Review of policies on managing and controlling pests and diseases of honey bees

Evidence profile on American Foulbrood (AFB)

This is the evidence paper on AFB that was developed during the policy review. **Part 1** sets out an overview of AFB, current prevalence, biology and control policy, including impacts and costs of the policy to beekeepers and Government. **Part 2** summarises the main points from discussions on AFB by the Review Group, including insights into beekeeping practices and behaviours provided by Bee Inspectors and beekeeping representatives (note: these points seek to capture the discussions and are not-attributed).

Readers' guide

Part 1 - Overview of American Foul Brood (AFB) and current control policy

Incidence and geographic distribution of AFB across England and Wales (E&W)– clinical and sub-clinical

1. **Inspection data**. The National Bee Unit's (NBU) pest and disease control (honey bee health) programme includes risk based and targeted apiary visits to inspect colonies for signs of pests and diseases. The programme uses a number of different processes to identify the number of apiaries to inspect including proximity to known risks and formulas which can be used to calculate the number of inspections required to detect a specific percentage disease level with a high level of confidence. Inspection data in Part 1 have been extracted from the NBU's BeeBase database (www.nationalbeeunit.com)

E&W Inspection data

Early days of inspections:

- The first foul brood order was introduced in 1942 when around 1000 samples of brood were examined and around 60% were infected with foul brood. Devon and Somerset were considered black spots.
- In 1943, more inspectors resulted in an increase in sampling (approx. 1700) in these high risk areas. AFB was found in about 65% of the samples examined. In 1944, the number of infected colonies was 6.8% although this started to fall in subsequent years.
- Inspections started to increase in the mid 1940s and until the mid 1950s the number of infected colonies was between 1300-2400 i.e., 2-3% of colonies inspected. At this time, there were estimated to be 450-500,000 colonies.

Trends in numbers of colonies inspected:

- From the 1950s, 75-100,000 colonies were inspected per year until the late 1980s when the number fell by 50% to around 35,000 colonies followed by further reductions in the 1990s and 2000s (lowest level was in 2005 when 19,661 colonies were inspected).

Trends in national AFB infection rates

- Longer term, the average percentage of infected colonies from 1944-2011 was 0.7% (range 0.1% to 1.57%). After inspection levels fell by 50% and more in the 1980s, 1990s and 2000s, the percentage of infected colonies has remained at less than 1% with the exception of 1998 (1.01%) and 2002 (1.09%).
- From 2001-2011 the average % of infected colonies was 0.34% with 2010 being the lowest recorded (34 colonies 0.10%):

Year	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
Inspections E&W	22,055	24,387	25,134	25,698	19,661	24,814	27,248	26,408	39,457	33,304	37,119
No. of infected colonies	111	265	107	82	49	68	60	64	93	34	104
AFB %	0.5	1.09	0.43	0.38	0.24	0.27	0.22	0.24	0.23	0.1	0.28

County/country data on AFB infection rates

The NBU's inspection data confirms that, on the whole, AFB disease occurs rarely. Maps of disease incidence over time suggest non-uniform patterns of AFB infection in England and Wales [see maps pages of BeeBase https://secure.fera.defra.gov.uk/beebase/maps/map.cfm].

Annex 1 (a) shows 2001 to 2011 data of 8 counties (Cambridgeshire, Cornwall, Devon, Dorset, Norfolk, Northants, Oxford and N. Yorkshire), in England and 6 counties in Wales (Clywd, Dyfed, Powys, Gwent, W. Glamorgan and Gwynedd) which had persistent outbreaks (infected colonies) over several years and the number of beekeepers involved each year (shown in brackets). Note that some beekeepers have infected colonies in more than one year. The data also suggest that in some years disease outbreaks affect only one or two beekeepers in these counties.

Annex 1 (b) shows AFB infections in the remaining counties in England and Wales from 2001 to 2011 (i.e. those where outbreaks tended not to be persistent).

Annex 1 (c) shows data for counties in England and Wales where there was continued infection over 10 years (2001-2011) and the number of (the few) beekeepers with infections for two, three and four (+) consecutive years. This data suggests that infection does not generally persist for more than two or three years in apiaries (as disease control/clean-up is effective in most cases).

