January/February 2006

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Chaotic Almond Pollination

It all began during the fall and winter of 2004-05. Two major negatives for honey bees combined to cause significant winter loss of colonies. Late summer and fall forage plants were scarce or lacking. That meant that brood destined to become "winter bees" (six month life expectancy) was malnourished and life spans were going to be significantly shortened.

Varroa mites were becoming quite resistant to treatments that had previously cut their numbers way down. The condensed fall brood had a high percentage of infestation. A combination of mite feeding damage and mite-vectored viral diseases seriously injured the already malnourished bees.

Thus, colonies with plentiful bees in the fall began to decline, precipitously, through the winter. It is estimated that the beekeepers across the country, and in California, lost close to 40% of their colonies.

News of the problem preceded the almond pollination season. Almond growers decided to pay a premium for bees to ensure themselves that they had a pollinator resource. Pollination prices jumped about 60%.

The demand for colonies of honey bees for almond pollination surpassed the ability of California beekeepers to provide enough bees long ago. Beekeepers from western states and many states east of the Rocky Mountains have been shipping their colonies to California for many years.

When it was determined that loads of honey bees from states with red imported fire ants had carried the ants into the state in previous years, rigid requirements for certification with an expectation of inspections, at border stations and in destination counties, were implemented.

Reports of previous problems at state border crossings limited the number of beekeepers who shipped bees a long way for almond pollination.

In February of 2005, California almond growers were short on bees. In a high demand, short supply market, prices continued to increase. Some beekeepers, new to California, arrived to find good prices and no problems placing bees. Some beekeepers even purchased packages from Australia, installed the bees, and rented the colonies, immediately. In a number of cases bees rented for early blooming varieties in one part of the state were moved to late blooming varieties elsewhere.

Later in 2005 the honey bees were faring quite a bit better. Colony numbers were returning to normal. Tens of thousands of packages were imported from Australia in time to build them up before winter. Beekeepers started their mite control earlier in the season to protect their winter bees. Late summer and fall forage were pretty good.

On the heels of the 2005 shortage, some almond growers wished to secure their bees early for 2006. Anticipating another possible shortage, growers reluctantly contracted for bees at $110-150 per colony, needing two colonies per acre. The $150 fee caught the attention of every U.S. commercial beekeeper.

Beginning in October of 2005, truck loads of returning California beekeepers and large numbers of eastern state beekeepers hit our border stations. The California Department of Food and Agriculture had the red imported fire ant criteria in pretty good shape. But, beekeepers were not aware that there are other ant species on the quarantine list. Weeds and weed seeds of quarantined plants can also stop a load of bees.

Then, as a final insult, it was determined that many shipments were likely to contain small hive beetles. The beetles had been vexing beekeepers in the southeastern states for years and were pretty well distributed east of the Mississippi River. However, now they were being brought into California.

Since the California Department of Food and Agriculture did not have much experience with this beetle, they gave it a temporary quarantine rating – "Q." In most cases that means that the pest cannot knowingly be brought into the state. In practice, it appears the state handled the beetle as if it were rated "B." In that case, the County Agricultural Commissioners decide if it can or cannot come into their counties and with what restrictions. In the bee breeding counties the beetles were not allowed in. The beetles can devastate mini-nucs that don't have enough bees inside to protect the brood. Complications arose at the border due to communication failures and misinformation.

At this point in time, forms for entering California with bees from out of state can be found at the following Web site: **www.cdfa.ca.gov/phpps/pe/bees.htm**. Other information covers the topics of red imported fire ants, small hive beetles and Africanized honey bees as they are being regulated in California.

Such a large number of colonies of bees arrived this year that there actually was a surplus. Just as the reduced number of colonies in 2005 sent prices up, the excess number in 2006 sent prices down. Beekeepers were approaching growers trying to entice them to ignore their previous contracts and get bees for less. For many beekeepers, this was a near panic situation. They had paid large sums of money to ship their bees to California and now they had no contracts.

Many lessons were learned. It is not a good idea to simply haul a bunch of bees to California hoping for an almond contract. Have a contract, in writing, before providing bees to any grower. Honey bees do not "winter" the same in California as they do in cooler climates. They tend to fly a lot more and consume more stores of honey and pollens. Growers found out the "cheap bees" were often just that – near empty or empty boxes. Some beekeepers found out that not all individuals inspecting colonies, to determine strength, use the same criteria. This is more of a problem dealing with "bee brokers" than with the bee inspectors from the ag commissioners' offices.

