

Investigating Honey Bee Colony Losses in England and Wales



The Food and Environment
Research Agency

Aim

The aim of these Defra projects was to investigate honey bee colony losses in England and Wales since 2007.

Background

In recent years beekeepers across Europe and North America have reported increased and sudden losses of their honey bee colonies. Historically, in the UK, beekeepers have experienced considerable fluctuations in colony numbers, often associated with incidences of severe weather (Figure 1), but since 2001 we have seen a steady increase in losses (Figure 2). Although *Varroa* is known to have had a major impact across Europe, other pests, pathogens, pesticides and contaminants have also been implicated. In Portugal and Spain a microsporidial fungus that infects the gut wall of adult bees, called *Nosema ceranae*, is believed to have been a factor in colony declines. It is often referred to as the “Asian variant” of *N. apis*, because its native host is the Asian bee. In the USA, *Israel acute paralysis virus* (IAPV) has been identified as a significant risk factor in sudden colony losses, termed colony collapse disorder (CCD). Defra commissioned projects to look at pathogens associated with colony losses in the UK, to collect consistent information on the incidence and extent of losses, and to increase screening of imports.

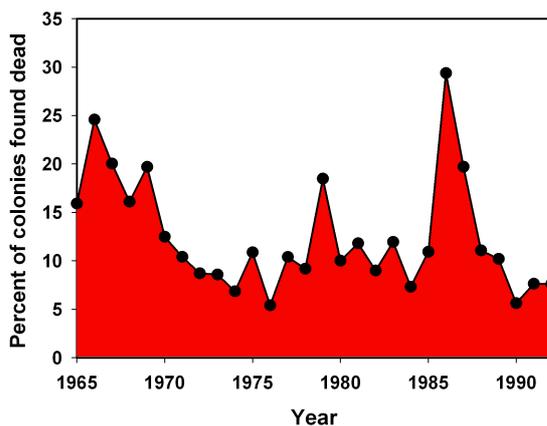


Figure 1. Historic inspection data

Numbers of dead colonies each year expressed as a proportion of total number of colonies inspected. In-season losses varied from 5-30%.

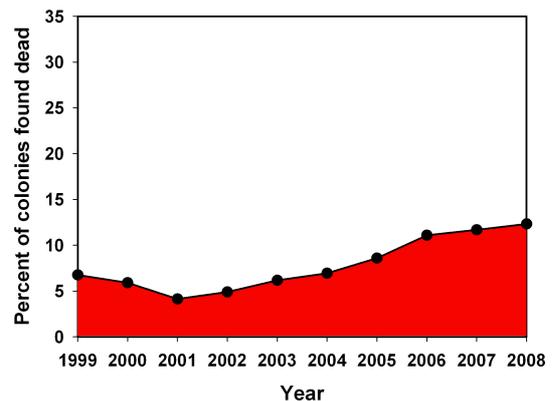


Figure 2. Recent inspection data

There has been a steady rise in colony losses since 2001. It has been suggested that this is, in part, linked to pyrethroid-resistant *Varroa* mites.