Persistent outbreaks

A snapshot of the data was taken to examine whether there was continued infection at any apiary site during 2006-2011. Three counties were selected at random - Devon, Cornwall and Oxfordshire and the findings were:

- Cornwall – 15 beekeepers had infected colonies during this period. Only one had infection in 2 consecutive years but at a different apiary
- Devon – 9 beekeepers had infected colonies during this period. Two had infection in more than one year but in both cases these were at different apiaries.
- Oxfordshire – 17 beekeepers had infected colonies during this period. Three had infected colonies in more than one year and some of these did involve the same apiary.

2. **Prevalence of AFB - Random Apiary Survey (RAS) results**

In 2009, Defra commissioned the NBU to undertake an assessment of the national

picture of honey bee pests and diseases (with the intention of using this assessment to inform the future honey bee pest and disease control programme, including establishing agreed outcomes). The NBU undertook this assessment from 2009 to 2011 by a random survey of apiaries (RAS).

From the RAS the prevalence of AFB across England and Wales was estimated to be 0.25% in Year 1 and 0.27% in Year 2. There were no significant correlations between AFB findings and apiary size, shared apiaries or beekeeper ownership (amateur v. professional).

Based on molecular analysis the pathogen prevalence for *P. larvae* was estimated to be 0.25% of apiaries in Year 1 and 0.2% of apiaries in Year 2 which is consistent with the clinical/inspection data. However as adult bees were used for these analyses, the prevalence of brood pathogens is likely underestimated.

Brief overview of AFB pathogen – infectivity, virulence, pathogenicity, incubation period, clinical signs, impacts on productivity and/or mortality of colony, sources and means of disease spread, susceptibility of bees, persistence of spores.

1. **Infectivity, virulence and pathogenicity** AFB is caused by the Gram-positive, spore forming bacterium *Paenibacillus larvae*. The spores infect larvae which are most susceptible 12-36 h after egg hatching. *In vitro* - a dose of 10 spores is sufficient for successfully initiating a fatal infection. The pathogen does not affect adult bees although spores can be transmitted by adults. High numbers of spores are produced by diseased colonies making AFB one of the most virulent bee diseases. There are thought to be at least four genotypes of the causative organism but the distribution and relative importance of these is not known [Genersch, E. (2010)].

2. **Incubation period** According to the OIE Terrestrial Code the incubation period is 15 days but the factors leading to onset of disease are poorly understood and spores can be detected on adult bees in colonies without clinical symptoms of disease.

3. **Clinical signs** AFB generally affects sealed brood and can be detected visually as the appearance of the sealed cell changes when the infected larvae die. Following infection the disease will develop by spreading through the brood. Once most of the brood is affected, the colony becomes unable to replace the ageing bee population eventually leading to death of the colony.

4. **Impacts on productivity and/or mortality of colony** Initially only a few cells will be affected but once there are clear clinical signs, disease spread throughout the colony is almost inevitable.

5. **Sources and means of disease spread** Transmission is horizontal and occurs by bees robbing honey from infected colonies or movement of combs, honey or hive equipment from an AFB infected colony to a healthy colony by the beekeeper [Hansen and Brødsgaard (1999)]. With respect to robbing the highest levels of transmission of AFB between apiaries occurs within 1 km of clinically diseased colonies [Lindström, et

al. (2008)]. [The most effective way of preventing the disease spreading to other colonies is by destruction of the infected colony].

6. **Susceptibility of bees to infection** Disease development can occur at various rates which may be influenced by a number of factors including differences in virulence and the susceptibility of bees to infection. There is evidence to suggest that there is genetic resistance to AFB.

7. **Persistence in environment** The spores are highly persistent, resistant to desiccation and remain viable for decades.

8. In 2010, a study of the pattern and spread of AFB cases in England and Wales between 1994 and 2009 was undertaken by Fera and Newcastle University. The study also looked for risk locations that may be consistently associated with AFB infection over time.

The study examined the pattern and spread of AFB in order to understand whether AFB occurs at random across the country and over time, or whether patterns exist that may infer proximity to potential risk points which may be a source of disease. In particular, the study assessed the extent to which AFB incidents were clustered (i.e., formed patterns) and considered possible causes by identifying 29 putative risk points. The locations of these 29 risk points were identified by the NBU's bee inspectors and included 17 honey packing plants, 13 crude hive product importers sites (two of which were also honey packers) and one site used for the disposal of waste honey barrels.

