

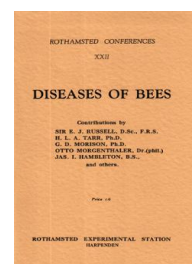
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## Diseases of Bees

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### Bee Paralysis

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## BEE PARALYSIS

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I HAVE to apologise for the incompleteness of these notes, which is due to my not having had sufficient time to study the data at my disposal.

**DEFINITION:** Bee Paralysis is a disease of adult workers, queens and probably drones, and it seems to attack all the common races of honey-bees kept in Great Britain. The affected stock dwindles slowly or more or less rapidly, owing to loss of adult bees. When the stock dwindles slowly, usually a percentage of only older (foraging) bees are affected. In a stock dying rapidly, foragers and younger bees are affected. Bees usually die away from the hive, but they may die scattered in front of the hives or even clustered in small numbers, resembling certain cases of acarine disease. The climatic conditions probably greatly influence the behaviour of bees outside the hive.

When a small percentage of bees is affected, some or all the diseased are hustled away from the hive by their seemingly healthy sisters. These diseased bees are lively with the abdomen not abnormally distended. They try again and again to enter the hive, but each time their healthy sisters forbid their entry, usually without attempting to sting them and often licking them as if to remove a substance from their bodies. The diseased bees lose their hairs in the struggles and they appear polished, darker and smaller than their sisters. In the end they may become almost hairless. They are often mistaken for robbers. Apparently they die from starvation and exposure outside the hive.

A small percentage of bees may be affected without the above mentioned behaviour occurring.

When a large percentage of bees is affected the stock is lethargic, the frames are not, or only slightly marked with faeces. The diseased bee moves its antennae normally; it flutters its wings considerably, but it cannot fly and it may not be able to right itself if turned on its back. The leg movements for walking are weak and the legs may tremble frequently, finally the bee dies lying more or less on its side with its legs tucked in or spread out in various ways. The mouth-parts are held rather extruded soliciting drink and the bee



continually tries to suck up fluids, but apparently without success. The bee attempts to clean itself or its neighbours with its mouth-parts. *It dies with the mouth-parts widely extended.*

“Respiratory” movements of the post-abdomen are variable, ceasing with loss of movement of wings and legs. The sting will often function on the stimulus of pressure shortly after other movements have apparently ceased. The post-abdomen is usually abnormally distended by the contents of the alimentary canal. The abnormal distention is usually due to :

1. Pale watery contents of the rectum,
2. Normal-looking but abnormal quantity of rectal contents,
3. Rectal contents normal in volume but proventriculus greatly distended with sugary solution.

The thorax and post-abdomen are usually rather polished through loss of hair which has probably been rubbed off by the diseased bees licking one another. The surface of the body may be coated with a very delicate film of sticky substance which, I think, is largely faecal in origin. This faecal matter seems to be passed out in very small droplets. It forms a good stratum for bacteria, which may easily contaminate smears of the blood of the bee. An obnoxious smell, often described as “fishy” may be associated with diseased bees. It may be due to secondary and tertiary amines in the faeces and it may be the chief reason for the eviction of the diseased bees by their healthy sisters.

To sum up, the chief characters of the disease are :—

1. Distended post-abdomen,
2. Trembling of wings and legs,
3. Distended mouth-parts and the bees die with them distended,
4. Exceptional thirst,
5. Loss of hair,
6. Fishy smell,
7. Inclusion bodies in cells of small intestine.

PERIODS OF DISEASE.—The disease may exterminate a stock within a few weeks or months, but its course is affected by many factors and the stock may recover by itself, or with the conscious aid of the beekeeper. The individual bee seems to succumb to the disease, which may be found during any month of the year, though it is commonest during May-July. It may reappear after disappearing for some months.

DISTRIBUTION IN GREAT BRITAIN.—Based on my records for the last ten years and including about 140 cases, the disease occurs throughout England and Wales and in Scotland at least as far north as Aberdeen, but it is much scarcer in Scotland than in England.



