Winterization techniques for populations of Apis mellifera ligustica and Apis mellifera carnica in western Montana

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Winterization techniques for populations of *Apis mellifera ligustica* and *Apis mellifera carnica* in western Montana

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Introduction

- The relationship between domestic honey bees (*Apis mellifera ligustica and Apis mellifera carnica*) and winter in a northern climate was studied to determine an effective, economical, and environmentally-sustainable method to keep the University of Montana Gardens' colonies alive over the winter.[1]
- The University currently owns two hives containing colonies of *Apis mellifera ligustica* and *Apis mellifera carnica* and has failed, thus far, to keep either colony strong enough to survive the winter.
- Previous winterization attempts have shown that the build-up of excess moisture will cause mold and a lack of protection from cold winds will cause cold pockets within the hive. [3]
- These findings suggest that proper ventilation and wind barriers will need to be included in the design process. [4]

***Figure 1*: Diagram of a Langstroth Hive**
Hive #1 and Hive #1 are both Langstroth hives, each consisting of two deep brood boxes (43.7 l capacity) with ten frames. The upper frames (6.5"x17.75"x1.5") and lower frames (9.25"x17.75"x1.5") have a plastic lining meant to replicate honeycomb.

Research demonstrates that the best way to winterize a Langstroth hive in cold, northern climates is to seal up cracks and most entrance points to keep internal temperatures consistent around 5 ° C. [4]

Popular winterization strategies in Canada recommend insulating the Langstroth hive by reinforcing the roof and walls with a barrier to block any incoming cold winds. [4]

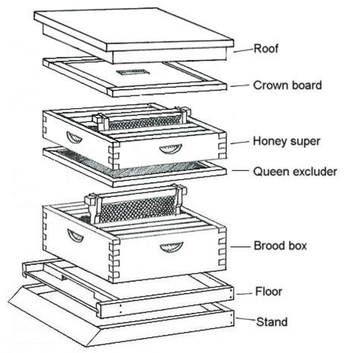

*diagram courtesy of Cox's Honey

Objectives

- Our research and methods focus on the techniques that northern latitude beekeepers use to ensure the survival of their colonies over the winter.
- **We hypothesize** that the winterization techniques placed upon Hive #1 and Hive #2, containing populations of *Apis mellifera ligustica* and *Apis mellifera carnica* respectively, will result in the survival of both hives during the 2019-2020 winter season.

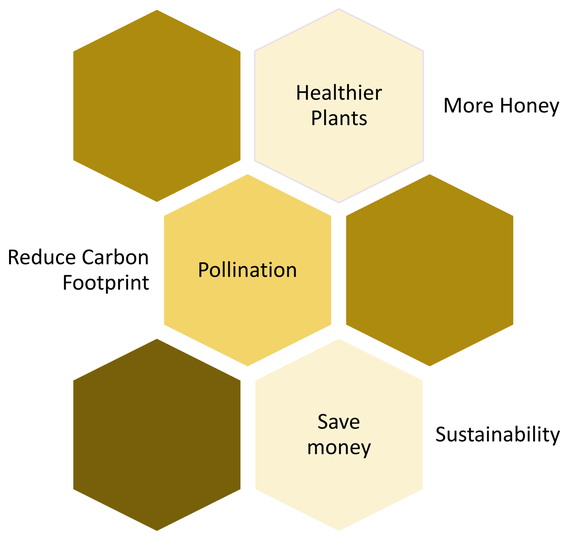

***Figure 2*. 6 reasons why successfully winterizing the University of Montana Garden's two hives containing populations of Apis mellifera ligustica and Apis mellifera carnica would be beneficial for the environment, cost, and garden's overall production.** [1]

- **The primary objective** of this study is to identify and implement techniques used by beekeepers in northern climates to best winterize the University of Montana Garden's hives to ensure the survival of populations of *Apis mellifera ligustica* and *Apis mellifera carnica* throughout the 2019-2020 winter season. [6]
- **Benefits**: Established colonies lower the risk of implementing new colonies every season and reduce any carbon footprint that shipping new bees across the country to Montana may have on the environment, furthering UM Gardens' mission of sustainability.
- Successfully winterizing bees would kickstart UM Gardens' pollination, ultimately contributing to earlier, healthier and fuller plants and produce for the Food Zoo.[1]

Methods

Winterization Design

- Winterization techniques were based on literature recommendations for northern climates written by researchers and beekeepers in Canada. This was due to Montana and western Canada's similar winter climates that consist of significant fluctuations in daily temperatures and precipitation events.

