

## **Yes, We Can Breed Bees Which Are Resistant to Varroa**

I started beekeeping in 1979 when I lived in Eversley, a village in North East Hampshire near the Berkshire border. At that time it had a mixed environment of woods, grazing meadows, forestry, heath, country estates and gardens. I joined the Wokingham Branch of the Federation of Berkshire Beekeepers, and we learned about beekeeping under the guidance of Mr Sprague, a kindly man with great experience and wisdom in the ways of bees. Those were the days of carefree beekeeping, before the scourge of varroa and its associated viruses.

I first experienced the ravages of varroa in 1993 when caring for a neighbour's hive, a strong hive full of bees with plenty of stores, which I expected to over-winter without any problems. On the following spring I found there were no live bees, a few dead bees and dead varroa mites covering the floor. In autumn I treated my own hives with the Bayvarol™, and they survived to the following winter. I used Bayvarol until we moved to Somerset in 1996. I continued using Bayvarol, but by then there were reports in the beekeeping journals of Varroa developing resistance to Bayvarol, and other remedies were available. Some treatments used chemicals, other treatments, such as removal of drone larvae and powdering with icing sugar, didn't use chemicals. So in 1999 I treated my three hives with a proprietary thymol based treatment, in accordance with instructions, but they all died over winter. I resolved to stop treatment for varroa in 2000, since it seemed that any form of treatment, whether it involved the use chemicals or not, caused disturbance to the colony and none were effective in eliminating varroa.

### **Why no chemicals?**

In 2005, five years after I stopped treating my hives with chemicals, I wrote to the British Beekeepers Association Newsletter, proposing that all British beekeepers stop chemical treatment so that our native bees could evolve to resist varroa. The letter was published and responded to by Richard Ball, Acting National Bee Inspector, who argued that the proportion of colonies that would survive without treatment would probably be less than one percent. How this figure was arrived at was not stated.

Though the need to treat varroa in the same way as the European beekeepers was necessary when it first arrived from the continent, it soon became apparent that the initial treatment, Bayvarol™, was becoming less effective as varroa developed a resistance to the chemical. So new chemicals were tried, with varying degrees of success: Apistan™, Apiguard™, oxalic acid, formic acid, and thymol based medications. Varroa then developed a resistance to these chemicals, and the chemicals also weakened the bees, as would be expected. The 'cure' was worse than the disease, and it didn't eliminate varroa.

At the time I wrote my first letter, there was evidence of feral colonies in buildings and hollows that managed to survive from year to year without any human intervention. My own empty hives

were frequently occupied by feral swarms, and they thrived and produced honey without any medication. Some of my colonies did succumb to varroa, but an increasing proportion managed to survive. My proposed solution, to cease chemical treatment, was ignored by all but a few far-sighted beekeepers, including Ron Hoskins who pioneered the Swindon Bee Project for propagating Varroa Resistant bees. See Appendix 3.

Around that time arose the Natural Beekeeping movement, with its principles of non-intervention in the lifecycle of the hive. But the majority of British beekeepers continued to follow the practices advocated by the BBKA and poisoned their hives with varroicides. Their colony losses continued to rise and honey yields decline. Four years after that first correspondence I sent another letter giving details of my experience and my methods for over-wintering hives.

See Appendix 4: my correspondence in the BBKA News of 2005 and 2009.

### **Signs of Resistance to Varroa**

How can one tell whether your colony has resistance to varroa? Ron Hoskins, who instigated the Swindon Bee Project, discovered evidence of varroa resistance in his hives after he stopped chemical treatment for varroa. See his article in the BBKA News February 2011: The “Swindon” Honey Bee.

