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**THE FOUL BROOD OF BEES
AND
THE FOUL BROOD LAW.**

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and

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Postoffice.

COLLEGE STATION, BRAZOS COUNTY, TEXAS.

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THE FOUL BROOD OF BEES.

The bee industry of Texas is assuming large proportions and has already become a very important source of income to many farmers of this State. It has come to the point of development where any disease of bees, so destructive as foul brood, means a very heavy loss to many beekeepers who can ill afford to suffer it. Moreover, this disease is spreading at an alarming rate and definite steps should be taken as early as possible to stop its ravages and prevent its distribution. It seems to the authors that the first step in this direction should be one whereby beekeepers may become more familiar with the disease and able to recognize it when present in their apiaries. At least, every beekeeper ought to know enough about foul brood to be on the watch for it and become sufficiently suspicious of it to seek definite information from this department if he is not sure himself. Moreover, every beekeeper should familiarize himself with the foul brood law of the State.

To these ends, the following non-technical bulletin has been prepared.

The authors are greatly indebted to the Bee Journals and to the publications of the United States Bureau of Entomology. They have drawn freely from bulletins and circulars of the latter by Dr. G. F. White and Dr. E. F. Phillips.

THE NATURE OF BACTERIA.

Since foul brood is caused by those minute organisms known as bacteria, something of their structure, habits and characteristics should be known.

Bacteria are commonly known as germs, microbes, etc. They are really exceedingly small plants, invisible to the naked eye, composed of one single cell and are found everywhere, in water, in air, in the bodies of animals, in the soils, and in and on the higher plants. Some cause disease in animals and plants, while some are very beneficial to man, especially those causing decay, those causing certain chemical changes in the soil, and those causing certain changes in milk, cream and butter.

Bacteria multiply at an enormous rate. A single bacterium will give rise to millions of individuals within twenty-four hours under the right conditions of food, moisture, temperature, etc. It is no wonder, then that a disease once started by these organisms develops rapidly.

Again, many bacteria at certain stages of their life, especially when conditions become unfavorable for multiplication, produce what are known as spores. These spores act for the bacteria much as seeds act for the higher plants. The spores are very tough bodies capable of withstanding high degrees of heat and cold, dryness and other adverse conditions. They rest over through these adverse conditions just as seeds do and then, when favorable conditions of heat, moisture, etc., return, grow and produce the bacteria again.

Foul brood is caused by certain bacteria that attack the brood of bees, producing a very high death rate.

TWO KINDS OF FOUL BROOD.

Recent investigation has shown, with a high degree of certainty, that there are two kinds of foul brood in the United States, the American foul brood, and the European foul brood. These are quite distinct from each other, and are evidently caused by two different species of bacteria. It must be said, however, that it is not easy to distinguish one from the other with certainty, except by a careful and complicated microscopical examination.

THE AMERICAN FOUL BROOD.

Cause of this Disease—Experimental evidence seems to show that this disease is caused by a definite bacillus known as *Bacillus larvae*, White. Dr. White has found this bacillus present in all diseased colonies studied by him and has succeeded in producing the American foul brood disease experimentally by feeding pure cultures of the *Bacillus larvae* mixed with sterile sugar syrup to healthy colonies. The bees to which he fed these bacilli developed the disease with all the typical symptoms within three weeks of the time of feeding.

Distribution—It is widely distributed all over the United States and is apparently more virulent in the West than in the East. It is found in the following counties in Texas: Fannin, Tarrant, Dallas, Kaufman, Ellis, Navarro, Limestone, Hays, Bexar, Bee, Live Oak, Medina, Uvalde and Zavala.

Although no thorough investigations have been undertaken, we believe that **only American foul brood occurs in Texas.**

Symptoms—The symptoms of American foul brood as given by Dr. E. F. Phillips are as follows:

“The adult bees of an infected colony are usually rather inactive and do little toward cleaning out infected material. When the larvae are first affected they turn to a light chocolate color, and in the advanced stages of decay they become darker, resembling roasted coffee in color. Usually the larvae are attacked at about the time of capping, and most of the cells containing infected larvae are capped. As decay proceeds these cappings become sunken and perforated, and, as the healthy brood emerges, the comb shows the scattered cells containing larvae which have died of the disease, still capped. The most noticeable characteristic of this infection is the fact that when a small stick is inserted in a larva which has died of the disease, and slowly removed, the broken-down tissues adhere to it and will often stretch out for several inches before breaking. When the larva dries it forms a tightly adhering scale of very brown color, which can best be observed when the comb is held so that a bright light strikes the lower side wall. Decaying larvae which have died of this disease have a very characteristic odor which resembles a poor quality of glue. This disease seldom attacks drone or queen larvae.”

THE EUROPEAN FOUL BROOD.

