



House of Commons
Environmental Audit
Committee

Insects and Insecticides

Written evidence

Only those submissions written specifically for the Committee for the inquiry into Insects and Insecticides and accepted as written evidence are included

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Written evidence submitted by Professor Dave Goulson, University of Stirling.

Insecticides

- I write with regard to the possible role of neonicotinoid pesticides in harming bee health, and other potential impacts on the environment. This class of compounds are widely used in the UK (1.3 million ha treated in 2010) and worldwide, mainly as a seed coating. They are absorbed by the growing crop and protect it against herbivorous insects. Concern has focused on the impact of neonicotinoids in the pollen and nectar of crops such as oilseed rape and sunflowers, which are consumed by both honeybees and wild bees such as bumblebees.
- I am an academic with 20 years' experience in studies of ecology, biodiversity and conservation, with a particular focus on bumblebees. I am author of a recent study on the impacts of neonicotinoid insecticides on bumblebees, published in *Science* in March 2012, which has been much-quoted during the recent controversy over insecticides (Whitehorn et al. 2012).
- Firstly, I would like to flag up my willingness to discuss any aspect of this study, and its implications, should this be useful.
- I am concerned that Defra's response to this work, and other studies, seems to be focused on trying to pick small holes and then using them as a justification for inaction. No study is perfect, and in practice it is impossible to carry out the ideal study. I would be happy to explain this in detail, but in essence a proper experiment requires natural, free flying bees in multiple areas with and without neonicotinoids. There are not areas without neonicotinoids in Europe. Hence if Defra are waiting for the perfect experiment to be performed, they will be waiting a very long time.
- There are major knowledge gaps which require further study. When neonicotinoids were first introduced for application as a seed dressing (rather than an aerial spray), they were welcomed as this was assumed to give better targeting of the crop and reduced environmental damage. However, this may not be the case, for the following reasons:
 - A) Published research by Bayer's scientists suggests that about 2% of neonicotinoid seed dressings are absorbed by the crop, leaving the fate of 98% unknown. These compounds are water soluble, and degrade very slowly in soil water. If they are drawn up by non-target vegetation, such as hedgerow shrubs, they could impact directly on numerous insects such as butterfly larvae. There appears to be just one study of levels in non-target plants, from the US, which found concentrations of neonicotinoid sufficient to kill herbivorous insects in dandelions growing near treated crops (Krupke et al. 2012, PlosONE). We do not know whether farmland vegetation in the UK is similarly contaminated.
 - B) Recent studies from Italy suggest that, no matter how carefully dressed seeds are drilled, neonicotinoid dust is created, sufficient to deliver lethal doses to flying insects nearby and presumably able to drift into non-target vegetation (Tapparo et al. 2012; Marzaro et al. 2011).

It seems to me that there is an urgent need to establish the fate of the 98% of neonicotinoids which are not in the crop, and to find out what impacts they might be having on the environment. Funding permitting, I am currently attempting to pursue this line of research.

26 September 2012

Written evidence submitted by Brighton and Lewes Beekeepers

The Committee of the Brighton and Lewes Beekeepers commend and support the decision to look into the issue of insecticides and honeybees.

1. The Committee of the Brighton and Lewes Division of the Sussex Beekeepers Association commend the decision to look into the issue of insecticides, in particular the group neonicotinoids, and their potential effects on honeybees and other pollinators.
2. As beekeepers we, and the members we represent, are concerned with increasing mortality rates of our bee colonies.
3. There are many scientific papers in the public domain which implicate systemic insecticides, specifically the neonicotinoids: Imidacloprid, Clothianidin and the carcinogenic phenylpyrazole: Fipronil, in the deaths of bees.
4. There is increasing evidence that these insecticides impair the bees' immune system rendering them more susceptible to other parasites and diseases, specifically Nosema. Synergistic action between insecticides and other pesticides and chemicals can also be lethal and need investigation.
5. We are also concerned that the initial short term toxicity testing required for licence is inadequate and has not detected chronic and sub lethal effects on pollinators, and worry that the testing may be inadequate for the safety of human beings as well.
6. We are concerned that the multinational chemical companies may be having undue influence in the granting of licences and the continued availability of their products in spite of widespread public concern.
7. The refusal to accept peer-reviewed scientific evidence by Syngenta and Bayer reinforces this view.
8. The failure of Defra to put a precautionary ban on these products, in spite of such bans being applied to certain uses of these chemicals in a number of European countries; France, Germany Italy, Slovenia, causes us to lose confidence in the British Government, and question who is the beneficiary of this inaction as it certainly is not the public, the environment, bees or beekeepers.

