



# Nosema

Nosema is the highly destructive effect caused by one of two (or both) fungi named *Nosema apis* and *Nosema ceranae*. While *Nosema apis* is generally a benign parasite of European honey bees all around the world, it can cause very serious damage to beehives if not addressed in time. These spore-forming parasites attack the lining of the mid-gut of the bees, which produce digestive enzymes that allow them to digest pollen. 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.

## Symptoms

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 board, combs, as well as the inside and outside of the hive. Bees infected with *Nosema apis* also show signs of dysentery and pay poor attention to brood rearing, turning to guard and foraging duties undertaken by older bees. Hypopharyngeal glands of infected EHB

lose the ability to produce royal jelly that is fed to brood. Sick bees with distended abdomens crawl in front of the beehives with their wings spread out.

Nosema can also cause bees to be unable to fly, or fly just short distances due to disjointed wings. Life expectancy of infected bees is usually reduced by 78 per cent. If the queen of the hive is infected with *Nosema apis*, her ovaries degenerate, leading to a major drop in egg production as a result of atrophied oocytes (early stage ova). A high proportion of the eggs laid by the queen might fail to produce larvae.



## How it spreads

The infection with *Nosema apis* is initiated when non-infected bees swallow the spores. Defecation inside the hive is the prime source of infection. The swallowing of the spores occurs when bees clean contaminated combs. The passage of *Nosema apis* spores between hives occurs by transferring contaminated combs between hives, splitting contaminated hives, and by feeding bees with honey contaminated with spores.

During spring months, the level of infection increases rapidly as brood rearing starts, and flight is restricted by unsuitable weather conditions. This causes the bees to spend more time in the hive and defecate inside, thus contaminating the combs and spreading the infection. In late spring, the level of infection decreases gradually as bees are able to fly and defecate outside of the beehive. Also, old bees die off and are quickly replaced by newly emerged ones, which are free of infection. The infection disappears during summer months due to the combs becoming significantly cleaner.

However, the infection may remain within a colony, reappearing in the next spring. Most healthy EHB colonies can handle *Nosema* infections well as long as they receive proper nutrition, and the weather outside facilitates flight and defecation outside of the beehive.



## Prevention

Beekeepers can successfully prevent infestations with *Nosema* in European honeybee colonies by performing a number of good husbandry practices.

Regularly feeding the bees with antifungal medication (Fumagilin-B) in gallons of heavy syrup in the spring and fall is one of the best preventive measures beekeepers can take to avoid *Nosema* problems. Keeping colonies in sunny winter locations and avoiding conditions of excess moisture inside the hive can also discourage infestations.



## Eradication

There are several eradication methods of the *Nosema apis*. Disinfecting contaminating combs is necessary in order to prevent further spreading of the parasite within the hive. This can be achieved by fumigation with 60-80 per cent acetic acid vapour. The vapour kills the spores within one week. Mix 1 part water to 4 parts glacial water-free acetic acid, and proceed at a temperature higher than 15°C for faster evaporation.

Treatment with Fumagilin-B is one of the easiest ways to treat infected hives. However, this solution is not efficient with heavily infected colonies. Given that spores of *Nosema apis* can be persistent for years, eradicating everything living in the hive and burning the equipment is the only solution.

Make a pile of the affected equipment (beehives, combs, honey and bees), and dig a hole next to it of at least 1 metre x 30cm, bigger if you are incinerating multiple hives. Set the frames containing contaminated honey around the main fire until they are dry enough to burn without the honey stifling the fire. It is important to use all precautions when incinerating the hives, and always have a nearby means of extinguishment available. The ashes and remnants should then be buried.



## 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

[https://www.countryrubes.com/images/NOSEMA\\_KH\\_ARTICLE.pdf](https://www.countryrubes.com/images/NOSEMA_KH_ARTICLE.pdf)  
<http://entomology.ucdavis.edu/files/147621.pdf>  
<http://scientificbeekeeping.com/nosema-ceranae-not-your-fathers-nosema/>  
[https://en.wikipedia.org/wiki/Nosema\\_apis](https://en.wikipedia.org/wiki/Nosema_apis)  
<http://www.depi.vic.gov.au/agriculture-and-food/pests-diseases-and-weeds/animal-diseases/bees/nosema-disease-of-honey-bees>

### BANNER PHOTOS ON PAGE 1

1. One of the signs of *Nosema ceranae*, 'Crawlers' in front of a beehive. PHOTO: Randy Oliver
2. Symptoms of *Nosema* on a hive. PHOTO: Georgia Department of Agriculture Archive, Bugwood.org
3. Hive affected with *Nosema*. PHOTO: Georgia Department of Agriculture Archive, Bugwood.org