Methods

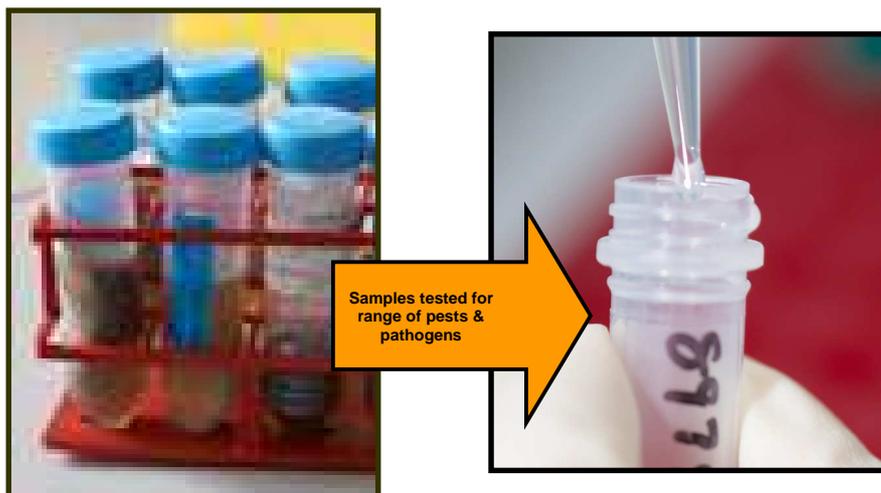
In 2007, bulk bee and larvae samples were collected from dead or failing colonies across England and Wales. These were tested for a range of pests and pathogens using “state of the art” molecular methodology (Table 1). In addition, a selection of comb samples from failed colonies were tested for the presence of 90 pesticides and 84 veterinary drugs. In 2008, Defra commissioned further studies to collect, compare and analyse samples from apparently healthy and diseased apiaries, respectively. As a result of further colony declines across the UK, increased imports of honey bee queens were anticipated, that would in turn require additional screening for diseases and exotic pests. The NBU also questioned beekeepers about their husbandry practices, and any losses they had incurred over previous winters.



Figure 3. An Inspector at work

Table 1. List of candidate pests and pathogens screened for

Nosema ceranae
Nosema apis
Acarapis woodi (Acarine)
Deformed wing virus
Black queen cell virus
Kashmir bee virus
Sacbrood virus
Acute bee paralysis virus
Chronic bee paralysis virus
Israeli acute paralysis virus
Apis iridescent virus
Melissococcus plutonius (causes European foulbrood)



Samples tested for range of pests & pathogens

Key Results

Surveys:

- Statistical information pertaining to the survival of honey bee colonies over the winter was collected from over 1000 beekeepers owning 10,000 honey bee colonies. Such data has not been previously gathered in the UK;
- The survey data suggested over 30% of honey bee colonies failed during the winter between 2007-2008; One in 5 colonies were lost over winter between 2008-2009.

Pathogen screening – Viruses:

- No “CCD type” symptoms have been reported by UK beekeepers;
- *Israeli acute paralysis virus* (IAPV), a virus identified as a significant risk factor for CCD in the USA, was not present in any of the dead or failing colonies tested in the UK;
- *Kashmir bee virus* (KBV), which has also been implicated in CCD in USA, was only present at very low prevalence (1% of samples screened);
- The majority of bees from colonies lost in the spring contained *Deformed wing virus* (DWV);
- The results indicated that of the honey bee pathogens tested, DWV is the only significant risk indicator when looking at healthy and unhealthy colonies;
- The presence of this virus in either brood or adult bees reduced the size of affected colonies by half (Figure 4).

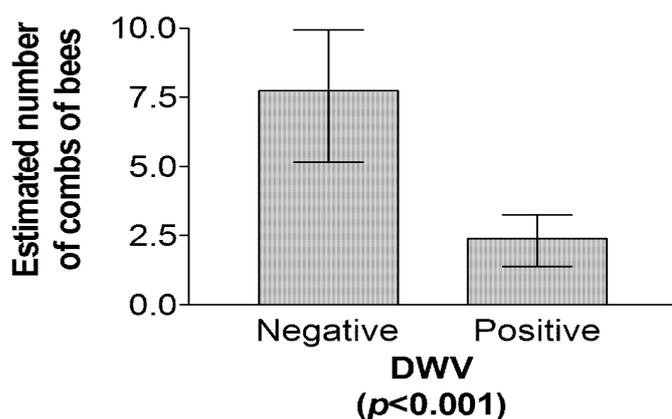


Figure 4. Multiple linear regression completed to investigate which pathogens may influence colony health – positive correlation between presence of DWV and numbers of combs of bees found per colony.

- *Chronic bee paralysis virus* (CBPV) is a sporadic problem;
- When found together, DWV and CBPV double the risk of bee death and dead bees have been found to have twice the number of pathogens as live bees;
- Although large individual losses in the summer were associated with CPBV infection, the presence of DWV is consistently the best indicator of a weak/lost colony.