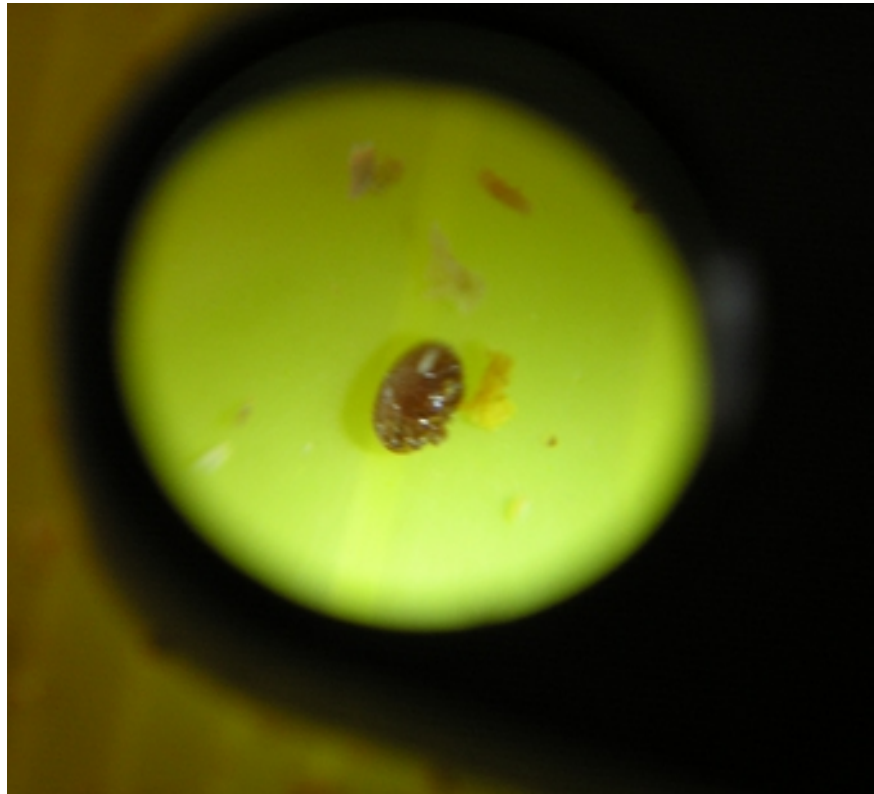
The debris collected on a sheet placed below the varroa mesh at the bottom of a hive can indicate hygiene behaviour, in particular bitten varroa mites and white antennae from unhatched varroa-affected pupa that have been dragged out of their cells. The bees somehow recognise those cells that contain varroa at their early stage of development, and rather than allow the bee to emerge, remove the pupa, and in so doing the attached varroa nymphs die. Of course the acid test for a resistant colony is survival and productivity.

You too can check whether your hives have resistance to varroa. Use a varroa screen as the hive floor. Put a panel of white or bright yellow plastic below the varroa screen, or else a panel with a sheet of white paper. This will catch the debris that falls from the hive and through the screen. Leave the panel in place for 24 hours, then carefully remove it and place it and the debris that may have fallen on it into a clean plastic or paper bag, so that the debris is not blown away. Take it indoors and empty the debris onto a sheet of white paper. Using a hand lens, preferably illuminated x 10 magnification, examine the debris for fallen mites and other items of interest.

