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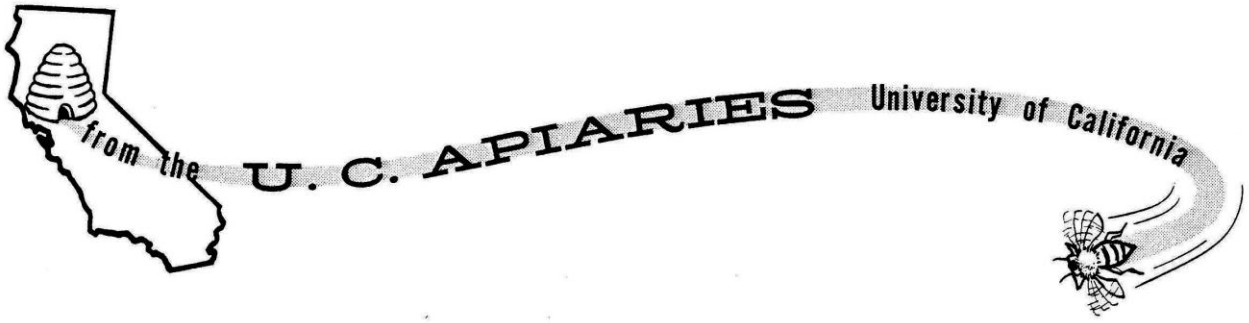

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What Price a New CE Specialist?

Recently, one of our commodity groups approached the highest level of the UC Cooperative Extension administration and asked what it would take to get a CE Specialist position – about to become vacated due to retirement – refilled IMMEDIATELY. The response was – a six-year commitment of $220,000 a year (salary, benefits, support, overhead), starting at the date of the retirement. There would be a brief lag due to recruitment and hiring procedures.

That is a bit steep for beekeepers and producers of honey bee-pollinated crops to provide, so I am going to give more advanced notice in the hope that the position of Extension Apiculturist can remain filled, with little gap, through routine EARLY decision making and planning. Thus, my targeted date of retirement, health permitting, is Aug. 31, 2014. That will complete my 38th full year of service since 1976.

Is Honey Honey?

Recently, there has been a furor over whether honey purchased on store shelves in the U.S. is real honey. The crux of the discussion centers on the term "ultrafiltered" honey. Yes, there is such a thing as ultrafiltered honey. Pharmaceutical and cosmetic companies use the product due to its lack of impurities. The honey is diluted with water, then pumped through micro-filters to remove particulates and some large enzymes, then dehydrated. This is an expensive process that is prohibitively expensive for use with retail, consumable honey. The process, using 25,000; 50,000; and 100,000 MWCO (molecular weight cut-offs) can be examined in detail in: Barhate, *et al*. 2003. *Processing of honey using polymeric microfiltration and ultrafiltration membranes.* Journal of Food Engineering 60(1): 49-54.

The honey in question was purchased from a shelf in a big-box store. In fact, an organization purchased honey from shelves of many big-chain stores. Examination of the honey determined that there was no pollen in the honey. That led to the honey being called "ultrafiltered," which we know is highly unlikely. Then, it is stated that they used the recently instituted California standard of identity for honey to prove it was not real honey. I imagine that they would use the following verbiage from the California Food and Agriculture Code as a basis for their claim: "Section 29413 (e) Honey sold as described in subdivision (d) shall not have added to it any food ingredient, including food additives, nor shall any other additions be made other than honey. Honey shall not have any objectionable matter, flavor, aroma, or taint absorbed from foreign matter during its processing and storage. Honey shall not have begun to ferment or effervesce and no pollen or constituent particular to honey may be removed except where unavoidable in the removal of foreign inorganic or organic matter."

It may be up to a court to decide whether the loss of pollen is "unavoidable" when honey is passed through a set of filter paper sheets that are used to remove dust, sugar crystals, and any other particulates that can act as nuclei around which sugar can form crystals and begin the granulation process in retail-packaged honey. Partially granulated honey loses its eye appeal on store shelves, with uneducated potential honey buyers thinking that the honey is beginning to spoil (cloudiness due to microbial growth).

If consumers believe that the commercial packing process decreases the nutritional value, flavor, or aroma of honey, they can purchase either honey in comb sections or honey from suppliers who simply sieve out pieces of wax after the honey is extracted from the combs. Honey with visible pieces of wax, bee parts, or any other debris must be labeled with the word "Substandard" or "Grade D" using USDA grading standards. Some states like California and Minnesota require a USDA grade on a honey label if the honey is going to be sold in the state but off the premises of the producer. That is why in CA we do not see jars of so-called "raw" honey, containing junk, which can be sold in many other states. If you wish to have USDA Grade A honey, simply strain it through a nylon stocking or nylon sieve that is used in paint buckets (before using the paint in a paint sprayer).

