

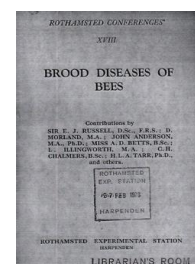
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## Brood Diseases of Bees

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### Appendix : Brood Diseases of Bees

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## BROOD DISEASES OF BEES

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organisms. It attacks the larvae at an older stage than is usual in the case of European foul brood. The larvae generally die at about the time of pupation so that much of the diseased brood is found to be capped, and a cocoon is often formed.

*Symptoms of American Foul Brood.* The prevalence of sealed cells, is characteristic of this disease. The sealed brood is seen to be sprinkled with open cells. Cappings may be stained by the decay going on within the cell; they may be sunken, or partially or wholly torn away by the bees. The smell is characteristic and a more reliable indication than it is in the case of European foul brood; it has been likened to that of an ill-kept glue pot. The brood may die as larvae or pupae. The dead grubs lie on their backs on the lower side of the cell in a stretched out position; in the case of the larvae the head is slightly raised, while the tongue of the pupa, pointing upwards and often sticking to the top of the cell, is very typical. At a certain stage of decay of the larvae, the mass, if stirred with the end of a match, can be drawn out like a thread. Brood which has died from other causes does not behave in this manner.

The dead brood changes to a coffee colour. The dried scales adhere strongly to the cell wall and cannot readily be removed, except when the cell is an old one lined with larval skins which tear away with the scale.

*Spread and Prevention.* All races of bees are equally susceptible to American foul brood. The disease attacks strong as well as weak colonies, and may occur at any time when there is brood in the hive.

Since the causative organism forms resistant spores which remain alive for many years in diseased material and in honey, the greatest care must be taken to disinfect or destroy any hive or appliance which has been in contact with infection. Honey from unknown sources should not be given to bees, nor should vessels which have contained honey be left where bees may have access to them. After handling diseased or suspected stocks, the beekeeper should disinfect his hands and his smoker and other tools. Washable overalls should be worn when working in an apiary in which disease exists. The exchange of combs between hive and hive even in healthy apiaries should only be practised with a full realization of the risk involved, and never where disease is suspected.

*Treatment.* Before treating stocks for American foul brood it is well to weigh the value of the bees and of the hive and combs, against the time and attention needed to save them, and the risk of the occurrence of further outbreaks of the disease in the event of some detail being overlooked.

Beginners would do well to call in the aid of an experienced beekeeper and to choose one of the more drastic of the measures here indicated.

Any comb, whether of brood or stores, and any part of a hive infected with American foul brood, is liable to carry contagion.

movements. The larvae usually die before the cells are sealed. In cases where the disease has taken a firm hold, some of the cells may be sealed, but the diseased larvae in them neither spin a cocoon nor pupate. The dead brood turns greyish and finally to a dark brown or black mass lying irregularly in the cell, and dries up, forming a scale which can easily be removed. The odour is unpleasant but very variable both in quality and intensity and is quite unreliable as a character for diagnosis. When *S. apis* predominates among the putrefactive organisms it somewhat resembles that of sour paste, whereas the *alvei* form of the disease has been referred to by Continental beekeepers as "stinking foul brood." On the other hand American writers state that in European foul brood there is usually little odour.

*Prevention.* European foul brood usually makes its presence known in spring and is essentially a disease of weak stocks. Owing to their more vigorous house cleaning habits, bees of the Italian race are less liable to suffer from it than are other races. A strong colony of Italian bees is but little liable to contract this disease. *Only strong stocks of vigorous bees should be kept.*

The following treatment is recommended for European foul brood, but it is essential first to make quite certain that it is not a case of American foul brood. (1) Unite weak stocks, because strong colonies are far better able to rid themselves of this disease. (2) Cage the queen, and later remove her and introduce a young Italian queen, allowing a clear ten days during which there is no egg laying in the hive. If a young fertile queen is not available the old queen may be removed at once and a virgin or queen cell provided. (3) Feed the colony with a dilute sugar syrup, until the honeyflow commences. (4) The colony may then be strengthened with combs of *sealed* brood from healthy stocks. During the ten days broodless period there will be no fresh diseased larvae, and under the stimulus of feeding, the infective material will be removed by the bees. Later the stock will be re-peopled with a race of bees less liable to succumb to this particular disease.