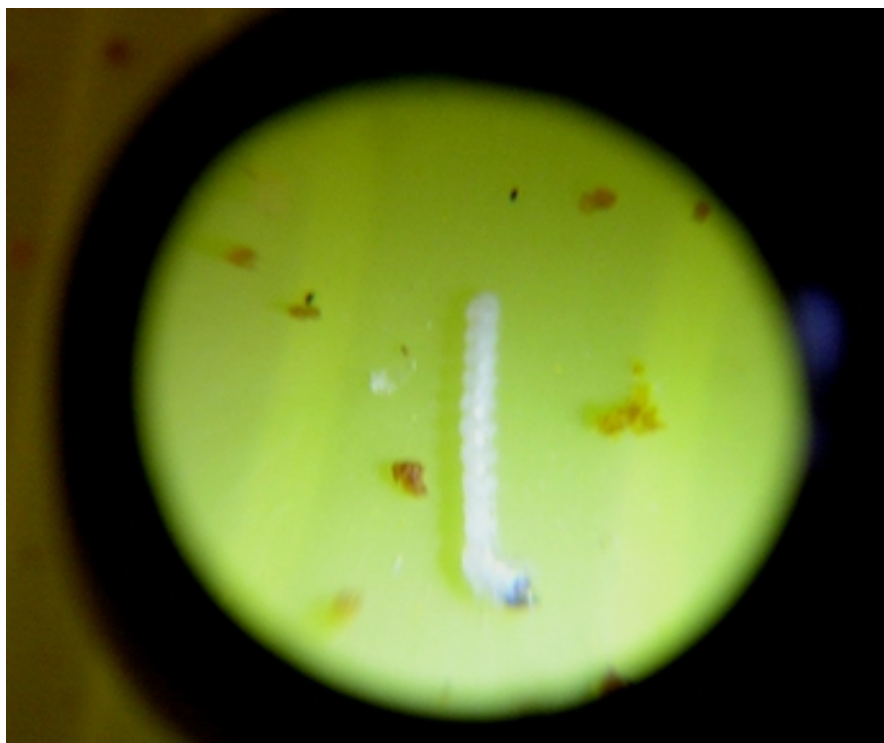
You may find pollen, small particles of old comb, white flakes of new wax (indicating that some young bees are producing it from their wax glands), and varroa mites. Look at these mites under the magnifying glass. You may find that some are alive and are crawling. Others may be dead and damaged: bitten bodies or legs removed. You can confirm this using a microscope. See photographs below, which I took using an illuminated magnifying lens, x 10.

You may also find white antennae, which are from larvae that have been removed from their cells before hatching. These are signs that the colony has developed a resistance to varroa, by hygienic behaviour. Not only that, the bees can also recognise and remove infected larvae from their

cells. It is happening in parts of England and it is noticeable that some feral (wild) colonies are managing to survive for years and even produce swarms. Such swarms are valuable, and all my colonies have come from them. This is a good development and ought to be encouraged by selective breeding.



Varroa bitten by the bees.



Antenna  
from varroa  
infected pupa  
removed by  
varroa  
resistant bees

## **Propagation of Varroa Resistance within a Local Beekeeping Association**

If a beekeeper is fortunate enough to discover a colony that exhibits all the desirable traits including hygienic behaviour and vigorous removal of varroa, infected larvae and pupae, then the local association may wish to breed from it. There are many ways of rearing queens that are described in detail in the beekeeping books and journals. They vary in complexity, and their success often depends on the skill of the beekeeper and the circumstances, such as weather, nature and size of the breeding colony etc. The following method is most suitable for propagating the desired strain for a group of beekeepers who wish to populate a contiguous area of countryside with that strain, without depleting the parent hive.

In May this year our division of the Somerset Beekeepers Association, the South East Division, met in my apiary. The purpose of the meeting was to propagate my strain of bees in the locality. Those who wanted to raise queens from my stock brought queenless nuclei made up from their own apiary. We took a frame with eggs and young larvae from my breeder hive and cut out strips of cells with eggs and young larvae, each about a 1 cm. wide and 3 cm. long. Take care to use a sharp blade and leave several cells with eggs or young brood undamaged. Each strip was pinned under the lower bar of a shallow frame in the middle of the nuclei which were kept in my apiary for 5 - 6 weeks, sufficient time for the queens to emerge and mate with the local drones, most of which were descendents of the varroa resistant strain. The idea was to make the bees in the nucleus raise queen cells from the introduced strip of eggs or young larvae from the breeding colony. Cutting a strip from a comb of young brood is much easier than grafting young larvae into empty queen cups. The breeding hive is only depleted of a square inch strip of brood comb for each nucleus seeded, so up to 50 or more nuclei can be seeded from one breeding hive with insignificant disturbance to it and insignificant loss of brood. See figures below and the photograph of developing queen cells being raised in a queenless nucleus from a strip of eggs/young larvae taken from the breeding colony.