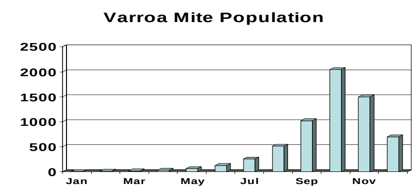
And, next year? The previous information should demonstrate that you cannot predict what is going to happen in the late summer and fall, until it happens. Many colonies, started from packages and splits (divides) a year ago, got through last season relatively unscathed by mites. But, unless those colonies are split again this year, the mites will be much more numerous than they were last year. Will we know how to deal with the mites and get started early enough on mite control this season? Time will tell!

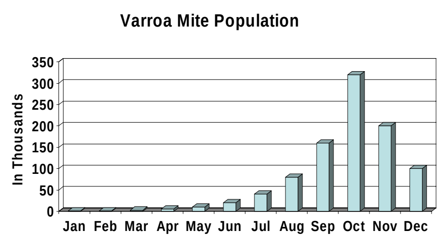
Divide and Conquer

Reports from various parts of the country suggest that there is a certain predictability of colony viability based on their individual history. Colonies that were started from packages or splits (divides) with few frames of brood seem to do well for the year that they are started and over the winter. During the following season, the colonies may look good, but late in the season and over the winter, they tend to dwindle seriously or die.

I believe that can be explained by following the population build up of varroa mites over the two year period. It is easiest to see this phenomenon graphically. Starting the first year with very few mites leads to a mite level at the end of the year that many colonies can tolerate. For this exercise, I am going to use doubling as the rate of mite population expansion. Actually, the mites do not double on the worker brood, but they more than double on the drone brood. So, I compromised.

In the graphics, the shape of the curve looks the same. That is because the math is the same. But pay particular attention to the value on the vertical (left) axis. In the first year case, the numbers stay at or under two thousand. Starting with around 600 mites the second year, the potential level approaches numbers that are
astronomical.





How can this information be used to help keeping bees successfully? For those who only produce honey, the colonies could be culled heavily in the fall and the overwintered colonies split the next spring in time to get the colonies up to size before the honey flow. The reduced mite loads in the splits and former parent colonies would allow the colonies to be strong that year. This cycle could be repeated annually.

Unfortunately, beekeepers who wish to use their colonies for almond pollination in February, or for production of queens and bulk bees in the spring, are not likely to want to cull colonies in the fall. (Actually, if some colonies seem to be sputtering going into winter, you will save time, money, and headaches by letting them go, early). That means that mite levels will not be reduced in the spring and mite populations will increase to unacceptable levels by summer. That normally leads to serious fall and winter losses.

Another approach to trying to prevent *Varroa* from getting too numerous in the colonies is to apply all the techniques that seem to be of some benefit – an IPM approach.

Screened bottoms do help to reduce mite levels if the mites that fall through the eight mesh screen can not get back onto the bees. The mites have to fall through to the ground or get stuck in something sticky under the screen. If formic acid is going to be used as a control treatment, use stainless steel screen – about 10X the cost of galvanized – to prevent severe rusting.

Removing frames of drones early in the season also helps to keep mite numbers subdued. If the mite load is heavy, that is really going to reduce the drone population, because mites tend to eliminate half of the drones, by themselves.

FSA Loans

The USDA Farm Service Agency (FSA) makes loans, partial loans, or guarantees loans to individuals who are having difficulty securing loans from typical financial lenders. Beekeepers trying to enter the commercial ranks of beekeeping are good examples. There is planning and counseling that precedes obtaining the money, but chances are good the funding will be made available.

There are two basic types of loans: Farm Ownership and Farm Operating. Each of these loans can be "direct," from the US government, or "guaranteed," where the beekeeper seeks a loan through a conventional lender, but the UDSA will cover up to 95% of any loss sustained by the lender. Direct loans are limited in numbers, because USDA only provides funding for a relatively small number of them.

In their 18-page color brochure, FSA has a chart that specifies the maximum amounts that can be borrowed. Direct ownership and operating loans max out at $200,000. The ownerships loans can be paid back over up to 40 years. The operating loans come due more quickly – one to seven years. The same payment schedules pertain to guaranteed loans, but the amount borrowed can be up to $782,000, currently.

In the brochure, there is an example of a Louisiana beekeeper who started with an ownership loan, then obtained an operating loan, and now is well on his way in commercial beekeeping.

For more information, contact FSA. Check your phone directory under USDA, Farm Service Agency, to find your local office. On the Web, the address is: www.fsa.usda.gov.

News Bites – Amer. Honey Producers

1. The Texas State Beekeepers have made a commitment to Dr. Tanya Pankiw, at Texas A&M, to provide $500,000 to help upgrade her honey bee laboratory.

2. Efforts directed toward obtaining an additional $500,000 for the USDA Baton Rouge bee lab seemed to be productive. The funds would be used to identify genetic markers of value to bee breeders. However, the perpetual problem with funding for the bee labs appears to be returning.

