The Traveling Beekeeper

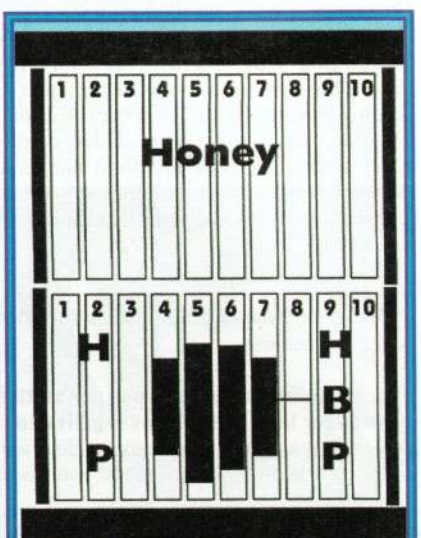
Moving Toward Cold

by LARRY CONNOR
Wicwas Press
1620 Miller Road, Kalamazoo, MI 49001
LJConnor@aol.com • www.wicwas.com

For most of North America, October is a transitional period when we start the move toward cold, but are not there yet. It is many people's favorite time of the year, cooler days and colder nights, a time of beautiful fall color and a chance to fix favorite foods associated with the season. Many of us think in terms of apple cider, pumpkin pies and getting the honey bottled and sold before the first of the year.

As I travel, people are asking important beekeeping questions suitable for their location. My Alaskan and Canadian beekeeper friends are undoubtedly long past their 'termination dusting' where the first snow on the mountain warns of just a few days to finish their season's outside work. Of course, they may have seen that dusting of snow back in August, and now have more than a little snow on the ground. Florida and Texas beekeepers fret about the fall rains—will they have enough soil moisture for fall and winter plants to build the bees to full strength for splits, queen rearing or almond pollination.

Midwestern beekeepers can expect freakishly early snows in October, and, in other years, no significant snow until January. It is a difficult time to make predictions.



Location of the thermal cluster in the fall. (From Dewey *Caron's Honey Bee Biology and Beekeeping*, Wicwas Press).

By Now

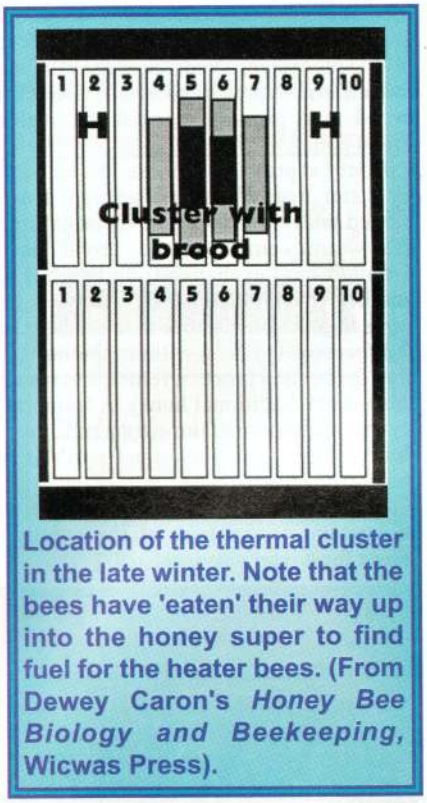
Except for subtropical and tropical beekeepers, the season is changing. The bees are responding to the shortening day length and the reduced food supply and they are making significant changes for winter. What are those changes?

• The bees have slowed brood rearing, and perhaps stopped producing brood completely. They reduce the amount of food they give the queen. Instead of polishing the cells for new brood, as the last brood emerges in the brood nest, they fill them with honey (moved from the supers above) and fall nectar, and sugar syrup you have provided. This behavior begins in mid-August in my neighborhood, as the bees trim the brood nest size, and are determined to have plenty of food supplies on hand when they start winter confinement.

•If the queen gets a vacation, this is it. Certainly she is not laying eggs at the rate she did in from the period from late winter to late summer. Her production of queen substance is reduced, but not stopped. Those queens in the tropics don't get much of a vacation, maybe a few weeks—maybe nothing, as compared to several months for northern locations.