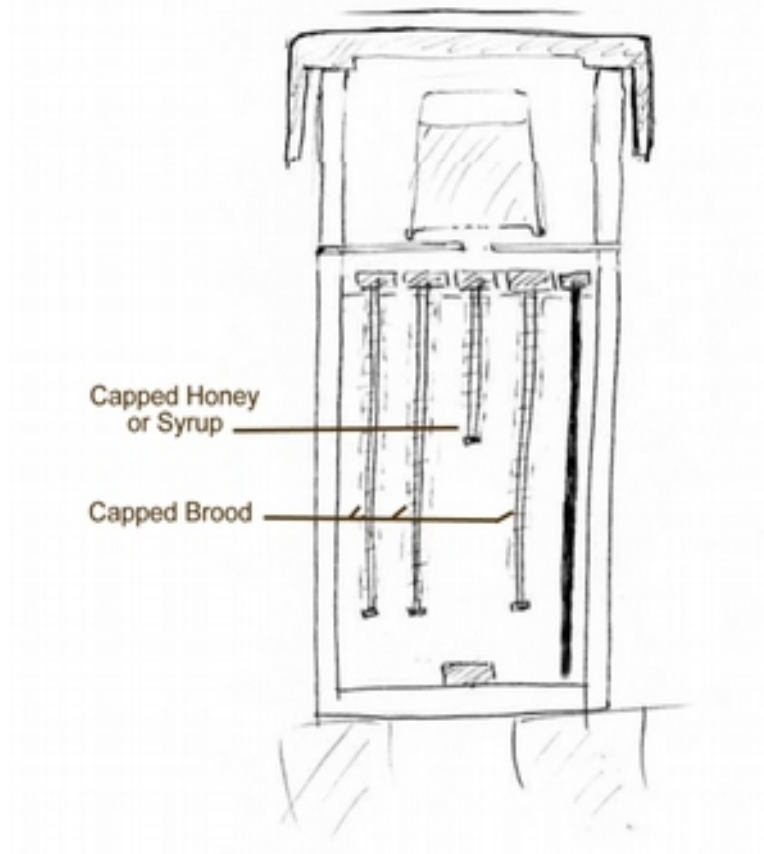


Fig. 1 Nucleus ready for egg strip

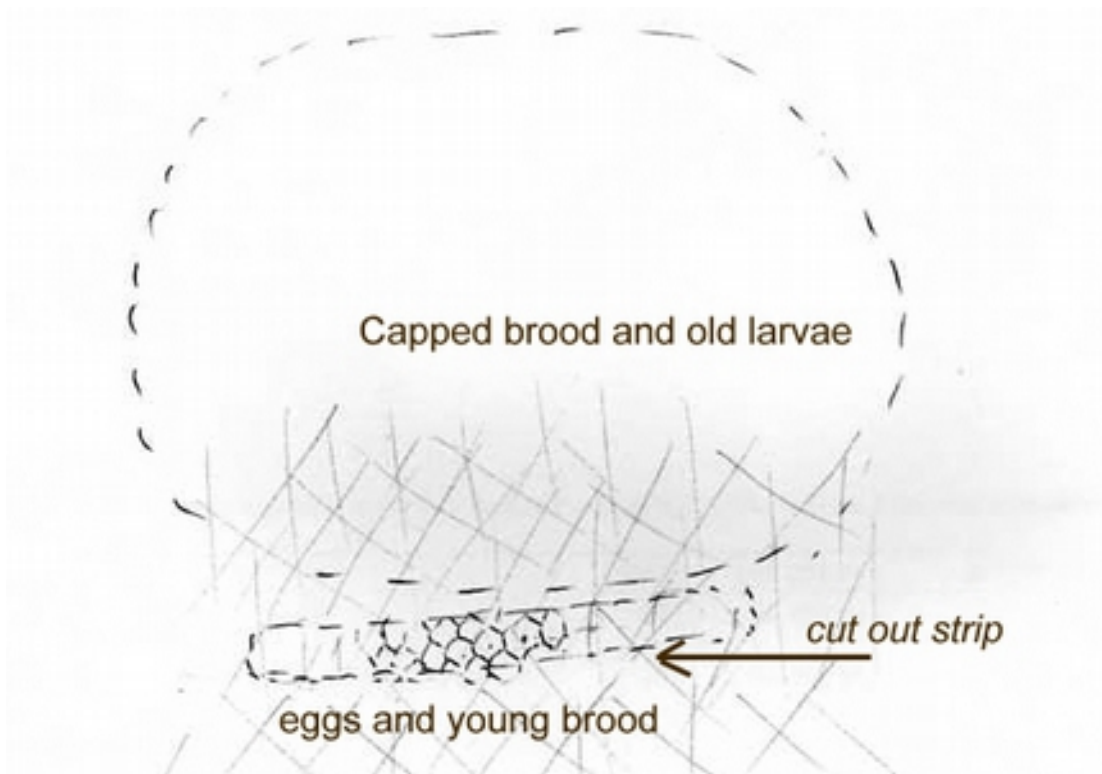


Fig. 2 selecting strip of brood comb



Fig 3. Strip of brood comb pinned under shallow frame



Queen cells raised on donated strip of eggs/larvae

We achieved a 50% success rate in raising new queens by this method. Those nuclei that failed to make queen cells on the strip failed because they had already made emergency queen cells on the combs in nucleus. To avoid this, the nucleus should be checked 4-5 days after it has been made up, and any emergency queen cells removed, before pinning the strip inside. Even where the strips were not converted to queen cells, and queen cells were made instead from eggs or young larvae already in the nucleus, the queens mated with varroa resistant drones mostly from my apiary, so a high proportion of hygienic characteristics would come from those drones.

## **Conclusion**

Beekeeping journals continue to be fixated on the threat from varroa. My experience in recent years, both with my hive and with hives of Natural Beekeepers and conventional beekeepers who do not use chemicals, is that hive mortality caused by varroa is negligible compared to other causes such as nosema, starvation, robbing by other bees, wasps and mice. I believe that treatment for varroa by chemicals is counter-productive, in that it weakens the bees and the surviving varroa become more immune to the treatment. Similarly, non-chemical