The key findings were as follows:

- the majority of AFB diseases clusters disappeared over time perhaps due to the vigilance of bee-keepers and the NBU's bee inspectors, and the destruction policy when disease has been detected, followed by increased local surveillance to check for, and manage recurrence of disease;

- AFB has a greater degree of clustering than EFB and some patterns of AFB infection could be due to localised spread of infection between apiaries;

- proximity to previous cases of AFB were significant predictors of risk of infection in neighbouring apiaries;

- three of the 29 locations potentially associated with clusters of infection showed a consistent association with diseased apiaries over time. These results suggest that apiary proximity to some commercial importers of honey or some sites used for the disposal of used honey barrels could be a risk factor for disease.

Further details are at Annex 4. In response to these results, the Honey Association developed a code of practice on biosecurity for honey packers to reduce AFB risks to honey bees.

Current policy aims

To limit the spread and impact of AFB.

The current objective of the bee health programme is :

- To protect stocks of honey bees needed for the pollination of agricultural and horticultural crops, as well as wild plants, and for the production of honey and wax; by
- Preventing the introduction of serious exotic bee diseases into the country, and limiting the spread and impact of serious notifiable diseases that are already present.

Note: this is being updated (see proposals in Defra and Welsh Government's 2012 consultation document ' Improving honey bee health – proposed changes to managing and controlling pests and diseases'

Current disease control programme (including legislation). Note: the programme includes disease control and surveillance

1. **Summary overview of legislation and controls:**
AFB is a notifiable disease for international trade reasons. EU legislation seeks to prevent the introduction and spread of AFB by including controls on importing honey bees from third countries and intra-Union trade. Domestically, AFB has been subject to statutory control, including destruction of infected colonies, in the UK since 1942.

The specific provisions in the Bee Diseases and Pests Control Order 2006 in relation to AFB controls at the apiary are set out in Annex 2. In practice, the NBU implements these provisions as follows:

- Following notification by the beekeeper (who is legally obliged to notify suspect cases to the NBU) and confirmation by the bee inspector, the apiary is put under movement restrictions and the affected colony and associated equipment liable to spread disease are destroyed usually under supervision of the bee inspector although this is not a specific requirement of the legislation;
- The standstill on movements remains in place for a minimum of six weeks after destruction;
- The Bee Inspector withdraws the notice if no further signs of disease are obvious. Bee Inspectors usually monitor the apiaries for the season after a confirmed case of AFB to check recurrence of the disease.

In addition, when AFB is confirmed, the bee inspector usually inspects apiaries in the surrounding area (up to 3km) and follows up contacts to check for disease symptoms and will implement control measures if disease is found. These additional inspections are precautionary to minimise risk of spread and disease recurrence.

2. **OIE Guidelines**
The OIE has published guidelines for the conditions relating to trade in honey bees

and apiculture products. These largely mirror the EU rules. The OIE guidelines also contain conditions for declaring country or zone freedom from AFB.

3. **Other discretionary elements of the disease control programme**:

- The NBU's Foulbrood advice leaflet highlights good practice on management and prevention of AFB, such as comb replacement and quarantine systems (barrier management) at colony or apiary level. Quarantine helps minimise the spread of infection in at risk colonies or in colonies with recent foul brood outbreaks.

- The NBU's surveillance work both checks the effectiveness of current policy and helps to prevent further spread. It targets apiaries at high risk of disease (whether AFB or EFB). Inspections are normally carried out from April to September. The NBU's current prioritisation of the risk-based inspection programme is as follows:

Inspection Priority	Description
1	Foul brood infected apiaries. Apiaries within 3km. of confirmed Foul Brood or 10km of Exotic Pest Risk Entry points. Colonies where disease is suspected, or those close to apiaries where foul brood disease has been confirmed. Colonies purchased or moved from infected apiaries, i.e. contact colonies. Apiaries having a history of foul brood disease. Colonies in areas where foul brood disease is thought to be prevalent.
2	Destructions/Treatments. Follow-up inspections in the season (April -September) after Standstill Notices have been withdrawn i.e., where foul brood was confirmed in the previous year.
3	Call out by beekeeper and inspections of colonies from which voluntary samples have been submitted
4	Follow up inspections, e.g. apiaries that have remained under Standstill over the winter.
5	Import and export examinations of bees under veterinary checks directives.
6	Assistance with suspect pesticide damage to honey bee colonies.
7	Honey sampling for statutory residue analysis on behalf of the Veterinary Medicines Directorate.
8	Education and extension programme .
9	Exotic Pest Surveys around known risk points- Exotic pest checks are also carried out within other inspection activities as appropriate.

