Improving Mite Control in Bee Colonies

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The *Varroa* Mite and Colony Collapse Disorder

Bees are fundamental both ecologically and economically because all kinds of plants and crops depend on them for pollination – and therefore reproduction. But bee populations worldwide are in sharp decline, a phenomenon called *Colony Collapse Disorder* ("CCD"). This has roused the attention of authorities in many disciplines.

A huge factor of CCD is the mite of the *Varroa* family – Varroa jacobsoni and Varroa destructor. It feeds by sucking hemolymph (~blood) from bees and it hatches its eggs in immature, capped bee brood. An infestation can kill an entire colony in one to two years.

Entomologists figured out that heat makes parasites latch off of bees, and that bees themselves are really resistant to heat. This has led farmers to do what amounts to cooking entire colonies in huge ovens, which has proven **inefficient** and **ineffective**.

Drone trapping and drone frames: a whacky crusade

The *Varroa* mite prefers to attack male brood because it incubates longer. Male brood is superfluous to domestic bee colonies, and drones are a drain on the colony's resources, so farmers use male brood as bait for the mite. They will then freeze, burn, rinse or sanitize the frames to kill the parasite, and the infant drones with it.

Several implementations of drone frames, which use cell size to influence bees to isolate male brood, have been put to market. This effectively creates *a mite trap using male brood as bait.* It means that you don't need to cook the entire hive to be rid of the parasite – only a frame will do.

The engineering challenge: improving the method

So far, research and implementation on mite control methods has been done mainly by entomologists. This means that the biology is pretty good, but the implementation is not much more sophisticated than cooking drone frames on a huge forest bonfire.

Products that have been put to market:

- literally ***melt themselves*** when operated.
- require risky circuits that pose a significant **fire hazard**.
- have no feedback control and use inefficient resistive heating, being at once **wasteful** and **inconsistent**.
- don't function well on infrastructural constraints posed by operation in rural areas.