# APIS

**Apicultural Information and Issues**

*From IFAS/University of Florida*
*Department of Entomology and Nematology*

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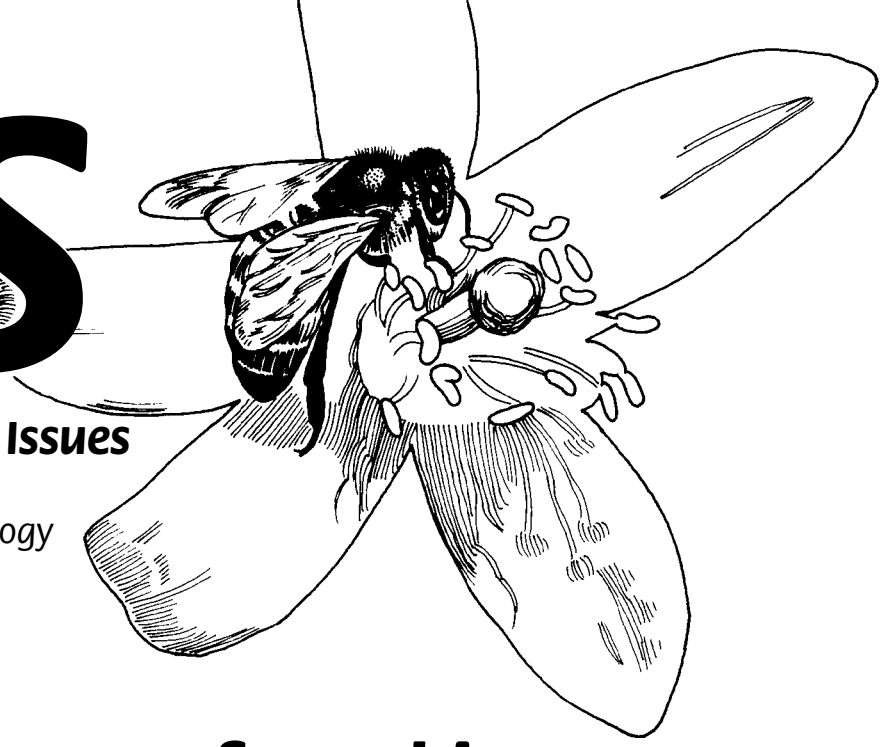

## Inside APIS:



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# The Tao of Smoking Bees

SOME MAY BE FAMILIAR with a martial art called Tai Chi Chuan, or ultimate fist, based on the Tao philosophy[1]. A principle of this form is that one should strive to be like water, at once the softest of materials, which at the same time is one that can erode rocks. Masters seek to be so soft that attackers' energy actually rebounds against them and they can be knocked down with little perceived action by the defender. Another way of putting this is that while less is more, much less is much more.

It is Costa Rican Dr. William Ramirez's opinion that many beekeepers in his country and other places in the American tropics oversmoke their colonies. Although not considered a problem in European bees, he says, which don't usually have much of a temper, when Africanized bees are treated this way, all hell breaks loose. At first blush, this concept appears to have little grounding in fact. Much has been said of the AHB and its reaction to smoke. Beekeepers who have been to international meetings or seen videos of Africanized honey bee management are aware of the large smokers used by beekeepers in the tropics to keep these sometimes overdefensive insects under control. In most cases, not only is an oversized smoke pot used, but there may be one employee whose only job is to make and apply more and more smoke. Use less, not more smoke is Dr. Ramirez' rebuttal to those who would counsel such a course of action.

