

into the supers loose and in handling it over to get at the thermometers we found that it felt sensibly warm at 50 degrees, but the warmth extended only a few inches from the central point of the cluster. On many hives we had strips of wood between the top bars, shutting off all upward ventilation, and found the same warmth just over the cluster. All such stock wintered well, but in small single-walled hives no warmth could be felt in many cases and all such colonies showed signs of diarrhoea. Hence the conclusion as stated. In making these observations we found that at 50 degrees there was no dampness in the chaff where there was upward ventilation, the heat of the cluster driving it outward to the surface where the chaff would often be found wet. But in the hives where the temperature ran much below 50 degrees the chaff would get damp down to the frames and the colony invariably wintered poorly. When the temperature in the hive ran low the moisture would collect on the sides of the hives and on the combs and become frosty. In all these cases we found the bees did not winter well, consuming large amounts of their stores and great numbers and sometimes the whole stock would die before spring. The colonies that kept up the 50 degrees were the ones that kept bright and clean and healthy, and the combs were also dry and clean. Hence, our belief with such protection as would permit the maintenance of this temperature, the effect was to force outward the dampness while a much lower temperature seemed to favor the accumulation of dampness close about the cluster and thus cause disease.

By the term "large hive" it would mean one large enough to prevent a temperature in the hive so low as to condense the vapor. For Canada, where it is much colder than here, the space for packing should extend all around the brood chamber and it should not be less than four inches. If packed snugly, I should think that much space would be sufficient. The packing may be dry forest leaves or very dry sawdust or the fine ribbon-like shavings of white poplar obtained in sawing sections, as these agents are less apt to mould than the various kinds of chaff, and appear to be fully as warm, especially the latter.

After making various tests on the different plans of ventilation, we came to the conclusion that upward ventilation, as generally managed, let the heat of the cluster escape too freely upward and outward, that the force by which the heated air arose being impelled by a strong current of cold air drawn in at the entrance, was

far greater than any one had supposed. We then began placing the little wooden strips between the top bars of the frames on nearly all of our hives to prevent all escape of the heat except by radiation through the propolis and wood. We soon found that we had to enlarge the entrances, as we observed from tests in our apiary and others near by that with only a small entrance and no upward ventilation bees could not be wintered no matter how well protected. They would get restless and fly out whenever the sun shone brightly, cold or no cold. We then made the entrance three-fourths of an inch deep and eight inches long for a full colony, wintering on the summer stands, and placed a board in front of the hive so as to prevent the cold winds from driving into the entrance. Mice have never troubled us, but when they do we shall take a piece of wire cloth over the entrance so as to allow the bees exit at the bottom. With us the above plan has been a great success resulting in a loss of fewer bees and the consumption of far less stores than any plan of upward ventilation we have tried. I recognize the fact, however, that a number of bee-keepers have succeeded well with upward ventilation, including my friend Mr. S. Corneil, who uses a heavy wool quilt over the frames which is effectual in confining the heat at the same time that the vapor is permitted to escape above. But there is this fact about ventilation that must not be overlooked. A large hive *freely* ventilated in any way is much more safe than a small one however well ventilated. Such a hive may contain a large amount of comb and stores or be largely composed of wood, if it is only big, frost does not penetrate to the centre as in a small hive and the bees may keep warm enough to survive. Ample protection is, therefore, more important than the system of ventilation.

We have no experience in bee-house wintering but think the temperature that would enable the bees to maintain fifty degrees over the cluster or about that, could be very readily ascertained by experiment. But the plan of ventilation adopted for the bee-house or cellar will affect very much the plan of ventilation required for the hives.

According to our experience a well banked cellar having no ventilation at all will safely winter bees if the hives are freely ventilated both at the top and bottom. In such case, upward ventilation, especially where there are many bees in a cellar and the temperature ranges about 45 degrees, is quite indispensable to the best results. On the contrary, if the repository has good sub-earth ventilation and a pipe leads from a point near the bottom to a stove pipe or