

Bee Health: Putting Control in Last Place

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Keeping our honey bees healthy is an enormous challenge these days. Here I outline a strategy that I urge all beekeepers to consider.

The strategy follows three deliberate steps: *Knowledge, Prevention and Control*. This sounds almost trite, but in fact many beekeepers jump from a little knowledge to a lot of control. Some go straight to the control step irrespective of knowledge. I would like all beekeepers to consider putting control last, which requires considerable restraint and caution. It is easy for all of us, as beekeepers, to think we need to help the bees every step along the way. Despite our tendency to try to control nature, it is not healthy for the bees to be fully domesticated, for them to be totally reliant on us. Since the introduction of *Varroa* mites, we have made our European-derived bees chemically dependent on our medications for their survival, and this is not a wise strategy. Bees really need to develop their own defenses against diseases and parasites. The best beekeeping practices follow the bees' lead. Management practices should intervene only to enhance the bees' natural tendencies, not to push them beyond their limits. The art of enhancing the bees' lead is the *Prevention* step of this strategy.

1. *Knowledge:*

- **Learn** about bee diseases and mite pests.
- Be able to recognize **clinical symptoms** of diseases and the **life-cycle** of the mites.

2. *Prevention:*

- Implement **novel beekeeping practices** to avoid getting and spreading diseases and mites.
- **Sample** your colonies for diseases and mites.
- **Bee self-defense!** Use stocks of bees that demonstrate some resistance to diseases and mites (see sidebar).

3. *Control:*

- Use **cultural / mechanical / non-chemical control** techniques to reduce transmission if your bees do have diseases or mites.
- **Last resort:** Use chemical treatments only when absolutely necessary!

Knowledge

Solid, research-based knowledge about honey bee diseases and pests is relatively easy to come by. There are a number of books on recognizing bee diseases and the lifecycle of mites (see references at end). Consider enrolling in our on-line course on "Healthy Bees" that can be accessed through www.extension.umn.edu/honeybees. Read bee journals, attend bee association meetings, and listen to talks by researchers!

Prevention

Beekeeping Practices:

The most essential beekeeping practice is to make sure all colonies have large pollen and nectar stores at all times. If you need your bees to be strong in February (for almond pollination for example) they should be fed a high quality pollen substitute or supplement in fall and winter. Knowing when and how much to feed bees is an art that comes with experience. In general, the more proactive you are about providing supplemental feedings, the better. Good nutrition is critical for keeping healthy bees.

Another essential practice you can implement to prevent diseases is to replace all combs within the brood nest of every honey bee colony every 3-5 years. Traditionally, beekeepers do not replace combs in the brood nest because it is costly to replace the foundation, and is energetically

costly for the bees to secrete wax to build new comb. Some beekeepers are proud to own combs that are over 30 years old.

Old combs in the brood nest harbor disease spores from at least three honey bee diseases: American foulbrood (caused by *Paenibacillus larvae*) chalkbrood (*Ascosphaera apis*), and nosema (*Nosema apis* and *N. ceranae*). These spores may remain viable in combs for many years. Many beekeepers have had the unfortunate experience of purchasing used equipment from a beekeeper, or hiving a new colony of bees in used equipment, and having the bees die from spores lurking in the combs.

In addition, beeswax absorbs some pesticides, depending on the properties of the particular compound. The accumulation of pesticide in beeswax most likely has negative effects on the health of bees.

Sampling:

Sampling your colonies for diseases and mites may be the most important thing a beekeeper can do. A little time spent on sampling could save your bees and could make or break your operation. Colonies should be routinely sampled for *Varroa* mites and *Nosema*. It is also wise to sample colonies for tracheal mites, particularly in some regions of the US (tracheal mites seem to be a problem still for some beekeepers in northeastern and northwestern states for reasons that are not clear to me).

I will not spend time here explaining how to sample colonies for *Nosema*, as Randy Oliver has done a good job of reviewing the procedure in recent articles in *American Bee Journal*. For *Varroa*, one of my graduate students, Katie Lee, will soon complete her Master's thesis on a simple and accurate way to sample colonies and apiaries for *Varroa* mites. She will publish beekeeper-

friendly guidelines based on her extensive sampling and statistical analysis. Stay tuned.

The point is, if you sample, you can make educated management and treatment decisions to control diseases and mites. If you don't sample, you have no clue if the bees are healthy, diseased, or loaded with mites. If you assume your bees are healthy just because they look good, you may suddenly lose them 3 months later. If you assume your bees have *Nosema* and mites and treat them without sampling, you may be spending a lot of time and money adding unnecessary and possibly harmful chemicals to your colonies. Unnecessary treatments risk the contamination of wax and honey and lead to the eventual development of resistance to the treatment by the disease or mite. The old adage, "Better be safe than sorry" does not hold for unnecessary treatments!