Experiments have shown that medication of the syrup has no direct effect. Beneficial results which have been reported of this treatment are due to the feeding rather than the medicament. Odorous substances such as formalin have been used in the treatment of European foul brood, allowing them to evaporate in the hive. It is thought that the presence of an irritating vapour causes the bees to fan more vigorously and that the scales therefore dry more quickly which makes them more easily removed.

#### *American Foul Brood*

A more serious disease, now generally known as "American foul brood" or alternatively "malignant foul brood" or "brood-pest," is caused by *Bacillus larvae* a spore-bearing bacillus, which is itself an agent of decay and does not tolerate the presence of other

## APPENDIX

# BROOD DISEASES OF BEES

By D. MORLAND, M.A.

Owing to the greater urgency of the problems of adult bee disease, brood diseases have lately been neglected in the United Kingdom: in consequence of which much of our knowledge of brood diseases is derived from work done in other countries.

### *Foul Brood*

There are at least two distinct diseases referred to by the term "foul brood." Owing to the somewhat variable nature of the symptoms, much uncertainty has existed, which has been increased by lack of agreement as to nomenclature. It should be pointed out that the terms "European" and "American" foul brood are not used with reference to their geographical distribution, and are only here used to avoid the worse confusion which has been caused by attempts to coin better names.

### *European Foul Brood*

The milder disease, called "European" in recognition of the early investigations of the English microscopist, Frank Cheshire, in collaboration with Dr. W. Cheyne, is now generally regarded both in North America and on the continent of Europe as being caused by *Bacillus pluton*—a non-spore organism which attacks the young larvae. In view of the difficulties attending its culture, further investigation of its pathogenic behaviour, and also of its relations with *Bacillus alvei* (see below) is desirable. Various other organisms invade the diseased brood, so that *B. pluton* can only be recognised in those which have recently become infected, while in dead larvae and those in more advanced stages of disease, it is masked by the presence of auxiliary, putrefactive agents. The two most important of these are *Bacillus alvei*, which Cheshire considered to be the cause of this disease, and *Streptococcus apis*. The symptoms and to some extent the course of the disease are apparently modified according to which of these secondary invaders predominates.

*Appearance of healthy brood.* In normal healthy brood the larvae are plump and pearly white in colour and lie at the base of the cell in the form of the letter C. The brood is regularly arranged and the cappings of the sealed cells are slightly convex. The smell is not unpleasant.

*Symptoms of European Foul Brood:* In a comb affected by European foul brood the diseased larvae become limp and watery yellow in colour, the lateral tracheal tubes showing through the skin. Instead of continuing to lie normally at the base of the cell, they assume a spiral or stretched out condition and exhibit uneasy

*Destruction of Stock.* (a) Where the hive and colony is of small value, the bees should be destroyed after nightfall by suffocation over a sulphur candle, or by pouring a little petrol or carbon disulphide into the hive from above, and closing again until all sounds have ceased. A good bonfire should then be started in a pit and the hive and combs placed on it. \* The pit should be filled in again before morning, to cover any wax or honey which may have escaped the flames. (b) When the hive is worth saving, it may be disinfected as described later and the combs alone burnt.

*The Shaking Treatment* consists of shaking the bees on to a newspaper in front of a new hive on the old stand, so that they run in and start life again as a swarm on strips of foundation. The honey in the honey-sacs of the bees is used up in the formation of wax. The old infected hive and combs should be quickly removed to a place of safety, out of reach of the bees, and dealt with as soon as possible. This treatment is better performed in the evening and during a honey flow, in order to avoid the spread of the disease to other colonies through robbing, and in any case syrup may with advantage be given after an interval of a few hours. Care should be taken not to allow unripe honey to fall anywhere but on the newspaper, and this should afterwards be gathered up and burnt. Many experts prefer to brush the bees off the combs instead of shaking them, especially when newly gathered honey is present. For additional security the swarm may subsequently be shaken again on to full sheets of foundation, but this puts a great strain on the bees. The shaking treatment is only advisable with strong stocks and early in the season. (d) The hive should be scraped clean, and disinfected, either by scorching all over inside with a painter's blow-lamp or by scrubbing with a stiff brush in hot water and soda. 1 lb. soda to 1 gall. water. † The use of goggles and rubber gloves is advised. This is a good opportunity for giving the hive a new coat of paint. (e) If the combs have been saved they may be melted down in boiling water. (The Solar extractor should not be used for this purpose, on account of the danger of spreading the disease.) The wax may then be used with safety even for the manufacture of comb foundation. The frames may be steeped in boiling soda if they are worth saving, but it is usually better to burn them. (f) Disinfection of combs. It is rarely advisable to save the combs, but in commercial apiaries, where large numbers of good combs would otherwise have to be sacrificed it has been found possible to disinfect them, using a solution of formalin in alcohol in the proportion of one part of formalin to four parts of alcohol, and allowing them to soak

