Nov/Dec 2007

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--

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Need HFCS Samples

Researchers at the USDA Carl Hayden Bee Research lab in Tucson are still very interested in analyzing samples of high fructose corn syrup (HFCS) that have been delivered to beekeepers. Of particular interest are samples collected at the time of syrup delivery or taken within the next 48 hours.

Syrup manufacturers are cognizant of elevated levels of hydroxymethylfurfural (HMF), but there still is some question about what else is in the syrup besides sugars.

Project Apis m (PAm) has contributed considerable funding to this effort and is a bit disappointed in the low number of samples that have been submitted.

If you have ordered a shipment of syrup to be delivered in the next month or two, please contact Dr. Diana Sammataro at the Tucson lab for instructions on how to submit a sample that will be appropriate for the study: 520-670-6380 Ext. 121, or by e-mail: Diana.Sammataro@ars.usda.gov. I believe that the lab actually will send you a "kit" including instructions for syrup collection and submittal.

Brief Almond Sales Update

Blue Diamond Growers sent a recent Update newsletter and their November /

December Almond Facts magazine to me. The price for Nonpareil averaged about $1.22 this year. A couple years ago almond growers told me that they could turn a profit at $1.00 a pound. That was before the price of renting bees increased significantly. So, it appears that almond growers should be doing better than breaking even, but they really have to keep an eye on their expenses, as do beekeepers, to keep their enterprises viable financially.

The newsletter also contained some data from 2001 to present. It showed the Year to Date shipments of almonds to have increased by an average 6.8% per year, with the only glitch being 2005, when shipments dipped by 20% before returning to the ever increasing trend line the next year.

Imidacloprid and the Real World

The Entomological Society of America met in San Diego in early December. I have been a member of the society since the 1960's, but this is about the third annual conference that I have attended.

There wasn't much on the program about honey bees and imidacloprid, but because it is being used in so many ways for pest control, I did have an opportunity to hear many reports of its use on turf and ornamentals.

If nothing else can be said, imidacloprid is a very interesting chemical. When applied to healthy plants, with no known organisms attacking or feeding on them, the plants grow faster and larger. Bayer chem.-ists believe this is due to enhanced biochemical pathways in the plants dealing with energy production and use.

Despite the fact that imidacloprid is pretty safe to use around vertebrate animals, it is pretty tough on invertebrates (including target and non-target insects). That leads to secondary, unexpected problems and some of those were discussed at the meeting.

In one case, it was suggested that imidacloprid be used on golf courses to eliminate insects feeding on the grass. That was done and for a year, and the lawn was spectacular. Then the grass began to look rather ill. More fertilizer and water did not help much. A careful look below the surface determined that there no longer were earthworms turning over nutrients and aerating the soil. While short term exposure to imidacloprid appeared to not injure the worms, following longer exposure the worms tended to develop swollen regions on their bodies. They looked like snakes that had just swallowed a very large meal. This was a lethal condition. It may take a while for the worms to come back, because imidacloprid does persist for quite a while in soils. Meanwhile, the grounds keepers at the golf course are pulling aerating equipment across the turf.

On Long Island, New York, use of imidacloprid around residences and businessses has put enough of the chemical into the soil to contaminate 12 of 15 wells that were sampled. Thus, in that area, imidacloprid is a "restricted use" material, to prevent use in gardens and around homes. Lawn pest control has reverted back to Dylox®. There also is some research suggesting that imidacloprid can be taken up by plants during the "dormant season."

A closer look at the activity of nematodes attacking lawn grubs determined that the nemas were not affected at levels of imidacloprid that reduced the grooming and evasive behavior of the grubs. In fact, the chemical and nematodes could be tank mixed and applied together.

In New York City there apparently is a park in which a valiant effort has been made to protect the American elm trees from Dutch elm disease. This is done by main-

taining a protective layer of insecticide on the trees to prevent the elm bark beetle from feeding on the trees and inoculating them with the causative fungus.

It was suggested that treatments around the roots with imidacloprid would protect the trees. A couple experimental trees were treated. Not surprisingly, the leaves on treated trees were larger than on non-treated trees. However, by late summer, the leaves had turned brown and fallen from the trees very prematurely. Close examination disclosed very heavy populations of spiders mites which damaged the leaves enough to make them drop.

This isn't terribly unexpected, since similar results have been observed on a number of agricultural crops. Besides stimulating plant growth, sublethal doses of imidacloprid seem to stimulate more rapid and higher numbers of egg production (hormoligosis) in some species of mites.