To prove his point, Dr. Ramirez ventured into a hot (literally and figuratively) Africanized bee yard in Trinidad last August as part of a field trip connected with the First Caribbean Apicultural Congress. One hive had already been provoked to the point that its occupants were pretty much out of control. Once a colony gets into that state, this generally alarms nearby hives and they also become defensive. Dr. Ramirez, however, approached a colony that had yet to be opened and applied the smoking ultimate fist, just a light puff to the entrance and under the top. He waited two minutes, then proceeded to manipulate the nest. After opening the colony, Dr. Ramirez put his hand in front of the smoker to delicately spread the plume over the top bars, minimizing the smoke, much like one would use a finger to control a water hose spray. In short order, he was able to complete his manipulations and move on without more than a sting or two. It was then that the idea hit me: Perhaps for the most defensive of bees, one should use the smallest amount of smoke, as any Tai Chi Chuan master might counsel.

Part and parcel of this is waiting at least two minutes after administering the first puffs before beginning manipulations. This initial time period in fact may be the key to the Tao of smoking bees. It is possible that once that time threshold has passed, a switch has turned off the colony's defensive tendencies. Puffing and *Continued next page*

[1] http://gnv.fdt.net/~taohouse/

# Determining Varroa Population Levels

One of the most vexing problems in controlling Varroa mites is getting an idea of the level of infestation found in a colony. This is not easy and requires constant monitoring. It is necessary not only for determining if treatment is necessary, but also to discover whether or not mites might be becoming resistant to treatment[2]. Varroa population levels can be determined on a relative basis using several techniques, including ether roll, drone brood examination and mite fall on a sticky board.

In the April 1998 APIS, I suggested that the sticky board in fact is a new, important and necessary tool in the beekeeper's bag of management tricks[3]. One can make sticky-board traps by cutting wax paper sheets to bottom board size and spraying the top with aerosol non-stick cooking oil (like PAM® or any other vegetable oil spray). Usually an 8x8 mesh or smaller hardware cloth is placed at least 3/8 of an inch above the sticky paper surface so the mites can fall through, but the bees can't. A variation of this is to use Varroa bottom boards without sticky paper. This is not a monitoring device so much as an alternative control mechanism that prevent mites from returning to the brood nest through means other than sticky materials[4]. Trapping technology like this is used in many other areas of production agriculture[5].

In the February 1999 *Newsy Bee*, Dr. Dewey Caron at the University of Delaware reports on a study using sticky boards comparing natural mite fall or that induced by using Apistan®. Both techniques gave similar proportional mite numbers. Average natural mite fall in July and September was 18 to 19 percent of that caused by Apistan®. The study concluded that monitoring mite populations using natural mite fall onto a sticky board is chemically free and economical, and more importantly, just as effective as the same technique that employs Apistan®.

Perhaps the most detailed publication on estimating Varroa population I have seen is printed by the MAFF (Ministry of Agriculture, Fisheries and Food) for use in the United Kingdom (England and Wales). Besides natural mite fall, the pamphlet (*Varroa jacobsoni*: Monitoring and Forecasting Mite Populations Within Honey Bee Colonies in Britian) also shows how to estimate populations using sealed brood or adult bees. Along with this publication comes a Varroa calculator, which looks and works like a circular slide rule. It employs the following ratios for determining final Varroa populations:

**Converting daily mite drop to estimated number of mites in a colony:**

November to February: Daily mite fall X 400 = Estimated number of mites.

May to August: Daily mite fall X 30 = Estimated number of mites.

March, April, September, October: Daily mite fall X 100 = Estimated number of mites. This number is considered much more of an approximation than the others because of rather large bee population shifts during spring and fall in Britain.

**Converting sealed brood and adult infestation:**

Number of sealed drone cells infested/ Number of drone cells sampled X Number of sealed drones cells in a colony X 10 = Est. number of mites in summer.

Number of sealed worker cells infested/ Number of worker cells sampled X Number of sealed worker cells in a colony X 1.8 = Est. number of mites in summer.

Number of adult bees infested/number of bees sampled X Total bees in colony X 2.9 = Est. number of mites in summer.

Number of adult bees infested/number of bees sampled X Total bees in colony = Est. number of mites in winter.