10	Random 10km square inspections (Random 10km squares are those in which the visits at 1,2,3,4,5,6 and 8 are not required and beekeepers within that square have not been inspected for some time. Priority cascades to those squares that have not had any visits for 5 years or more, with the oldest dates of inspection being targeted before more recently visited squares.

- In addition, the NBU also provides training and education of beekeepers on disease recognition and on other aspects of beekeeping, helping to raise awareness for rapid detection and compulsory reporting of notifiable diseases.

- As well as Government based controls, the Honey Association have published a voluntary code of practice on biosecurity at packing plants to reduce the risk of AFB infections from imported honey (due to robbing by local honey bees).

Effectiveness and impacts of current controls

The prevalence of AFB is very low and has reduced from 265 colonies infected in 2002 to current low levels (104 in 2011 or 0.27% of inspected colonies by the NBU) and confirmed by the RAS. Prevalence of clinical disease has declined to negligible levels due to current control measures which suggests that effective disease control policies are in place. With such low prevalence, we can only detect AFB by surveillance of a large number of colonies, eg, through the current risk-based inspection programme, or by effective reporting by beekeepers.

Costs incurred from AFB outbreaks

1. Beekeepers have provided the following examples of costs they incur when AFB has been confirmed at an apiary. The replacement costs include the destruction of colonies and lost honey production.

Example 1 (source: beekeeper)
Based on average costs, frame costs for a full colony - £68.74
Lost honey production - £357.00
Replacement queens+50% for losses - £56.25
Replacement bees (taking bees from working hive at 25% of that hives honey production - £90.00
Cost of destruction and follow up (2 days @£100) - £200.00
Total costs associated with AFB limited to one hive £571.99

Example 2 (source: beekeeper) Around £1000 per outbreak in an apiary due to replacement costs of new queen/bees and if he/she has to purchase a new hive/box, plus consequential losses of honey in that season.

Example 3 (source NBU Bee Inspector)

Average colony value £350

Frames £20
Foundation £10
Plastic queen excluder £5
Labour £25 (2hrs)

There may also be further costs such as non-fulfilment of pollination contracts, and other costs associated with standstill notices being imposed.

Insurance against losses

2. Bee Disease Insurance Ltd. (BDI) is an insurance company set up and run for beekeepers by beekeepers. It compensates subscribing beekeepers in England and Wales in respect of losses caused to their colonies by the statutory honeybee diseases and pests (ie, AFB, EFB, Small hive beetle and Tropilaelaps). For beekeepers owning 40 or more hives a different scheme (Scheme B), operates. This scheme is available to beekeepers that may or may not be members of a BDI member association. BDI also promotes research, education and disease control methods for honeybee disease.

To government

3. The costs incurred by Government relate to surveillance, investigation, diagnosis, disease control measures, including outbreak investigation, education and training (all provided free of charge). The NBU's budget for the programme from Defra and WG is £2.2m. Costs incurred per outbreak are difficult to determine. Surveillance costs are the largest element incurred by Government ie, the costs of actively looking for disease and checking the effectiveness of disease control policy.

4. A case study from Scotland showing the costs incurred by the Scottish Government over recent years to deal with AFB and EFB outbreaks is at Annex 3.

Part 2- Main points made on AFB policy by the Review Group. These points were taken into account in developing the proposed changes to AFB policy.

1**. Are we succeeding to achieve our policy aims?**

- The negligible levels of AFB observed from inspection data and from the RAS results suggested that current controls are working well and policy aims are being achieved (to limit the spread and impact of AFB as part of an overall aim of protecting stocks of honey bees for pollination services).

- The fact that our controls are working and disease levels are low would suggest that we do understand the biology of AFB and the causative agent well enough. If we didn't, then our controls would not be as effective.

- It was noted that the regulations controlled the disease and not the AFB pathogen. As a result, the risk of AFB disease would remain and its eradication would be difficult to achieve and the effort/resources required would be disproportionate to the benefits (for pollination services). Continuing imports of honey from countries with AFB (ie, expect bees to have occasional access to imported honey potentially leading to infection) presented an ongoing risk, although this was now being addressed by the Honey Association's code of practice for packing plants.

