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STATE BOARD OF AGRICULTURE.  
OFFICE OF THE STATE INSPECTOR OF APIARIES.

BROOD DISEASES OF BEES,  
THEIR TREATMENT

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## MAILING SAMPLES OF BROOD FOR EXAMINATION.

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The Inspector of Apiaries solicits for examination specimens of brood thought to be diseased. The sample should be taken from a center brood frame and should contain no honey. It should be cut so as to exactly fit into a strong mailing box. Comb section boxes, to which are nailed pieces of wood from a cigar box, or small tin boxes make excellent packages. The comb should not be wrapped in paper or cotton, because this may hinder or make diagnosis impossible. The box should be securely fastened and wrapped in paper, with the name and address of the sender written plainly in the corner. It is also advisable to send a letter stating the condition of the colony, the number of colonies you have, the number, if any, recently lost, and such other details as may suggest themselves. Address communications to

**Dr. BURTON N. GATES,**

*Inspector of Apiaries,*  
AMHERST, MASS.

# BROOD DISEASES OF BEES, THEIR TREATMENT AND THE LAW FOR THEIR SUPPRESSION IN MASSACHUSETTS.<sup>1</sup>

BURTON N. GATES, Ph.D., *Inspector of Apiaries, Amherst, Mass.*

There is undeniable proof of the occurrence in Massachusetts of two distinct brood diseases of bees, American foul brood and European foul brood, which cause inestimable loss to beekeepers, and indirectly to orchardists and growers of cucumbers under glass. Each of these diseases attacks the developing brood, and each results in a marked reduction of the population of a colony, if not its death. Also, the adult bees are rendered inactive, making diseased colonies of bees unproductive. Each disease, if untreated, may destroy entire apiaries, as has been commonly experienced.

A preliminary study of the occurrence of these diseases in Massachusetts was published in 1908 as a bulletin entitled "Bee Diseases in Massachusetts."<sup>2</sup> Since then there has been enacted by the General Court a law "to provide for the appointment of an inspector of apiaries and for the suppression and control of contagious bee diseases," which appears on page 10. The Inspector of Apiaries solicits the co-operation of each beekeeper in the State, and will gladly examine samples of broods believed to be diseased. These should be mailed according to directions on inside front cover.

<sup>1</sup> This paper has been compiled largely from "Brood Diseases of Bees," by E. F. Phillips, Ph.D., Bureau of Entomology, United States Department of Agriculture, Circular 79, and from the present writer's publication, referred to below.

<sup>2</sup> "Bee Diseases in Massachusetts," by Burton N. Gates, Bureau of Entomology, United States Department of Agriculture, Bulletin 75, Part III, and also published by the Massachusetts Agricultural Experiment Station as Bulletin 124. A copy may be had free by addressing Director, Massachusetts Agricultural Experiment Station, Amherst, Mass. To these the reader is referred for more detailed accounts of brood diseases.

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## AMERICAN FOUL BROOD.

### *Cause.*

The cause of American foul brood is definitely known to be a germ or bacterium, *Bacillus larvæ* White, which kills the developing brood.

### *Appearance.*

The brood is usually attacked about the time that the cells are capped. The larvæ (grubs) die, decay begins and the cappings of the cells become sunken and perforated. A comb in this condition presents a scattered and irregular arrangement of the brood. The larva or grub when first affected turns a light chocolate color, gradually darkens, and in an advanced stage becomes the color of roasted coffee. If a toothpick is inserted into a dead larva, and then slowly removed, the decayed material often adheres and stretches an inch or more before breaking. This is spoken of as "ropiness." The decayed brood has a characteristic odor, resembling a poor quality of glue, — the "glue-pot" odor. Finally, the broken-down tissues, having sunken to the lower walls of the cells, dry down into a characteristic mass sometimes called a "scale," which adheres closely to the cell. These scales can be removed only with difficulty, and are frequently diagnostic. Larval queens and drones, it has been found, are seldom attacked. The disease, however, apparently affects the activity and vigor of the adult workers.