25 October 2012

Written evidence submitted by William Summers

Honeybee pollination services raise farmers profits. Any deleterious effects on honeybees caused by systemic seed dressings is an unintended consequence. Farmers should support a strategy to not kill bees if universally applied. They see no point or purpose in using undressed seed if other farmers do use it, killing or damaging bees. Only the law can ensure this by "restraint for mutual benefit". The way forward is to investigate with the farming industry a strategy of not using systemic neonicotinoid seed dressings and sprays on rape seed, field beans and other (bee pollinated) flowering crops. Farmers once relied on contact non-systemic insecticides and can do so again, but not between sunrise and sunset. To preserve pollinating insects is collective, enlightened self interest, but government must first lead with a law banning neonicotinoid use in any form on flowering crops. There would be no losers, not even the chemical manufacturing companies who would sell more, less dangerous insecticides and be better targeted.

Using contact sprays only between sunset and dawn for crops in flower is not an unreasonable request given that nights are already worked fetching in the harvest. Why not to save the bees without which there would barely be a harvest as in 2012 when bees were unable to forage and pollinate?

There is a time in the affairs of men which taken at the flood lead on to fortune—so let this be done now—or we shall lose the tide.

29 October 2012

Written evidence submitted by the Soil Association

Summary

- The UK Government is ignoring the strong and quickly growing body of scientific evidence which points to the damaging impact of neonicotinoid pesticides on pollinating insects, including bumblebees and honey bees (see Annex 1).
- Scientists have established that very, very low doses of neonicotinoids, well below what European governments consider a 'safe' level of toxic chemical, can disrupt bee behaviour in ways likely to contribute to the collapse in numbers of honeybees, bumble bees and other pollinating insects.
- Defra has made commitments to put in place new research to explore further the impacts of neonicotinoids on bumblebees and have acknowledged that the risks of pesticides to bees needs to be updated, but these plans ignore the weight of existing evidence, and will delay the action that the Government should take now.
- The European Food Standards Agency has admitted that neonicotinoid and other systemic insecticides have not been properly evaluated ever since their introduction and use of some neonicotinoids has been either banned or suspended in the USA, Germany and France. Italy banned neonicotinoid insecticide use on maize and this led to a halving of winter honey bees deaths over three years.
- There are a range of methods which farmers can use which do not require the use of neonicotinoid pesticides – in Italy government research showed banning neonicotinoid use on maize did not affect farmers' profits.
- UK and EU pesticide safety testing is not of an acceptable standard. First, it relies not on science but on industry data, which is not subject to scientific peer-review and publication. Second, there is no requirement for companies to publish all the research they conduct, with the risk that cherry-picked, favourable studies are used to obtain regulatory approval. Third, no safety testing which looks at the impact of repeated, very low doses (below accepted 'safe' levels) of pesticide are required. Fourth, little or no research is done on the impact of likely combinations of pesticides (the cocktail effect) that insects like honey bees and other insects will actually encounter on farms.

Introduction

1. The Soil Association is a UK charity, campaigning for healthy, humane and sustainable, food, farming and land use. We welcome fact that the EAC has launched this inquiry and we are pleased to have the opportunity to submit evidence to it.

2. *“The world of systematic insecticides is a weird world, surpassing the imaginings of the brothers Grimm... It is a world where the enchanted forest of the fairy-tales has become the poisonous forest in which an insect that chews a leaf or sucks the sap of a plant is doomed.”*

Rachel Carson, *Silent Spring* (2012 marks the 50th anniversary of the publication of the book).