- Nevertheless the group proposed that our longer term aim should be to eradicate AFB at least regionally as/if this becomes feasible.

2. Effectiveness of the response?

- Destruction of infected colonies and equipment by burning and standstill on the rest of the apiary were recognised as the best control measures for AFB and had led to low levels of diseases. In addition, all beekeepers registered on BeeBase within 3km of disease outbreak are alerted to enable the identification of any further cases and reduce the risk of spread.

- Extending the control to be applied across the apiary was supported by some members of the group although current evidence suggested that destruction of infected colonies was effective.

- Although some countries use antibiotics, these suppress rather than treat AFB and would not be considered as an option here.

- Imported consignments: There had been low incidence of AFB in imported consignments – see Annex 1(d) – which suggests that these are not an important risk factor. The NBU have also increased the number of consignments imported from other member states which are inspected.

- We needed to develop tougher policies to address the problem of (the limited number of) beekeepers with recurrent outbreaks of AFB who do not follow the bee inspector's advice to improve their beekeeping practices leading to continuing disease risks at their apiaries and risks to other beekeepers' apiaries nearby.

- The response to AFB needed to include greater emphasis on beekeepers helping themselves rather than relying on Government. This needed a greater buy-in from beekeeping local associations to raise the profile of pests and disease risks and the importance of beekeepers skills and competence in managing these risks. It was difficult for government to justify spending money on bee health year after year, without the beekeeping sector doing more to help itself.

3. What's stopping eradication of AFB?

- AFB was a disease spread by beekeepers with risks coming from equipment sold, imported stock, hospital sites and the inability of beekeepers to spot disease. It was possible that some beekeepers were self-treating for AFB which might help to explain why AFB cases cropped up at 'random' in the RAS results.

- Effective disease control and management of disease risks required efficient and effective biosecurity (practical disease prevention measures) by beekeepers who needed to accept responsibility for their role in this. It was the beekeepers responsibility to ensure they had proper biosecurity in place whether in relation to the buying or introduction of bees or buying or moving equipment and bees. Local associations need to be involved in reducing disease risks, such as offering sterilising equipment or comb exchange.

- There was some discussion about recent studies possibly demonstrating that apiary tools can transfer AFB. It is well accepted that poor practices can lead to spread of AFB. Anecdotal evidence suggested that outbreaks of AFB can sometimes be linked to abandoned hives and equipment and/or beekeepers extracting honey for several other beekeepers.

- It was noted that Argentina had a national queen breeding programme aiming to introduce AFB resistance to its honey bee stocks and this could be an alternative approach or additional to disease control programmes. Such a programme would have high costs and success was uncertain due to interbreeding with non-resistant stock.

4. Education and training

- Disease recognition by beekeepers was currently poor. The group agreed that education was an important policy response and we should look at how to make it more effective, including understanding how best to engage with beekeepers who are unwilling to adopt best practice. This could include training aids, such as PC or internet based self-learning programmes, photos or other visual aids.

5. Where can we innovate and work in different ways to maintain AFB at

current low/negligible levels achieve this goal, including beekeepers' role?

- the practical objective must be to keep the rate of increase of AFB cases below 1 (ie, the basic reproduction number R_o would be less than 1).

Note: The basic reproduction number of an infection is the mean number of secondary cases caused by an individual infected soon after disease introduction into a population with no pre-existing immunity to the disease in the absence of interventions to control the infection. $R_0 < 1$ the infection will die out in the long run (provided infection rates are constant). But if $R_0 > 1$ the infection will be able to spread in a population. The larger the value of R_0, the harder it is to control an outbreak/epidemic.

- colony destruction was the appropriate response to AFB. It was unlikely that eradication could be achieved because of the continual potential for AFB to be introduced into the country, e.g. via imported honey.

- self-policing or self-regulation by beekeepers was an option but was unlikely to be effective for AFB. Its success in other countries was unknown, except New Zealand where it had led to increased disease burdens.

- additional approaches to help beekeepers detect AFB could include (i) issuing beekeepers with lateral flow devices. However this would be a challenge for many beekeepers as use of these devices and interpretation of the results required specific skills, so overall this was probably not a workable option; (ii) beekeepers could send suspect combs to a central facility for examination and diagnosis.