## EUROPEAN FOUL BROOD.

European foul brood is the most disastrous and widespread of bee diseases in Massachusetts, but is the most difficult to diagnose from gross examination.

### *Cause.*

The cause of this disease has not yet been announced, but it is believed to be a specific, bacterial organism.

### *Appearance.*

The larvæ (grubs) are attacked at an earlier stage than is the case in American foul brood, the majority dying before they are sealed. When first affected the larva shows a

minute yellow spot on the body near the head, and usually is restless in the cell. The disease soon kills the larva, which turns yellow, then brown, and finally almost black. When a stick is inserted in the decayed mass the tissues usually do not stretch out, but the ropiness, which is characteristic of American foul brood, occasionally does occur in European foul brood. Finally, when the decayed mass dries down, there is formed an irregular scale, which is only slightly adherent to the lower cell walls. The odor of the decaying brood is not the "glue-pot" odor of American foul brood, but, if any is noticeable, it suggests a sour, yeasty smell. This odor may not be characteristic. European foul brood attacks both queen and drone larvæ. The disease spreads rapidly, being extremely infectious in the spring and early summer, but may seem to disappear in the late summer and autumn, only to reappear another season, which is said never to occur with American foul brood. The vigor and activity of the adult bees are affected.

#### TREATMENT.

Both American foul brood and European foul brood are successfully treated by the same method.

#### *Drugs.*

Various drug treatments have been recommended for spraying, feeding and fumigation, but beekeepers are urged to regard these as absolutely worthless in combating brood diseases, as has been proved by experiment.

#### *Shaking Treatment.*

Shaking is the treatment which is recommended by the United States Department of Agriculture, and is pronounced satisfactory throughout the United States. The key to successful treatment is the removal of the bees from infected materials.

Prepare a clean and uninfected hive, preferably with new frames containing *half-inch* starters of foundation. The diseased colony should then be drummed or shaken into the new hive containing the narrow strips of foundation, care being taken not to allow honey to drop from the infected combs. In this way none of the infected honey becomes

deposited in the new cells, but is consumed in constructing them. If desired, the bees may be drummed or shaken first into a clean box and then hived on starters. The box should afterward be burned. Some beekeepers prefer to shake onto a paper spread before the entrance to the new hive, the bees being allowed to "run in;" in this way the paper catches any infected honey which may fall from the combs, and may be burned later. Several weak colonies may be shaken together to form one colony in strength equal to a good prime swarm. One queen may be caged temporarily, or the colonies may be united, regardless of the several queens.

Shaking should be done so as to prevent robbing and thus the spread of the disease. This may be accomplished in a building, within a screen cloth cage, or in the evening, but preferably when there is sufficient honey flow to prevent robbing. Care should be taken not to smear the hands or clothing with honey.

If desired, the shaking treatment may be modified, using a bee escape instead of shaking the bees from the combs. The infected colony is removed from its stand, and a clean hive with starters set in its place. The queen is at once transferred to the new hive, where she is joined by the field bees. A bee escape is fitted to the entrance of this old hive, so that the bees of the diseased colony can leave but not enter it, and the infected hive is either placed on top of or close beside the new one. In this way the bees from the old hive will join those in the new one. The shaking method will be found the easier and quicker, however.

With either of these methods, in order to prevent the bees from deserting the strips of foundation, it is well to shade the hive, cage the queen or cover the entrance with perforated zinc until the colony is well established with brood.

#### *Second Treatment.*

It is frequently necessary to give a second treatment by shaking the bees onto a new foundation, either starters or full sheets, in new frames, four or five days after the first treatment. The comb made after the first treatment should be melted for wax and the honey disposed of so as not to come in contact with bees.

### *Disposal of Infected Material.*

Too great care cannot be exercised in disposing of infected materials in order to keep them away from healthy bees. All of the products of the infected hive, brood, wax and honey, and the hive furniture, bottom boards, covers, hives, frames and supers may be saved provided their value warrants a little labor.