Background

3. It is estimated that pollinating insects add some £430 million to the British economy by pollinating crops¹. Insect pollinated crops have become increasingly important in UK crop agriculture and, as of 2007, accounted for 20% of UK cropland value. Future land use and crop production patterns may further increase the role of pollination services to UK agriculture, highlighting the importance of measures aimed at maintaining both wild and managed species².
4. Over the past few years there has been mounting evidence of a global decline in pollinator numbers. There are number of theories for why pollinators have been suffering such declines, including the intensification of agriculture (causing loss of suitable habitats), poor weather and disease. A major cause is thought to be the type and extent of pesticide use on farmland.
5. The University of Reading concluded that: *“even when correctly applied pesticides can have adverse impacts upon bees by reducing their breeding success and resistance to disease, and by reducing the availability of valuable forage plants.”*³
6. A relatively new group of insecticides called neonicotinoids has been most strongly implicated. Scientific evidence against these chemicals is strong, which is why some of the individual neonicotinoid pesticides have been suspended on certain crops in several European countries (e.g. France, Germany and Italy). However the UK government has not yet accepted this scientific evidence.
7. Neonicotinoids are a relatively new class of insecticides, launched in 1991. They are synthetic derivatives of nicotine, the tobacco toxin. They are designed to be persistent and target the insect’s immune system, binding with its nicotinic receptors and interrupting the sending of nerve impulses. These pesticides are systemic, i.e. they permeate throughout the plant.
8. There are seven different active ingredients: acetamiprid, clothianidin, dinotefuran, imidacloprid, nitenpyram, thiacloprid, and thiamethoxam.

¹ <http://planetearth.nerc.ac.uk/news/story.aspx?id=988>

² Pollination services in the UK: How Important are Honeybees?
Breeze T.D., Bailey A.P., Balcombe K.G. and Potts S.G.

Agriculture, Ecosystems & Environment (2011) Vol 142 no. 3-4 (Pages 137-143)

³ www.foe.co.uk/beesreport

9. The most popular of these is imidacloprid. It is one of the fastest growing insecticides in terms of sales and is one of the most widely used insecticides in the world⁴. It is highly toxic to bees and is the best researched neonicotinoid in terms of the threat it poses to wild pollinators and honey bees.
 10. These pesticides are used in a number of ways. The most popular use in the UK is as a seed treatment, in particular for the crops oil seed rape and maize. Scientists are now discovering that very, very low doses of neonicotinoids, well below what European governments consider a 'safe' level of toxic chemical, can disrupt bee behaviour in ways that are likely to be contributing to the collapse in numbers of honeybees, bumble bees and other pollinating insects.
- ***The use (or abuse) of evidence in this particular case, for setting policy and regulations on pesticides.***
11. Methods used during development and initial safety and efficacy testing of pesticides should be changed as it is clear that they are insufficient to demonstrate safety. This is for four main reasons.
 12. First, the current UK system of pesticide regulation relies on the use of industry data, which is not subject to scientific peer-review and publication. Second, there is no requirement for companies to publish all the research they conduct, leading to the risk of only cherry picked, favourable studies being used to obtain regulatory approval. Third, no safety testing which looks at the impact of repeated, very low doses (below accepted 'safe' levels) of pesticide are required. Fourth, there is no research on the impact of likely combinations of pesticides (the 'cocktail effect') that insects like honey bees and other insects will actually encounter on farms.
 13. The continued decline in bird numbers and biodiversity generally in the UK makes it clear that further efforts to reduce pesticide risks and impacts should be prioritised and pursued.
 14. The recent draft UK National Action Plan for the Sustainable Use of Pesticides (NAP) highlights the relative lack of concern the UK Government appears to have with regard to pesticide use, as compared to other EU countries. The draft lists existing regulatory measures and non-regulatory initiatives aimed at reducing risks and impacts. In doing so it makes no commitment to change or further reduce pesticide impacts and risks or dependency on the use of pesticides. Contrary to the relevant EU Directive which stipulates that National Action Plans should be "aimed at setting quantitative objectives, targets, measures, timetables and indicators to reduce risks and impacts of pesticide use in human health and the environment" the UK NAP completely fails to implement this requirement.

⁴ Yamamoto, I. "Nicotine to Nicotinoids: 1962 to 1997", in *Nicotinoid Insecticides and the Nicotinic Acetylcholine Receptor*, eds. Yamamoto, I. and Casida, J. Springer-Verlag, Tokyo, 1999 pp. 3–27.