- continuing efforts by government and stakeholders were needed to raise beekeepers' awareness of AFB through skill training programmes.

- need a greater emphasis on the promotion of bee health rather than focusing on disease; this might require a culture change in the interactions between bee inspectors and beekeepers.

- need to explore ways of exerting peer pressure amongst beekeepers to encourage each other to manage and respond to disease risks more effectively.

- need to explore possible options for selecting bees which are resistant to AFB.

- need to consider controlling the disease at population level to maintain R_o at less than 1 – to achieve this, it was not necessary to respond to all cases of disease, only those cases that matter.

6. What risk factors are associated with AFB spread?

- Overall it was agreed that the main risk factor associated with AFB spread was poor disease prevention measures (biosecurity) across all aspects of beekeeping whether through buying and selling bees, movements of bees or equipment or other practices by beekeepers, such as poor care/inspection of their stock, not registering on BeeBase, not reporting suspect disease, not taking up opportunities to improve their skills through training; alternative views and practices which may

be irresponsible (risk of disease spread).

- In addition, there were risks from importing bees although there was no evidence that this had lead to AFB outbreaks.
- The following were possible solutions to addressing these risk factors:
    - consistency of education and training particularly in relation to biosecurity, including managing risks associated with movement of bees and equipment;
    - accreditation of bees for sale by the suppliers;
    - encourage local associations to offer their members part exchange/replacement of old comb and/or offer the use of sterilisation kits.

Annex 1 (a) - 2001 to 2011 data of 8 counties in England and 6 counties in Wales which had persistent outbreaks (colonies) over several years and the number of beekeepers involved each year (shown in brackets) (Source BeeBase data August 2012)

England	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**
County											
Cambs	4 (2)	1 (1)	0	0	6 (4)	1 (1)	1 (1)	0	5 (4)	0	0
Cornwall	23 (6)	17 (6)	8 (3)	7 (4)	3 (2)	15 (1)	9 (2)	2 (1)	2 (1)	5 (4)	22(8)
Devon	14 (7)	11 (6)	6 (3)	10 (6)	1 (1)	1 (1)	7 (3)	5 (1)	2 (1)	1 (1)	7(5)
Dorset	2 (1)	3 (2)	0	1 (1)	2 (1)	0	0	0	1 (1)	1 (1)	0
Norfolk	1 (1)	0	0	0	0	4 (1)	8 (1)	2 (1)	0	6 (1)	0
Northants	0	0	1 (1)	2 (1)	0	0	4 (1)	1 (1)	1 (1)	4 (3)	1(1)
Oxford	6 (3)	2 (1)	2 (2)	2 (1)	3 (3)	2 (2)	6 (3)	34 (4)	14 (7)	7 (5)	1(1)
N. Yorks	0	0	0	2 (1)	0	0	0	0	13 (5)	5 (3)	0
Others*	23	198	28	18	12	33	11	16	36	2	47
Total	**73 (31)**	**232 (32)**	**45 (19)**	**42 (21)**	**27 (16)**	**56 (12)**	**46 (19)**	**60 (16)**	**74 (41)**	**31 (20)**	**78 (28)**
Inspections [1]						**20097**	**22147**	**22182**	**33294**	**28431**	**31826**
% of infected colonies found						**0.28**	**0.21**	**0.27**	**0.22**	**0.11**	**0.25**
Wales											
Clwyd	1 (1)	3 (2)	2 (2)	2 (1)	3 (2)	0	3 (2)	1 (1)	0	0	4(2)
Dyfed	6 (3)	9 (2)	40 (6)	22 (3)	7 6)	10 (5)	10 (7)	3 (2)	15 (5)	2 (1)	15(3)
Powys	31 (4)	2 (1)	7 (4)	7 (5)	8 (2)	2 (1)	0	0	3 (1)	0	0
Gwent	0	2 (1)	3(2)	9 (1)	2 (1)	0	1 (1)	0	1 (1)	0	7(3)
W. Glamorgan	0	0	8 (2)	0	1 (1)	0	0	0	0	1 (1)	0
Gwynedd	0	17 (4)	2 (1)	0	1 (1)	0	0	0	0	0	0
Total	**38**	**33 (10)**	**62 (17)**	**40 (10)**	**22 (13)**	**12**	**14 (10)**	**4**	**19**	**3**	**26**