Another interesting behavioral trait of predators, that feed on prey that has fed on imidacloprid treated plants, is that they literally "slow down" in their movements and they "lose their appetites." A really interesting example was of ground beetles that fed on Colorado potato beetles that had feed on treated foliage. The ground beetles wandered off slowly, didn't move for a long time, then seemed to return to normal movement and feeding. A very similar effect was observed with lady-bird beetles (lady bugs) that fed on aphids that were feeding on imidacloprid treated plants. And, a parasitoid that follows frass tunnels of Japanese beetle larvae took 2-3 weeks to get back to normal behavior when taken out of contact with the treated soil.

The sublethal effect on most invertebrates seems to be "intoxication" from which they can recover, if they are not killed, while slowed down, by something else. The ability to survive "knock down" by sublethal doses of imidacloprid suggests that many insects do have an enzyme system that can detoxify the chemical over a period of time, but it can take quite a while.

These are just a few examples illustrating that we have just begun to scratch the surface concerning the consequences of using neonicotinoids in crop, urban, and forest ecosystems. It is not reasonable for us to expect that Bayer researchers could examine every microhabitat in which their products are being used and determine the effects on every creature. However, once it was pointed out to them that there might be problems in some areas, such as with honey bees, it does not seem that they responded as quickly as they might have to dealing with the beekeepers' concerns.

Honey Bee Papers at Ent Soc

The session that I thought might be most enlightening was the special session on CCD. However, there were few surprises and not much new information.

Pesticides in Hives and Bees - Dr. Chris Mullen, an insect toxicologist at Penn State University, presented an overview of his findings when checking for 171 pesticides in bees, stored food and beeswax from CCD and apparently healthy colonies. While the list of chemical encountered was extensive, only a few chemicals were determined to be around in much abundance.

I'm sure that you are not surprised to hear that mite control materials were relatively abundant and at the tops of the lists. I found it interesting that chlorpyrifos (Lorsban®) was near the top of the lists, too. That chemical is used fairly sparsely, now. Also pretty abundant were fungicides. It never occurred to me that they would hang around in the hive. Dr. Mullen stated that in some cases fungicides "synergize" the toxic effects of certain insecticides, but no examples

were presented. Also, up to five pyrethroids were found in some samples, but we still are using them quite a bit.

Were neonicotinoids found? Yes. Were the amounts very high? No. They were way down the lists (beeswax and stored pollen).

So, it appears that the residues in the bees and beehives reflect what the bees are being exposed to in their environment. None of the chemicals appeared to be a specific cause of honey bee losses or to cause CCD.

Israeli Acute Paralysis Virus – There was a bit more stated about IAPV than was written in the December 2007 issue of the American Bee Journal. There are at least four different "strains" of IAPV. One is found only in Israel. We have a western US strain and two eastern US strains (one very similar to that in Aussie bees). It appears that the virus was introduced into the US at least two different times. It also seems that New Brunswick beekeepers have been having trouble keeping their colonies alive and they have IAPV in their colonies, too.

Dr. Ilan Sela, the Israeli investigator who named IAPV, shared some further information about the virus. We already knew that it could work its way into the honey bee's genes, but it also can do the same in *Varroa*. IAPV seems to be a really close relative of KBV (Kashmir bee virus). KBV is very lethal to honey bees, if it gets reproducing in them.

Dr. Sela thinks that IAPV likely may be causing honey bee physiological and behavioral changes, "priming" the bees for CCD, more than actually causing the disorder. That may result in bees that die, bees that survive, or bees that get CCD.

Integrated Virus Detection System – Dr. Colin Stewart, entomologist in the USDA APHIS Veterinary Service, explained a bit about how the IVDS instrument operates. In essence, it takes proteinaceous materials of the correct size, puts an electric charge on the particles, then separates them by size. As they come through the column, a printer records "spikes." The "amplitude" (height) gives a pretty good indication of how much is there. Where the spike is on the chart (left to right) gives an amazingly accurate indication of what the material is. So far, the instrument can differentiate between RNA viruses of honey bees, and specifically identify protein from *Nosema*. They are relating spikes to known viruses, but it appears as though they have a few peaks, from CCD samples, that don't relate to any known viruses, at this time.

A number of individuals are feverishly working on the paper work and instrument overhaul, to get an IVDS instrument operating at the UC Davis Bee Biology Facility during almond bloom. There will have to be a team of experts around to interpret results and keep the instrument operating properly.

Bacteria in CCD Bees – Dr. Jay Evans reported on attempts to identify bacteria found in CCD bees. It took a lot of genetic work (428 sequences) to determine that 17 were different from each other and related to 8 species of bacteria. Those bacteria have been found associated with the intestines of bees all over the world, so Jay called them a "stable bacterial community" and "uniform gut flora" from around the world. What is interesting, though, is that a number of these organisms can not be raised in laboratory culture. The researchers are wondering what would happen to the bees if they "knocked out" the organisms, selectively, using antibiotics. Dr. Martha Gilliam, years ago, was unable to demonstrate bee-specific microbes in honey bee intestines, so perhaps these organisms are residents of intestinal or fat body cells, similar to "symbiotes" of cockroaches.

