

Honey Bee Diseases and Their ManagementAditya Kumar Sharma^{*1}, Rajnish Kumar², Shailendra Kumar Mishra³ and Ankit Kumar⁴**Abstract: -**

Honey bees (*Apis spp.*) play a pivotal role in agricultural ecosystems through pollination and the production of valuable hive products. However, the sustainability and productivity of apiculture are significantly threatened by a diverse range of diseases caused by bacteria, fungi, viruses, protozoa and parasites. These diseases directly affect brood development, adult bee survival, colony strength, foraging efficiency and ultimately low honey production. The present study provides a comprehensive overview of the major diseases affecting honey bees, including American foul brood, European foul brood, Chalk brood, Stone brood, Sac brood, Nosema disease, Amoebic disease and Acarine disease. Emphasis has been placed on their causative agents, characteristic symptoms, modes of infection and appropriate management strategies. Early diagnosis based on visible symptoms, regular colony inspection, maintenance of proper hive hygiene, adequate ventilation, strengthening of colonies and timely implementation of suitable control measures are essential for minimizing disease incidence and preventing colony damages. Effective disease surveillance and sustainable management approaches are therefore crucial for safeguarding apiculture and ensuring the continued contribution of honey bees to agricultural productivity and ecosystem stability.

Keywords: Honey bee, Apiculture, Bee diseases, Colony health and Management etc.

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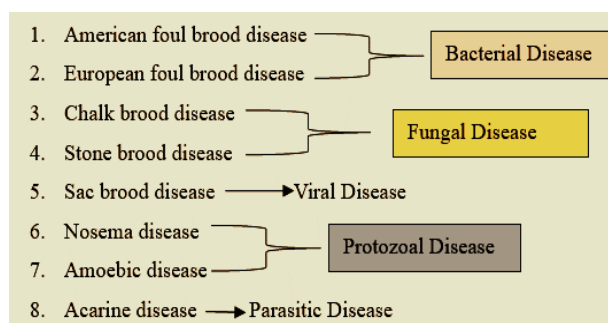
Introduction:

Honey bees (*Apis* spp: Apidae: Hymenoptera) are the most economically and ecologically important beneficial insects contributing significantly to agricultural productivity through pollination and providing valuable products such as honey, beeswax, royal jelly, propolis and bee venom. The rearing of Honey bee is called Apiculture or Bee keeping. Among the major biotic constraints, diseases and insect pests are considered important threats to honey bee health, colony survival and apicultural productivity. Inspection for bee diseases is an important part of beekeeping. Apiary inspectors and beekeepers must be able to recognize bee diseases and parasites and to differentiate the serious diseases from the less important ones. The purpose of this publication is to identify parasites, pests, and other abnormalities of the honey bee and to acquaint readers with the laboratory techniques used to diagnose diseases.

Honey bees are susceptible to a wide range of disease and pests that affect brood development, adult longevity, foraging efficiency, and overall colony performance. Major diseases, bacterial infections such as American foulbrood (*Paenibacillus larvae*) and European foulbrood (*Melissococcus plutonius*), fungal diseases including chalk brood (*Ascosphaera apis*) and stone brood

(*Aspergillus* spp.), viral infections such as deformed wing virus, acute bee paralysis virus and chronic bee paralysis virus as well as protozoan diseases caused by *Nosema apis* and *Nosema ceranae* are of major concern worldwide (Kumar *et al.*, 2023). The major malfunctioning process of honey bee are followed given below.

Major diseases include:-



1. American foul brood disease: American foul brood (AFB) is one of the serious bacterial larval diseases of honeybees, caused by spore-forming, Gram-positive bacteria (*Paenibacillus larvae/Bacillus larvae*). It is also known as dreadly disease of Honey bee. The bacterium exhibits highly aggressive pathogenic behavior resulting in the devastating collapse of bee colonies. The spores of bacteria are ingested through food, specifically honey, pollen and royal jelly.

Symptoms:

1. The disease primarily affects sealed brood, leading to larval death.
2. Infected larvae typically turn brown, emit a characteristic foul fishy odour

and form hard scales that adhere tightly to the cell walls.

3. Capped brood that is sunken, perforated or discoloured, with a dark, coffee-like appearance.
4. Infected larva darkens and dies.



Affected by *Paenibacillus larvae/Bacillus larvae*

Management:

1. Rapid detection and destruction of infected colonies.
 2. Dipping of the hive part in hot paraffin wax or a 3% Sodium hypochlorite solution.
 3. Dusting the comb with sulphathiazole powder.
2. **European foul brood disease:** It is caused by the Bacteria - *Melissococcus plutonius/Bacillus pluton/Streptococcus pluton*. It is the non spore forming bacteria. Adult bees and honey can act as vectors and transport bacteria between hives and apiaries. The infection process initiates when bees ingest food that is contaminated

with the bacterium. Upon reaching the bee's midgut, the bacterium multiplies and induces physiological damage to the epithelial cells and the peritrophic matrix.

