

UBeeO™ is a novel tool for bee producers to identify colonies that use hygienic behavior to resist *Varroa* mites and bee pathogens. UBeeO can be used to help beekeepers make informed selection decisions and incorporate UBeeO-linked traits into their breeding program. Since 2022, the Vermont Bee Lab has partnered with four Vermont queen producers to introduce UBeeO into their selection programs and monitor the outcomes. Here, we share what we have learned and answer commonly asked questions about UBeeO.

How does UBeeO work?

UBeeO is a liquid formula that mimics the natural pheromones emitted from unhealthy brood within the hive (so called, 'unhealthy brood odor', or UBO). UBeeO can predict a colony's ability to resist *Varroa* mites and other diseases through hygienic behavior. By applying UBeeO to a section of capped brood, a beekeeper can test the bees' sensitivity to these pheromones, and thus their ability to detect and remove unhealthy brood. To perform the test, UBeeO is sprayed on to an isolated section of capped brood and the frame is returned to the colony for two hours. UBeeO scores are calculated by counting the number of UBeeO-treated wax caps that are manipulated (e.g. chewed open) by the bees during the two-hour test period. Colonies that manipulate 60% or more of the cells are considered "high-scoring" (Figure 1).

What are the benefits?

UBeeO testing predicts a colony's ability to self-manage *Varroa* mites and diseases through hygienic behavior. Similar to previously published research, our trials in Vermont have demonstrated that high-scoring UBeeO colonies have lower *Varroa* prevalence and loads throughout the season (Figure 2). Preliminary data also suggests that high-scoring colonies have lower virus loads and may reduce *Nosema* spp. loads more rapidly by late season.

What to expect?

Based on our data, beekeepers should expect to see 9-30% of their colonies score "high" on UBeeO in the first year of testing. The number of high-scoring colonies you have will likely depend on previous selection methods. Our studies suggest that apiaries that have previously used hygienic selection methods like the freeze-killed brood assay have higher average UBeeO scores (Figure 3).



Figure 1. The UBeeO test area after 2 hours. More than 60% of cells are manipulated, making this a high-scoring colony. Worker bees detect the UBeeO scent and uncapped the cells to inspect developing brood.

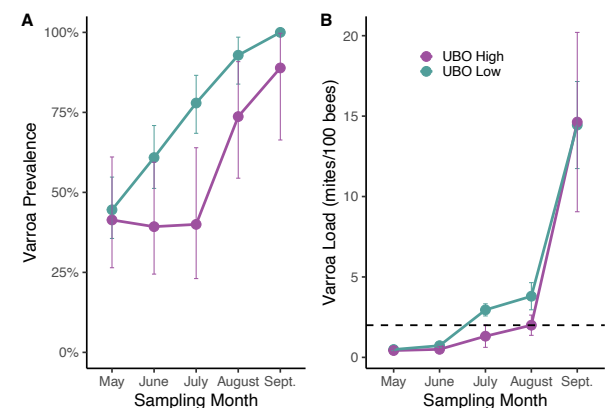


Figure 2 Average *Varroa* prevalence (A) and *Varroa* loads (B) from May-September for low-scoring UBeeO colonies (green) and high-scoring UBeeO colonies (purple). Prevalence refers to the percentage of colonies with *Varroa* loads > 0. Load refers to the number of mites per 100 bees. The hatched line represents mite treatment threshold. Any colonies treated for high mite loads were removed from subsequent time points. High-scoring colonies showed lower *Varroa* prevalence throughout the season and lower *Varroa* loads in May-August. On average, mite loads of high-scoring colonies remained below the treatment threshold (hatched line) for most of the season while low-scoring colonies had to be treated as early as July.



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UBeeO™ Factsheet 2024



UBeeO™ For Producers

When to perform UBeeO tests?

Preliminary data suggests that UBeeO scores are more reliable and better at predicting *Varroa* loads when colonies are tested in spring or early summer (May-June) during a nectar flow. Testing early in the season also allows producers to consider UBeeO scores when selecting breeder colonies for the same year. If UBeeO is performed during a nectar dearth, preliminary data suggests that feeding bees 1:1 sugar syrup within the week prior to testing may simulate a nectar flow and improve colonies' overall scores.