### *Care of the Brood.*

Healthy brood in infected combs, provided it will be profitable, may be tiered above a queen-excluding zinc, on a weak colony which is diseased. After a week or ten days all the bees which are worth saving will have emerged. This colony, now strengthened, should be treated.

### *Care of Infected Honey.*

With the general occurrence of brood diseases, and since honey is the important medium in the transmission of brood diseases, it is not safe to feed honey, unless boiled, to bees. Honey from infected colonies is, however, considered wholesome for human consumption. To render honey sterile and safe for feeding it should be diluted with equal parts of water and boiled hard for nearly or quite an hour. Candy for queen cages and feeding should be made from sterilized honey.

### *Care of Wax from Infected Colonies.*

Wax from diseased colonies should be rendered over fire; the solar wax extractor should not be used. Wax when made into foundation is considered safe.

### *Care of the Hive Furniture.*

All parts of hives in which infected colonies have been should be scraped clean, and the refuse particles of propolis and wax burned. Frames and section boxes, being inexpensive, are usually also burned. The inside parts of hives, after being thoroughly scraped, should be sterilized by fire. A gasoline torch is commonly used, but any method

which will char and blacken the wood will be satisfactory. Cracks, corners and crevices must not be neglected. A hive thoroughly flamed is safe to be used again.

#### THE SPREAD OF THE DISEASES.

Especially in the decayed brood, in the resulting dried scales, in the honey and pollen of an infected colony, there occur innumerable germs or spores of the disease organism, each capable of growth and production of the disease. These spores are the resting stage of the organism, are resistant to heat and cold, dryness and antiseptics, and may be compared to seeds of the higher plants. In contact with the living tissues of the larval bee, these spores may germinate, grow, reproduce and multiply. Thus, if infected material comes in contact with a healthy colony, there is great danger of the spread of the disease. Honey particularly is an important means of its dissemination. Every beekeeper should realize, therefore, that each case of either brood disease is capable of infecting all the bees within a radius of several miles.

#### *Robber Bees.*

Robber bees are known to be one of the chief agents in spreading the diseases. If a colony dies, no matter from what cause, do not risk the removal of the remaining stores by robbers, but immediately close up the hive bee-tight and remove it to a building secure from bees. If a colony is discovered to be diseased, contract the entrance and protect it from robbers; then treat.

#### *Honey.*

Honey has been shown to be the chief medium for the transmission of the disease germs. Consequently feed no honey unless thoroughly boiled. Leave no honey about where bees may possibly get at it. Do not allow bees to clean up scraps of comb, section boxes, partially filled supers or tools smeared with honey. In treating, take care that the honey of the infected colony does not shake out into the new hive or onto the ground.

## CAUTION.

Prevent robbing.

Clean up the bee yard.

Do not feed honey unless boiled.

Have a sample of brood examined if a colony dies, fails to build up or dwindles.

Treat colonies immediately upon determining that they are diseased.

Combs, supers, section boxes, etc., should not be transferred from hive to hive in an infected apiary.

Melt up old combs; burn the refuse.

When handling infected material, and after treating a diseased colony, as a precaution, disinfect the hands, tools, etc., with a 5 per cent. solution of carbolic acid, or a solution of 1 part of corrosive sublimate (mercuric chloride) to 1,000 parts of water.

In introducing queens, the candy in the mailing cage should not be put into a healthy colony. It is safer to remove the queen to a sterile cage and introduce her, unaccompanied by her escort of workers.

In purchasing bees, the buyer should be certain that he is getting stock free from disease.

Beekeepers in the vicinity of greenhouses where bees are used to fertilize cucumbers should insist that discarded hives and combs are not thrown out, exposed to the access of robbers. If of no value to the cucumber grower, such material should be burned.

Do not be mistaken in believing that the so-called "bee moth" or "wax moth" causes the loss of a colony of bees. The destruction by this insect is usually secondary; frequently one of the brood diseases is primary, and the "moth" enters as a direct result of the depleted condition of the colony.

## OTHER DISEASES OF BEES.

There are several other diseases or so-called diseases of bees, among which may be mentioned chilled brood, overheated brood, starved brood, pickled brood, dysentery and paralysis.

