actual board is made the yearly operation of adding the sugar candy is routine. The board itself is made with the same outside dimensions as the hive. The board looks like an inner cover without the hole, and usually has somewhat higher sides to hold more sugar. We use 1/4 inch tempered or hardened particle board with 3/4" side boards.

The formula for the candy is as follows:

15 lbs. sugar
3 lbs. white corn syrup
4 cups water
1/2 tsp. cream of tartar

Dissolve the sugar in water and stir while heating the mixture to 240ºF. Let the syrup cool to about 180º, then beat until thickened and pour into the board to harden. Once the candy is hard they can be put onto the colonies, candy side down, over the top frames. Some beekeepers pour the candy into wax paper lined molds instead of making regular boards, and then put these molded blocks on top of the frames while the inner cover is placed over them. The blocks must therefore be no thicker than the depth of the inner cover rim. If the bees do not use the candy, the boards can be saved, or the sugar melted and used for spring feeding as syrup.

Note from Editor: This method for making sugar works, but there are risks to the health of bees when heating sugars. If the sugar is caramelized, the resulting candy can kill your bees. The brown sugars and breakdown products like hydroxy-methylfurfural (HMF) are toxic to bees in low doses. Therefore, you must carefully watch the heating process to ensure no browning. There are also non-heating alternatives to making the sugar. Unfortunately, they require a strong stirring arm – but they are guaranteed safe to bees.

Here are two links on how to make candy boards. The first is a typical heating method (http://www.ilsba.com/uploads/1/0/6/4/10649295/honey_bee_candy_board_recipe.pdf), and the second is a non-heating method that I prefer (http://www.beverlybees.com/i-want-candy-so-lets-make-a-candyboard-for-winter-feeding/).

Colony Inspection during Winter

By Roger Hoopingarner, Michigan State University

Sometimes when I talk to beekeepers about opening their hives when the temperature is below 55^{o}F, they are quite concerned about killing the colony. First it is important to remember that the bees don't heat the entire inside of the hive except for the amount that escapes from the cluster.

Secondly, it certainly would be better to "damage" the bees a little if your inspection prevented the colony from dying because of lack of food. A quick peek under the cover to look at the position of the cluster and the amount of food still present takes only a minute or two, and to move a frame of honey next to the cluster will disturb it but the alternatives are not very favorable.

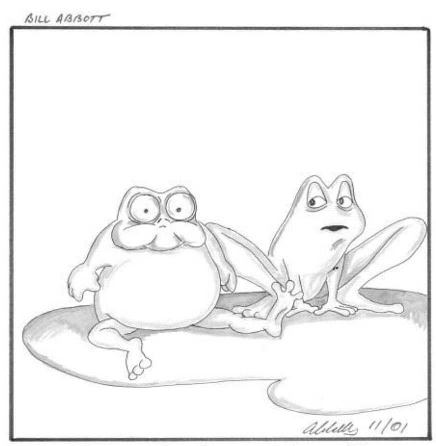
It generally is best to select the day that you examine the colony such that the temperatures are maybe in the 30's or 40's; however, even colder temperatures have been used when necessary.
We routinely examine our colonies the last part of February when we add our pollen substitute patties. If we have colonies that we suspect might be getting low on food, we will examine them earlier and add honey or candy boards to the colony.

What should you expect when you open a colony in winter? A little would depend when you did the examination and how many hive bodies were being used to hold winter stores. If the bees are already to the top of the colony in early to mid-January then I suspect they will not have enough honey for the cluster to survive, and feeding will be in order by using candy boards or adding a super of honey.

Bees eat and metabolize the honey in order to heat the cluster. The metabolic heat escaping from the cluster allows the bees to gradually move upward. Therefore, the movement of bees has somewhat of a "chimney" or central core effect. If temperatures are still very cold when they reach the top of the hive, the colony will starve even though there is still honey in the hive. So if the bees are not at the top of the hive when you examine them in the winter, it generally is a good sign.

The size of the winter cluster (number of bees) has a direct relationship to winter survival as a large cluster can cover more honey from side to side in the hive, and thus not starve as easily as a small cluster. The colder the temperature the smaller the cluster will be relatively speaking. That is, given the same number of bees, the colder the temperature the smaller the cluster will be.

Food consumption within a winter cluster is also dependent upon the temperature in a U shaped curve. Food use per bee goes down as the temperature drops until it gets to approximately 45^{o} F., then food use begins to rise again as the temperature continues to drop. This is one of the reasons that specially built wintering houses keep the temperature in the low to mid 40 degrees. At this time (early January) the bees have been using more honey than normal since we had such a cold December. It might pay to look at your colonies a little earlier this year.



"Ate another bee, tough guy?"