The current type of straining to extend shelf life of honey has been used for probably a century or more in the honey business. This is the first time that anyone has suggested that the honey purchased is not honey.

Pristine Revisited

There have been so many reports of brood problems, following Pristine® fungicide applications on various crops around the country, that something is happening which requires explanation. Well-designed and conducted laboratory and semi-field experiments, as well as other experiences under real world conditions, have demonstrated that Pristine can be applied to blooming crops with no negative impacts to the bees. What might be causing these differences?

In at least one case in northern California, in which queen honey bees could not be reared in colonies containing Pristine-contaminated almond pollen, the fungicide was tank-mixed with a super spreader, super-penetrant adjuvant (polyether-polymethylsiloxane-copolymer). So, we return to a subject I have covered before.

Adjuvants can be combined with pesticides to improve coverage on plant surfaces. They induce water droplets to spread out and form a thin layer over the plant surface. In some cases, the penetrant activity moves the pesticide into the plant tissue. Newer organosilicones adjuvants boast of their ability to move pesticides through woody tissues, through bark, and even through the waxy cuticle of a *Eucalyptus* leaf. The first line of defense of honey bees against toxic chemicals is their waxy cuticle. There is a video on adjuvants and bees, with sound that is a bit difficult to follow, at: http://www.extension.org/pages/58642/abrc2011-a-primer-on-pesticide-formulation-inerts-and-honey-bees.

Apparently, EPA has been convinced to take a closer look at "inert ingredients" in pesticides. In most cases those chemicals are proprietary secrets and are not identified on the label. Alkylphenol ethoxylates are commonly used in adjuvants. Due to links to endocrine system disorders, akylphenol ethoxylates are being phased out at this time. Since failure of pupae to emerge into healthy adult bees begins 17 days after some Pristine applications, and continues for a week or more, could this be a disruption of the honey bee hormonal system due to the consumption of contaminated pollen?

Possible interactions between honey bees and inert ingredients and adjuvants in pesticides could be:

1. Direct acute toxicity to adult or immature honey bees, leading to death.
2. Direct, subacute toxicity, leading to reduced lifespan or physiological inability to accomplish tasks vital to the colony.
3. Interactions with other chemical residues in the hive, making the residues more toxic – synergism.
4. Transportation of other chemical residues and larger molecules through normal tissue barriers in bees. Some of the newer organosilicones are involved in gene transformation of plants, improved virus vectoring, and support of nanoparticle delivery in gene therapy.

Given the ever-increasing number of pesticide residues being found in beeswax, stored pollens, and bees; trying to determine which chemical combinations may be detrimental to honey bees will be a huge task (see: http://www.extension.org/pages/60318/pesticides-and-their-involvement-in-colony-collapse-disorder. However, in the case of Pristine use in almonds, protecting honey bees is not difficult. Applications of any pesticides should be made later in the day, when the pollen has been removed from the blossoms and the pollen-collecting bees are done for the day. Pristine is an excellent fungicide for controlling both early and late fungal diseases of almonds. To avoid selecting for disease resistance by repeat applications of the same chemistry, it is best to reserve a Pristine application for later-season disease problems. That application can be made after the petals have fallen and the bees are gone. UC researchers have demonstrated the product to be equally effective from full bloom to jacket split. Also, Pristine has intrinsic adjuvants that make an application rain-fast in one hour and move the active ingredients systemically (translaminar) into the plant. There is no need for extra, expensive tank-mix adjuvants to obtain the full effect of the product.

To summarize, Pristine has borne the brunt of recent complaints about fungicides that damage brood production in honey bee colonies. Previously, captan and Rovral had that dubious honor. Controlled studies and various field experiences have demonstrated that Pristine, alone, is not likely a problem. However, applications of Pristine have been followed by predictable losses, especially when combined with the organosilicone adjuvants. This dilemma illustrates how very little we know and understand about the complexities of pesticide/honey bee interactions.

Multi-Organizational Meeting

Over a period of six days, at two hotels and four meeting sites, a large group of national honey bee researchers, extension specialists, and state and federal regulatory personnel met in the Washington, DC/Beltsville, MD, area to discuss the state of the art in honey bee research and colony manage-ment. They left very few leaves unturned, but no true "breakthroughs," especially those applicable to colony management and colony health, emerged.