The pamphlet has good photos showing the amount of sealed brood and number of adult bees present on frames for final estimations. Dr. S. Martin of the UK's National Bee Unit (NBU) developed the calculator and publication. Forecasting mite buildup is tricky, according to the pamphlet, since no definitive data exist on what size population will cause irreversible damage. The author suggests that when a colony has a peak mite population less than 2,500 in August and September, it will not collapse the following winter. Above this number, probability of a colony collapsing increases as the mite population increases. The calculator can by used to determine the lowest mite population level at certain times necessary to ensure the peak of 2,500 will not occur during the remainder of the year.

> *"Monitoring mite populations using a sticky board is just as effective as the technique that employs Apistan®."*

Again, these numbers were published specifically for UK conditions. They will not necessarily apply elsewhere in the world, but do show show how mite populations can be estimated. For further information on the calculator and pamphlet, contact NBU, CSL, Sand Hutton, York YO41 1LZ. Some of the same material can be found in an earlier MAFF publication on the World Wide Web[6]. ■

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*Tao of Smoking Bees Continued* going in immediately, as is the wont of many beekeepers unwilling or unable to wait, may not allow enough time for the colony to get the message. Much more study is required on this issue to better develop scientific knowledge about honey bee reaction to smoke. The defensive threshold may be quite different at certain times or with specific races of bees. The smoker remains the first line of defense, and the dictum to keep it well lighted and at the ready should always be heeded by the careful beekeeper. ■

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[2] http://www.ifas.ufl.edu/~mts/apishtm/apis99/apfeb99.htm#1
[3] http://www.ifas.ufl.edu/~mts/apishtm/apis98/apmay98.htm#3
[4] http://www.ifas.ufl.edu/~mts/apishtm/apis98/apdec98.htm#6
[5] http://www.treemail.nl/missinglink/old/prod02.htm
[6] http://www.tdale.demon.co.uk/BeeKeeping/maff_index.htm
[7] http://www.ifas.ufl.edu/~mts/apishtm/apis99/apjan99.htm#1
[8] http://www.ifas.ufl.edu/~mts/apishtm/apis90/apjul90.htm#4
[9] http://www.ifas.ufl.edu/~mts/apishtm/apis97/apaug97.htm#4
[10] http://www.ifas.ufl.edu/~mts/apishtm/papers/CANADA.HTM#3
[11] http://www.apimondia99.ca/

# Measuring Relative Toxicity: The $LD_{50}$ Level

In the January 1999 *APIS*, I referred to differences in toxicity of chemicals by using the term $LD_{50}$[7]. This is the standard way to determine chemical toxicity and is a concept anybody who is even remotely involved with control materials should be familiar with.

The exact lethal dose of any chemical is difficult to determine. Almost anything taken to extreme, including unusually benign materials like water, for example, can be lethal. There are many variables that could be responsible for the death of any test animal within a specified group of organisms. Thus, scientists have had to come up with a procedure to determine relative toxicity. This is usually expressed as an $LD_{50}$ level, and is the dosage of a material that kills, or is lethal to, 50 percent of a test population.

As a hypothetical example, if a friend weighed 177 pounds (70 kilograms), and ate 500,000 milligrams (about a pound) of some material and did not die, one would probably consider it safe. If his buddy (same weight, sex, etc.) ate 400,000 milligrams and died, one might conclude it was unsafe. In a larger sample, it might be observed that five out of 10 friends died after consuming 450,000 milligrams of the material. This would in fact be the oral (consumption) $LD_{50}$ level and it would be stated as 450,000 mg/70 kilograms (6428 mg/kg). Again, in this example there would be survivors. Thus, it is only possible to say that 50 percent of individuals would die at the $LD_{50,}$ but not specifically which ones.

The basic rule to remember is that, in general, the larger the number the safer the material. Most $LD_{50}$s are calculated on rats, but other test animals may also be used. Whether what can be applied to rats or other test animals is also true for humans remains controversial.