Are UBeeO-linked traits heritable?

Research suggests that UBeeO-linked traits can be inherited by daughter colonies. However, inheritance in our trials ranges from 10-31%, depending on mating strategy (Figure 4). Through our preliminary data, the greatest level of inheritance has been achieved by controlling both the matriline and the patriline through instrumental insemination. However, open-mated systems can be used successfully, especially when mating yards are drone saturated with high UBeeO stock. We recommend performing UBeeO tests on all overwintered daughter colonies in May/June before marketing queens as 'High-scoring UBeeO Queens'.

Where to get UBeeO tests?

UBeeO will be made commercially available in Spring 2024. It is currently available through Optera (see link below).

Questions?

Contact the Vermont Bee Lab at vbl@uvm.edu to learn more about our ongoing efforts to support queen producers in Vermont.

To learn more about UBeeO and the science behind the technology, visit Optera's website www.opterbees.com

Prepared in collaboration with Optera and Betterbee

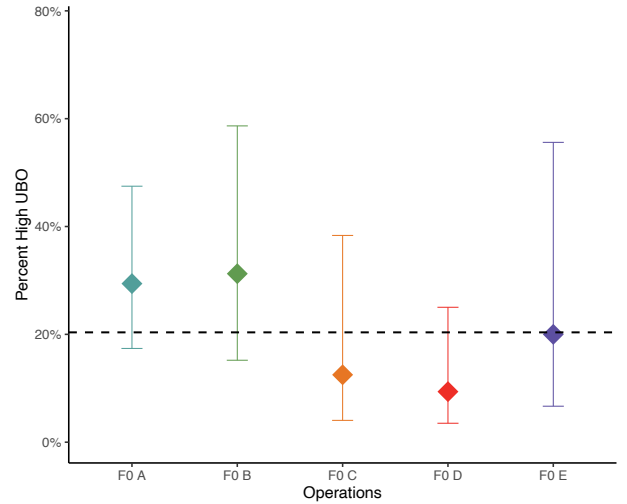


Figure 3. The percentage of high-scoring UBeeO colonies present among five Vermont first-generation honeybee cohorts. The hatched line represents an average across all cohorts (F0 A- F0 E). F0 A and F0 B had previously used freeze-killed brood assays to select breeder queens.

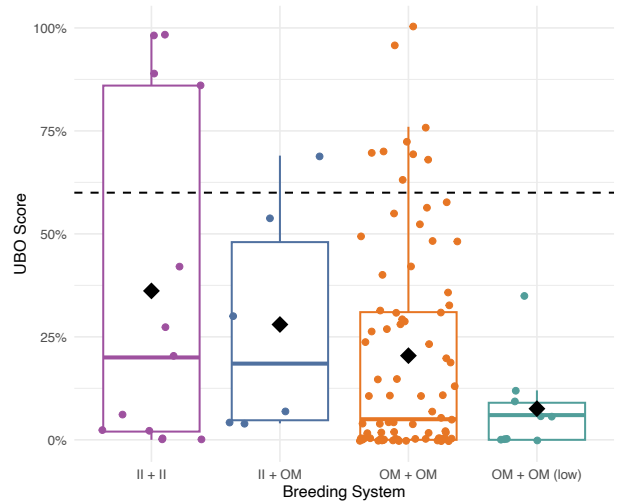


Figure 4. The UBeeO scores of daughter colonies produced from high scoring UBeeO mothers with varied mating strategies. II+II denotes that both the mother and daughter queens were instrumentally inseminated. II+OM denotes open mated daughter queens from instrumentally inseminated mother queens. OM+OM denotes that both the mother and daughter queens were open mated. OM+OM (low) served as a control and denotes open mated daughter queens from low UBeeO scoring, open mated mother queens. Black diamonds represent the average UBeeO score of daughter colonies produced by each mating strategy. The hatched line denotes the threshold for 'high-scoring' colonies at >=60%.