I used to go to large meetings and then review the discussed topics in this newsletter well in advance of the bee publications. Now, however, information can be shot over cyberspace, electronically, in no time. Unlike the "bad old days," when you had to wait for the April edition of the *American Bee Journal* to read the abstracts of all the presentations from the American Bee Research Conference, the abstracts arrived in my office by email this week. If you haven't signed up for this particularly good "bee news service," please do. The link to the subscription page is http://www.americanbeejournal.com/site/epage/79423_828.htm. However, the abstracts

frequently do not contain information on how these research results might influence your beekeeping practices, so I still have something to write about in newsletters.

We devoted the first two days of the six-day marathon in Washington, D.C. to an in-depth critique and planning session for the Bee Informed Partnership (BIP) project being overseen by Dr. Dennis vanEngelsdorp, now on the faculty at the University of Maryland. Dennis is managing a multi-million dollar epidemiological study on colony health across the country designed to "decrease the number of managed honey bee colonies that die over the winter."

I have devoted a separate article on the BIP project, because this project and the survey are so important. The next news item, "Surveyed to Death?" details the issues.

Surveyed to Death?

It must seem to some beekeepers that every time they turn around, they are asked to fill in another set of forms. Counties or states want them to register their apiary locations. NASS wants to know how much honey they produced. The FSA office wants to know how many colonies you will be operating this year. In fact, we asked California beekeepers to return a survey in one of my past newsletters. Now, Dennis vanEngelsdorp has asked beekeepers, nationwide, to go to the web and fill out his "Wintering" and "Annual" beekeeping surveys. Actually, Dennis has had pretty good response from non-commercial beekeepers, but he feels he should have data from around 300 commercial beekeepers to make meaningful analyses. He has data from only 44. Now Dennis would like the data submitted QUARTERLY.

As his peers, we suggested strongly that something had to be done about "survey fatigue" if folks were going to buy in. Each person submitting data over the web is given a user ID and provides a password. Thus, only the individual beekeeper can submit, see, or change their data. The programmers intend to modify the survey software to combine the wintering questions and the season management questions into a single form. Their new program will open up at your last filled-in data sheets when you log in, and all you have to do is tweak whatever details have to be adjusted for the next submission. That should save a bunch of time.

Comprehensive, real-time, summary reports are constantly being generated from analyses of incoming data and are available for anyone to see online. We had an opportunity to see some of the draft reports. The data is displayed as graphs – some bar graphs and some pie charts. While those presentations can give you a glimpse of overall averages, interpretations of results might not be as straight forward as they look. So, each set of data will be accompanied with "Opinions" from any Scientific Advisory Board member who wishes to comment on the results. The Scientific Advisory Board members will have access to more detailed data sets, if they think that is worthwhile, but they will have no indication of who submitted any of the data; it will just be a table of numbers. As a beekeeper, you can review your own personal data and compare it to national averages, but you will not be able to see any other individual beekeeper's data.

When you finish removing bees from almonds, raising and selling queens and bulk bees, dividing up all the strong colonies, and moving your bees to their next resting places, please take the time to visit the BIP

website: http://beeinformed.org. Go down to the mostly hidden sign up ("Sign in to participate!") link at the lower left corner of the page, just above the Google ad with all the human and one dog face, and click on it. The "Participate" page should come up. From, there, just keep going until you can enter your data. You will see, very quickly, how your management decisions and experiences match up with the averages of those from other participants. It is apt to be quite informative.

Pattern of Colony Losses

Dewey Caron and Ramesh Sagili have an interesting graphic included in their ABJ abstract (#3). They segregated northwest commercial survey data and northwest non-commercial operators' data and compared those trends to national average colony losses over the past five years. In all three data sets, the losses were higher in the even numbered years (2008 and 2010) than in the odd numbered years (2007, 2009, and 2011). I have mentioned this before, but had not put years with the phenomenon. Remember, the first really big loss year was 2006. Apparently, a year with heavier losses provides more opportunities to start new colonies from scratch or from splits the following spring. Those new colonies do well for a year and then they begin to have problems. I still believe that what is happening is that young colonies can outrun the problems with parasites, diseases, and toxicants when they are rapidly building population numbers. The next year, if they are not split heavily, or in some other manner made "forever young," they succumb to build-up of the problems they formerly outran. The take-home message is to try to keep your colonies as "young" as possible.