15. In March 2012 Defra said that it would review the evidence on neonicotinoids and take action if necessary. Before the review was published, Defra's Chief Scientist until September 2012, Professor Sir Bob Watson, acknowledged that the Government's focus on managed honey bees means that it knows a lot less about other pollinators and the effects chemicals may be having on them:
16. *"I fully recognise that the issues that have been raised are not just about honey bees but are relevant to a broader range of bees and pollinator species. We are considering the research in that wider context...we have less baseline knowledge of the effects of all pesticides, not just neonicotinoids, on pollinator species other than honeybees. We also have a less developed basis for interpreting the available evidence."* (Letter to Friends of the Earth, Buglife, Soil Association and ClientEarth, June 2012).
17. The EU as a whole is also taking stronger action with regard to this problem. The European Food Safety Authority (EFSA) has recently published an opinion on how the pesticide risk assessment for bees should be conducted⁵. The body has concluded that neonicotinoid and other systemic insecticides have not been properly evaluated ever since their introduction. The EFSA opinion will form the basis for new guidelines for the tests (to be published in late 2012) required to be carried out by the pesticide manufacturers and how member states should assess the information submitted.
18. These guidelines will only be relevant for new products, or those being reviewed. It is not clear what the situation for systemic insecticides already on the market will be. Individual member states could choose to suspend all neonicotinoid product approvals until the new protocols are introduced. The European Parliament is calling for stronger regulations and a review of the risk assessment, along with more independent research and public scrutiny of the system. We strongly support this approach and urge the UK Government to fully support such calls.
19. A number of other European countries have recognised the weight of evidence in terms of the case against neonicotinoids.
20. Italy temporarily suspended use of three neonicotinoid products in 2008 – the suspensions have been renewed each year. Research in Italy found that the ban has led to a halving of winter deaths of honeybees over three years. France has recently banned the use of the neonicotinoid, Thiamethoxam, due to concerns about its impact on bees. This chemical remains in use in the UK – in fact its use has increased substantially over the past few years.⁶
21. In France the use of Gaucho (Imidacloprid) on sunflower seeds was banned in 1999 after one third of bees died following its widespread use; in 2004 use on sweetcorn seeds was also banned. Bee populations are reported to have increased again after the ban. In 2012, the French Government announced plans

⁵ http://bees.pan-uk.org/assets/downloads/Bee_factsheet4.pdf

⁶ Food and Environment Research Agency (2012) Pesticide Usage Statistics

to suspend the neonicotinoid, Thiamethoxam due to concerns about its impact on bees.

22. In 2008 Germany suspended use of some seed treatments containing clothianidin, imidacloprid or thiamethoxam because of mass bee deaths caused by dust arising from seed drilling which drifted crops where bees were feeding.
23. In the US Imidacloprid was voluntarily withdrawn by manufacturers from use on almonds in 2011, under pressure from the state government of California,
- ***The application of real-world – ‘field’ – data. What monitoring there is of actual – rather than recommended – levels of pesticide usage, and the extent to which that influences policy on pesticides.***
24. Until recently there had been relatively little research using real world ‘field’ data. We welcome the fact that there is now better evidence for such field risks, yet the UK Government is still not taking such evidence into account strongly enough.
25. The Government’s review of evidence with regard to pollinators and neonicotinoids was published on 18th September 2012⁷. The review acknowledged that there was evidence of harm in laboratory studies but that more research is needed in field conditions. It acknowledged the need for more research into impacts on solitary and bumble bees. It recommended changes to the regulatory process to ensure that the risk assessment for pesticide products considers the impact on all bee species, but still took the decision not to suspend or place any restrictions on the use of neonicotinoid pesticides.

Any potential impacts of systemic neonicotinoid insecticides on human health.

26. The impact of systemic neonicotinoid insecticides on human health is a relatively under-researched area. The World Health organisation (WHO) put the neonicotinoids imidacloprid, thiacloprid (the only neonicotinoids listed) as Class II (moderately hazardous).
27. Most neonicotinoids show much lower toxicity in mammals than insects, but emerging science demonstrates that many may also have neurodevelopmental effects, and some are considered likely carcinogens by US Environmental Protection Agency (EPA)⁸.
28. The fact that these insecticides are systemic means that they cannot be washed off food. Neonicotinoid pesticides are regularly found in food consumed in the UK. The regular Expert Committee on Pesticide Residues in Food (PRiF) reports show details of the pesticides found in food purchased in the UK. For example

⁷ <http://www.defra.gov.uk/publications/2012/09/18/pb13818-pesticides-bees/>

⁸US EPA Factsheets. <http://www.epa.gov/opprd001/factsheets/>.

the 2010 report shows that the neonicotinoid pesticide imidacloprid was found in grapes, beans and basil. The neonicotinoid which the French Government have recently announced plans to ban (thiamethoxan) was also found in lettuce and grapes. The most recent report (first quarter of 2012, published Sept 2012) showed that imidacloprid was found in beans, broccoli, grapes, lettuce, okra and peppers.⁹

What alternative pest-control measures should be used, such as natural predators and plant breeding for insect-resistance, in a bid to make UK farming more insect- and bee-friendly.