As the bees downsize the brood area, they maintain a small area on one or two frames where the queen will start laying eggs after the Winter Solstice. The bee cluster will be in this area. Around this perimeter are cells filled with pollen, often covered with honey, and the outer core of honey.

• Stored honey (and sugar syrup) is also stored at the side and above this area, the future thermal cluster. The bees will get into the cluster whenever the temperature inside the hive box goes below 58 degrees F. The cluster will be loose at first, but get tighter and tighter as the temperature falls. Bees at the outside of the cluster will become chilled and move toward the center of the cluster as warmer bees move outward. Heater bees consume honey and generate heat by metabolizing the sugar in their blood (hemolymph). To generate the heat necessary to keep thousands of insects warm the heater bees consumer honey and burn it by shivering or flexing their wing muscles. They uncouple these muscles from the wings and alternately contract and relax these muscles. When brood is present, each bee will press her thorax onto the top of one cell below her, and warm the pupa inside through the cell cap. She also presses her antennae against the brood surface. After 30 minutes the bees have reached the amazing temperature of 43 degrees C (109 degrees F) and are exhausted from the most rigorous work they do in their lifetime, even compared with active foraging.



Location of the thermal cluster in the late winter. Note that the bees have 'eaten' their way up into the honey super to find fuel for the heater bees. (From Dewey Caron's *Honey Bee Biology and Beekeeping*, Wicwas Press).

The warmed pupa radiates heat to surrounding pupae. The non-heating bees are tightly packed around the brood and the heater bees, forming a layer of insect body insulation to hold the heat onto the brood and comb. They move from the outside in and inside out to make sure all bees share the warmth.

Most amazing for me is the change in our understanding of the role of the empty cells in the brood nest. Long considered to be a reflection to the low level of diploid drone production in hives (where an egg is fertilized with sperm that has the same genetic makeup, or allele, for sex determination, and results in a diploid drone), it now appears that there is an additional role for these empty cells. Worker bees crawl into the cells, uncouple their wings, and shiver to generate heat. Once we thought these bees were resting, but not true. Thermal cameras show they are working hard to warm the brood inside the hive. This system seems far more efficient as a means of spreading warmth inside the brood than pressing against the sealed brood cell.

Honey is provided to these 'heater bees' by sister bees that have uncapped and moved honey located some distance from the warm center of the brood nest. Through food exchange from one bee to another (tropholaxis), this behavior insures that the precise bee that needs to be fed receives the food without the need to stop the heating process, refuel, and restart the heater! Additional honey is temporarily stored in some of the empty cells to reduce the distance bees must move it to support the heater bees.

These behaviors are important for us to understand as we look at the colony's needs for winter survival.