[1] Individual figures for England and Wales not available

	(9)					(6)		(3)	(7)	(2)	(8)
Inspections[2]						**4717**	**5101**	**4226**	**6163**	**4873**	**5293**
% of infected colonies found						**0.25**	**0.27**	**0.09**	**0.31**	**0.06**	**0.49**
Total E&W inspections	**22055**	**24387**	**25134**	**25698**	**19661**	**24814**	**27248**	**26408**	**39457**	**33304**	**37119**
Total E&W infected colonies	**111**	**265**	**107**	**82**	**49**	**68**	**60**	**64**	**93**	**34**	**104**
% of infected colonies found	**0.5**	**1.09**	**0.43**	**0.38**	**0.24**	**0.27**	**0.22**	**0.24**	**0.23**	**0.10**	**0.28**

Annex 1 (b) - AFB infections in the remaining counties in England and Wales from 2001 to 2011 (ie those where outbreaks tended not to be persistent) (Source: BeeBase inspection records)

AFB outbreaks (colonies infected) – breakdown of 'other counties' shown in Annex 1 (a)

County	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
Avon		2		1			1				
Beds	1					14					
Berkshire								2			
Bucks											5
Cheshire							2	7			
Cumbria									3	1	8
Derbyshire		1	2		1				1		
Durham	1										
E. Yorks									2		15
Essex				1		12					
Gloucs									3		
Gtr London		8		2			2				1
Gtr Manchester		2	1				1				
Hampshire									3		
Herefordshire	4	3					1				2
Hertfordshire			3	3							
Humberside	6										
Isle of Wight					1				2		
Kent	2		3	3	3		1				3
Lancs									1		1
Lincs			3	2	1				1		
Leicestershire		15									3
Merseyside			2	2					2		2
Northumberland											2

County	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
Notts								4			
Shropshire		3						1	1		
S. Yorkshire	1										
Somerset			1						8		
Suffolk			3				2	2	6		
Surrey			14				1				
W. Yorks			4	4					2		5
Warwickshire		154*	1			5			1		
W. Midlands		4									
West Sussex		1	3								
Wiltshire	3	5			6	2					
Worcs										1	

- Includes major outbreak at beekeeper with 300+ colonies

Annex 1 (c) - Data for counties in England and Wales where there was continued infection over 10 years (2001 to 2011) and the number of beekeepers with infections for two, three and four (+) consecutive years (Source: BeeBase inspection records).

	No. of beekeepers with infected colonies in two years	No. of beekeepers with infected colonies in three years	No. of beekeepers with infected colonies in four+ years
England			
Cornwall	3	3	0
Devon	3	3	0
Oxford	2	1	1
Cambs	1	0	0
Dorset	0	1	0
Wales			
Clwyd	1	1	0
Gwent	2	0	0
Dyfed	2	1	2
Powys	1	1	0
Gwynedd	0	1	0
W. Glamorgan	1	0	0

Annex 1(d) - Number of EU imports and detection of pests or diseases from 2007 to 2011 (Source: BeeBase inspection records):

Year	Queens	Nucs	Total No. of Consignments	Physical checks	Doc checks	Findings
2007	7741	0	97	6 (6%)	4 (4%)	0
2008	5609	300	99	22 (22%)	15 (15%)	4 – bald, chalk brood, failing queen 1 EFB, 2 AFB
2009	5606	12	80	20 (25%)	40 (50%)	3 – chalk brood, varroa
2010	7291	100	125	19 (15%)	75 (60%)	6 – chalk brood, sac brood, varroa
2011	4163	405	86	16 (18%)	37 (43%)	1 AFB. chalk brood

Note: checks undertaken by the NBU at the destination apiary

Annex 2 - Further details of legislation governing AFB

EU Legislation:

- AFB is a notifiable disease for the purposes of Council Directive 92/65/EEC which lays down animal health requirements governing trade in and imports into the Community of certain live animals, ova, etc] It is also listed in the OIE's *Terrestrial Animal Health Code.*
- All honey bees imported into the EU from third countries or moved between member states must be certified as coming from an area which is free from AFB (not under AFB controls).
- Imports from third countries must enter the UK at a Border inspection Post where documentation is checked before the consignment is released to the importer. On arrival at the destination apiary, the beekeeper must send the attendant workers, packaging and other material that accompanied the bees to the NBU who check for the presence of small hive beetle or tropilaelaps mites.
- Intra-EU trade is not subject to compulsory inspection, although spot checks are allowed. The NBU carries out a 50% documentary check and 30% physical check of imported consignments. If AFB is detected, this is reported to the European Commission and the Member State of origin.

