

quoted above, where simple fragments of infected wax, when placed on agar jelly, gave rise to a culture of *Bacillus alvei*.

This question I hope to touch on again after I have had an opportunity of supplying healthy bees with foundation made from infected wax.

The other question is whether the temperature to which wax is raised during foundation making is sufficiently high to destroy the spores of foul brood? In order to decide this question there are several points to be noted. The first is the character of the heat. We know that moist heat will destroy bacteria and their spores much more quickly than dry heat, and Mr. Corneil, of Lindsay, has raised this point several times, claiming that the heat to which the bacteria are exposed in melted wax is not moist heat, but dry heat, consequently we must heat to a high temperature and for a long time, in order to destroy the spores. The point is undoubtedly well taken, and can only be settled by direct experiment. In order to determine the temperature at which the spores are destroyed in melted wax, I used a method which was first described by Koch. Sterilized silk threads were saturated with a beef tea culture of *Bacillus alvei* in which there were large numbers of spores. These threads were then allowed to dry, and in the dry state were preserved. These dried threads were introduced into the melted wax and allowed to remain in it for a definite time at a fixed temperature. At the end of that time the thread was introduced into melted agar or into beef tea, heated to the melting point of wax, and thoroughly shaken, so as to separate the wax as much as possible from the threads; then the culture medium was rapidly cooled and the tubes placed in the ordinary cultivating oven kept at 98° F. If I obtained a growth of bacteria I concluded that the threads had not been sufficiently heated in the wax; if I did not, I concluded that they had been sufficiently heated. The following are my results:—

At 212° F. (100° C.) for	$\frac{1}{2}$ hour,	growth.
" "	$\frac{1}{2}$	"
" "	1	"
" "	$1\frac{1}{2}$	"
" "	2	"
" "	$2\frac{1}{2}$	no growth.

At 194° F. (90° C.) for	$\frac{1}{2}$ hour	growth.
" "	$\frac{1}{2}$	"
" "	2	"
" "	3	no growth
" "	4	"

On the other hand a temperature of 122° F. (50° C.) did not destroy the spores in twenty-four hours.

I have repeated these experiments several times with the same results, so that I would conclude that to destroy the foul brood in wax it is necessary to heat to a temperature of at least 194° F. for at least three hours. Now the question arises does this take place during the process of manufacture of comb foundation? In order to get as much data as possible on the subject I wrote to Mr. Larrabee, of Michigan Agricultural College, as he had kindly offered me any assistance in his power. He applied to two prominent foundation-makers for the information. From their replies it is apparent that for a short time at any rate during the refining and purifying of the wax, it reaches a temperature quite at or near 212° F. During sheeting, however, it apparently does not reach a temperature much above the melting point, say 175° F. They both seemed to agree that steam heat for too long a time injures the quality of the wax.

In the *American Bee Journal*, 1891, page 470, we find some statements on the subject in a reply by two prominent foundation makers, to an article by Mr. Corneil upon the dangers of infected comb foundation. One of them, Mr. Daland, states that in refining it is heated for sometime at 212° F., and is kept liquid for twenty-four hours. The other, Mr. M. H. Hunt, states that it is kept at the boiling point for six or seven hours. If these are the actual temperatures reached during foundation making I am inclined to think there is little danger from foul brood in that direction.

I thought it possible that the whole question could be settled by introducing a certain amount of some disinfectant, say Beta Naphthol, into the melted wax, but my results have not been satisfactory. Apparently even the introduction of one per cent. Beta Naphthol into wax did not