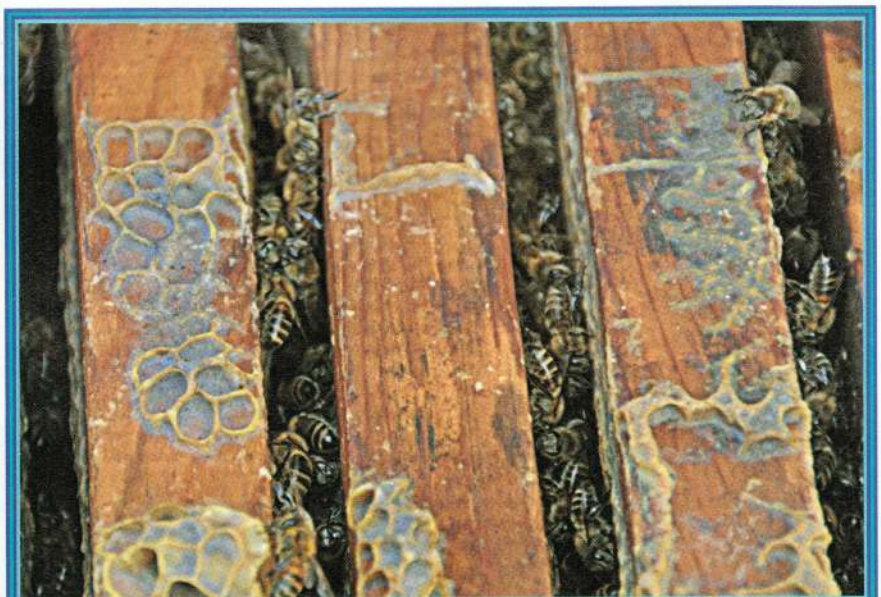
After Solstice

In most colonies, January marks the start of brood rearing in the brood cells. If the thermal cluster was confined to the food area, it is now locked to the area where the bees are producing bees. Winter survival becomes a reflection of a few basic but absolutely critical factors:

• Bee population. Small colonies are more challenged to produce a successful winter cluster than huge colonies. At least that is what I was taught. When we see small five-frame nucleus colonies survive the winter, we start to suspect that there is some key relationship that must exist between the queen, brood area location, population size, and the location of the fuel for thermal bees.

Large colonies are what we traditionally seek to get the colony through the winter. If 20,000 bees die out of 40,000, there are still enough bees to keep the colony alive through the winter. I have often written about the need for young, healthy bees for brood rearing in the fall. Several key writers talk about producing healthy nurse bees back in August to have healthy bees going into winter. The assumption is that they need the food reserves stored in their body to feed brood, that there is not access to enough pollen during the winter to sustain protein levels without depleting body resources of these 'fat' or 'winter bees'. To that impressive responsibility, we must also have a population of bees that is able to work efficiently as heater bees; bees that have the stored 'stuff' necessary to convert a lot of honey into heat so the brood and thermal cluster are maintained until temperatures warm enough next season.

We traditionally consider the pile of dead bees at the entrance of the hive to be the bees that were old going into the hive in the fall, when old foragers and even old nurse bees were used to keep the winter cluster warm, serving as insulation for the colony. At some point they were not longer needed, or were biologically programmed to die. They fall to the bottom of the hive or colony and are eventually cleaned out by the bees or the beekeeper as warm weather returns.



Bees in a thermal cluster in northern Vermont, December 2, 2010 in Mike Palmer's winter yard. The outer bees move inward. To read more about heater bees consult Jurgen Tautz's *The Buzz about Bees: Biology of a Superorganism*, Springer (2008).

In a wind-protected site, Palmer winters double nuclei hives. Each double hive sits on an empty super to get it out of the snow (which often covers these colonies). Each colony has a side entrance at the bottom and an upper entrance drilled into the box. Each nucleus has four frames, but a honey super above.

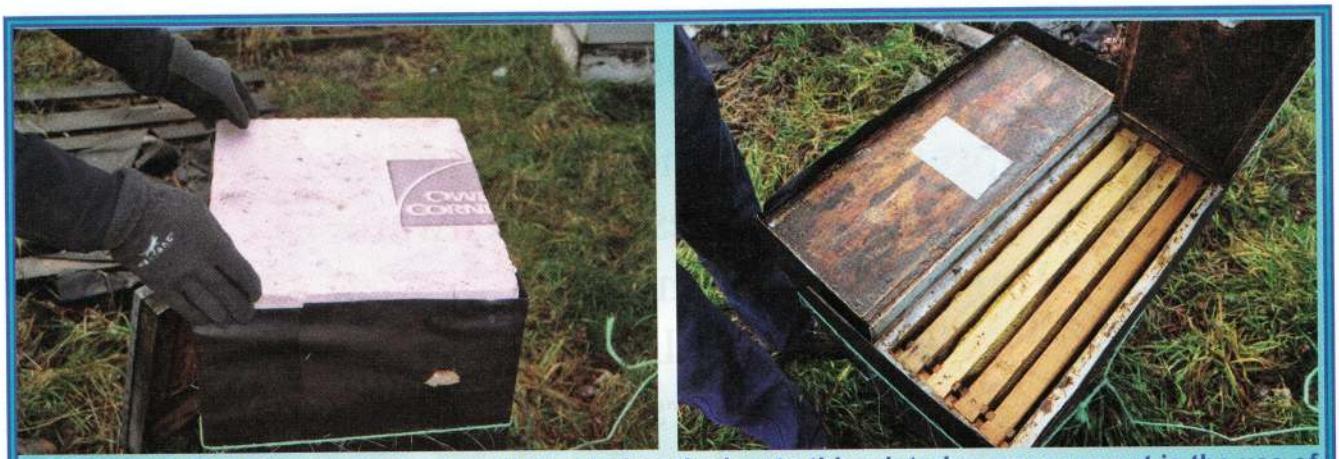
Certainly, **anything that stresses a bee population will increase the mortality rate**. This may be a single factor, such as feeding by varroa mites. Or it may be a combination of sub-lethal insecticides, colony hive treatments, poor fall food nutrition, Nosema, and a whole list of ordinarily minor bee sniffles, aches and pains that should not kill a bee.