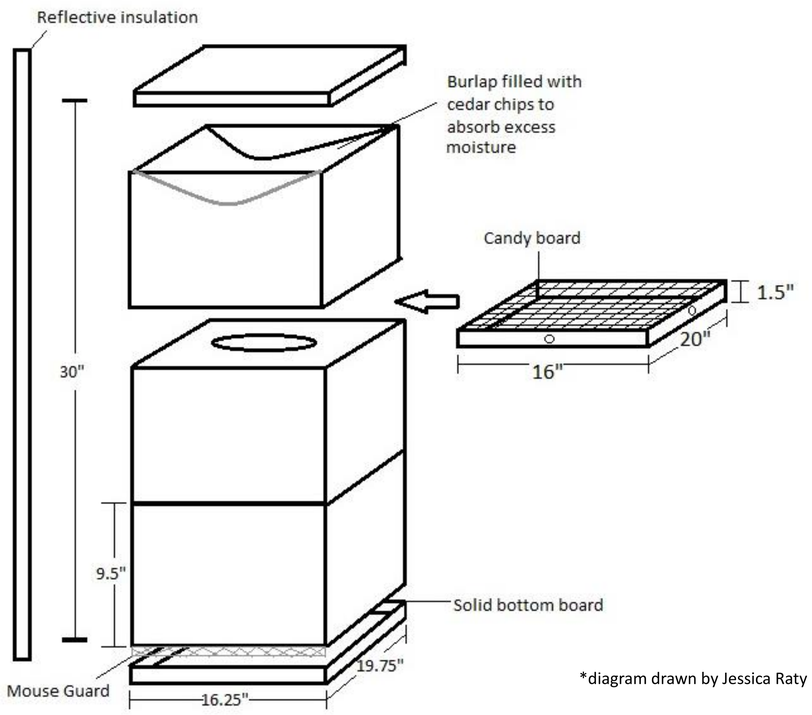

*diagram drawn by Jessica Raty

***Figure 3*: Diagram of Hive #1's Winterization layout.** Hive #1's winterization design was designed to minimize hunger and moisture build-up and maximize ventilation and heat. [1] Colonies should have about 90 pounds of honey reserves to feed on over the winter. [2] Research shows that honey bees consume the least amount of honey (winter food stores) when their metabolic rate is low, typically around 5°C. [4] Winterization design includes candy board, burlap pocket to hold cedar chips, mouse guard, solid bottom board, and a tarp windbreaker.

Insulation and Ventilation

- Hives were positioned in a protected inset of the University of Montana's Lommasson Building facing southeast.
- A windbreaker, made up of six hay bales (18"x36"x14") covered with a tarp, was implemented near the hives to protect them from any incoming Southeast winds.
- Hive #1 and #2's screened bottom boards were removed and replaced with solid, wood bottom boards to further insulate the hives.

- Hive #1 and Hive #2 were fitted with extra Langstroth brood boxes (9.5"x16.25"x19.75").
- Each box was bolted with breathable burlap and filled with cedar chips.
- Cedar chips were added to absorb excess moisture in the hive as airflow circulation was reduced to block cold air from entering and keep the interior of the hive warm. [3]

- Hive #1 was also given a sugar feeder near the entrance from November 2nd , 2019 to January 22nd, 2020 for additional energy reserves.
- The extra brood box filled with cedar chips was placed on top of the candy board as indicated in Figure 3.

- Hive #2 was winterized using techniques that research indicated would be most effective, cost-efficient, and sustainable.
- No candy mold or sugar feeder was provided to Hive #2.

Hive #1's Candy Board

- Purpose: Provide colony with extra food storage for the winter.
- Structure: Recycled wooden frame (16"x20"x1.5") with chicken wire stretched across opening (9"x13").
- Mix: 2 cups sugar, 1 cup water and 1 tb white vinegar.

Results

Post-winter analysis list for UM Garden's Langstroth hives.

Evidence	Hive #1	Hive #2	Additional Comments
Excess Moisture	No	No	No signs of mold or excess water.
Varroa mites	Yes	No	See Figure 5.
Clustering	Yes	N/A	See Figure 4 for Hive #1. Hive #2's survival makes it difficult to know if clustering occurred.
Excess honey stores	No	Yes	Hive #1's candy board was mostly empty and the bottom frames contained mostly comb. Hive #2 was half full.
Queen	Yes	Yes	Hive #1's queen was within the cluster. Hive #2's queen assumed alive due to hive survival.

Table 1. Recorded on March 24th, 2020.

- The population of *Apis mellifera ligustica* in Hive #1 died. Evidence of clustering (see Figure 4) indicate that internal hive temperatures dropped too low for the colony to maintain a stable living temperature of 5°C. [3]
- Hive #1 showed signs of varroa mites (see Figure 5), suggesting a weakening of the colony's health.
- Hive #1's brood box was mostly lined with comb with little evidence of honey.
- Hive #2, containing the population of *Apis mellifera carnica*, survived. No evidence of a varroa mite infestation and the colony entered spring with excess honey stores.

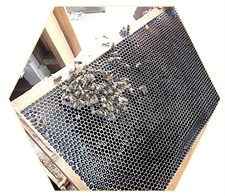

Figure 4. Evidence of clustering in Hive #1. Cluster had a 4" diameter.

Conclusions

- Neither Hive #1 or #2 showed evidence of excess moisture in terms of mold or water build-up, suggesting that the extra brood boxes with burlap coverings and cedar chips were effective at absorbing excess moisture.

***Figure 5*. Evidence of varroa mites on a bee (*Apis mellifera ligustica*) in Hive #1.**

Hive #2 survived the winter without a candy board, indicating that the extra supply of food may not be necessary for survival.

The data indicates that the pre-winter honey stores, lack of varroa mites and reduction of excess moisture helped Hive #2 survive the winter.

It is unclear if Hive #1 died due to the colony's (*Apis mellifera ligustica*) inability to adapt to changing weather conditions or infestation. Further testing would be required to test the species' resiliency to cold climates and disease.

Future Directions

- To explore other popular winterization techniques, both commercial and homemade and identify methods that are practical, sustainable, and cost-effective.
- To further examine the relationship between varroa mites and other subspecies of *Apis mellifera* and investigate if certain species have greater resiliency.
- To determine whether additional factors play a role in the winter survival of populations of *Apis mellifera ligustica* and *Apis mellifera carnica.*

References and Acknowledgements

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