No matter what test population is used, establishing the $LD_{50}$ is not an exact science. Varying $LD_{50}$ levels reported by different organizations is a testament to this. Determination is also made more difficult because levels can be different based on the type of exposure. For example, larger numbers are usually calculated for dermal (skin) contact than for consumption by mouth, which is much more risky. In the final analysis, it is up to each individual to determine what specific risk any chemical might be either to themself or their bees. An established $LD_{50}$ level provides a vital clue, but not a definitive answer, to these important questions. ■

# Supplemental Protein Feeding

As far back as 1990, I discussed the concept of what a quality protein source means to a honey bee colony. Much of the inspiration for this was work cited in Australia[8]. It is becoming clearer that good nutrition cannot be ignored if bees are to achieve their maximum production, especially in these times when stress factors are combining to become lethal to bee colonies[9]. Research in Canada, for example, has shown that well nourished bees are able to withstand being parasitized by Varroa better than less well fed sisters[10].

A recent article in *BEE BIZ* (Number 9, February, 1999, pp. 12-14) titled "Your Bees Are What You Feed Them," confirms that if you feed your bees well, they will feed you well. The author, Mr. Charlie Stevens, outlines the evolution of supplementary feeding in Condamine Apiaries, Queensland, Australia. Mr. Stevens says bees have benefited from the policy of when in doubt, FEED. He says among other things that protein cakes have been very important to his operation. They are approximately 100 mm x 50 mm x 15 mm, and two cakes are fed at 21-day intervals. They may increase the number of cakes fed per hive if conditions deteriorate. The only restriction they place on feeding is cost, preferring to feed all hives two cakes at 14-day intervals, prior to and during nectar flows. The cost of the cakes is AU$6.50 per kg (2.2 pounds = one kg) up to 99 kg and AU$6 per kg for 100 kgs and over. There are 20 kgs of protein cakes per carton and one carton will feed 100 hives. Although touting the advantages of these cakes, no information is provided in the article on what they are composed of. Only the name of the manufacturer, C.B. Palmer & Co., is given, along with the fact that the cakes are pollen enriched. Mr. Stevens does say experience using soy flour has not been satisfactory. *Continued next page*

> *"If you feed your bees well, they will feed you well."*

# Apimondia in Vancouver

It's not too early to begin planning for the North American beekeeping event that will usher in the new century in grand style. Apimondia (International Federation of Beekeepers' Associations) is scheduled to meet in Vancouver, B.C., Canada, September 12-18, 1999. This will be the first time the convention has met in temperate North America since the 1967 conference in Maryland. It should not be missed by anyone on the continent interested in bees and beekeeping. The organizing committee has invited over 200 speakers who will participate in some 30 sessions. The commercial exhibit has space for 154 booths. Already confirmed enterprises include equipment manufacturers from the United States, Canada, México and Europe. Specialty exhibits will deal in everything from venom collection to basic beekeeping education.

The second circular has been distributed. It itself is worth having as a souvenir. The cover of the folder features a full-color rendition of a honey bee superimposed on a Canadian maple leaf. Inside is a three-page foldout panoramic view of Vancouver's harbor. For more information, contact Venue West Conference Services, #645- 375 Water St., Vancouver, British Columbia, Canada, V6B 5C6; fax: 604-681-2503; E-mail: congress@venuewest. com. Full details about this event are found on the World Wide Web site[11]. ■

Many pollen supplement recipes are based on low fat soy flour that may or may not be pollen enriched[12].

Mr. Stevens concludes that "hive population is critical, we endeavor to operate hives with at least five well filled out frames of brood and maintain hive population levels in the area of 35,000 bees per hive. To sustain these levels we must provide supplementary protein, this is where the protein cakes come into their own. We have no faith in supplementary foods for bees that do not contain pollen or honey. From our observations we believe that caring for the nutritional well-being of our hives assists hives in dealing with bee diseases often related to stress. For the future we plan to continue to fine-tune our supplementary feeding program and have developed an interest in the value of supplying water by means to top feeders to hives. Comments by researchers and our own experience of supplying water for hives indicates that a ready supply of water may add another dimension to our understanding of the complete nutritional needs of our bee hives. Research into honeybee nutrition should be ongoing, we have already benefited as an industry from research in this field."[13].

