A microscopic image showing a dense field of small, oval-shaped spores, likely Nosema, against a dark, textured background. The spores are light-colored, possibly greenish or greyish, and have a distinct, slightly irregular shape. Some spores are clustered together, while others are more isolated.

Nosema Hidden Killer

Another explanation for bee losses

By Mike Sandridge

CASE STUDY

I'm going to be your case study



A example case

- Package Bees from GA, on used and new comb
- Nucs from hives with VA queens
- No outward signs of Nosema
- Nucs built up well but survival rate about 60%
- Package bees some built well while a number of others lagged
- Strongest Nucs and Packages moved to pollination in late May

Case continued

- Several slow builders moved to pollination
- Gradual losses of 50% occur by September
- Multiple supersede events in all
- Hives decline quickly
- Pollen collection is lower than normal
- First return hives respond to feeding and rebuild
- Second set 2 months later don't respond and quickly collapse upon return
- Within 3 weeks all the returned hives and those on site collapse 36 hives. Nearby yard also impacted 4 hives.
- Bees just disappear leaving food behind. (looks like absconding)
- Testing identified very high levels of *Nosema ceranae*

The formula

Environmental Stress

+

Pest

+

Disease

=

Colony Collapse Disorder

Environmental factors

- Habitat
- Changing Weather Patterns
 - Drought or Wet all the same too much of either
- Pesticide Usage
- Fungicide Usage
- Competition

Pest

- Tracheal Mites
- Varroa Mites
- Small Hive Beetles
- Mammalian predators
- Other Insect predators
 - Hornets, Yellow Jackets

Disease

- Viruses
- Brood diseases
 - European, American, Chalk
- Nosema Apis
- *Nosema ceranae* – stealth killer
- others

Stealth Killer

- Nosema disease is the most widespread adult bee disease in the world.
- Although there are a number of symptoms, these often go unnoticed, and the poor performance of a colony is blamed on other factors.
- There are no classic signs of the disease, and hence it frequently goes undetected.
- Heavily infected bees live only half as long as non-infected bees.
- Nosema disease is most likely present in all colonies all the time, and only likely to cause bee losses when conditions favor the micro-organism.

Nosema ceranae

- *Nosema ceranae*
 - first described in 1996
 - identified as a disease of *Apis mellifera* in 2004
 - in Taiwan.^[1]
 - Since its emergence in honeybees, *N. ceranae* has been identified in bumblebee species in South America,^[2] China,^[3] and England where infection studies indicate *N. ceranae* has a higher virulence in bumblebees than honeybees.^[4]
 - This pathogen has been tentatively linked to colony collapse disorder

The Path to Collapse

- Higes and Meana explained that the pathogenesis of ceranae infection in a colony progresses through four stages:
- 1. **Asymptomatic**—the infection builds slowly the first year (?), goes unnoticed, but can be detected microscopically in foragers.
- 2. **Replacement**—The bees rally by rearing more brood, even through winter.
- 3. **False Recovery**— This may occur the second summer, during which the colony rebounds somewhat. However, in this phase the infection starts to move into the house bees.
- 4. **Depopulation and Collapse**—Finally, the bees “lose ventricular function” (they can no longer digest food), stop eating (and stop taking medicated syrup, or pollen supplement), and simply starve to death in the midst of plenty. Most adults die far from the hive, leaving only a handful of young bees and the queen.

What is it?

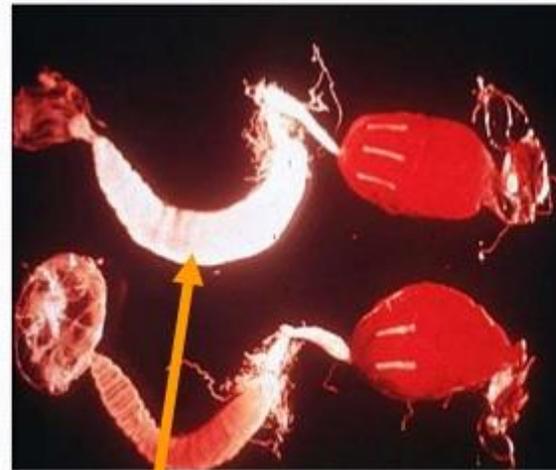
- *Nosema ceranae* is a microsporidian
 - a small, unicellular parasite
 - mainly affects *Apis cerana*, the Asiatic honey bee.
 - Along with *Nosema apis*, it causes the disease nosemosis,
 - What is nosemosis? It is
 - The most widespread of the adult diseases of adult honey bees
 - Simple it is an Infection of the gut

NOSEMOSIS (Nosema Disease)

- **CAUSAL AGENT:** *Nosema apis* and *Nosema ceranae*.
- that infects the intestinal tract of adult bees. It is a serious adult disease.