Symptoms:

1. Infected larvae exhibit abnormal colour changes as the disease progresses, initially appearing pearly white but later turning yellow.
2. Twisted or contorted larvae are also observed, which serves as a distinctive symptom.
3. Cells are poorly capped and mixed with normal cells.
4. Larva dies in a coiled stage causing Sour/foul smell.
5. Infected colonies emit a foul odour resembling rotten or decaying broods.



Affected by *Melissococcus plutonius/Bacillus pluton/Streptococcus pluton*

Management:

1. Provide balanced nutritious diet.
2. Proper hive ventilation.
3. Use of Oxytetracycline hydrochloride.

3. **Chalk Brood Disease:** It is otherwise known as Kalkbrut disease. It is caused by fungus *Ascosphaera apis*, which converts larvae into chalk-white masses of mycelium. The pathogen mainly infects drone brood and less often to worker brood of the honey bee. Adults are not affected. An affected larva becomes overgrown by fluffy, cotton like mycelia and swells to the size of the brood cell.

Symptoms:

1. Infected larvae become mummified, appearing white or black and chalk like in texture.
2. Infection generally occurs through ingestion but may also occur through the external body surface.
3. Fungus spreads through contaminated food, tools and combs and infected colonies.
4. The fungal hyphae grow in the midgut, reaching the surface after sealing the

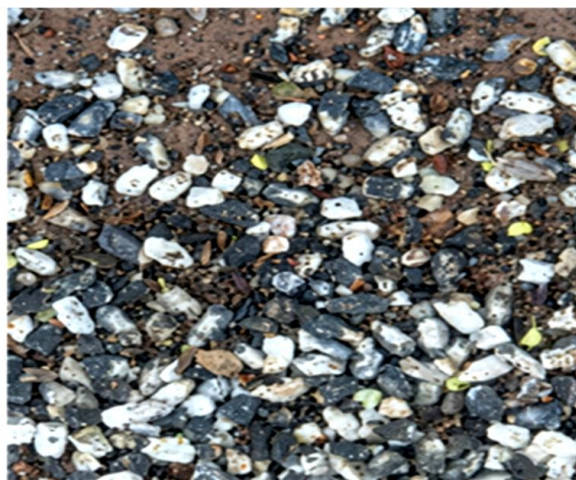
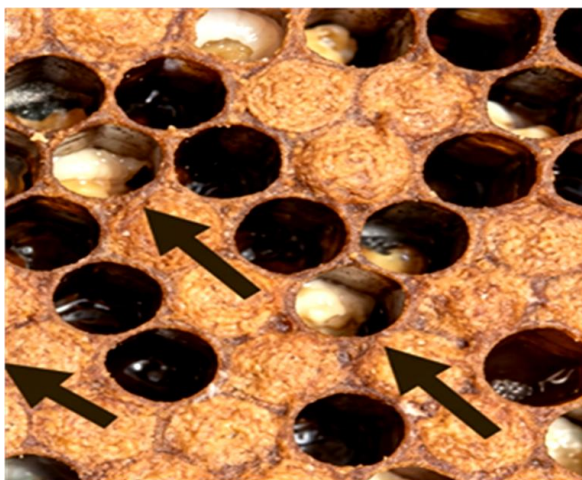
cells, generating a microaerophilic condition, which allows the growth of fungi, later producing mummified corpses with the appearance of chalk.

Management:

1. Ventilation should be increase.
2. Transfer of healthy bee to another hive.
3. Avoid brood chilling.
4. Enhancing colony vigor.

4. **Stone brood disease:** It is also known as Steinbrut disease, caused by the *Aspergillus flavus*, *Aspergillus fumigatus*, *A. niger*, and sometimes other *Aspergillus* species are associated with the disease. These fungi are common soil inhabitants that are also pathogenic to adult bees, other insects, mammals, and birds. The disease is generally sporadic but can become problematic under warm and humid conditions.

Symptoms:



Affected by *Ascosphaera apis*

1. Fungus erupts from the integument of the larva and forms a false skin, and larvae are covered with powdery fungal spores.
2. The fungus grows rapidly and forms a characteristic whitish-yellow collar like ring near the head end of the infected larva.
3. Dead larvae turn black and become difficult to crush, hard like mummies, hence the name stone brood.
4. Disease is rare, so minor one.



Affected by *Aspergillus flavus*, *Aspergillus fumigatus*, *A. niger*

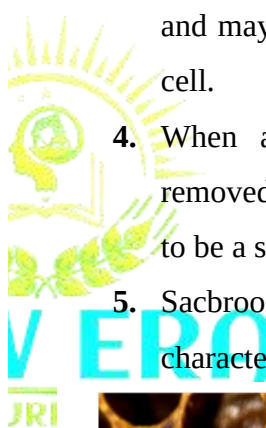
Management:

1. Sterilization of the hive with formaldehyde fumes.
2. Keep the hive **warm, dry and well ventilated**; avoid damp apiary sites.
5. **Sac brood disease:** It is the serious brood disease of Honey bee and also known as Thai sac. Mostly affects the Indian Honey bee (*Apis cerana indica*) during spring season. The destructive virus is *Morator*

aetatus. Infected colony decline gradually with few or no replacement workers, resulting in a losses of 20-80% of Honey production.