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COMPARISON WITH OTHER DISEASES.—The disease is also called “Black Robber Disease,” from the appearance and behaviour of the bees in certain cases. It may be the disease noted by Cheshire, who ascribed the cause to an organism he called *Bacillus gaytoni*. Unfortunately he did not publish a detailed investigation of the disease or the Bacillus. Certainly, abnormal numbers of bacteria are often present in the alimentary canals of diseased bees and they deserve study. Bee Paralysis resembles the diseases known as May-Sickness, Paratyphoid, Septicaemia, Schwindsucht, Schwarzsucht, Bee Paralysis in America and intoxication and some other diseases associated with fungus or yeasts in the alimentary canal. It may be the Schwindsucht or Schwarzsucht of writers in German, and it may be the Bee Paralysis of America, though Prof. Phillips, on seeing a stock affected with the disease, said that it was not American Bee Paralysis. The symptoms suggest that the disease is located in the alimentary canal and that later paralysis of the nervous system sets in.

INCLUSION BODIES.—The diagnostic characters of Bee Paralysis are not very satisfactory since they are shared by many other diseases. What one wants is a character peculiar to the disease—as for instance the presence of *Nosema* in the alimentary canal indicating *Nosema* infestation. As far as I am aware, no microscopic character diagnostic of the disease has hitherto been found. I now think that I have found such a character. It exists in the form of minute spherical or ellipsoidal bodies which I call “inclusion bodies,” inside the cells of the anterior end of the small intestine.\* The bodies measure 1-5 microns in diameter, the largest bodies occurring in the cells of the small intestine just behind the openings of the Malpighian tubes and they become smaller the further back they lie till they disappear at about the end of the first quarter of the small intestine. Large numbers are grouped together in each cell. They lie most abundantly between the nucleus and the inner wall of the cell. I have found these bodies in all bees that I considered afflicted with Bee Paralysis and not in bees suffering from other diseases, nor in healthy bees of different ages or at different stages of activity. They are not described by writers on the histology and cytology of the alimentary canal of healthy bees.

What are these bodies? I suggest that they may be “inclusion bodies” like those found in animals and plants suffering from certain virus diseases. If the suggestion is correct, Bee Paralysis is a virus disease, which may be diagnosed by these bodies in the cells of the fore end of the small intestine. Since the bodies do not occur in healthy bees they are not likely to be metabolic products of a normal bee. They do not appear in the cavity of the small intestine or in the rectum amongst the faeces or in the blood. On the whole, I think that the evidence is against their being bacteria, fungi or yeasts.

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\*Figs 1 and 2.



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TECHNIQUE.—I have not yet succeeded in seeing these bodies in fresh tissue or in tissue which is preserved but not sectioned and stained, but this is due chiefly to the difficulty of freeing the cells from the thick layer of muscles and the cuticle between which they lie. The method I adopt is to fix the alimentary canal from the living bees in Bouin's fixative, then pass it through the usual reagents to embedding in paraffin wax. The sections are stained with safranin and methyl violet, resulting in the inclusion bodies being stained bright red by the safranin and clearly differentiated from the surrounding tissue which is stained various combinations of violet and red. Other fixatives and stains will demonstrate the bodies, but the staining is not so differential.

TREATMENT.—The most satisfactory treatment for Bee Paralysis is feeding with syrup (1-2 lbs. per B. S. frame of bees), unless a honey-flow happens to coincide with the outbreak of disease and the stock is strong enough to take advantage of the flow. A change of queen is desirable since there is some evidence that a diseased queen is able to transmit the disease to workers. The disease does not spread easily in an apiary. There seems no need to burn the equipment of a stock which succumbed from this disease alone, yet it seems wise to keep the equipment of an affected stock confined to the single hive.

In conclusion, Bee Paralysis is a field of research where many workers would find problems of scientific interest and practical importance.