Specific provisions in the Bee Diseases and Pests Control (England) Order 2006 in relation to AFB:

Article 3 of the Order makes provision for the notification of the presence or suspected presence of a notifiable disease or a notifiable pest to the Secretary of State (in practice this is the NBU). The giving of such notification triggers a prohibition on the movement of things that might spread the disease or pest (article 4). Under the Order, AFB is specified as a notifiable disease. Where an authorised person (for the purposes of the Order this is a Bee Inspector) has reasonable grounds for suspecting the presence of a notifiable disease or a notifiable pest, he/she must serve a notice prohibiting the movement of certain items (article 6(1)). If a Bee Inspector is obstructed in the exercise of his power of entry he/she may serve a notice prohibiting movement of certain items (article 6(2)).
Article 7 sets out the measures that apply on confirmation of the presence of a notifiable disease. This provides that in the case of AFB, a Bee Inspector shall serve a notice to the owner or person in charge of a hive, requiring the destruction of any bees, combs or bee products from the hive; may serve a notice requiring the destruction or treatment of debris from the hive and any appliances or things liable to spread the disease; and may serve on any other person who is the owner or person in charge of any appliances or other things liable to spread the disease a notice requiring their destruction or treatment.
Article 12 requires the provision of facilities and the giving of information to Bee Inspectors where a notifiable disease is suspected. Article 12 also prohibits the use of substances that may disguise the presence of or render difficult the detection of a notifiable disease other than in accordance with a notice requiring treatment under article 7.

The Order is available at:
http://www.legislation.gov.uk/uksi/2006/342/introduction/made

Annex 3 - Case studies from Scotland (source: Scottish Government)

		2009	2010
Inspections		2717	3139
Cases	AFB	136	11
	EFB	310	71
Response			
Costs (Govt)		£127k	£104k

Annex 4 - AFB infection - analysis of spread and possible risk locations by Fera and Newcastle University

This sets out the aims and key findings of a study of the pattern and spread of American Foulbrood (AFB) cases in England and Wales between 1994 and 2009. The study also looked for risk locations that may be consistently associated with AFB infection over time.

The locations of these 29 risk points were identified by the NBU's bee inspectors and included 17 honey packing plants, 13 crude hive product importers sites (two of which were also honey packers) and one site used for the disposal of waste honey barrels.

The key findings were as follows:

- the majority of AFB diseases clusters disappeared over time perhaps due to the vigilance of bee-keepers and the NBU's bee inspectors, and the destruction policy when disease has been detected, followed by increased local surveillance to check for, and manage recurrence of disease;

- AFB has a greater degree of clustering than European Foulbrood and some patterns of AFB infection could be due to localised spread of infection between apiaries;

- proximity to previous cases of AFB were significant predictors of risk of infection in neighbouring apiaries;

- three of the 29 locations potentially associated with clusters of infection showed a consistent association with diseased apiaries over time. These results suggest that apiary proximity to some commercial importers of honey or some sites used for the disposal of used honey barrels could be a risk factor for disease.

From a policy perspective, there are three key implications from the results:

1. Localised spread of infection between apiaries may be due to foraging by bees but also may suggest between-apiary spread by beekeepers, emphasising the need for strict hygiene practices to reduce the spread of infection and/or spores by beekeepers.

2. The majority of potential risk locations (26/29) showed no consistent correlation with AFB, suggesting that most premises processing imported honey or crude hive products are operating without presenting a consistent risk to local honey bee stocks.

3. The consistent correlation of disease incidence with proximity to the location of two honey packing plants provides a reasonable basis for action to be taken by these plants (and associated disposal sites) to reduce the risks from these sites as potential future sources of infection. It is important to stress that the analysis shows a strong statistical correlation between incidence and the location of these two plants but does not prove that they are the cause or source of the AFB infections.

Reference https://secure.fera.defra.gov.uk/beebase/downloadNews.cfm?id=74 June 2010

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