Pathogen screening – *Nosema* sp:

- *N. ceranae* was confirmed for the first time in the UK in 2007, but *N. apis* was more common (Figure 5.);
- Both *Nosema* spp were found to be widely distributed across England and Wales (Figure 6), and are equally associated with healthy and unhealthy colonies;
- Many apiaries contain both species.

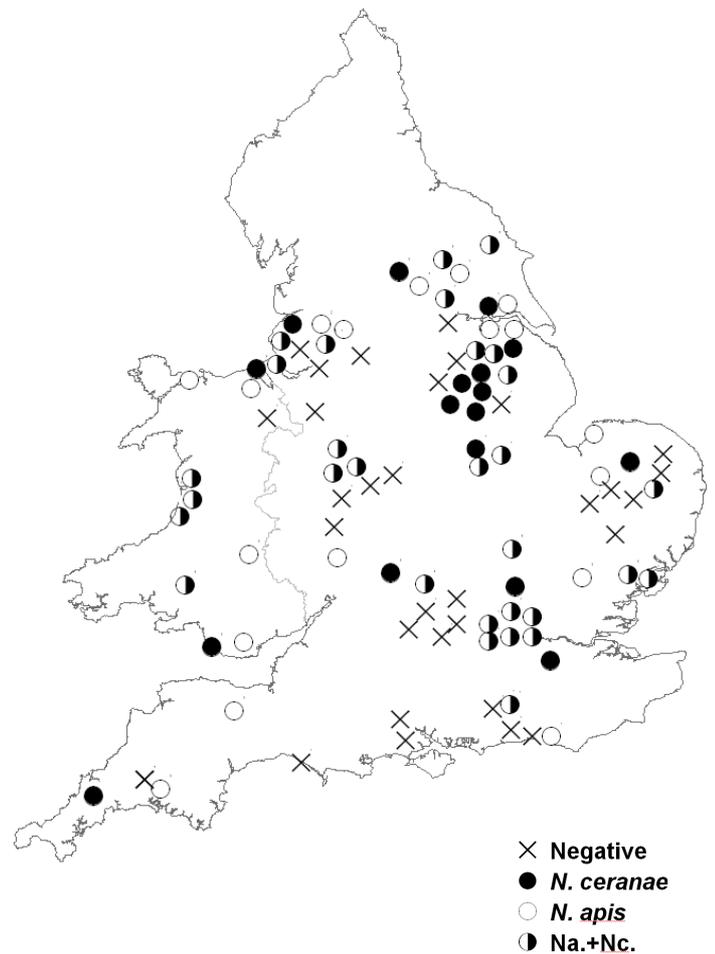
Figure 5. Spores of the microsporidial pathogen *Nosema* spp.



55% of colonies screened were *Nosema* negative
 19% of colonies were *N. ceranae* positive
 18% of colonies screened were *N. apis* positive
 8% of colonies screened contained both species

(n = 401 colonies)

Figure 6. Distribution of *Nosema* sp. in honey bee colonies across England and Wales (2007/08)



Import assessments:

- With respect to the import of honey bee queen cages, there was a 20% decrease in imports from EU countries, and 41% increase in imports from third countries in comparison to 2007;
- 35% of third country imports showed visual symptoms of *Nosema* infection.

Pesticides and veterinary drugs:

- None of the pesticides or veterinary drugs for which we tested during this study were detected at levels that would be expected to cause harm to honey bees.

Conclusions and benefits

- Given that DWV is strongly associated with *Varroa* infestation, and that colonies containing the virus halved in size, this highlights the need for appropriate mite control;
- For the first time, information quantifying over-winter losses has been collected for English and Welsh honey bees. This is an important dataset, that will allow subsequent fluctuations to be properly monitored.

Future work

To properly understand the relationship between apiculture practices and ultimate colony condition, we need to compile firm facts not just about incidence of disease, but also a variety of aspects of colony management. Such consistent data about beekeeping practices in the UK has been lacking. For these reasons, in 2009 the NBU launched its first annual national bee Husbandry Survey. Designed to be the most comprehensive survey of beekeeping practices ever completed in England and Wales, first results are now available on BeeBase, on Research and Development output pages, and have been published in the February edition of BBKA news.

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