Honey Bee Pheromones and Behavior

Dr. Gene Robinson reported on how current genetic techniques allow us to look more deeply into how pheromones influence changes in what bees are doing. We now are able to determine which genes are turned off (down regulated) and turned on (up regulated) by examining the bees genes.

As queen mandibular pheromone (QMP) increases, the genes for nursing turn on in honey bee workers of the right age. Responses to brood pheromone and to returning pollen foragers lead to similar results. The nurse bees are prevented from aging into foragers. When that change does occur, the nursing genes are turned off and the genes for producing juvenile hormone are activated.

However, considering just QMP and brood pheromone (of the whole bunch that honey bees have), it appears that there are at least 29 different ways in which these two chemicals overlap in their effects on worker bees, so a simple on and off is way too simplistic.

But, beekeepers will get a kick out of one part of their studies. Researchers found that when worker bees are stimulated by alarm pheromone, there is the immediate "releaser" effect: defend the colony for a while. If stimulated by alarm pheromone repeatedly, there is a "primer" effect on the genes in brains of the workers that causes them to respond to subsequent disturbances with increased stinging. DUH!

Bt Toxin Cyt1A and Bees

Of the many studies conducted on the effects of *Bacillus thuringiensis* and the toxin from that bacterium on honey bees, almost all of them showed that there was little danger to bees. Cyt1A is one of the toxins produced in some lines of genetically modified corn. A more recent study determined that exposure to what was supposed to be Cty1A from corn plants, which usually binds to lipid membranes, actually opened channels into the cell walls of bees. This is an unexpected result and the researchers believe that perhaps another toxin, Cry11A, also is being expressed in the plants from which the toxin was extracted.

Bumble Bees in the Greenhouse

This study is mentioned only to demonstrate the creativity of a graduate student, Andrew Joseph, from the University of Kentucky. The goal was to determine if bumble bees were providing adequate pollination in greenhouse tomatoes without having to go inside and check.

Since bumble bees are "buzz pollinators" (they shake the flowers while hanging on the outside), could the vibrations be sensed by hooking a "pick up" to the basal stem of the tomato plant?

The answer is, "Yes." The student attached a phonograph needle assembly to the stem of the plant and when the bee vibrated a flower, the movement of the stem was adequate to be seen on the attached computer.

On the practical side, at about 100^{o}F the pollen became "sterile" and the bees knocked off visiting until it cooled down.

Stingless Bees Dance

Dr. Adrian Wenner will appreciate this work. Megan Eckles from UC San Diego (La Jolla) and James Nieh from UCSD (San Diego) went to a large open field and trained stingless bees to a feeder. Between the nest and the feeder they stretched a string with patches of cloth at about 15 foot intervals. On the way back from the feeder, the foragers would make extremely short stops at the patches and bite them, leaving a pheromone trail.

The researchers could take the end of the string at the feeder and move it way off target and the bees would follow the string anywhere (vision or olfaction?). They even tried reversing the ends of the string. That didn't change anything, so there seems to be no polarity to the trail. Without the string and patches, the bees mark the most elevated items, like tall weeds or small tree branches.

Upon returning to the nest, the stingless bees dance on a dance platform. Yes, distance and direction, and they have a sound component to the dancing, very similar to honey bees. So, how do they measure distance?

The bees were trained to fly through a tunnel to get to the feeder. The inside walls of the feeder were marked with vertical lines. The more lines the bees passed when they were flying the same distance, the further away the distance instructions (up to 10X) were in the dance. The recruits flew right past the feeder in the field.

Now, for the most interesting challenge. The trees in the area where the bees are foraging are up to 80 feet tall, and these researchers are certain that a height component has to be included in the dance. They intend to train foragers to feeders at various heights, including the top, of an 80 foot tower and analyze the dances to determine how the elevation is transmitted to the recruits. Since I had a few seconds to think about this, would the bees take the recruit right to the base of the tree with the marked trail, or would the trail stop when the recruit reaches the appropriate place to start an upward incline?

Hygienic Bees Smell Chalkbrood

Jodi Swanson reported on studies conducted at the University of Minnesota, as one of Dr. Marla Spivak's students. First they compared the volatiles emitted by healthy and chalkbrood infected larvae. Three chemicals, found only in infected larvae, were tested for detection by honey bees. The bees could detect phenyl alcohol, phenethyl acetate, and benzyl alcohol.