29. There are a wide range of pest-control alternatives to the use of pesticides for insect control.
30. Many crop pest species have natural predators (e.g. ladybirds for aphids) or parasites (e.g. nematodes for slugs and snails). These can be deliberately introduced to a crop or encouraged by providing suitable habitat (e.g. rough unfarmed areas around fields). Often natural predators get removed from the system by pesticides, either directly or through dramatic reduction in prey, resulting in die-off of the predators and subsequently disrupting ecosystems by adversely affecting food webs. Therefore reducing pesticide usage and encouraging natural predators can help control pest species as well as improving the health of the whole ecosystem.
31. Methods such as crop rotations, (as opposed to monocultures) and a variety of measures to encourage natural predators of pest species are widely used in farming worldwide.
32. Such methods are widely used in organic farming, which does not use neonicotinoids and does not rely on pesticide use. Biodiversity, in terms of a wide range of plants, insects and animals, is key to organic farming. Each plant or animal has a specific role in the life of the farm, and this is especially true of the bee. Bees and other pollinators play a crucial role in pollination, so that we can grow fruits and vegetables.
33. Intensive agricultural techniques are causing such concern that new research is being carried out at the laboratory of Apiculture and Social Insects at the University of Sussex. Professor Francis Ratnieks, who heads the laboratory stated: "The use of herbicides and intensive forms of agriculture means that fields of wheat and barley now have few weeds. Fields of grass now have few wild flowers, clover is less used and much of the heather moors have been ploughed up."¹⁰

⁹<http://www.pesticides.gov.uk/Resources/CRD/PRiF/Documents/Results%20and%20Reports/2012/Q1%202012%20Final.pdf>

¹⁰ <http://www.sussex.ac.uk/lasi/sussexplan/agriculture>

34. The focus on natural ecosystems and native species, as well as the lack of pesticides used in organic farming, make it a haven for pollinators. Organic farms also provide the wild spaces at not just at field margins and in hedgerows, where bees nest and shelter, but also providing a diversity of flowers and habitats for bees to feed throughout the field.
35. In particular, red and white clover are mainstays of organic farming systems. Red clover (*Trifolium pratense* L.) is used extensively as part of the rotational farming systems that maintain soil fertility without the use of chemical fertilisers. In addition it is one of the bumble bees favourite foods. White clover (*Trifolium repens*) is also found in abundance on organic farms. Honeybees are particularly drawn to this plant.
36. *"In the economy of nature the natural vegetation has its essential place...Such vegetation is the habitat of wild bees and other pollinating insects. Man is more dependent on these wild pollinators than he usually realises. Even the farmer himself seldom understands the value of wild bees and often participates in the very measures that rob him of their services....These insects, so essential to our agriculture and indeed to our landscape as we know it, deserve something better from us than the senseless destruction of their habitat. Honeybees and wild bees depend heavily on such weeds".*

Rachel Carson, Silent Spring.

Annex 1

In 2009 the NGO Buglife wrote a detailed overview of the evidence in this area: 'The impact of neonicotinoid insecticides on bumblebees, honey bees and other non-target invertebrates¹¹'.

Since then, a number of other scientific research papers have been published which add further evidence. A selection of these is outlined below.

Title: Neonicotinoid Pesticide Reduces Bumble Bee Colony Growth and Queen Production

Authors: Penelope R. Whitehorn, Stephanie O Connor, Felix L. Wackers, Dave Goulson

Journal: *Science* (2012); vol 336 no. 6079 (pages 351-352)

DOI: 10.1126/science.1215025

Summary: Exposed colonies of the bumble bee *Bombus terrestris* in the laboratory to field-realistic levels of the neonicotinoid **imidacloprid**, then allowed them to develop naturally under field conditions. Treated colonies had a significantly reduced growth rate and suffered an 85% reduction in production of new queens compared with control colonies.