Beekeeper Survey

By Jeff Harris

Your MSU Apiculture Team would like you to take a survey about your beekeeping operation and practices. Our approach is to establish a baseline or snapshot of beekeeping practices during each year over the next few years. The primary goal is to see if beekeeping practices change with implementation of our extension program. Do beekeepers gradually change practices after we teach them better ways of dealing with the biggest problems in apiculture?
The content of the surveys will not be published. Instead, we will use the surveys to document changes (or lack of changes) in beekeeping practices to granting agencies and to our extension

administration. It will also help us to decide the best approaches to teaching beekeepers, and it may lead us to modify the ways in which we conduct seminars, workshops and conventions.

We are currently seeking approval for our initial survey. It should go online sometime in January 2015. It will remain available for several months, and we will announce its availability once it is posted. We will post it to our "Resources" heading at our website (http://blogs.msucares.com/honeybees/).

I encourage all of you to respond to the survey and provide input. This is one mechanism that can help us better understand your needs.

No Glass Ceiling for Worker Bees

By James Gorman

The honeybee hive would not seem to be the place to look for individuality, flexibility in job duties and social mobility. But by using new techniques for analyzing bee behavior, researchers at the University of Illinois at Urbana-Champaign, recently found that the life of a bee is less rigidly determined than had been thought.

They first discovered that an elite 20 percent of foragers do 50 percent of all the foraging, and then found that membership in this group was surprisingly flexible. When the elite bees were removed from the hive, less hard-working bees raised the level of their activity and a new elite emerged.

Gene E. Robinson, the director of the Institute for Genomic Biology at the university, said he and other researchers set out to look at the behavior of bees in a new way partly because of "an increasing appreciation of the role of the individual in social insects."

Teasing out the differences in individual levels of foraging activity required some new tools for observing the bees and for analyzing the data.

To work on the first part of the problem, Dr. Robinson said, Paul Tenczar, a retired computer entrepreneur and enthusiastic citizen scientist, joined the lab. He worked with scientists to devise a kind of E-ZPass system for bees involving tiny electronic ID tags, entry and exit tubes for a hive, and laser scanners to track the bees as they passed through the tubes (think toll plazas).
But even with the technology functioning at a high level to track the bees' activity, analytical tools had to be developed to understand and interpret the data, Dr. Robinson said.

The results, which the team of scientists reported in the September issue of Animal Behaviour, showed first that there was an elite group among the foraging bees.

Then, by removing those top performers, the team found that other bees took their place. It was, said Dr. Robinson, "elitism with a populist streak."

They also found, in mining the data, that over the life of an individual bee, patterns of foraging activity fluctuated and that individual bees had different life histories.

The approach to studying behavior using so-called big data is like that used by Internet companies to track people's shopping behavior. Such new techniques, Dr. Robinson said, showed the power of "massive amounts of surveillance" to "reveal previously inaccessible data about individual behavior" in insects. And just when bees thought Facebook had ignored them.

Originally published in the Science section of the September 8, 2014 *New York Times*.

Varroa and Viruses

By Jeff Harris

Our understanding of the relationship between Varroa mites and viruses is changing at a fairly rapid pace. Although there is still much more to learn, the developing picture of viruses and mites is extremely complex. One particularly perplexing phenomenon is the existence of honey bees testing positive for the presence of Deformed Wing Virus (DWV) but not showing any pathological symptoms of the disease. This occurs very frequently in colonies that have low mite populations. DWV has become widespread because it can be transmitted from bee-to-bee by (1) drones mating with queens,

(2) queens passing the virus to workers when she lays eggs, and (3) workers passing the virus to other workers when feeding brood food to developing larvae. Apparently, queens and workers can function quite normally with non-replicating viruses in their tissues.

The mystery is what happens when mites are added to the hive. Somehow, the mites change the situation and bees begin to die from viral infections. There is no definitive answer to exactly how the mites change the situation, but here are three possibilities being examined by researchers:

1. **Feeding by the mites suppresses the immune system of bees**. Scientists have found that there are substances in the saliva of mites that can suppress the immune system of bees. The viruses also can block certain aspects of the immune response from bees, but apparently, different viruses affect the immune system differently. Some believe that the extra immune-suppression by the mites is just enough to push the bees over the edge, and the viral replication explodes and eventually kills bees.

2. **Co-infection by more than one virus leads to additive immunosuppression.** The varroa mites seem to serve as vectors for several viruses at one time when feeding on bees. In some cases, different types of viruses (for example DWV and Varroa virus-1) may each independently block a portion of the bee's immune system. So, together, a two or multiple virus cocktail is more likely to cause disease in the bee because of the combined immune-suppression mechanisms from different viruses.

3. **Viruses can form chimeric (hybrid) viruses that are more lethal than the parent viruses.** This is a truly fascinating process that has been recently confirmed in honey bees. It seems that Varroa mites somehow aid the process of forming these chimeric viruses. One reported chimeric virus seems to have a major portion of its genetic code coming from DWV. This module of the virus may allow it to replicate better within an individual bee. The other major portion of the chimeric virus comes from Varroa virus-1. The function of this portion of the chimera may increase the bee-to-bee transmission of the chimeric virus. Thus, the hybrid virus is more virulent than either "parent" virus, and bees succumb quickly to these viral infections. The big question is how does the presence of mites increase formation of the chimeric viruses? No one knows yet!