## MASSACHUSETTS LAWS WITH REFERENCE TO CONTAGIOUS BEE DISEASES.

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### CHAPTER 653, ACTS OF 1910.

AN ACT TO PROVIDE FOR THE APPOINTMENT OF AN INSPECTOR OF APIARIES AND FOR THE SUPPRESSION AND CONTROL OF CONTAGIOUS BEE DISEASES.

*Be it enacted, etc., as follows:*

SECTION 1. The state board of agriculture shall appoint some person qualified by scientific training and practical experience in bee keeping to be state inspector of apiaries, to serve until the thirty-first day of March in the year nineteen hundred and eleven, who shall be responsible to the said board for the performance of his duties under this act, and may be removed from office by the said board for neglect of duty or malfeasance in office. The inspector of apiaries, with the approval of the said board, may appoint such deputies, not exceeding three, as he may deem necessary. The inspector and each of his deputies shall receive five dollars for each day of service actually rendered under this act and the amount of the travelling and other necessary expenses incurred in said service.

SECTION 2. It shall be the duty of the inspector of apiaries to prepare and distribute from time to time such literature upon the subject of bee culture, with the approval of the state board of agriculture, as may be deemed advisable. He shall also make or cause to be made through his deputies, annually, such inspection of the apiaries throughout the state as may be deemed necessary to discover and suppress all bee diseases of a contagious nature, and he shall have authority, with the approval of the said board, to make and issue reasonable regulations for carrying out the provisions of this act.

SECTION 3. No person shall keep a colony of bees affected with the disease known as foul brood, or black brood or with any other infectious or contagious disease harmful to honey bees in the egg, larval, pupal or adult stage, except as provided by section four of this act; and every bee keeper, when he becomes aware of the existence of such a disease among his bees, shall at once notify the inspector of apiaries of the existence of the same. Any person who, knowing that a contagious or infectious disease exists among his bees, sells, barter or gives away, or in any other way disposes of the same in whole or in part, or any product of the same, or any hive, super, frame, section or other appliance used about the diseased bees, in such manner as to cause the spread of the disease, shall, upon conviction before a court, be liable to the penalties named in section eight of this act.

SECTION 4. The inspector of apiaries shall, upon the discovery of a case of foul brood, black brood or other infectious or contagious disease, send to the owner of the diseased bees an order in writing that such bees shall be held in quarantine until such time as the same are released by a written permit from the inspector of apiaries, and bees so placed in quarantine shall not be removed from the premises of the owner under the penalties named in section eight of this act.

SECTION 5. Upon the discovery of a case of foul brood, black brood, or other infectious or contagious disease in any apiary or colony, the inspector of apiaries or his deputies shall give such instruction to the owner or caretaker thereof, as to the treatment of the diseased colonies, as may be necessary. If, upon subsequent inspection, the disease is still found to exist in the apiary or colony, the inspector of apiaries or his deputies may cause the diseased colonies to be destroyed in such manner as to prevent the spread of the disease.

SECTION 6. For the purpose of enforcing this act the inspector of apiaries or his deputies shall have access, ingress and egress to all places where bees, bee products or supplies or appliances used in apiaries are kept.

SECTION 7. The inspector of apiaries shall keep a detailed

record of the number and location of all apiaries visited by him or his deputies, the number and location of all colonies found diseased, and the treatment thereof, and the expenditure incurred in the performance of his duties. He shall report to the state board of agriculture annually, and at such other times as the board may request, and his annual report shall be published in the annual report of the state board of agriculture.

SECTION 8. Any person convicted of the violation of any provision of this act shall be subject to a fine not exceeding ten dollars for the first offence, to a fine not exceeding twenty-five dollars for the second offence, and to a fine not exceeding fifty dollars for any subsequent offence.

SECTION 9. A sum not exceeding five hundred dollars may be expended by the state board of agriculture in carrying out the provisions of this act.

SECTION 10. This act shall take effect upon its passage.  
[Approved June 15, 1910.]