11

Title: A Common Pesticide Decreases Foraging Success and Survival in Honey Bees

Authors: Mickaël Henry, Maxime Beguin, Fabrice Requier, Oriane Rollin, Jean-François Odoux, Pierrick Aupinel, Jean Aptel, Sylvie Tchamitchian, Axel Decourtye

Journal: Science (2012); vol 336 no. 6079 (pages 348-350)

DOI: 10.1126/science.1215039

Summary: Exposed on free-ranging honeybee foragers labeled with a RFID tag to non-lethal levels of **thiamethoxam** (neonicotinoid pesticide) resulting in high mortality due to homing failure. Levels of mortality were high enough to put a colony at risk of collapse.

Title: *In situ* replication of honey bee colony collapse disorder

Authors: Chensheng Lu, Kenneth M. Warchol, Richard A. Callahan

Journal: Bulletin of Insectology (2012) Vol 65 n. 1 (pages 99-106)

ISSN: 1721-8861

Summary: 16 hives were treated with **imidacloprid**, at dosages reflecting imidacloprid residue levels reported in the environment previously. Treatment lasted for 13 weeks after which all hives were alive. However, after 23 weeks 15 of 16 imidacloprid treated hives (94%) were dead. Dead hives were remarkably empty except for stores of food and some pollen left, a resemblance of CCD. The survival of the control hives that were managed alongside with the pesticide-treated hives suggests this was down to the treatment and not other environmental factors.

Title: Pesticide exposure in honey bees results in increased levels of the gut pathogen *Nosema*

Authors: Jeffery S. Pettis, Dennis vanEngelsdorp, Josephine Johnson & Galen Dively

Journal: Naturwissenschaften (2012) Vol 99 no.2 (pages 153–158).

DOI: 10.1007/s00114-011-0881-1

Summary: Exposed honey bee colonies over three brood generations to sub-lethal doses of **imidacloprid**, and then subsequently challenged newly emerged bees with the gut parasite, *Nosema spp.* The pesticide dosages used were below levels demonstrated to cause effects on longevity or foraging in adult honey bees. *Nosema* infections increased significantly in the bees from pesticide-treated hives when compared to bees from control hives demonstrating an indirect effect of pesticides on pathogen growth in honey bees. Interactions between pesticides and pathogens could be a major contributor to increased mortality of honey bee colonies, including colony collapse disorder, and other pollinator declines worldwide.

Title: Influence of dinotefuran and clothianidin on a bee colony

Authors: Toshiro Yamada, Kazuko Yamada & Naoki Wada

Journal: Japanese Journal of Clinical Ecology (2012) Vol.21 No.1 (pages 10-23)

Summary: Treated eight colonies of ~10,000 honeybees with **dinotefuran** or **clothianidin**. Treatments were foods containing **dinotefuran** of 1 ppm to 10 ppm or **clothianidin** of 0.4 ppm to 4 ppm fed into a beehive. Three levels of concentration for each pesticide were 10, 50 and 100 times lower than that in practical use. The changes of adult bees, brood and the pesticide intake in each colony were examined and suggest that each colony with the pesticide administered collapses to nothing after passing through a state of CCD. The high-concentration pesticides seem to work as an acute toxicity and the low- and middle-concentration ones do as a chronic toxicity.

Title: Multiple Routes of Pesticide Exposure for Honey Bees Living Near Agricultural Fields

Authors: Christian H. Krupke, Greg J. Hunt, Brian D. Eitzer, Gladys Andino, Krispn Given

Journal: PLoS ONE Vol 7 no.1: e29268.

DOI: 10.1371/journal.pone.0029268

Summary: Neonicotinoid insecticides have been found in previous analyses of honey bee pollen and comb material but the routes of exposure have remained largely undefined. Used LC/MS-MS to analyze samples of honey bees, pollen stored in the hive and several potential exposure routes associated with plantings of neonicotinoid treated maize. The results demonstrate that bees are exposed to these compounds and several other agricultural pesticides in several ways throughout the foraging period. During spring, extremely high levels of clothianidin and thiamethoxam were found in planter exhaust material produced during the planting of treated maize seed. Neonicotinoids were also found in the soil of each field we sampled, including unplanted fields. Plants visited by foraging bees (dandelions) growing near these fields were found to contain neonicotinoids as well. This indicates deposition of neonicotinoids on the flowers, uptake by the root system, or both. Dead bees collected near hive entrances during the spring sampling period were found to contain clothianidin as well, although whether exposure was oral (consuming pollen) or by contact (soil/planter dust) is unclear. We also detected the insecticide clothianidin in pollen collected by bees and stored in the hive. When maize plants in our field reached anthesis, maize pollen from treated seed was found to contain clothianidin and other pesticides; and honey bees in our study readily collected maize pollen. These findings clarify some of the mechanisms by which honey bees may be exposed to agricultural pesticides throughout the growing season.

