**Breeding Balance**

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The story of my investigation of Varroa resistant bees and my subsequent experience in breeding for that resistance has so far been a seven-year ride, and one that has, I think, improved me as a person and a scientist. This work gave me a PhD, a post-doctoral position and now, a permanent position as a researcher at the Norwegian Beekeepers Association where I strive to make this knowledge accessible to all.

Breeding for Varroa resistance, i.e. using the natural abilities of the bees to overcome the parasites struck me, a student of evolutionary biology, as a viable solution, because this is what nature does all the time: our ecosystems are stable and extinctions are generally rare because the species adapt and change in response to each other and in doing so, they coexist. This type of dynamic equilibrium is an actively changing solution to the mites, which would adjust itself when needed without the dramatic colony losses that Varroa became known for when it invaded.

When I first began my work on Varroa resistant bees I knew nothing about bees, or Varroa. For the first winter and spring I tore through every scientific paper, book and beekeeping blog I could find, trying to accumulate as many facts, opinions and perspectives as possible. My task was to investigate a population of supposedly Varroa-resistant Buckfast bees in Norway and uncover the truth of their resistance as well as possible mechanisms for it.

I got lost the night I travelled to Oslo, driving down pitch black, spruce-forested roads. Doubt began to creep into my mind whether I was really cut out for this level of unknown; both in research and in environment—I had never been to Norway either.

As luck would have it, I ended up asking for directions at the very house I was supposed to stay at. Terje, the beekeeper of the soon-to-be-known Norwegian resistant bees had kindly welcomed me into his house for the month it would take me to run my experiments.

I did not believe that the bees were resistant when I first began, yet a good scientist holds no expectations for the outcome of their work; they need only design a solid, repeatable method and follow it, letting the object of their study reveal the truth on its own.

In a stark contrast to the book learning I had given myself prior, Terje taught me just as much in a completely different way: Here I could see the bees, could hear them, hold them. Terje transferred to me a level of tangible understanding that I could never have achieved through ink on paper.

The evidence to this day remains as solid as it did that first year: mite levels were always lower than the controls we set out and the reproductive rate of mites was reduced by approximately 30%, the same numbers observed in other studies on other populations in other countries hundreds of miles away. The name of the game the bees were playing was “balance”, controlling the mites just enough so the colony could succeed. We could never take back the introduction of Varroa destructor, however the bees had proven they could evolve to live with it.

So, the bees really were adapted. What then, were they doing to keep the mites under control?

In this category, I have to admit, my carefully designed experiments yielded nothing: I could not find more removal of bee brood on the very same frames I observed the decline in mite reproduction, and the level of damage on the mite bodies collected under the colonies was no different from our controls either. It was about 11pm on a night in my last week, when I was starting to question my life choices, that I noticed something odd about the cell caps of the brood harvested from Terje’s colonies. The cells had been recapped.

On nearly every frame, and in very high levels, uncapping and recapping was apparent, and yet next to no cells on the control frames had been recapped at all.

Whether recapping actually does something to affect the mites by itself, or whether I simply missed the brood removal in some way, I cannot tease apart at this moment.

My theory is this: A cell can be uncapped many times, and often, it is uncapped quite early in the brood’s development. The mite, to reproduce, lays a male egg first, which will mate with the consecutive daughters that molt to adults before the bee emerges. If the mites must be mated to produce offspring, then taking out the male becomes a viable strategy for the bees, because even if the daughters can mate the next time they visit a brood cell, one round of reproduction is knocked off their probable three (remember that 30%?).

Recapping could provide this disturbance, as male eggs are always laid at the top of the cell to avoid being crushed by the pupating bee larvae, right within reach of an uncapping bee. The foundress must journey to the top to lay it and she is either disturbed or else the egg is.

Whether cell uncapping and consequent recapping produced the observed results or not was fairly moot for the effect however, the fact was the only thing Terje had done to his bees was stop treating them.

So, taking a bit more data about the levels of Varroa throughout a season, I moved to the next phase of my journey: I had been invited to design a breeding program for a new population of Norwegian bees, this time a Carniolan stock, and, using the methods Terje had pioneered, we would repeat the selection, this time very well-recorded.

Our methods here did include varroa counts, in hopes that we could expedite the process by promoting the best colonies rather than letting the inadequate die, and our rules were as follows:

Rule 1. Traits like docility and honey production were still first and foremost on the list. I had encountered several resistant populations that were of little use to beekeepers and so, were not propagated anywhere beyond their university-owned operations.

Rule 2. Varroa counts in autumn that remained under 10 mites per day achieved the highest scores, and any colony over 30 mites per day was slated for requeening or removal next season. I always encouraged treatments for these colonies too as they could share their mite loads and hinder the integrity of the data from the better colonies.

Rule 3. Mating was isolated to the valley in which we worked, but the mating was free. Drone competition is an integral part of the honeybee mating system, and I wished to interfere as little as possible with things I did not fully comprehend the benefits of.

As far as results go, the very short time we have been working on this project (two years of actively selected queens) has yielded little significant change in Varroa (expected), but quite an increase in the accuracy of the recapping trait (how often the bees successfully uncap mite-infested cells). So far, I am hopeful, and with any luck, this project will be a well-documented version of a strategy that we know already works.