Cause of this Disease—European foul brood is caused by a definite bacil-

lus, known as *Bacillus alvei*. The disease seems to be more destructive in cool, damp weather and seems to cause more rapid loss than the American foul brood. It is not yet known to occur in Texas but is rapidly spreading westward. It is often called "black brood."

Distribution—European foul brood has been found in New York, Vermont, Massachusetts, Connecticut, New Jersey, Pennsylvania, Ohio, West Virginia, Michigan, Indiana and Illinois. It seems to be rapidly spreading toward the Western United States, and very likely the beekeepers of Texas will suffer from the disease before many years have passed, and especially so if colonies are imported indiscriminately from the East.

Symptoms—Again Dr. Phillips gives the symptoms of this disease as follows:

"Adult bees in infected colonies are not very active, but do succeed in cleaning out some of the dried scales. This disease attacks larvae earlier than does American foul brood, and a comparatively small percentage of the diseased brood is ever capped. The diseased larvae which are capped over have sunken and perforated cappings. The larvae when first attacked show a small yellow spot on the body near the head and move uneasily in the cell. When death occurs they turn yellow, then brown, and finally almost black. Decaying larvae which have died of this disease do not usually stretch out in a long thread when a small stick is inserted and slowly removed. Occasionally there is a very slight "ropiness," but this is never very marked. The thoroughly dried larvae form irregular scales which are not strongly adherent to the lower side wall of the cell. There is very little odor from decaying larvae which have died from this disease, and when an odor is noticeable it is not the "glue pot" odor of the American foul brood, but more nearly resembles that of soured dead brood. This disease attacks drone and queen larvae very soon after the colony is infected. It is as a rule much more infectious than American foul brood and spreads more rapidly. On the other hand, it sometimes happens that the disease will disappear of its own accord, a thing which the author never knew to occur in a genuine case of American foul brood. European foul brood is most destructive during the spring and early summer, often almost disappearing in late summer and autumn."

There seems to be some doubt regarding the real cause of this disease.

THE TWO DISEASES CONTRASTED.

AMERICAN FOUL BROOD.

1. Widely distributed over the United States.
2. Affected brood turns light chocolate and finally resembles roasted coffee.
3. When a small stick is inserted in a dead larva and slowly removed, the tissues will adhere to the stick and stretch out for several inches. This is called "ropiness."
4. The dead brood has a characteristic odor of a poor quality of glue.
5. When larva dies it finally forms a tightly adhering scale of very dark brown color.
6. This disease seldom attacks drone and queen larvae.
7. Not so infectious and spreads more slowly.

EUROPEAN FOUL BROOD.

1. Only known east of the Mississippi river at present.
2. Affected brood turns yellow, then brown and finally almost black.
3. The dead brood does not, as a rule, show this "ropiness." If any "ropiness" is shown it is not very marked.
4. Very little odor and no odor of glue. Sometimes smells like soured dead brood.
5. When larva dies it forms an irregular scale that does not adhere strongly to the lower side of cell.
6. This disease attacks drone and queen larvae soon after the colony becomes infected.
7. More infectious and spreads more rapidly.

LOSSES CAUSED BY FOUL BROOD.

The losses from foul brood result from the effects on several different phases of the bee industry. The most direct loss occurs from the actual deaths of colonies of bees together with the loss of the honey that these colonies might have made. One beekeeper in Ventura County, California, lost 137 colonies of bees out of 151 in a little over twelve months from American foul brood. It is estimated that the European foul brood caused a loss of \$45,000 in bees alone in a limited area in New York during 1899 and 1900. The losses due to a decrease in the sales of bees and in the sales of beekeeper's supplies and the check on commercial queen rearing cannot be estimated.

HOW FOUL BROOD SPREADS.

The germs causing these two foul brood diseases are very easily carried from place to place on the legs, mouth parts, and bodies and in the honey stomachs of the bees and on the hands and tools of persons working with infected colonies.

Diseased Colonies—When a colony contracts the disease nearly every part of the hive becomes infected with the foul brood germs. Moreover, a diseased colony soon becomes so weak that it is unable to defend itself from robbers and these bee robbers are almost sure to carry away some of the germs on their bodies or in the honey that they get and thus they introduce the disease into their own healthy colony. Consequently, a constant watch must be kept for diseased colonies and just as soon as found they must be treated or destroyed.

Feeding Honey.—Since honey in diseased colonies contains the foul brood germs, it is really dangerous to feed honey to healthy colonies unless one is sure no foul brood exists in his apiary or unless the honey has been boiled from half an hour to an hour. We believe it would be very unwise to buy honey in the open market to feed to bees. It is much safer to feed them on a supply of syrup of sugar and water.

