



# Nosema

**Nosema is a spore-forming fungal parasite that affects honeybees. Nosema infections can often go unnoticed because there are no obvious symptoms of the disease.**

## Background

Nosema is the most widespread bee disease in the world. There are two main species that affect honeybees: *Nosema apis* and *Nosema ceranae*, which have similar life-cycles. A third species, *Nosema neumannii*, was discovered in Uganda in 2017.

Nosema is generally a rather benign parasite of European honey bees, though it can cause severe damage to colonies if not addressed in time.

*Nosema apis* has been known to parasitise European honeybees for over 100 years, while *Nosema ceranae* initially parasitised Asian honeybees, and spread to European honeybees recently. *Nosema ceranae* appears to be the more damaging species.

## How it affects the hive

These spore-forming parasites attack the lining of the mid-gut of the bees. As the parasites develop and produce more spores, they feed on the epithelial cells of the lining of the mid-gut, thus reducing the efficiency of the gut in digestion and absorption of pollen and weakening the bees.

When there are too many spores in a cell, it explodes, releasing them into the mid-gut. Some spores may pass through the small intestine to the rectum. A heavily infested bee can contain as many as 30-50 million spores.

Nosema can affect colonies in a variety of ways, including digestive problems, reduced life expectancy, reduced brood rearing and susceptibility to other diseases. Nosema can also cause K-wing, which impairs bees' ability to fly. If the queen is infected it severely affects her egg-laying ability.

## How it spreads

Bees ingest Nosema spores from contaminated food or water sources. The spores reproduce in the bee's gut and are spread in the hive through feces. Other bees get infected when cleaning the hive. Trophallaxis, the mouth-to-mouth sharing of food, also spreads Nosema within the hive.

Nosema spores pass between hives by transferring contaminated combs, splitting contaminated hives, and feeding bees with honey contaminated with spores.

It can also spread through robbing and the natural drifting of bees between hives.

Infection levels within a hive tend to increase rapidly during spring as brood rearing starts, and bees defecate inside the hive more when weather conditions may be unsuitable for foraging. Infection levels often die down in late spring, disappear during summer and reappear the following spring.

## Symptoms & detection

Most of the time, Nosema causes nonspecific symptoms that make it difficult to distinguish it from other diseases.

Infected bees usually defecate inside the hives, leaving yellow or yellowish excrement stains on top bars of frames, bottom boards and combs, as well as the inside and outside of the hive.

There are no symptoms that clearly point to Nosema infection, but rather a number of symptoms that are associated with the disease.

Beekeepers should look for colony symptoms such as:

- declining population
- poor honey production
- reduced brood production
- poor survival over winter
- dysentery in and around the entrance of the hive (only with *Nosema apis*)
- worker bees crawling around the hive with swollen or greasy-looking abdomens (only with *Nosema apis*).



Stains on a hive as a result of Nosema-induced dysentery

The only accurate way to diagnose Nosema is through microscopic detection of spores. Samples of bees may be sent to a veterinary laboratory or apiary officer for analysis. It is considered a serious infection if the sample contains more than 1 million spores per bee.



## Prevention, treatment & control

Nosema is often present in honeybee colonies; however, a strong colony with good nutrition and a healthy queen will be better able to resist infection. Keep hives dry and protected from cold and wet winds. Make sure that colonies have access to good nutrition.

In some jurisdictions, the antibiotic Fumagillin is recommended as a treatment for nosema infection. However, antibiotics should never be used when the honey super is on the hive. Antibiotics can leave residues that may last in the hive for years, and that could contaminate any honey produced.

***Antibiotic treatment of Nosema is illegal or restricted in some jurisdictions. Always check your local regulations before applying any treatments and follow the guidelines for safe application.***

Antibiotic treatment is not efficient with heavily infected colonies. Gamma radiation is effective in decontaminating equipment, but it can be expensive and may not be a practical option. Given that spores of *Nosema apis* can be persistent for years, eradicating everything living in the hive and burning the equipment is often the only solution.

It is important to use all precautions when incinerating the hives, and always have a nearby means of extinguishment available.

### Locate the source

Before eradicating *Nosema apis*, it is necessary that you identify the source of the infection first. This will allow you to prevent spreading it, allowing for a complete eradication of the parasite. The most common causes of infection are:

- swarms of infected bees
- contaminated equipment (especially used equipment)
- uniting diseased hives with healthy ones
- visits by other beekeepers.

### Sources

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