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\* Remember that petrol and carbon disulphide are dangerously inflammable, the vapours should be allowed to dissipate first.

† Before painting, the soda must be washed away and the last traces neutralized with a weak solution of vinegar, or the paint will not take well.

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for 48 hours. For details, reference should be made to recent American literature.

### *Other maladies of brood*

*Sac brood.* An infectious disease of brood which is apparently due to a filtrable virus. The dead larvae form watery sacs which contain some granules of broken down tissue, but no bacteria. The scales are easily removed from the cells. This disease is not usually serious.

*Chalk brood.* The larvae die and turn to white mummies of a cork-like consistency. It attacks chiefly the drone brood, and the Dutch race of bees seem to be most susceptible. It is not serious and usually disappears as the season proceeds. It is caused by a fungus *Pericystis apis*; closely related to the white pollen mould *P. alvei*. This disease is favoured by damp, ill ventilated hives.

*Stone brood.* A disease similar to chalk brood, in which the dead larvae turn to hard grey masses in the cell. It is caused by the fungus *Aspergillus flavus*. This disease is more serious than chalk brood but is not yet known to occur in this country. In Germany it is said to attack adult bees in addition to brood.

### *Accidental injury to brood*

*Chilled brood* is purely accidental in origin. It may be due to inadequate protection of hives in spring or to a colony having expanded its brood nest too early. Cold winds or spring frosts will find out such colonies. A more common cause of chilled brood is unseasonable manipulation of colonies by the too enthusiastic beginner, or the unwise "spreading" of brood by the insertion of empty combs between combs of brood in the hope of stimulating the queen to lay. Unless it is a very bad case, the dead brood is not allowed to putrefy in the comb, but is quickly removed by the bees. In the case of chilled brood the whole patch of larvae dies and not cells here and there as in foul brood.

*Starved brood.* Colonies which have indulged in breeding beyond their resources, in the expectation of an early honey flow, which fails to materialise, may find themselves faced with starvation. The usual result is a cessation of egg laying, and the casting out of pupae. The younger larvae also may be removed, and apparently are consumed by the worker bees. The remedy is syrup feeding. Both the above conditions more commonly occur with Italian strains, which are inclined to be speculative in their brood rearing; the black races being more conservative in this respect.

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*Heated Brood.* Brood may occasionally die of over heating. This sometimes occurs when moving stocks of bees by rail if there is brood in the hive. If the travelling box is left in the sun during the journey, bees and brood may die. In opening colonies in very hot weather, combs of brood should not be put in the sun or some of it may be killed by the heat, drying, or the intensity of the light, or by a combination of these factors.

*Spray Poison.* In districts where spraying and dusting of fruit and crops with insecticides is practised, bees may collect the poison. In the former case, heavy mortality among the bees may cause such depletion in the hive that brood may die showing the symptoms of neglect and chilling. Where poison dust is used, it is liable to be collected with the pollen, and lead to direct poisoning of the brood in the hive.

*Poisonous Plants.* In California, brood is said to suffer from poisoning by the nectar of certain plants. No case of this kind has been known to occur in Great Britain.

*Pollen Shortage.* This causes severe mortality of bee brood in parts of Australia. Such a thing is never known in this country.

It should be clearly understood that neither form of foul brood can be spontaneously engendered in cases of accidental mortality. Since foul brood is due to definite disease organisms, infection must be brought from another case of the disease. Micro-organisms are frequently found in the decaying remains of dead brood, but this is only to be expected and they are not necessarily those which cause disease.