Although many would agree that more study is needed in bee nutrition, the demands of the moment (e.g. tracheal mite, Varroa, small hive beetle) have often meant that funds for studying the basics are often not available. Fortunately, a recent contribution in the area comes from Brazil. Drs. Cremonez, De Jong and Bitondi, at USP Ribeirão Preto, have recently published a study in the *Journal of Economic Entomology* (Vol. 91, No. 6, December 1998, pp. 1284-1289) in this arena. Its title is "Quantification of Hemolymph Proteins as a Fast Method for Testing Protein Diets for Honey Bees."

The authors fed several diets to young worker bees. One hundred twenty newly emerged bees were confined for six days, fed various diets and their blood (hemolymph) collected. The protein concentration of the hemolymph was then calculated using a spectrophotometer. The diets consisted of:

1. Half freshly collected bee bread; half candy.
2. 40 percent soy bran flour; 10 percent sugar cane yeast; 50 percent sucrose.
3. Half pollen trapped from colonies; half candy.
4. Half fine ground corn meal; half sucrose
5. 50 percent sucrose solution in water (protein free).

The results showed that there was no difference in diets being accepted and consumed. The table below shows the protein levels in individual bees:

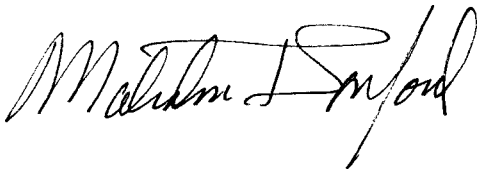
| | Diets | | | | |
|---|---|---|---|---|---|
| Age, days | Bee bread | Soybean/ yeast | Pollen | Corn meal | Sucrose |
| 0 | 7.50 ± 1.53 | 5.73 ± 2.12 | 4.41 ± 0.71 | 7.03 ± 1.68 | 7.10 ± 2.12 |
| 2 | 9.11 ± 2.17 | 7.16 ± 1.15 | 7.66 ± 2.43 | 6.72 ± 1.10 | 4.34 ± 1.41 |
| 4 | 14.93 ± 2.42 | 10.58 ± 3.35 | 8.13 ± 1.71 | 4.27 ± 1.13 | 3.78 ± 2.15 |
| 6 | 27.57 ± 7.41 | 24.06 ± 2.54 | 11.36 ± 2.92 | 3.98 ± 1.02 | 2.17 ± 1.14 |

The protein level increased over the six days for the bee bread, soybean/yeast and pollen diets, but decreased for both the corn meal and protein-free diet. Highest protein levels were seen in bees feeding on bee bread, followed by soybean/yeast and pollen.

A pollen substitute should be inexpensive, nutritionally adequate and readily consumed, the authors state. A rational approach would be to investigate animal and human foods already on the market and test their value in beekeeping. Ingredients available in one country may not be in others or may be too expensive. Likely candidates are different soybean flours (solvent or expeller processed), yeasts (torula, brewers) and perhaps others that become available in the future. A specific plant in Brazil, the barbatimão, for example, is another possibility[14].

The authors say that measurement of protein in the hemolymph of adult worker bees is a useful, rapid, practical and precise method for determining diet suitability. They conclude that because diets were most different in six-day-old bees, and those fed on bee bread had the highest protein levels, the logical strategy would be to use these conditions as standards when comparing various formulations. ■

Sincerely,



[12] http://www.ifas.ufl.edu/~mts/apishtm/apis92/apfeb92.htm#2
[13] http://www.honeybee.com.au/Library/ca.html
[14] http://www.ifas.ufl.edu/~mts/apishtm/papers/TERES.HTM#12

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