3. It is expected that very soon a proposed "U.S. Standard of Identity for

Honey" will be published in the Federal Register. Usually, that means there is a 30 day comment period, then the (hardly ever) amended document is published as a permanent regulation.

4. The National Honey Board is trying to formulate a list of analytical laboratories from around the country that will be able to conduct the tests dealing with the standards.

5. The National Honey Board also is working with individuals who are trying to develop a consumer-acceptable "dry, crystalline" honey.

6. It appears that a new label will be printed for bottles of Tylan® (tylosin) with instructions for usage with honey bees. A 100 gram bottle, mixed with 22 pounds of sugar, will provide 500 individual treatment doses. This would treat 166 colonies with the required three consecutive treatments, **after disease is found in the bees**.

7. Scary prognoses from a major bulk honey purchaser and shipper: "U.S. honey producers will not be able to compete on the bulk honey world market much longer."

8. "Before long foreign honey will come into the U.S. already packed for retail shelves."

9. Suggestion for above problems: "Emphasize the high quality of U.S. honeys and find niche markets not in competition with the global market."

10. Two opinions on a "reasonable, sustainable price" of bulk honey for U.S. producers: a. between $0.90-$1.10 for white honey and $0.80-$1.00 for darker honeys. b. a "fair price" for honeys would be $0.75-$1.25.

Research Reports – Amer. Honey Producers

1. Dr. Gloria deGrandi-Hoffman: Working on adjustments with liquid protein diet so that the price is reasonable and the shelf life of partially consumed diet is acceptable. Also working on formulations to deliver 2-heptanone, at mite-toxic but bee-friendly levels, to bee colonies. It appears that the 2-heptanone (an organic solvent) dissolves a portion of the mites' cuticle. Even though dried fruit films did not deliver the chemical as desired, the researchers hope to have test formulations in the hives of beekeepers by late July or early August.

2. Dr. Allen Sylvester is the individual searching for genetic markers of value in breeding bees. His first target is genes for resistance to chalkbrood disease.

3. Dr. José Villa is studying tracheal mite resistance mechanisms in honey bees. The infestation rate of Russian bees is about half that of Italian bees. Russian bees do considerably more individual grooming.

4. Drs. John Harbo (retired) and Jeff Harris are studying the details of *Varroa* removal by hygienic bees. They have found that SMR bees remove infested brood at the pink eyed pupal stage. What they really want to determine is what happens to the mother mites that were in the emptied cells.

5. Dr. Tom Rinderer is continuing studies on the results of various crosses of Russian stocks. Tom is having difficulties keeping Italian queens in the population for 24 months. However, around 75% of the Russian queens will survive for two years. Tom also found that laying worker colonies can be requeened about 50% of the time, if the new queen is introduced as a cell. Queen longevity in splits varied from 45-65% at the end of the year. Experience with early season feeding suggested that Russian bees might be able to be stimulated to almond

sized populations in February, if kept in a warm location. Some less attractive lines of Russian bees have been removed from the program.

6. Dr. Bob Danka is trying to determine how well Russian stocks and VSH (*Varroa* Specific Hygiene – used to be SMR: Suppression of Mite Reproduction) lines pollinate crops. Previous studies demonstrated a 10% increase in pollen foragers for each additional frame of bees (Italian or Russian). For each additional full frame of brood, forager numbers increased 40%.

7. Dr. Lila De Guzman observed that small hive beetles (SHBs) can pupate in the hive, if enough debris is allowed to accumulate on the bottom board. Entrance reducers did not do much to limit SHBs entering the hives. Russian colonies have fewer SHBs than Italian colonies. African "cape" bees, that live with the beetles, remove 67-91% of them from the colony. European honey bees tend to remove only 57%. However, once they get into the hive, both races of bees are infested at about the same level. The beetles prefer to move down into an empty cell in the brood nest and lay eggs, through the cell walls, in the six occupied cells surrounding the empty cell. Russian and Italian bees removed about 79-80% of the infested brood, but they removed a bunch of non-infested (at least to the unaided eye) brood, as well. The beetles laid more eggs in cells of Russian than Italian bees: about 50 per cell when laid through the cell wall and around 20 through the cappings. About 15 beetles per cell result from those infestation levels. The most disturbing observation: Baton Rouge beetles seem to be resistant to coumaphos. Currently, Florida beekeepers are using lime in the tray of the West beetle trap. But, care must be taken because lime dehydrates bees.

