Nosema ceranae

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What is Nosema ceranae and how do you test for it?

***NOSEMA CERANAE* has been termed the 'Asian variant' of a more familiar honey bee pathogen, *Nosema apis*, and was originally described in 1996. Both species are microsporidial pathogens that are thought to represent very primitive, but highly specialised parasitic fungi. Both species exist as spores which fire a tube into the cells of the honey bee gut wall. The pathogen then reproduces by injecting genetic material into cells of the gut wall and forming new spores within the host cells.**

Both *N. apis* and *N. ceranae* can be identified in adult bee samples using a standard adult disease screen. However, they are very similar when viewed using conventional microscopy, therefore species discrimination benefits from more sensitive tests. Several tests are available which focus on the detection of species-specific genetic material. CSL (Central Science Laboratory) staff have advanced these detection methods by developing a method based on real-time PCR (polymerase chain reaction), a sensitive method which can detect and quantify low levels of pathogen infection.

WHAT IS THE EUROPEAN DISTRIBUTION?

N. ceranae is already widely distributed in Europe, having been confirmed in many countries including Denmark, Finland, France, Germany, Greece, Italy, Serbia, Spain, Sweden and Switzerland. Scientists have only recently developed diagnostic tests for this pathogen so, although it looks like it has spread rapidly, it would be more accurate to say that our ability to detect it has spread rapidly.

WHAT ARE THE CLINICAL SYMPTOMS OF *N. CERANAE*?

A good description of the disease has come from a paper written in French by leading Spanish researchers:

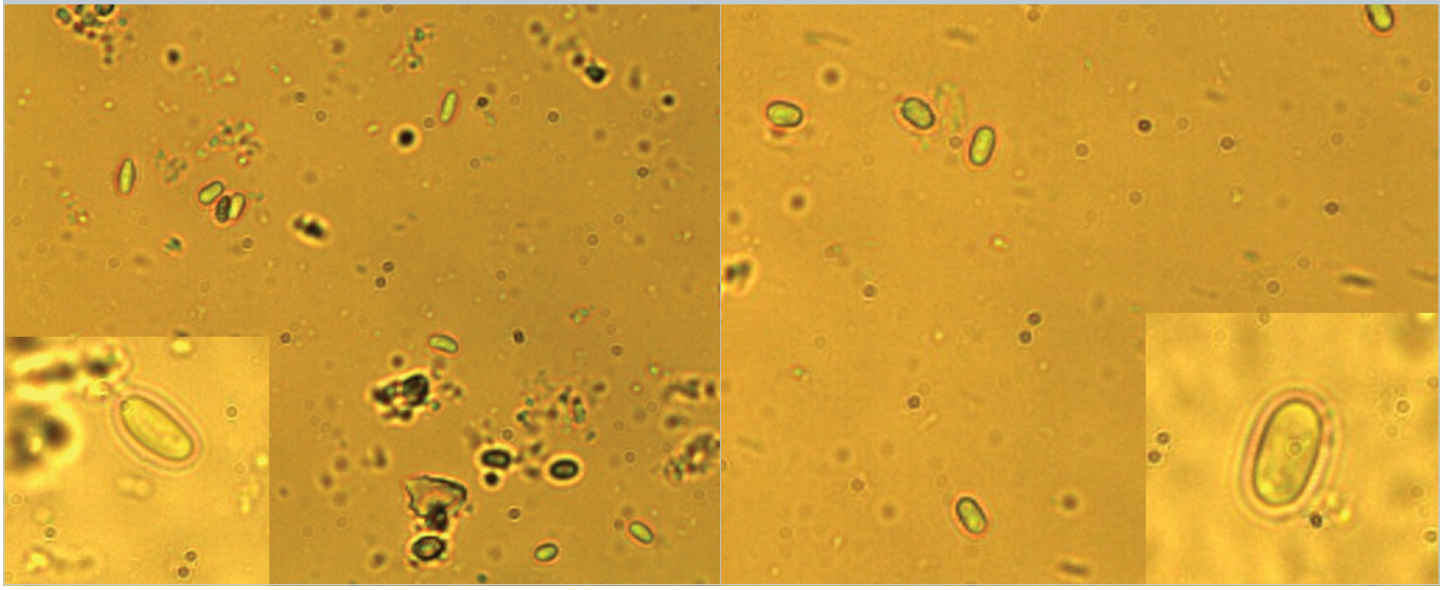
> *'What we are calling dwindling syndrome is not a new phenomenon. We first noticed losses in the late 1990s but the problem became serious in autumn/winter 2004 and spring 2005. This phenomenon is characterised by a progressive reduction in the number of bees in a colony with no apparent cause, until the point of collapse. The beekeeper may well also note a decline in colony productivity. In the final phase of this decline, secondary diseases frequently appear, including chalk brood and American foul brood. Eventually the affected colonies contain insufficient bees to carry out basic colony tasks and the colonies collapse. Mortality in front of the hives is not a frequent symptom of N. ceranae infection and there are usually no symptoms of diarrhoea or visible adult bee deaths.*

Sometimes the disease affects the whole apiary and other times only specific colonies will show symptoms. Dwindling sometimes occurs rapidly but may also occur over several months. In general, the beekeeper observes a lack of vigour and fitness of the colonies.'