SYMPTOMS:-

- Bees become dysenteric with distended abdomen with faeces, shining and swollen abdomen.
- Affected worker bees have disjointed wings & are found crawling near the hive entrance.
- On dissection of the infested bees, the mid intestine is seen swollen & dull greyish-white in colour as it is full of spores.
- Many bees loose body hairs.

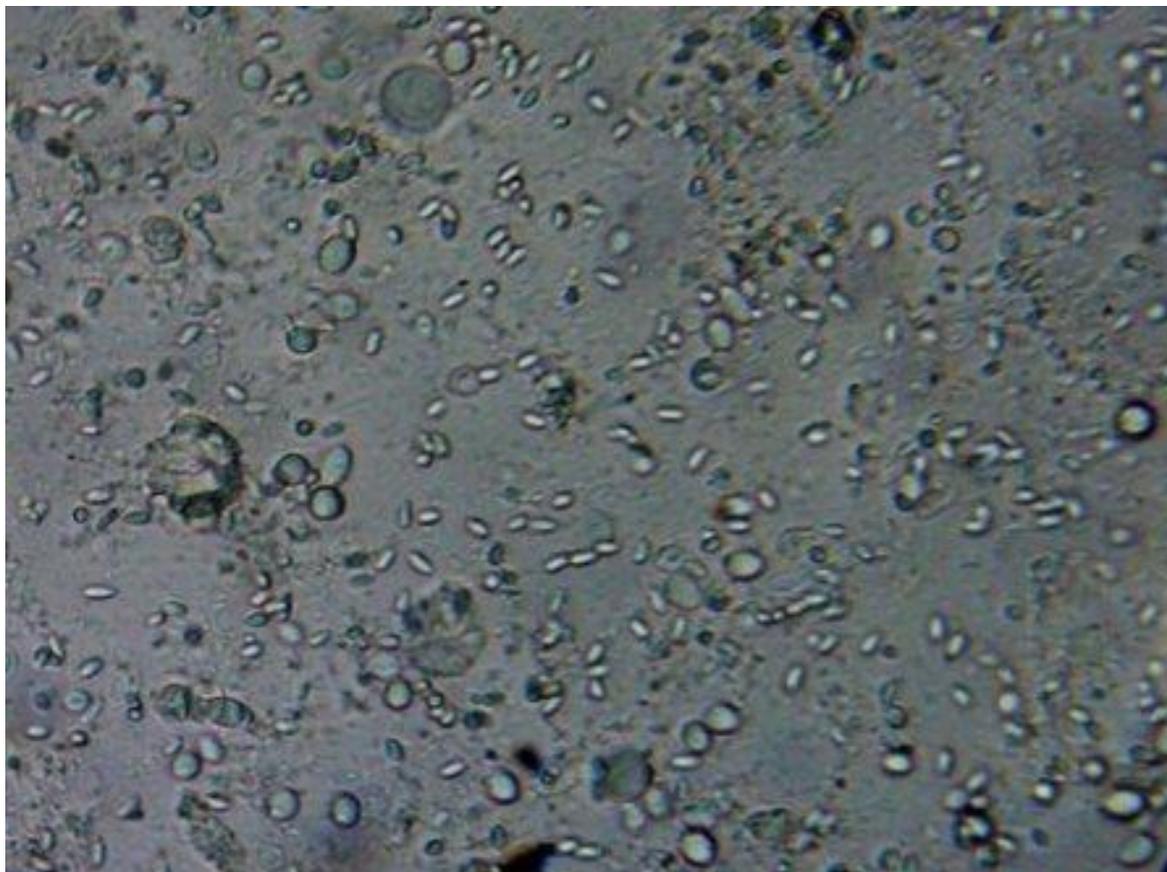


Hind gut is inflamed by protozoa

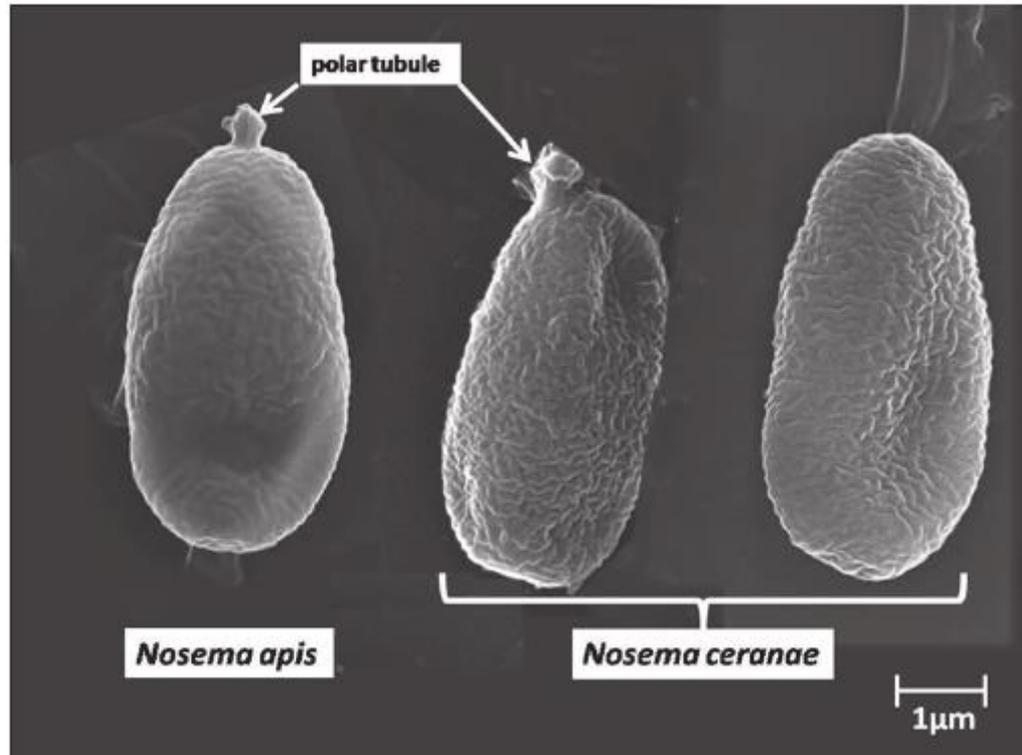
Spores

N. ceranae and *N. apis* have similar lifecycles, but they differ in spore morphology. Spores of *N. ceranae* seem to be slightly smaller under the light microscope and the number of polar filament coils is between 20 and 23, rather than the more than 30 often seen in *N. apis*

Under the Microscope



Spores Up Close



N. Ceranae impact

- The disease afflicts adult bees and depopulation occurs with consequent losses in honey production.
 - One does not detect symptoms of diarrhea as in *N. apis*.
- *N. ceranae* can quickly cause a colony to die
- Bees can die within 8 days after exposure to *N. ceranae*

How does this manifest?

- The forager caste seems the most affected, leaving the colony presumably to forage, but never returning. This results in a reduced colony consisting mostly of nurse bees with their queen.
- It has been suggested that the most effective control of *N. ceranae* is the antibiotic fumagillin as recommended for *N. apis*

What about the equipment and honey?

- In most of the U.S., winter freezing is enough to kill most of the spores of *N. ceranae*!
- One week in a freezer kills 90% of spores
- This supports the observation of a number of commercial beekeepers that letting deadout equipment “rest” for a month at cold temperatures resulted in better colonies when restocked in the spring.

Why does cold impact?