When treated with water (control) and the three odor components, healthy larvae were removed only when treated with phenethyl acetate. This being the case, will treating healthy larvae with that compound be a replacement for the liquid nitrogen technique for selecting stocks with elevated hygienic behavior?

Starved Larvae Attract More Nurse Bees

Bradley Metz, working at Texas A&M with Dr. Tanya Pankiw, deprived larvae of food for various lengths of time and watched the behavior of nurse bees when they were returned to the hive. If the larvae left the cells, they were consumed by the bees. If they stayed in the cells, they attracted many more nurse bees than did normal larvae, and the nurses remained head first in the cells long enough to suggest that they were feeding the larvae.

Hexane extracts of the starved and well fed larvae were placed in wells of plastic dishes and placed with the bees. The extracts of starved bees attracted more nurse bees than that of the normal bees. But, the nurse bees only gave the cells a cursory inspection and moved on.

Package Installation – What's New?

Looking in the April, 1936, issue of the American Bee Journal for another article, I ran across this information from Dr. John Eckert. Dr. Eckert was a professor of apiculture at UC Davis at that time and Secretary of the California Bee Breeders' Association.

Briefly, here are some important considerations Dr. Eckert emphasized when installing packages.

1. Order well in advance of date of desired delivery (eight to ten weeks before expected honey flow, but not before pollens will become available). Have "express agent" call when packages arrive.

2. Have hives set up and ready to go before packages arrive.

3. Examine bees when picking up from express agent. Look for live queens and too many dead bees. If queen is dead, contact shipper for a replacement, immediately.

4. Take bees to a warm room (60-70^{o}F) and feed 50-50 sugar syrup by painting on screen until they won't take any more. Then, move bees to cool (45-60^{o}F), dark location until late afternoon.

5. Take bees to the field. Reduce entrances to about a half inch. Open package and check queen for obvious injuries. Place feeder can, holes down, on top bars of frames. Be sure to remove cork or metal disk over candy end of queen cage. Poke small hole in candy to get bees started. If there is no candy, fill the area with "white inside of ordinary soft chocolate covered candy."

6. Position queen cage, wire screen down, just under top bars between two frames near the feeder can. [Note: attendant bees are not removed.] "Shake some bees over the queen cage and set the shipping cage, top side down, on two sticks on top of the frames. Cover the cage, frames, and feeder can with apiece of burlap and close the hive. [You have to look at the accompanying photo to see that an empty deep super surrounds the mass and holds the hive top in place.

Here we are, 71 years later, and do we handle our packages a bit different? Yes, we take a few short cuts (spray bees with syrup; shake bees out of package cage; no burlap; a small, soft marshmallow instead of having to eat parts of chocolate candies), but we really haven't improved much on this process over seven decades.

Is Honey Simply Honey?

Definitely not, according to Vetakey Stashenko, PhD and naturopathic doctor from the Ukraine. In a very well written article in the March 2007 issue of the Journal of the American Apitherapy Society, Dr. Stashenko describes the physiology of human taste perception, then describes the different taste components of honey. Additionally, Dr. Stashenko relates how major taste qualities of various honeys impact human health.

Referring to ancient Tibetan and Chinese medical practices, the following are a few relationships between honey and health. The Tibetans describe six tastes: sweet, sour, salty, bitter, burning, and binder (tart, astringent), "with sweet taste causing the strongest healing power." Sour is said to "act negatively on the teeth, makes the face wrinkled, and forces the body to lose water by increasing the production of saliva." The rest of the tastes are listed with their attributes.

It is the art of medicine to blend these tastes of natural substances into appropriate medicines. Honey was often used as the medicine or as the diluent to make the other substances palatable.

Some theoretical examples of varietal honeys and their target organs for repair are: buckwheat for spleen, pancreas, stomach, liver, gall bladder, larynx, lungs, heart and ulcers; basswood for spleen, pancreas, stomach, heart, liver, and gall bladder; willow for increasing appetite, quenching thirst, relieving poisoning and rehabilitating the voice; and horse chestnut honey and pollen for varicose veins, hemorrhoids, and phlebitis.

However, there were caveats. Too much of a substance with a predominant taste can produce detrimental side effects to certain organs: saltiness to the heart; burning to liver and gallbladder; sour to spleen, pancreas, and stomach; bitter to lungs and large intestine; and sweet to kidneys and bladder.

If you would like to read this whole interesting article and many more pertaining to using hive products for health, you can order a copy of the March 2007 back issue of the journal ($6), or join up ($45) to receive quarterly issues of this publication by contacting the American Apitherapy Society, 4835 Van Nuys Blvd., Suite 100, Sherman Oaks, CA 91403, (818) 501-0446, aasoffice@apitherapy.org or visit www.apitherapy.org.

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