Disinfecting Tools and Hands.—In working with diseased colonies and infected hives and frames one is sure to get the germs on one's hands and on the tools with which the work is being done. It then becomes necessary to wash the hands and tools in a solution of 1 part of corrosive sublimate to 500 parts of water or 1 part of carbolic acid to 20 parts of water. Either one of these solutions will kill the germs and prevent their being carried from one hive to another.

The Purchase of Bees.—The authors are firmly convinced that no bees or queens should be purchased of any beekeeper until he gives conclusive proof that his apiary is absolutely free from foul brood.

TREATMENT OF FOUL BROOD.

In order to know, perfectly, the existing condition of the interior of a hive of bees, and in order to combat any bee disease successfully, the bees should be in a modern, moveable frame hive. In such a hive it is possible to note the first signs of the disease and to promptly administer the proper remedy.

The majority of the "box-hive beekeepers" think it too expensive to get a modern hive. This is a mistake. With a little care in manipulating the bees in their new home they will repay their owner, not only for the hive, but also for his trouble.

The State Entomologist has the authority to order any beekeeper to transfer his bees from box hives into modern, moveable frame hives within a specified time, so that he or his deputies can make a thorough inspection when necessary.

The only way for the beekeeper to exterminate Foul Brood is to transfer his bees into moveable frame hives. He can then watch the bees as they build up their new combs. If the disease should appear in the brood he can then easily follow either of the remedies given.

Burning—When a colony of bees, affected with foul brood, has been reduced to such a condition that it is not worth saving, or when the beekeeper is inexperienced and has no experienced person to help him, it should be destroyed by burning.

The apiary should be inspected during the day and all affected hives marked. The inspectors of this office use a cross on the front top of the cover and one on the left side of the hive body.

In the evening, after the bees from the fields are all at home, the bees are killed, either with sulphur fumes or the gas of carbon bisulphide (high-life.) In using sulphur, the fumes can be blown into the hive through the entrance with an old bee smoker. The entrance must then be tightly closed. This smoker cannot, of course, be used for healthy bees afterwards.

If no smoker is handy, a shallow tin vessel of hot coals on which a handful of sulphur is thrown and then placed on the bottom board under the affected colony, has been found to work successfully. The hive must

be air tight. To kill the bees with carbon bisulphide (highlife), saturate a piece of cotton with about two tablespoonfuls of the liquid and then place it between two frames of the diseased colony. Great care should be exercised not to have fire anywhere near the bottle containing the liquid for it is highly inflammable.

After the bees have been killed, carry them to a hole, previously dug, to be burned. Where several colonies are to be burned, the hole should be about eight feet square and from one to one and one-half feet deep. In this hole, have a good blazing brush fire. The heat of the fire can be increased by pouring over the brush a quart or two of kerosene oil before lighting.

The affected hives are placed on the earth thrown out of the hole, so that if any material falls from the hives or frames while being taken out to be burned, it can be raked into the hole before it is closed up after the burning. The hive cover, if it is worth saving should be scorched by holding over the blaze with an iron rod or hayfork. The body and bottom should be treated in the same manner. Throw the frames into the fire taking the precaution not to scatter any infested honey or dead bees during the process. When the fire is pretty well burned out, rake the earth back into the hole, taking first that part on which the diseased hive stood while burning the frames and bees. If this hole is carefully covered there will be no trace of the disease.

The scorched hives are then disinfected by painting with a carbolic acid solution, one part acid to two parts of water, and well aired before using.

Shaking.—Where the disease has not greatly weakened the colony and the owner of the bees is not running a risk, they can be treated by the shaking method. This simply consists of shaking the bees into a clean hive with frames containing foundation starters. It is chiefly based upon the McEvoy method so successfully used by one of the oldest inspectors of this country, William McEvoy, of Woodburn, Ontario, Canada. We will give his method and follow the same with a few changes that were found necessary in some portions of Texas. This method is as follows:

“During the honey flow, the combs and bees are removed from the infected hives and replaced by new frames containing only foundation starters. The bees are now shaken from the comb into the hive and allowed to remain until the starters are drawn out. None of the brood or honey are left in the hive. This shaking is done in the evening after the bees have ceased flying, so that there will be no danger of robber bees carrying the infected honey to other hives. After the starters are drawn out (usually about four days) they are replaced with frames containing full sheets of foundation, and the bees again shaken into the hives. By this method all honey taken into the infected hives by bees is used up in wax secretion before any brood can appear. The diseased brood is piled up two or more tiers high, and as many of the larvae as may be allowed to mature. They are then also shaken on to the foundation starters and in four days on to full sheets. If there are enough bees to make a swarm, give them a queen or a queen cell; or several small batches of young bees can be united and then a queen given to them.

The old frames are then burned. Those used with the starters are disinfected with carbolic acid solution, one part acid to two parts water."