Bee Self-Defense!

Honey bees are a super-organism, in all senses of the word. In terms of health, each individual bee has an immune system that provides physiological defenses against diseases and parasites. But the colony as a whole has collective behavioral defenses against pathogens and parasites, in addition to the individual physiological defenses. A strong colony with particular genetic traits can defend itself against a number of diseases and parasites in ways an individual bee cannot. This colony-level response of thousands of individual bees turns the female-based bee society into something more akin to a super-heroine. The colony, when functioning as a large healthy organism, is awesome.

The wisest strategy is to keep bees that can defend themselves against diseases and mites. Honey bees can evolve resistance to pathogens and pests naturally over time, or they can be selectively bred for resistance. Keeping bees that can defend themselves allows beekeepers to reduce their reliance on chemical controls, which is the best solution in the long run.

Why haven't we made more progress toward breeding resistant bees? The unfortunate answer is that it has been easier to treat them and not care if they have traits that allow them to defend themselves. We've been doing the defense for them. I'm afraid we're losing that battle. It's time to let them bees help themselves. If we reduce chemical treatments, and implement a regular sampling regime, we will know which colonies and apiaries are surviving better than others.

¹ Kleinschmidt GL, Furguson F (1989) Honey bee protein fluctuations in the Channel Country of southwest Queensland. *Australasian Beekeeper* 91:163-165.

See also: Sanford MT (1990) A Saga of "Sad" and "Bad" Bees. *Apis Newsletter* <http://apis.ifas.ufl.edu/apis90/apjul90.htm>

Control

Cultural / mechanical / non-chemical control techniques:

Even with the most tenacious preventative measures, and even using stocks of bees that demonstrate resistance, some colonies will come down with a disease, or mite levels will increase to the point where treatment is needed to prevent colony loss. The chances that diseases and mites will spread in an operation will increase with the number of colonies and the frequency they are moved together on trucks and placed in common yards.

Before reaching for antibiotics and miticides, I urge all beekeepers to consider trying some alternative control tactics. Here I list a few cultural, mechanical and non-chemical control practices that can be employed to eliminate or at least reduce the need for chemical intervention. I'm sure there are other practices already being used, or just waiting to be discovered by beekeepers willing to explore alternative control measures.

For example, if a colony has American foulbrood, all the adult bees can be shaken off the combs that contain diseased brood and highly contagious spores, and the bees can be introduced into a new colony on brand new foundation. A new queen, one preferably bred for hygienic behavior, can be introduced into the new colony and the colony can be fed sugar syrup until the disease spores the adult bees may be carrying are flushed through their system. By the time the new queen is laying eggs, the disease spores will be essentially eliminated and the colony can continue on, disease-free.

For *Varroa* mites, some hobby and sideline beekeepers have success trapping the mites in drone brood and then freezing the drone combs containing drone brood before the drones emerge as adults.

Good bee nutrition may serve both as a solid preventative and as a control. For example, ensuring that colonies have good stores of protein, either as stored pollen or through supplementary feeding of pollen can reduce the levels of *Nosema apis* infection (Kleinschmidt and Furguson, 1989¹). This effect is likely due to the bees being able to rear more

bees to compensate for the loss of foragers, the age group that dies from *Nosema*. This finding suggests that the link between good bee nutrition and disease resistance deserves close attention and much more research!

Chemical controls:

My aim in writing this article is to put chemical controls in last place, both in mind and in practice. They should be only used as a last resort, with great reluctance and restraint. I am not calling for a complete moratorium on chemical controls. I am asking that all beekeepers think, and think again, before applying antibiotics and miticides to bee colonies. Think about *Prevention*. Think about being proactive, not reactive. Think about what the bees can do to help themselves.

Knowledge.
Prevention.
Control.

To keep bees healthy, I encourage all of us to spend the most time on the first two steps, which will allow us to eliminate or reduce the amount of time on the last step.

Good references on Bee Diseases and Pests

Bailey L, Ball BV (1991) *Honey Bee Pathology*. 2nd Ed. Academic Press, London.

Graham JM, ed. (1992) *The Hive and the Honey Bee*. Revised edition. Dadant & Sons, Hamilton, Illinois

Morse RA, Flottum K (1997) *Honey Bee Pests, Predators, and Diseases, Third Edition*. A. I. Root Company, Medina, Ohio.

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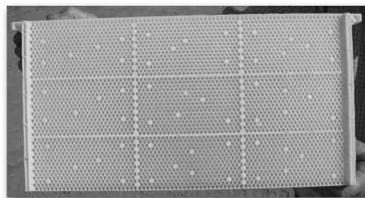
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