

Nosema disease in honey bees

What is it?

Nosema disease is caused by two gut-infecting fungal parasites: *Nosema apis* and *Nosema ceranae*. These microscopic spores infect worker bees, drones, and queens. Once ingested, the spores invade the gut cells, multiply, and rupture them – releasing new spores that infect additional cells or are excreted, spreading the infection to other bees.

Spores are highly resilient and can survive in the environment for years.

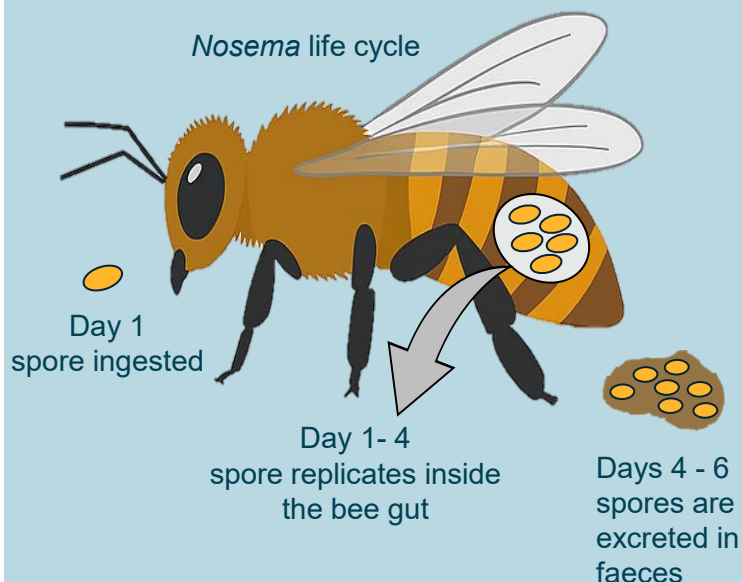
Symptoms are subtle and can be mistaken for other diseases

***N. apis*:** Faecal streaks on the outside and inside of the hive, and crawling, flightless bees near the entrance (symptoms may also result from other causes). Spore loads peak in spring, with a smaller peak in autumn, and infections may disappear entirely in summer.

***N. ceranae*:** Reduced adult bee numbers. Prefers warmer climates than *N. apis*. Spore loads can peak in spring and summer.



Above: Electron microscope image of a *Nosema* spore (scale = 0.003 mm)



How it spreads?

- Contaminated food and water
- Cleaning contaminated faeces from comb (worse after winter)
- Dead bees crushed during hive work
- Trophallaxis (food sharing between bees)

Effect on bees & colony

- Reduced lifespan (notably with *N. ceranae*)
- Malnutrition and increased energy demands
- Impaired cognition causing disorientation
- Reduced foraging efficiency
- Reduced immunity
- Underdeveloped hypopharyngeal gland
- Reduced egg-laying by queens
- Lower sperm viability in drones
- Higher risk of colony death with other stressors (e.g., disease, chemicals, poor nutrition)



Pollen grain

Nosema spores visible under 400x magnification

Shannon Holt

Diagnosis requires microscopic examination

Species ID requires molecular testing

Prevent and manage *Nosema* by maintaining strong and healthy colonies

- **Nutrition:** Ensure adequate honey and pollen stores; feed sugar water and high-quality pollen substitutes when stores are low (note protein-deficient pollen is linked to increased *Nosema* levels)
- **Hive size:** Reduce colony hive size to appropriate level for the colony, i.e., remove unnecessary supers, especially for winter
- **Barrier system:** Implement or review measures to reduce beekeeper cross-contamination between hives
- **Hygiene:** Clean tools between hives, regularly replace brood frames, and wash gloves and bee suits
- **Hive placement:** Keep hives in a sunny and warm position during winter
- **Queen management:** Ensure the colony has a young, vigorous queen and requeen regularly
- **Genetics:** Select for *Nosema* tolerant or resistant stock



Had a *Nosema* outbreak?

Sterilising tools and equipment

Nosema spores are effectively killed by heating to 60°C for 15 minutes. Wash bee suits and gloves on a hot cycle (note: high temperatures may cause shrinkage). Remove beeswax from hive tools and heat-treat with a blowtorch between hives.

Sterilising brood comb

Nosema spores embed in wax and are difficult to eliminate. The most effective approach is to remove and replace with new foundation wax. Alternatively, comb can be heat-sterilised at 49°C for 24 hours – to kill the spores without melting the comb.



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