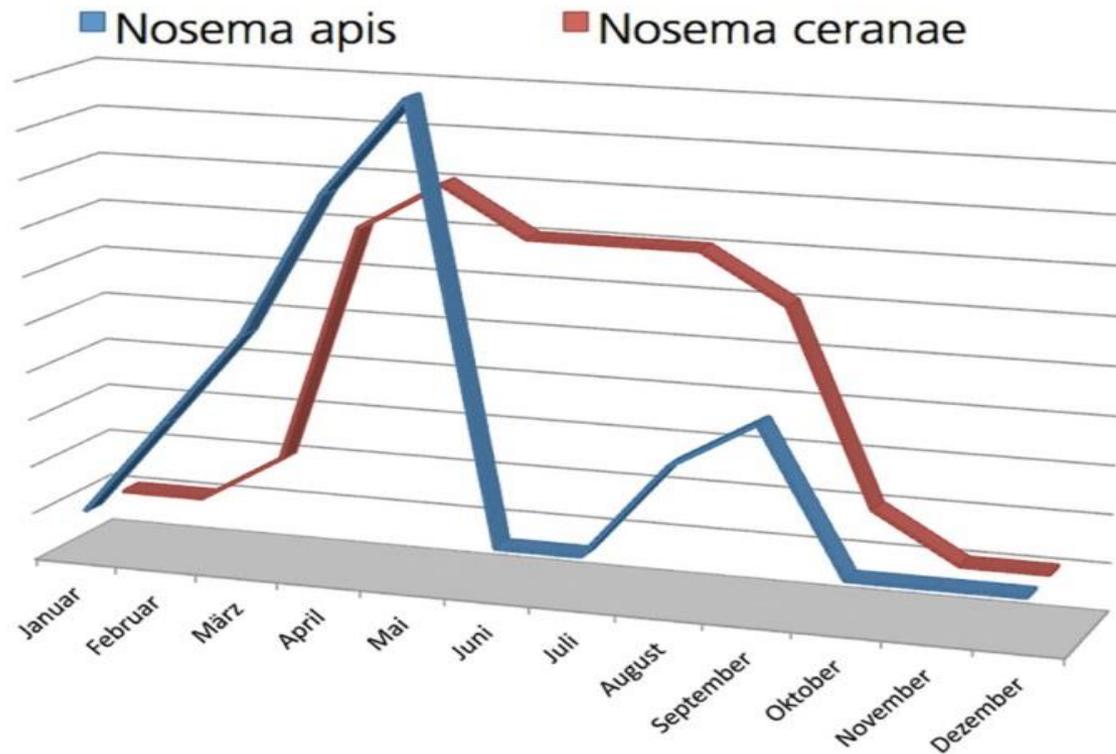
- This is a disease that is favored by warm and wet climates.
- Freezing temperatures breakdown the spores and the dry air associated with the temperatures further damages the spores.
- The spores usually survive (when they do) in their host, in this case they kill off the host that allows survival

Symptoms

- Reduction in the colony population – this may be rapid or subtle, and is often termed ‘spring dwindle’, occurring in August , September, October
- A serious reduction in honey production in heavily infected colonies, compared with lightly infected colonies
- An accumulation of dead bees at the hive entrance (cool weather). This is not common, as most field bees die some distance from the hive
- Flightlessness in adult bees. They crawl along the ground, and their hind wings may be unhooked from the front wings and held at unusual angles. This is also a symptom of pesticide poisoning or viral infestations
- A sickly look and greasy-looking abdomen in adult bees
- Greyish-white, dull intestines
- NO dysentery, with hives covered in spots of fecal matter.
- Death of the colony

Difference between Apis and Ceranae

Unterschiedlicher Infektionsverlauf der beiden Nosema-Arten



Apis – what we can see.



An outcome in the winter/late fall



Winter losses



Note the stained comb



What to do???

- Reduce stress as much as possible
 - Pest are primary target
 - Feed as needed
 - Water in drought
 - Site in dry locations for wet years
- Vigilance
 - Don't lull yourself with easy explanations
- Test at first signs

Reduce stress



Reduce Stress



Available Treatments

- Fumagilin-B only approved solution in US
 - **It does not kill the spores of either species, but can greatly reduce spore production, and the overall infection rate within the colony.**
 - **The long residual life of fumagillin in honey has led to its being banned in several other countries, for fear of honey contamination. Be careful in its use not to treat when it is likely to be stored by the bees in honey for human consumption.**
 - **Fumagillin may have to be used repeatedly over a period of two to three years in order to allow the bees to really clean the combs of spores.**
- Isolate and freeze equipment or irradiate



Quick Spore Kill 90%



In Europe



Nozevit is completely natural herbal product, produced according to the traditional recipe from plant polyphenols and purified water.

“In view of the fact that the preliminary study of “Nozevit” performance was carried out on a small number of bee colonies, the results of the study cannot be considered as conclusive. However, based on the fact that the number of Nosema spores was considerably reduced upon preventive and curative use of “Nozevit”, we believe that the preparation deserves further studies.”

American Bee Journal (2009) pg 485 - **Experimental Treatment of Nosema Disease with “Nozevit” Phyto-pharmacological Preparation by Ivana Tlak Gajger , *Zdravko Petrinc, Ljiljana Pinter, Zvonimir Kozarić Faculty of Veterinary Medicine, University of Zagreb, Heinzelova 55, 10,000 Zagreb, Croatia E-mail: ivana.tlak@vef.hr**

Questions?