Varroa destructor Genome

A long string of cooperators combined forces to organize the *Varroa destructor* Sequencing Consortium (ABJ abstract #6). Why spend the time and money to figure out what genes are in varroa mites? Because once determined, we should be able to find one or more Achilles' heels that we can target to knock their biochemical pathways out of commission and put the mite out of business.

The one thing critical with this approach is to interfere with pathways unique to the mite, but do not harm the bees. In ABJ abstract #5, the researchers from the Beltsville lab reported having completed the genome sequencing for *Nosema ceranae*. Now we have that information for both *N. apis* and *N. ceranae*. The two species can be compared to determine why their pathologies differ in *Apis mellifera*. And, yes, they can look for biochemical pathways to disrupt in *Nosema*, too.

Nosema Infections in Commercial Bees

Studies conducted in nuclei by Bob Cox and Kate Aronstein on *Nosema apis* (ABJ abstract #7) and in full-sized colonies by Eischen *et al.* (ABJ abstract #9) on *Nosema ceranae* came to similar conclusions. The nucs inoculated with *N. apis* showed impaired colony build up, smaller adult populations, proved less likely to build into colonies useful for pollination or honey production, and two of them lost their queens.

Frank's full-sized colonies had eight permutations of treatments with 50 colonies each treatment (400 total colonies). In the

table accompanying the text it was evident that colony survival was suboptimal. The best overall survival was 33 of 50 (66 percent) in colonies fed substitute and treated with amitraz and fumagillin. These colonies were the second best in average strength in frames of bees (12.9). Second best surviving colonies (22 of 50 = 44 percent) were those fed fumagillin only. Frame strength average was 10.3. The highest average frame counts (14.4) were in the colonies with the third best survival rate (20 of 50 = 40 percent). These colonies were treated with amitraz and fumagillin. The survival rates of the other treatments were in the 17 to 23 (34 to 43 percent) range, but the average frames of bees ranged from 1.9 to 7.5. It was obvious in this commercial operation that extra feeding and varroa mite control were not adequate to maintain colony strength. The most successful four treatment groups all contained fumagillin.

Having seen the previous data, it is interesting to note what Zachary Huang's lab discovered (ABJ abstract #14) about feeding fumagillin to honey bees to control *Nosema ceranae*. In their studies, they found that the antibiotic impacts both the parasite and the protein makeup of the honey bee intestinal tract. In fact, as the level of fumagillin decreases in the bees over time, it reaches a low level which actually stimulates spore production of *N. ceranae*. A similar effect is seen with *N. apis*, but it is not nearly so pronounced. It could be that the low levels of fumagillin may be suppressing the honey bee immune system. The use of fumagillin as a last resort cancer treatment in mammals severely impairs their immune system.

Adjuvants, Again

Chris Mullin and his cooperators at Penn State University (ABJ Abstract #20) have been reverse-engineering some pesticide formulations and testing some of the common "inert ingredi-ents" for honey bee toxicity. N-methylpyr-rolidone (NMP) was the first to be empha-sized. The researchers found that NMP is toxic to honey bees, especially so for brood. With a bit of NMP in the commercial form-ulations, Bravo® was four times as toxic to brood as the active ingredient chlorothalonil is by itself. Tactik® also was four times as toxic to brood as was straight Amitraz. As I mentioned earlier, it is going to be very difficult to try to regulate pesticides based on potential danger to bees when so many inert ingredients and adjuvants are complicating the picture.

Bacteria to the Rescue?

Preliminary studies conducted in Argentina suggest that metabolites produced by bacterial strains of species of *Bacillus* and *Enterococcus*, isolated from honey bee midguts, may be useful in *Nosema ceranae* suppression. The search was prompted by the fact that fumagillin can no longer be used legally in most member states of the European Union.

Most bacteria secrete active biological chemicals into their environment. Some are toxins, including bacteracins that hamper the ability of related bacteria to grow. Some are surfactants, including cyclic lipopeptides that are powerful inhibitors of bacteria, fungi and viruses. These researchers wished to test the metabolic byproducts on the microsporidian, *Nosema ceranae*.

Fortunately, the tested compounds did not harm honey bees. A compound the researchers labeled "Surfactin S2" was found to reduce spore production and to increase sugar syrup consumption compared with inoculated bees fed straight sugar water.

The results are discussed in Porcini, *et al*., 2010. *Effect of bacterial metabolites on microsporidian* Nosema ceranae *and on its host* Apis mellifera. Parasitol Res (2010) 107: 381-388. Web: DOI 10.1007/s00436-010-1875-1.

Sincerely,

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