Simplify

So let's establish ground rules for good wintering success.

1. **We must have a vigorous population of younger bees suitable for the hive container they are in.** A five-frame nucleus will have fewer bees, but they must be young and healthy.

2. **They must be healthy, well fed bees.** No varroa mites. If you have colonies in October that are mainly old bees, you might as well as put them out of their misery right now. These are the colonies that have had drone layers or laying workers, a small brood nest, or some other factor that can be



(l) With top and bottom entrance/ventilation holes, the key to this wintering arrangement is the use of insulation board on the top of the hive, under the outer cover. The hive is wrapped in roofing paper to retain winter heat and to serve as a windbreak. (r) Palmer's system for wintering nuclei uses a second box containing honey. Four additional frames of honey eliminates the need for a feeder. A separate four-frame inner cover provides cluster space over the tops of the frames. The cover is taped closed so the bees do not chew on the insulation board.

put down as 'failure to thrive'. Remove the frames, shake the bees on the ground and spray them with soapy water to kill the bees. If the bees are healthy but just too small a population (you tried to make a nucleus, but it is not strong enough for winter), shake the bees in front of a strong hive and secure the equipment for the winter. Don't even think about combining two weak colonies—it is a waste of time and effort. The math is 1 plus 1 equals 0.

3. **There must be abundant food reserves.** The bees should be in the lower box with one or two boxes of honey directly overhead. As the cluster grows in the late winter and early spring, be prepared to feed during the winter if the weather permits. A candy board, fondant, or even granulated honey can be fed when offered to the bees in the right way. More and more beekeepers who are wintering five-frame nuclei hives are adding a second box of honey so the bees will work up. They also bundle the smaller hives together and wrap them with insulation, maintaining separate lower and upper entrances.

4. **Ventilation must allow the products of respiration of all those heater bees to escape from the hive**. Those products are carbon dioxide and water vapor. A top moisture barrier to soak up moisture (a box of wood shavings) with insulation board will help, but an upper entrance will make it much more successful.

5. **The colonies must be protected from strong wind.** This is the area where I know I have failed some hives. When a colony is in a blast of cold air, it will put more stress on the heater bees to keep the winter cluster warm. It may increase ventilation, but no hive needs an Alberta Clipper blowing though the hive. A natural wind shadow, a side of a building, some snow fencing, or even a pile of wooden pallets next to the hive will reduce the blast of cold air. Combine this with a sunny winter site (so the bees can get a cleansing flight when it gets into the 40s), and these factors will be a huge help in wintering bees.

Getting bees through the winter is an ongoing challenge. Make it easier on the bees by doing some work on the colonies before they are locked down for the winter.

Watch for an exciting new book from Wicwas Press. Check out www.wicwas.com. While on the website register for the Southern New England Beekeepers Assembly featuring Judge Dan O'Hanlon and Drs. Ernesto Guzman and Larry Connor. The date is November 19, 2011 in East Lyme, CT.

Vermont beekeeper Mike Palmer checking honey stores in a double nucleus.