

always found the bees wet in their winter clusters, and he thought it an evil but when we come to see what the bees are doing we find that the water is a necessity and that bees could not raise brood without it.

Bees place their honey for winter stores above their clusters as the active bees in the cluster can readily get out and in at the top, but by no possible efforts could they make their way through the closely packed lethargic bees at the bottom of the cluster. When the active bees relieve the hibernating bees the active bees pour out in numbers and surround the torpid bees, and by transferring their heat to the cold bees enable them to move into the cluster.

Some preparation by the bees, filling themselves with honey, is necessary when going into the dormant state and some properties in the cluster favourable to hibernation must exist to keep the dormant bees alive. If all the bees in the cluster become torpid from want of food the bees will soon die, but if there is food for all, and a portion of the bees form a heat centre in the cluster, and keep giving off their products of respiration, the whole cluster of bees will keep alive and survive the winter. The heat given off by the active bees cannot reach the dormant bees at the bottom of the cluster, but the respiratory products can reach all the bees in the cluster and prevent their loss by radiation—as the odours of flowers protect the flowers from loss of heat. When bees condense their aqueous vapour in the cluster the remaining respiratory product (carbonic acid gas), must descend, being much heavier than air, and it also prevents radiation and will protect the bees at the bottom of the cluster from loss of heat.

Queenless colonies sometimes winter with but little loss of bees, and in spring may be strong in numbers. If

a queen with sealed brood be given to colonies in this condition they have been known to make strong stocks in summer. Should a queen, however, be given without sealed brood or young bees the queen would be of no use to the old bees, even should they accept her which would be exceedingly doubtful. It is therefore evident that it is the brood raised in winter that is the important factor in building up colonies in the spring and that a colony raising no brood in the winter will gradually die out in spring.

The bees will always raise brood in season and out of season, if their means will allow, in efforts to make the birth rate as high as possible above the death rate. They know something about the decline of empires. They built their empires before man appeared, and for aught we know to the contrary will continue building empires after man has disappeared. The bees and flowers were among the first to come and they will be among the last to go.

The so-called spring dwindling in colonies is owing to the bees not being able to raise brood, hence, to beekeepers the importance of knowing how to assist the bees in keeping up their population. The bees have no difficulty in keeping up their population in summer, the great difficulty is in winter and spring.

To raise brood in clusters the brood raising area in the cluster requires to be protected by a wall of packed bees, and the wall has to be thicker as the temperature is lower. If we assume that in our climate, in winter a two-inch wall of bees is necessary to surround a brood raising area, then a four-inch cluster will raise no brood. A six-inch cluster will give brood area of four inches and four clusters sixteen inches. A twelve-inch cluster will take the bees of four six-inch clusters and will have only half the radiating