Mr. McEvoy does not disinfect his hives. In the experiments carried out by this department in North and Central Texas it was found absolutely necessary to thoroughly disinfect the hives before again using. Besides, we have always found it best to disinfect the hands, tools and clothing after working with foul brood. A person cannot be too careful and should not run any risk whatsoever. This is the only way to ever exterminate this dreaded disease.

Fumigating—In the last few years, discussion arose in different bee journals as to the value of formaldehyde for curing foul brood. The idea was to fumigate the frames containing infested honey and brood with formalin gas in an air tight box. Some beekeepers reported it to be a success, while others state that it proved a failure, for it would not do the work.

Finally, the Bureau of Entomology at Washington, D. C. took up the work and showed that, when combs were subjected to the fumes of the gas for forty-eight hours, in a Novy's Anaerobic jar, all germs of the disease would be destroyed, but as the average beekeeper would not have the requisite facilities, skill, and knowledge to carry on such a work, he had better not take his chances of transmitting any infectious disease through combs fumigated under conditions such as he is able to provide.

STATE INSPECTION.

The authors are also firmly of the opinion that State inspection by men who understand their business will aid very greatly in controlling these diseases and **if made thorough enough, will eventually stamp them out.** The work, however, will demand a considerable sum of money from our Legislature and will demand men who, in addition to being reliable inspectors, are also good teachers and can show beekeepers in a simple plain way how to treat these diseases. That foul brood can be treated in such a manner that it may be eradicated, has been conclusively demonstrated.

FOUL BROOD LAW.

HOUSE BILL NO. 293.

An act: To provide for the protection of Honey bees against foul brood and other contagious diseases, and providing that all beekeepers report to the State Entomologist when infectious diseases exist: providing for collecting the expense of eradicating the disease, and fixing the charges upon the owner of the bees; providing for the extermination of all contagious diseases; and providing penalties for the violation of this Act.

SECTION I. BE IT ENACTED BY THE LEGISLATURE OF THE STATE OF TEXAS

If any owner of, or any person having control or possession of any honey bees in this State, knows that any bees so owned or controlled are affected with foul brood, or any other contagious disease, it shall be and is hereby made his duty to at once report said fact to the State Entomologist, setting out in his report all the facts known with reference to said infection. The State Entomologist shall have full power in his discretion to order any owner or possessor of bees dwelling in hives without moveable frames, or not

permitting of ready examination, to transfer such bees to a moveable frame hive within a specified time. In default of such transfer the State Entomologist may destroy, or order destroyed, such hives, together with the honey, comb frames, and bees contained therein without recompense to the owner, lessee or agent thereof.

SECTION II. The State Entomologist shall prescribe such rules and regulations as may in his judgment seem necessary for the eradication of all contagious diseases of bees, and if at any time the Entomologist finds, or has reason to believe that the owner or keeper of any bees, or the owner of any apiary has refused or is refusing to comply with all or part of any such rules or regulations, then and in that event the State Entomologist is hereby ordered to inspect said bees, and if necessary, burn diseased colonies, appliances and honey and do any and all things necessary in the premises to eradicate foul brood or any other infectious disease of bees.

SECTION III. When any owner or possessor of bees shall fail to carry out the instructions of the State Entomologist, as set forth in the Secs. I and II of this Act, the State Entomologist shall carry out such destruction or treatment, and shall present to the owner of said bees a bill for the actual cost of such destruction or treatment. In the failure of the owner or possessor of such bees to pay said bill within thirty days after the delivery of same to himself, tenant, or agent, or within thirty days after mailing same to his usual Postoffice address, the State Entomologist shall certify to the County Attorney of the County wherein such bees are located, the amount and items of said bill; and the County Attorney shall file suit for the recovery of said account. All moneys recovered by the County Attorney for such destruction or treatment shall be paid into the hands of the County Treasurer, to become a part of the fund for carrying out the provisions of this Act.

SECTION IV. No person shall ship, barter or give away bees, honey, or appliances, from any other State or country into this State, nor shall any person in Texas receive such unless the bees, honey, or appliances in question have been thoroughly inspected before reaching the State by a competent inspector; and that this inspector has made report in writing to the State Entomologist of Texas giving in detail the condition of the apiary and full assurance that the apiary is apparently free from contagious diseases.

SECTION. V. The fact that the season when young colonies of bees will leave the mother colonies is near at hand, that there is no existing law properly governing colonies affected with foul brood, create an emergency and an imperative public necessity, requiring the suspension of the constitutional rules which requires bills to be read on three several days, and the same is so suspended, and this act shall take effect and be enforced from and after its passage; and it is so enacted.

PAT M. NEFF, Speaker of the House of Representatives.

HON. HAL SEVIER, Author.