WHY HEAT?

- The parasitic mite *Varroa Destructor* and its associated viruses are the leading cause of honeybee colony mortality in the Northeast, leading to yearly colony losses that average around 50%.
- Pesticides are the traditional *Varroa* treatment. While effective, they leave toxic residues in the honeycomb and mites have started developing a resistance.
- Finding alternative treatments to pesticides is an important step for increasing sustainability in the beekeeping industry.
- Honeybees can survive higher temperatures than *Varroa* mites, so by intentionally heating a colony, mites can be killed with little to no damage to the bees. This treatment is known as hyperthermia.
- Hyperthermia also has the potential to treat against viruses as well as mites, something pesticides do not do.

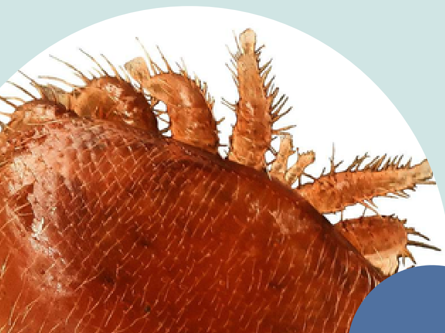

Photo credit
Sam Droege

HOW TO HEAT?

To explore hyperthermia as a treatment for *Varroa* mites, Lemon Fair Honeyworks (Andrew Munkres) designed a mechanical heating system consisting of a fan heater mounted above the hive, a blower pan beneath the screened bottom board, and a connecting duct. The system circulates heated air through the colony, creating a continuous loop to warm the hive.

An integrated thermostat and timer manage treatment temperature and duration.

Questions? Contact us at:

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HYPERTHERMIA

As a *Varroa* Mite & Virus Control Method in Honeybee Colonies

A collaborative project of Lemon Fair Honeyworks and the Vermont Bee Lab

VERMONT BEE LAB

LEMON FAIR HONEYWORKS

RAW HONEY FROM UNTREATED BEES

NORTHEAST SARE
Sustainable Agriculture Research & Education

THE RESEARCH

Our research focused on identifying the conditions that maximize the effectiveness of hyperthermia treatment:

- Summer 2024: Evaluated hyperthermia efficacy and the optimal heating duration by treating colonies at 109°F for different durations (2-4h).
- Summer 2025: Investigated the optimal treatment temperature by exposing colonies to temperatures ranging from 109-111°F and comparing outcomes with untreated control and chemical-treatment groups.
- Current research: Examining the effect of different internal hive humidity levels on treatment efficicacy.

RESULTS & FUTURE APPLICATIONS

Data collected during the first summer led to two key findings. First, hyperthermia proved to be a viable treatment option for Varroa mites: colonies treated with hyperthermia had mite loads below treatment threshold at 3 days and 21 days after treatment (**Figure 1**). Second, a treatment duration of two hours was optimal. There were no significant differences in treatment success among the different heating durations, indicating that a two-hour treatment is most efficient while remaining viable.

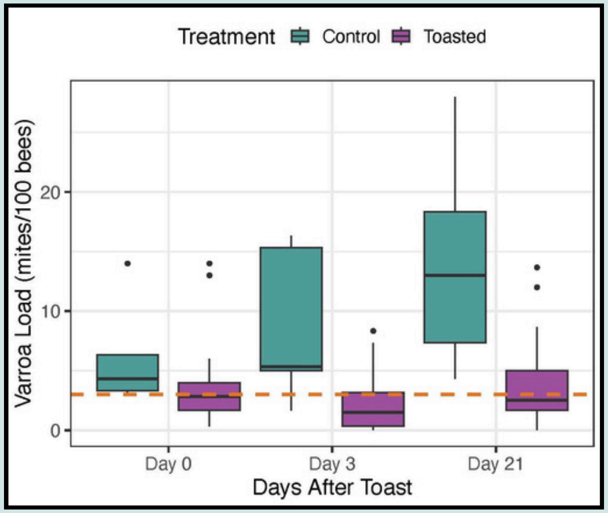

Figure 1. Varroa loads in heat-treated ("toasted") and untreated colonies at pretreatment (Day 0) and 3 and 21 days post treatment.

Data from the second summer found that 110-111°F was the optimal treatment temperature for reducing mite loads. Additionally, deformed wing virus (DWV-A) loads remained relatively unchanged in heat-treated colonies but increased in untreated control colonies, indicating that hyperthermia may help limit the proliferation of certain viruses (**Figure 2**).

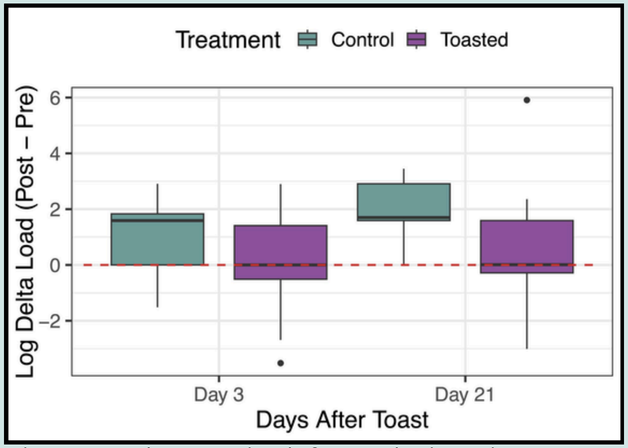

Figure 2. Changes in deformed wing virus A (DWV-A) loads in heat-treated "toasted") colonies measured 3 and 21 days after treatment, relative to pretreatment (Day 0) levels.

Experimentation in 2025 indicate that higher humidity may improve treatment efficacy. This hypothesis will be tested this summer.

We envision hyperthermia becoming a valuable addition to the beekeeping toolbox. Building on this existing heat treatment technology and research, the Vermont Bee Lab is developing portable thermochemical heating devices that could simplify deployment and broaden adoption