

## Honey Bees and the Shivering-Cold Vermont Winters

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Colder weather has arrived and we've had some snow. This prompts two often-asked questions: "What do the honey bees do in the winter? Do they hibernate?"

For the most part, honey bees are alive and active 24/7/365. That said, activity at this time of the year is limited but precisely tuned to surviving the cold.

First, honey bees do not function as individuals and cannot survive as an individual at any time of the year. They function as a "superorganism" – a colony - in which every individual performs a function. For the colony to survive, each individual must perform its respective function and it in turn relies upon all of the other individuals to do the same (the roles of the worker bees – the non-egg-laying females – change over the course of their lifespan) but that's another news item!

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## *Generating Heat to Stay Warm*

Honey bees generally do not fly much when the outside temperature drops below 60°F (15.5°C) and they become comatose and can die at about 42°F (6°C).

Once the outside temperature drops below about 64°F (18°C), the colony begins to form a loose “cluster” in which the bees group themselves into a shape resembling a ball called a **cluster**. As the outside temperature drops, this cluster tightens.

The colony does not heat the space in the hive; they heat the cluster – themselves! The temperature inside the hive away from the cluster is the same as the outside air temperature.

To generate heat, the bees contract their wing muscles isometrically, that is, the wing muscles contract but the wings don’t move. This is much like what happens when we are cold and our muscles shiver to generate heat. One bee doesn’t generate much heat but when many thousands of individuals in the colony are doing so together (think 20,000 or more), they keep the center of the cluster toasty warm.

This requires a lot of energy. Stored honey is the carbohydrate energy source that the bees need to fuel this muscle-flexing, heat-generating action.

All of this said, it’s helpful to get a few warmer winter “thaw” days every now and then when the bees can fly and “relieve” themselves. These are called **cleansing flights** and are important to the health of the colony.



**Winter  
cluster**

*Honey bee colony clustered.*

*Courtesy [www.scientificbeekeeping.com](http://www.scientificbeekeeping.com)*

*Note that we never open hives like this during the winter. Our hives are wrapped and insulated to enhance colony survival. This photo was taken in the California foothills where winter temps can be very moderate.*



## The Cluster

The cluster is not a simple agglomeration of bees. It has two layers: the outer mantle layer and the inner core.

### Cluster Mantle

The outer mantle layer is very tightly packed with bees facing inwards. These bees are packed very tightly so that their bodies trap air between them, effectively forming an insulating layer. There is some thought that these mantle bees that are exposed to the cold ambient temperatures rotate inward to warm themselves though there's no research that supports this idea.

### Cluster Core

The core inside the mantle is less densely packed so the bees have room to move around for essential activities such as brood rearing or feeding. This is where the queen remains all winter.

The temperature of the core varies. If the colony is broodless (no baby bees being produced) the core temperature will be about 65-70°F (18-21°C). Later in the winter, as the queen starts laying eggs again readying for spring, the core temperature will exceed 90°F (32°C).

Since the mantle bees are so tightly packed, airflow to the core is reduced, carbon dioxide levels from their respiration rise and oxygen levels fall to about 15% (from about 20.9% in air). This causes the bees' metabolic rate in the core to drop which reduces food consumption and respiration heat loss.

The winter cluster is more complicated than we've described here, but honey bees' winter survival tactics are more evidence of how truly amazing this superorganism, *Apis mellifera*, is.

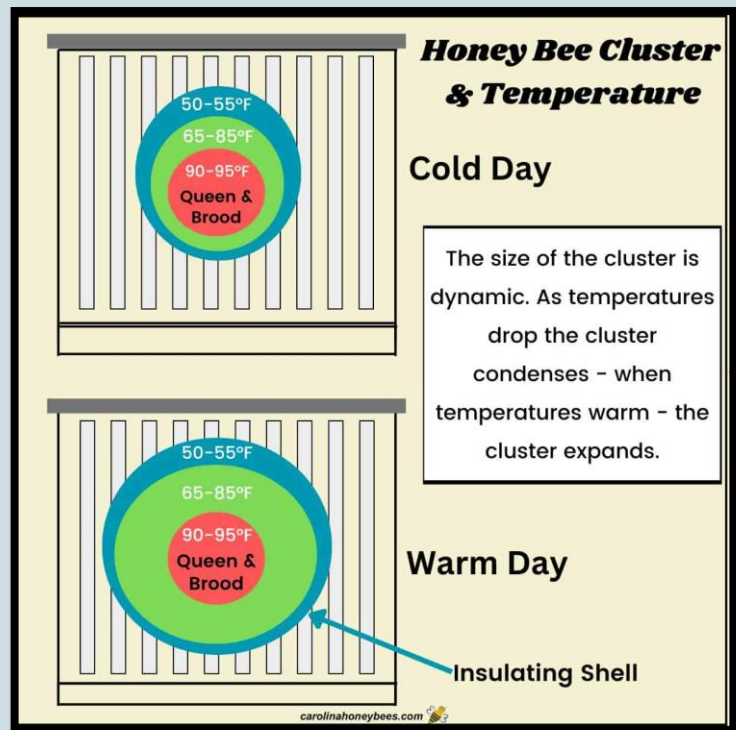


Diagram courtesy of Carolina Honeybees, LLC.

<https://carolinahoneybees.com/>