intervention, such as the use of icing sugar and drone comb removal, also disturb the colony. In summary, in trying to treat varroa, British beekeepers have been weakening their stock. We have been breeding RESISTANT VARROA, when we should have been breeding RESISTANT BEES.

Joe Bleasdale

Little Orchard, Hardway, Somerset

September 2014

## APPENDIX

1. Research paper by Lisa Marie Burley: The Effects of Miticides on the Reproductive Physiology of Honey Bee (*Apis mellifera* L.) Queens and Drones

<http://scholar.lib.vt.edu/theses/available/etd-08162007-092313/unrestricted/lmburley.pdf>

2. Research on Varroa Resistant Bees in Russia and USA

[http://www.ars.usda.gov/Services/docs.htm?docid=2744&page=15&pf=1&cg\\_id=0](http://www.ars.usda.gov/Services/docs.htm?docid=2744&page=15&pf=1&cg_id=0)

The end of this article, published in the United States Department of Agriculture web site, gives a detailed description of the reproductive timescale of the varroa mite, alongside the development of the worker bee. It describes how bees from Eastern Russia, that demonstrated inherent resistance to varroa, were imported into the USA and used in breeding trials. The article refers to research papers on the subject, including the observations of Ibrahim and Spivak recorded in the American Bee Journal 2003, 144:406, that bees with the inherited trait of mite suppression selectively removed pupae from the cells that had reproductive mites.