   A really bizarre aspect of viruses is just how it is possible that chimeric viruses can form in the first place. Viruses use RNA or DNA to hijack the gene-decoding machinery within the host cells to mass produce new virus particles. But apparently this process is not perfect, and quite often defective virus particles are made. These defective viruses may only have the genetic code for a portion or module of the whole and natural virus.

   The defective virus particles can become incorporated into the genetic code of the host's cells, and it can actually be carried into new generations of animals if the host reproduces. What is really peculiar is that these defective particles can merge with host genetic sequences and the sequences of other viruses to create the chimeric viruses.

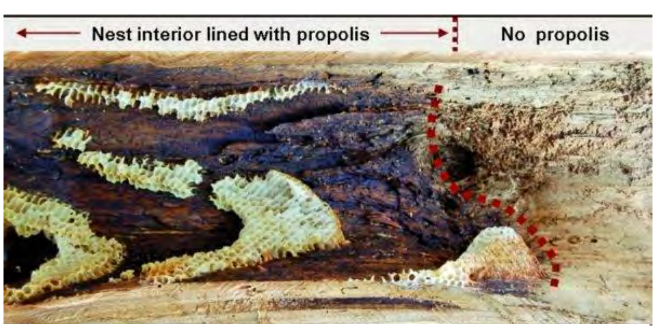
   The implications are astounding: viruses can actually grab pieces of host DNA or RNA and take it with them as they infect a different animal host. For example, an aberrant DWV may take a portion of the honey bee genetic code with it when infecting a Bumble Bee. Ultimately, the virus could then add portions of the second host's genetic code – a DWV with pieces of both bees. Thus, viruses may be important drivers of mutation in all genetic systems. Pretty cool stuff.

How important is propolis…really?

By Audrey Sheridan

That depends on who you ask. Beekeepers grumble about boxes sticking together, top bars sticking to boxes and tenacious residues on their skin and clothes. In the words of Murray Hoyt, author of *The World of Bees* (1965), propolis "is the bane of a beekeeper's existence". On the other hand, bees celebrate a home that is well-sealed, weatherproofed and fortified with an antimicrobial substance that is superior to anything their "keepers" can provide. North American honey bee breeders have intentionally selected *against* heavy propolizing behavior over the decades due to the inconvenience of propolis to the beekeeper (Fearnley 2001). But, was this a wise thing to do? In retrospect, perhaps the overall health of bees would be greater today if we allowed them to hold on to their natural defense mechanism against pathogenic and unsanitary microbes.

Where does propolis come from? Well, in North America, mostly from the leaf buds of trees in the poplar family (*Populus* spp.), or from several other resinous plant species where poplars do not grow (Burdock 1998). A very specialized group of forager bees collects the plant resins and mixes it with wax and pollen to produce "bee glue". Burdock (1998) roughly estimates propolis composition as being "…50% resin and vegetable balsam, 30% wax, 10% essential and aromatic oils, 5% pollen and 5% various other substances, including organic debris". Resin (propolis) foragers comprise a small percentage of a colony's foraging force. As stated by Simone et al. (2009), "…a total of 5-15 foragers will continuously collect resin during a single day". Consequently, resin foraging



A natural colony in a tree (Simone et al.2008)

is not energetically expensive for the colony and does not detract from the effort of food collection. The prophylactic qualities of propolis are evident when you compare colonies with high and low propolis usage. Propolis-rich nest environments have fewer microorganisms overall than nests that are not enriched with the resinous substance (Simone et al. 2009). Colonies supplied with lots of propolis also have considerably less stressed immune systems. Propolis contains compounds called *flavonoids*, which have antiviral, anti-inflammatory, ant-carcinogenic and antimicrobial activities. These compounds are found throughout the plant kingdom and are thought to be the main active compounds in propolis. The activity of propolis against bee-specific diseases is largely undiscovered, although there is evidence that propolis extracts from a Brazilian species of the *Baccharus* shrub inhibits the growth of *Paenibacillus larvae* (American Foulbrood) (Bastos et al., 2008). Considering the poor general health of honey bees in this country, it may be a good idea to select *for* propolis production and bite the bullet of inconvenience.

References

Bastos E.M.A.F., M. Simone, D.M. Jorge, A.E.S. Suarez and M. Spivak. (2008). In vitro study if the antimicrobial activity of Brazilian and Minnesota, USA propolis against *Paenibacillus larvae. J. Invert. Pathol.*97: 273-281.

Burdock G.A. (1998). Review of the biological properties and toxicity of bee propolis. *Food and Chem. Toxicol.* 36(4): 347-363.

Fearnley J. (2001). Bee propolis: natural healing from the hive, Souvenir Press, London.
Hoyt M. (1965) The world of bees, Coward McCann, Inc., New York.

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

Bee News and Views is brought to you by support from:

MSU Department of Biochemistry, Molecular Biology, Entomology and Plant Pathology

MISSISSIPPI STATE UNIVERSITY EXTENSION SERVICE