Symptoms:

1. Affected larvae change from pearly white to gray and finally black.
2. Death occurs when the larvae are upright, just before pupation.
3. Head development of diseased larvae is typically retarded; the head region is usually darker than the rest of the body and may lean toward the centre of the cell.
4. When affected larvae are carefully removed from their cells, they appear to be a sac filled with water.
5. Sacbrood-diseased larvae have no characteristic odour.



Affected by *Morator aetatus*

Management:

1. Burning of the infested hive.
2. Maintenance of strong and vigorous colony.

3. Sterilisation of beekeeping equipments with KMnO_4 @ 50 g/lit water followed by hot water dipping.
4. Fumigation of hive by formic acid (85%) @ 5 ml/hive.
5. Caging queen for 21 days for creating broodlessness condition.
6. **Nosema disease:** Nosema is caused by *Nosema apis* and *Nosema ceranae*. It is a microsporidian protozoan disease that infects the intestinal tract of adult bees. It is a serious adult stage disease of Honey bee. Nosema can cause detrimental effects on honey bees, colony development, queen performance, and honey production.

Symptoms:

1. Bees become dysenteric, with a distended abdomen containing faeces; the abdomen appears shiny and swollen.



Affected by *Nosema apis* and *Nosema ceranae*

2. Affected worker bees have disjointed wings and are found crawling near the hive entrance.

3. On dissection of the infested bees, the midgut is seen swollen & dull greyish-white in colour as it is full of spores.
4. Many bees loose body hairs.

Management:

1. Replacement of the queen each year achieves high survival ability for hives and the production of honey.
2. The application of natural compounds (phenolics and organic acid) is one of the best chemotherapeutics against this disease.
3. Feed the affected colony with Entakon M (Metronidazole 400 mg + Tetracycline 333 mg) @ 500 mg/l of water of sugar syrup at weekly interval.
4. Sterilisation of brood boxes and frame hives with Glacial acetic acid fumes (soaked in cotton or rag at 120 ml (hive) or 40% formalin fumes only after the queen and the bees have transferred to new foundation Combs.
7. **Amoebic disease:** It is caused by a protozoa *Malpighamoeba mellificae* which infests the malpighian tubules. This protozoan is found in the Malpighian tubules of adult bees. Malpighian tubules are long, threadlike projections originating at the junction of the midgut and the hindgut. It is the major excretory organ of all terrestrial insects.

Symptoms:

1. It infests the malpighian tubules of honey bee and caused by presence of amoeba cysts. The cysts measure 5–8 m in diameter.
2. The bees get infected by ingesting the cysts which accumulate in the posterior end of the midgut or in the rectum.
3. The Cysts get loose, swollen and enter the glassy malpighian tubules entering intestine and show faecal matter at that place.
4. Mostly dominant in summer season (April and May).
5. It is also produce Dysentery of Adult Honey bee.

Management: Only way to control is by proper hygiene and by the disinfection of equipments by 2% carbolic acid. Transferring of bees to a fumigated box.

8. Acarine disease: It is also known as Acarosis disease and Isle of Wight (Because it was observed in Isle of Wight in 1904). Acarosis is caused by the honey bee tracheal mite *Acarapis woodi*, *Acarapis externus* and *Acarapis dorsalis*. Only *Acarapis woodi* is known to be harmful. It is a small parasitic mite infects worker, drone and queen honey bees in the form of Endo parasite. It can be serious if not treated. It affects mostly the trachea and body fluid.

Symptoms of Acarosis disease:

1. Mites live and reproduce in trachea.
2. They pierce the tracheal tube walls & feed on the Hemolymph of the bees.
3. The infected stage is its only adult stage.
4. They enter the Prothoracic spiracles on the 1st segment and work their way inwards into the trachea, damaging the linings while feeding on blood & depositing their faeces in the passage.
5. This Mite cause 'K' winged condition of honey bee where the wings are held to unusual angle and bee's are unable to fly.

Management:

1. It can be controlled by exposing the affected colony to a mixture of Safrol oil + Nitrobenzene + Petrol.
2. Cotton soaked in Methyl salicylate and placed under the hive in flat perforated lid.
3. Use of resistant hybrid bees known as Buckfast bee, developed by Brother Adam at the Buckfast Abbey.
4. Use of grease patties (Typically made from 1 part vegetable shortenings mixed with 3-4 parts powdered sugar) placed on top bars of the hive. Menthol allowed to vaporize from crystal form or mixed into the grease patties.

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