3. The Swindon Bee Project:

[http://www.moraybeedinosaurs.co.uk/stanton\\_park.html](http://www.moraybeedinosaurs.co.uk/stanton_park.html)

4. Below is my correspondence from the BBKA News of 2005 and 2009 on the subject of varroa.

### **BBKA News**

FREE TO MEMBERS OF THE BRITISH BEEKEEPERS' ASSOCIATION No.  
154 AUGUST 2005

#### **A Radical Solution**

**We seem to be spending a great deal of time and effort in trying to mitigate the problems of varroa. Now that varroa has become resistant to the chemical treatment, we are trying other methods, all of which cause distress to the bees.**

**I propose a radical solution: Leave them alone!** Yes, colonies will die, but if they cannot resist the varroa by their own strategies, such as swarming or actively removing the mite themselves, then they are not fit, so good riddance. After a few years only resistant colonies will thrive. If varroa can build up resistance, so can our bees!

*Joe Bleasdale, Somerset BKA*

#### **In Response**

**I would agree with Joe Bleasdale that leaving *Apis mellifera* and *Varroa destructor* 'to it' has the merit that only stocks and mites able to maintain a symbiotic relationship would survive.**

This equilibrium exists with varroa's natural host *Apis cerana*. However, it is important to consider other possible implications to our environment. A full debate would fill a book but a précis would centre on the value bees represent



to pollination. It is often claimed that every third mouthful of our food is reliant on insect pollination some, of course, being by *Bombus* and other bee species, which are not adversely effected by varroa. However, Defra have put a farm gate value, in England, of pollination by honey bees at £120,000,000 which may be conservative as many experts suggest a higher monetary value. Carreck and Williams estimated £200,000,000 for the United Kingdom.

Following the discovery of varroa in the UK beekeepers used pyrethroid treatments where they realised that varroa infestations were present and losses did not exceed 50%. If varroa were to be left uncontrolled we do not know the survival rate but it would be negligible, probably less than 1%. As a result many honey bee pollinated crops would fail resulting in a food production crisis and perhaps affecting the well being of man. Can we accept such a risk? This has been illustrated this season in California, USA, where high losses of honey bees have meant that it has been necessary to tranship bees from Florida and import bees from Australia to make up the difference to ensure pollination of almond crops. Then there is the economic threat to the beekeeping industry and people's livelihoods to consider.

Primarily man has caused varroa infestations in our bee colonies by interference with species boundaries. We must accept responsibility and control varroa levels ensuring that bees do not suffer any ill effects and can maintain their place within our ecostructure. As beekeepers it is our duty to monitor our bees and select strains that show tolerance to varroa. In this way we can accelerate a timetable to develop the same symbiotic relationship that Joe Bleasdale suggests in a rapid, dramatic and perhaps damaging way.

*Richard Ball, Acting National Bee Inspector*

### **BBKA - Supporting Bees and Beekeepers**

FREE TO MEMBERS OF THE BRITISH BEEKEEPERS' ASSOCIATION  
NO.178 AUGUST 2009

#### ***What is Best for the Bees?***

You kindly published my letter in the BBKA News of August 2005, with a response by Richard Ball, who explained why it was necessary to continue treating our bees for varroa. During the previous and intervening years I have tried a wide range of approved treatments and I am still of the opinion that we are doing more harm than good, both to our bees and to the environment. Invariably the hives that I have treated have either succumbed over winter, or went into a severe decline. Those that I left alone have fared well.

My present colonies are all from swarms that have entered my empty hives during the past three years, saving me the bother of collecting them. They are docile and productive and probably came from a feral colony in a nearby wood, though I have not yet located it. I over winter each hive by placing an empty super on the bottom, above which I place a queen excluder. This keeps the mice out, for I have found mice guards to be ineffective. It also prevents dropped varroa from circulating in the brood chamber. I have found it unnecessary to feed my bees, for there is a strong late autumn honey flow. The best help that the Government can give to beekeepers is to encourage a more sustainable environment, through planting orchards, hedges, woodlands with lime and sweet chestnut and nectar bearing crops like clover, lucerne and sunflower. Then our bees can look after themselves in a land of plenty.

*Joe Bleasdale, Somerset BKA*

## 5. Colony Losses since stopping Chemical Treatment

The first table below shows my experience with colony losses since I stopped treating my hives with chemicals in 2000. The second table is a summary of recent experience of our local group of Natural Beekeepers in the Frome and Bruton area of East Somerset.