DOES *N. CERANAE* EQUAL CCD?

Leading US researchers found *N. apis* to be more highly associated with CCD (Colony Collapse Disorder) than *N. ceranae*.

Nosema ceranae (left) and *Nosema apis* (right) with a single spore inset (x 400 and x 1000 magnification, respectively)



Courtesy of the National Bee Unit

N. ceranae may well be a key player in CCD. However, it is likely to be acting in concert with other pathogens or conditions.

In Europe the situation is different. Abnormal colony losses reported in Europe have been attributed to the presence of *N. ceranae*. *N. ceranae* was the reported cause of 20,000 colony losses in the Salamanca region of Spain in November 2004.

IS *N. CERANAE* IN ENGLAND AND WALES?

The National Bee Unit (NBU) started screening samples using real-time PCR assays in late November 2007, immediately after assay validation. Assay validation was delayed due to the absence of certified reference material for *N. apis* and *N. ceranae*.

In total, 309 samples have been tested for the presence of both species using real-time PCR. All positive results were confirmed using published assays for the detection of these pathogens. Positive results have therefore been confirmed using two or three methods, both based on the detection of species-specific DNA. Of these samples, 31 tested positive for *N. apis* (10%), 14 for *N. ceranae* (4.5%) and 3 (1%) tested positive for both Nosema species.

N. ceranae positives were confirmed across six counties of England (Cornwall, Essex, Lincolnshire, Hertfordshire, Greater London, North Yorkshire) and three in Wales (Glamorgan, Powys, Dyfed).

WHAT CAN YOU DO?

N. ceranae infections have been reported NOT to show typical signs of Nosema infection. For example, dysentery and crawling bees may well be absent.

It is important to note that the pathological data from Spanish apiaries are not consistent with a fast-acting, short-duration syndrome. More usually, signs of gradual depopulation, low honey production and higher autumn/winter losses are more likely indicators of the presence of this parasite.

A routine microscopic assessment will confirm infection of both Nosema species, but will not necessarily be able to distinguish between them. However, once diagnosed, treatment for *N. ceranae* is identical to that for *N. apis*. The usual veterinary medicine is equally effective against both Nosema species therefore, practically, management of the disease *N. ceranae* is the same as that described for *N. apis*. Therefore we recommend a routine adult bee disease screen for all colonies showing symptoms that cause concern and indicate possible Nosema.

Following the poor season we have all experienced as beekeepers, it is crucial that colonies entered the coming winter period in fine fettle. Your colonies need to have been well fed and other pests and diseases controlled as effectively as current treatments allow.

FUTURE RESEARCH

The NBU will carry out a more detailed survey to estimate the prevalence and impact of both Nosema species across England and Wales. As part of this process, additional samples will be collected by inspectors in the 2008 season and screened for both Nosema species. In addition, historical samples stored at the Central Science Laboratory will be tested along with imported bees. Such data will provide a better indication of geographical spread and timing of introduction.

Finally, with the permission of the beekeepers concerned, the condition of all affected colonies will be monitored.

For updates of this and other current research, please see the News and Research pages on the NBU beebase website at (http://beebase.csl.gov.uk). ⌘

Nosema Treatment – a note from the Editor

Treatment to control *Nosema apis* in a colony of bees should be two-fold: firstly by good husbandry, ie, by maintaining strong colonies with an effective system of comb renewal so that combs are as new as possible; secondly by the administration of doses of an antibiotic, fumagillin, in the autumn feed of affected colonies.

With a little training, the spore stage of Nosema can be identified. Abdomens of worker bees are ground up in a mortar with a little water and a drop of the resulting liquid spread onto a microscope slide. The tell-tale rice grain shapes can be seen using a microscope with a magnification of 400x. If you take a large enough sample of bees, you could probably detect minute levels of Nosema in many colonies. For a realistic result, it is recommended that you use around 30 bees.

Fumagillin is sold as Fumidil B. It should be mixed with the winter feed. One dose is 14 lb of sugar made into winter feed with 7 pints of water (or the approximate metric equivalent). The powder is very fine and tends to form little pellets on the surface of the syrup. It must not be added to hot water or syrup as the high temperature deactivates the antibiotic.

My advice is to make the syrup and let it cool until it feels just warm to the touch. Half fill a cup with dry sugar and add the dose of powder. Stir the two together. Add a little cool water and stir to make a paste with the sugar grains breaking up the powder globules. Add more water, a little at a time, until the powder is thoroughly mixed. Put this into the syrup and stir well. 'Wash' out the cup with some syrup and your dose is ready.

Feed so that the dose is the last food received by the colony. Last food in – first eaten is the order of the day with bees so this helps to ensure that fumagillin is present in the bees' guts throughout the winter and, more importantly, in the spring as well.

In the spring, colonies with Nosema should also be put into sterilised hives and have as many combs as possible renewed.