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# Management of Nosema Diseases in bee colonies

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Nosema disease is a fungal infection that affects honey bees. In Kenya, it is known to be caused by the *Nosema ceranae* pathogen. The spores of the fungus enter the gut of a bee, where they multiply and cause damage to the gut lining, reducing the bees ability to absorb nutrients. The disease is transmitted from the infected bees to healthy ones through feeding (trophallaxis, the transfer of food by mouth from one individual to another), contaminated equipment and beekeeping tools.



Bees *Diarrhoea* at the hive entrance. Photo courtesy of Flickr/D. Broberg

### Predisposing factors

Several factors that predispose honeybee colonies to Nosema disease, include:

- **Environmental stressors:** Stressors such as cold weather, poor nutrition, and exposure to pesticides can weaken bees' immune systems and make them more susceptible to Nosema infection.
- **Overcrowding:** Overcrowded colonies can be more prone to disease outbreaks, such as Nosema.

- **Poor hive hygiene:** Hives that are dirty or poorly ventilated can create a favourable environment for the growth and spread of Nosema spores.
- **Weakened or ageing colonies:** Older or weakened colonies may be more susceptible to Nosema disease.
- **Lack of genetic diversity:** Bee colonies with low genetic diversity may be more susceptible to Nosema disease and other infections.
- **Poor queen health:** A colony with a poor-performing queen may not have the necessary workforce to fight off Nosema infection.
- **Lack of treatment or prevention:** Beekeepers who do not regularly inspect and treat their hives for Nosema disease are more likely to experience an outbreak.

## Signs and symptoms

Nosema disease have a range of symptoms, and some infected bees may not show any visible signs of the disease. Common signs and symptoms of Nosema disease in honey bees include:

- **Diarrhoea:** Infected bees may exhibit diarrhoea, which can result in a noticeable increase in dead bees outside the hive entrance.
- **Fecal staining:** One of the most common symptoms of Nosema disease is faecal staining, which is caused by bees defecating inside the hive. This result in brown or yellowish staining on the outside of the hive, and on the bees themselves.
- **Reduced lifespan:** Infected bees may have a shorter lifespan than healthy bees. This is easily noticeable by experienced beekeepers who inspect their hives regularly.
- **Decreased foraging activity:** Bees infected with Nosema may

fly less frequently and for shorter distances, which reduce the overall foraging activity of the colony. It also affects the colony's strength due to declining feed resources.

- **Impaired learning and memory:** Bees infected with Nosema may have difficulty learning and remembering important tasks, such as foraging routes or nest location. This slowly reduces the worker bee population in the hive and thus weakens the colony.
- **Decreased colony productivity:** Nosema disease can reduce the overall productivity of a colony, leading to reduced honey production, brood production, and queen production.
- **Digestive issues:** Infected bees may have difficulty digesting food, leading to malnourishment and weight loss. They may also have diarrhoea, which can be visible on the outside of the hive or the bees themselves.
- **Increased bee mortality:** Nosema disease causes an increase in bee mortality, with dead bees often found around the entrance of the hive.

If you suspect that your honeybees are infected with Nosema disease, it is important to take action quickly to prevent the spread of the disease and minimize its impact on the colony.



*Honey comb showing bee fecal substances as a result of bee diarrhea. Photo courtesy of IZSLT/Giovanni Formato*

## Economic importance

Nosema disease infections has significant economic implications for beekeepers and the agricultural industry as a whole. Here are some of the ways in which Nosema disease may impact honeybee colonies and their economic value:

- **Reduced honey production:** Infected colonies may produce less honey than healthy colonies, which lead to a reduction in honey production and lower revenues for beekeepers.
- **Colony loss:** Nosema disease infections cause significant colony loss, which be a major financial burden for beekeepers who need to replace their colonies.
- **Decreased pollination services:** Honey bees play a critical role in pollinating crops, and Nosema disease infections reduce the number of bees available for pollination. This can lead to lower crop yields and reduced agricultural productivity.
- **Increased cost of production:** losses of colonies, application of control measures and requeening can increase the cost of beekeeping.
- **Negative impact on bee health:** Nosema disease weaken honeybees' immune systems, making them more susceptible to other infections and diseases. This leads to further economic losses and long-term impacts on the health and productivity of honeybee colonies.

## Field Diagnosis

Keen and observant beekeepers can carry out simple tests. This includes taking a look at the colouration of the worker bee digestive system (the gut). This can be achieved by pulling off the bee sting with tweezers/ finger nails).

- For bees that are healthy and not infected by the Nosema disease, you will see a reddish colour of the gut.
- For diseased bees, the gut will look milky white.

However, this can be a continuous test since this sign is visible at the advanced stage of the infections.



*Milky White colouration of gut of diseased bees. Photo courtesy of CIAPA/Mariano Higes*



*Normal colouration of bee gut system. Photo courtesy of CIAPA/Mariano Higes*

### **Prevention and Control**

To reduce the risk of Nosema disease infections in honey bee colonies, it is important for beekeepers to take steps to maintain hive hygiene, manage colonies to reduce stress, and ensure bees have access to

appropriate diet and water needs. They should also regularly inspect their hives for signs of infection and take prompt action if an outbreak is suspected.

Prevention and control of Nosema disease in honey bee colonies can be accomplished through a combination of good management practices. Here are some steps that beekeepers can take to prevent and control Nosema disease:

- **Good hive hygiene:** Keep hives clean and well-ventilated to prevent the buildup of spores that cause Nosema disease.
- **Reduce environmental stressors:** Limit bees exposure to pesticides, e.g., by creating buffer areas that can lower pesticide drifts into the apiaries; choosing apiary location well to avoid pesticide poisoning; and siting apiary to ensure bees are protected from extreme weather conditions such as direct sun heat.
- **Regular hive inspections:** Inspect hives regularly for signs of Nosema disease, including dead bees outside the entrance, bees with diarrhoea, or reduced colony productivity.
- **Queen replacement:** If a colony has a poor-performing queen, replace her with a healthy queen to ensure the colony has the necessary workforce to fight off Nosema infection through cleaning the hive and removing infected bees.
- **Manage colony size:** Avoid overcrowding colonies, as this can increase stress and make them more susceptible to Nosema disease. This can be achieved through colony division or use of additional super based on the hives.
- **Genetic diversity:** Maintain genetic diversity in the bee population to promote overall hive health and resistance to Nosema disease.



**Compiled by:** Kasina M.J, Kimitai R.K, Toroitich D., Mulwa J.M., Onyango I.A., Guantai M.M., Ndung'u N.N., Kinyanjui J.M., Kimani C.W., Nyambati E.M., Mungube E., Changuony K., Ilatsia E., and Kasina J.M

**For further information, contact:**

Institute Director  
Apiculture and Beneficial Insects Research Institute  
P.O. Box 32-30403 MARIGAT  
Director.ABIRI@kalro.org

**Editors:** Nyabundi K.W., Mukundi K.T., Omondi S.P., Maina P., Wanyama H.N., and Mugata R.K.

**Design and Layout:** Odipo S.N

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