Year	Hives after Winter	Total Honey Crop (pounds)	Hives before Next Winter	Loss	Gain
2000	0	90	4 (1 bought, 1 nucleus, 2 swarm)		4
2001	4	169	5 (2 swarms, 2 merged)	0	1
2002	3	60	4 (1 swarm entered*)	2	1
2003	3 (mice)	128	5 (1 nucleus, 1 swarm entered)	1	2
2004	4	45	5 (1 swarm entered)	1	1
2005	1 (2 starved, 1 queenless)	27	4 (3 swarms entered)	4	3
2006	3	19	3	1	0
2007	2	16 ivy	3 (1 swarm entered)	1	1
2008	3	35	3	0	0
2009	2 (1 knocked over)	50 +38 ivy	3 (1 swarm entered)	1	1
2010	3	35	1 (1 paralysis, 1 wasps)	2	
2011	1 (v. cold isolated cluster)	0 (cold wet summer)	2 (1 small cast caught)	0	1
2012	2	50 (cold v. wet summer)	3 (1 swarm entered, merged with 1 queenless swarm)	0	1
2013	2	30 (bitter spring: chilled brood)	5 (+1 split hive + 2 nuclei raised from the same colony)	1	3

\* "swarm entered" means that a swarm, usually from a feral colony, entered my empty hive.

### Colony Gains/Losses by Natural Beekeepers in East Somerset (Frome/Bruton)

Colonies before winter 2012	Colonies after winter 2012/13	Main cause of winter losses	Gains in Summer 2013	Colonies October 2013	Colonies after winter 2013/14
<b>21</b>	<b>13</b>	Bitterly cold March resulting in starvation and/or chilled brood	22 from swarms, 3 from splits.	<b>25</b>	<b>24</b>

The conclusions from these tables are:

- Very cold wet summers from 2006/8 and 2010/12 account for my poor honey crops.
- Inexplicable colony losses that can be attributed to varroa (i.e. no bees dead or alive in the hive on the first inspection after winter) were at a peak in 2004 to 2005. Since then, increase has been mainly from feral swarms entering my empty hives, and their survival chances are increasing.

In England and Wales, the figures published by the Food and Environment Agency for colony losses from 1999 to 2008 show a steady increase from 5% to 12%.

See <https://secure.fera.defra.gov.uk/beebase/downloadNews.cfm?id=60>

The BBKA press release of June 2012 gives the losses from 2007 – 2012:

2007/8	2008/9	2009/10	2010/11	2011/12	2012/13
30.5%	18.7%	17.7%	13.6%	16.2%	33.8%

[http://www.bbka.org.uk/files/library/bbka\\_winter\\_survival\\_survey\\_release\\_final\\_14\\_june\\_13396](http://www.bbka.org.uk/files/library/bbka_winter_survival_survey_release_final_14_june_13396)

[63845.pdf](#)

Explanations given for the 2011/12 losses were:

- a) Queen related problems such as drone laying queens
- b) Clusters unable to reach food reserves in the hive
- c) Poor weather affecting queen mating
- d) Increased wasp activity possibly due to mild autumn

I think the hives that succumbed to wasp attack were dosed with thymol preparations such as Apiguard™ and Apistan™. The scent of thymol is strong and disrupts the natural scents of the hive and colony pheromones, so confusing the bees who cannot distinguish friend from foe. Anecdotal data from beekeepers in the Frome area of Somerset indicates very high losses (around 50%) in the winter of 2011-12, by beekeepers who treated their hives with chemicals.

The explanation for the increased 2012/13 losses was the wet and cold summer of 2012: poor foraging and virgin queens were not properly mated. The survey went out in February 2013, and I am sure the losses were even greater, about 50%. In March the weather became even colder and the weaker hives were unable to cover the brood, so there were no young bees to replace the overwintered bees.

In the USA in 2011, the winter losses were 30%.

See <http://www.ibra.org.uk/articles/US-honey-bee-winter-colony-losses-2010-11>