8. Dr. Kate Aronstein described some of the results of the honey genome project. The honey bee genome is about 1/10 the size of the human genome. The source of bees for the project was drones from the Weaver operation. The third "release" of the genetic code is available on-line. In addition to listing what has been found in the bee, the site displays homologous codes from *Drosophila* (the lab fruit fly) and a mosquito. In *Drosophila*, in particular, researchers already know what a lot of the genes code for. We now know that when two different alleles appear on the bee sex determination locus, the result is a female bee because a female specific protein is produced by the csd portion of the genome. In drones (only one sex allele) or diploid drones (two similar alleles), the csd portion of the genome just does nothing, so the result is a male. Studies also are being conducted to determine what genes are turned on and off during the aging process of bees and the response of the immune system to disease pathogens. Specifically, work is being conducted on responses of bees to AFB and chalkbrood. Both of those organisms are being "sequenced" to determine what they use for mechanisms to avoid the immune system of the bee.

9. Dr. Pamela Gregory, now conducting research at the USDA bee lab in Weslaco, compared the consumption and physiological effects, on newly emerged worker honey bees, of fresh pollen, old pollen, FeedBee®, and BeePro® Dry. Some of the tests included Africanized honey bees (AHBs). The only differences between AHBs and European honey bees (EHBs) were: 1. AHBs bulked up more quickly – four days versus eight for EHBs, and 2. EHBs were heavier when they finished feeding. Bees preferred fresh pollen and began consuming it heavily on days two and three. FeedBee was attractive the first four days. The bees were reluctant to get started

on BeePro, then ate it on days three and four, best on day five. Consumption of feeds and weights of bees varied consistently (best to worst) from pollen, FeedBee, BeePro, old pollen, control (unfed). Life expectancies followed the same pattern.

10. Dr. Raul Rivera also reported on studies with Apiguard®, a timed-release, gel formulation of thymol. According to the literature, the treatments work between 50-150°F. Two treatments are supposed to be better than one. In cool weather, two doses of 50 grams each, at 14 day intervals, worked well. In warm weather, it took three doses of 25g each to perform as well. When there was little or no brood in the colony, control reached 90-96%.

11. Dr. Jeff Pettis, at the USDA bee lab in Beltsville, MD, conducted more studies on the effects of coumaphos-contaminated comb on development and longevity of honey bees. Queens reared in cell cups containing 100 ppm coumaphos (the residue tolerance level set for beeswax by EPA) only had a 45% chance of emerging, and they were light weight. One queen made it from a 1,000 ppm cell, but she weighed only half of normal. If thy made it to the mating nucs, queens reared with or without coumaphos had the same mating success. Queen loss over six months was: control – 50% (inexplicably bad); 10 ppm – 45%; 100 ppm – 31%. Emergence of worker brood was: control – 95%; 100 ppm – 78%; 500 ppm – 60%; 1,000 ppm – 50%. Thirty to fifty of each set of worker bees were confined to cages with sugar syrup for 21 days. It appears that if they make it to adulthood, then their life spans are similar: control – 21.0%; 100 ppm – 17.5%; 500 ppm – 18.0%; 1,000 ppm – 20.0%. Drones were not included in this study, but they appear to be the caste of honey bees most susceptible to coumaphos.

<u>Research Report – American Bee Research Conference</u>

Each year the American Association of Professional Apiculturists (AAPA) sponsors the American Bee Research Conference (ABRC). This year the researchers, extension and regulatory personnel met in conjunction with the American Honey Producers' Association. One of the presentations is reviewed below. Extracts will be printed in the American Bee Journal later this year.

Dr. Nancy Ostiguy, at Penn State University, has been studying virus diseases of honey bees. Pouring over old data, it appears that sacbrood (a viral disease of honey bee larvae) was more common before we started using antibiotics. When tracheal mites became distributed, sacbrood increased a bit. With *Varroa*, sacbrood is even more common. Usually a spring phenomenon, if a colony has chalkbrood, it is likely that sacbrood will reappear that season. Fortunately, sacbrood does not cause colony collapses. However, Kashmir virus, also vectored by *Varroa*, does kill adult bees.

Their studies on deformed wing virus (DWV) determined that it is directly correlated to colony crashes. An adult bee emerging with DWV only lives about 48 hours. If a mite feeds on the pupa and causes a deformed adult to emerge, any lab manipulation of the bee will kill it. If a mite feeds on the pupa and it emerges looking "normal," inoculations with heat-killed *E. coli* will kill the bees. Bees reared mite-free can handle injections of heat-killed *E. coli* with no problem. DWV also appears to be transmitted "vertically" (through successive stages of the life cycle). DWV is distributed in every tissue of the drones that have been studied, including the reproductive tract. It causes drones to fly prematurely and mature drones were not found in the colony populations. The more they looked, the more

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places DWV was found – in bee tissues and in hive stores. It is no wonder that we have problems keeping our colonies alive.

Sincerely,

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