Title: RFID Tracking of Sublethal Effects of Two Neonicotinoid Insecticides on the Foraging Behavior of *Apis mellifera*

Authors: Christof W. Schneider, Jürgen Tautz, Bernd Grünewald, Stefan Fuchs

Journal: PLoS ONE (2012) volume 7 No1: e30023.

DOI: 10.1371/journal.pone.0030023

Summary: In addition to testing according to current guidelines designed to detect bee mortality, tests are needed to determine possible sublethal effects interfering with the animal's vitality and behavioral performance. Several methods have been used to detect sublethal effects of different insecticides under laboratory conditions using olfactory conditioning. Furthermore, studies have been conducted on the influence insecticides have on foraging activity and homing ability which require time-consuming visual observation. This experiment tested an experimental design using the radiofrequency identification (RFID) method to monitor the influence of sublethal doses of insecticides on individual honeybee foragers on an automated basis. Electronic readers were positioned at the hive entrance and at an artificial food source to obtain quantifiable data on honeybee foraging behavior. This gave detailed information on flight parameters. By comparing several groups of bees, fed simultaneously with different dosages of a tested substance it was possible to monitor the acute effects of sublethal doses of the neonicotinoids imidacloprid (0.15–6 ng/bee) and clothianidin (0.05–2 ng/bee) under field-like circumstances. Both substances led to a significant reduction of foraging activity and to longer foraging flights at doses of ≥ 0.5 ng/bee (clothianidin) and ≥ 1.5 ng/bee (imidacloprid) during the first three hours after treatment. This study demonstrates that the RFID-method is an effective way to record short-term alterations in foraging activity after insecticides have been administered once, orally, to individual

bees. Field relevant doses of imidacloprid in sunflowers and oilseed rape were estimated to be around 0.13 ng and 0.023–0.03 ng, respectively. At these doses there was no effect of treatment.

Title: Combined pesticide exposure severely affects individual- and colony-level traits in bees

Authors: Richard J. Gill, Oscar Ramos-Rodriguez & Nigel E. Raine

Journal: Nature (2012)

DOI: doi:10.1038/nature11585

Summary: Reported widespread declines of wild and managed insect pollinators have serious consequences for global ecosystem services and agricultural production. Bees contribute approximately 80% of insect pollination, so it is important to understand and mitigate the causes of current declines in bee populations. Recent studies have implicated the role of pesticides in these declines, as exposure to these chemicals has been associated with changes in bee behaviour and reductions in colony queen production. However, the key link between changes in individual behaviour and the consequent impact at the colony level has not been shown. Social bee colonies depend on the collective performance of many individual workers. Thus, although field-level pesticide concentrations can have subtle or sublethal effects at the individual level, it is not known whether bee societies can buffer such effects or whether it results in a severe cumulative effect at the colony level. Furthermore, widespread agricultural intensification means that bees are exposed to numerous pesticides when foraging, yet the possible combinatorial effects of pesticide exposure have rarely been investigated

These experiments show that chronic exposure of bumblebees to two pesticides (neonicotinoid and pyrethroid) at concentrations that could approximate field-level exposure impairs natural foraging behaviour and increases worker mortality leading to significant reductions in brood development and colony success. It was found that worker foraging performance, particularly pollen collecting efficiency, was significantly reduced with observed knock-on effects for forager recruitment, worker losses and overall worker productivity. Moreover, this provides evidence that combinatorial exposure to pesticides increases the propensity of colonies to fail.

The importance of Insect pollinators

Title: Pollination services in the UK: How Important are Honeybees?

Authors: Breeze T.D., Bailey A.P., Balcombe K.G. and Potts S.G.

Journal: Agriculture, Ecosystems & Environment (2011) Vol 142 no. 3-4 (Pages 137-143)

DOI: 10.1016/j.agee.2011.03.020

Summary: Insect pollinated crops have become increasingly important in UK crop agriculture and, as of 2007, accounted for 20% of UK cropland and 19% of total farmgate crop value. Analysis of honeybee hive numbers indicates that current UK populations supply 34% of pollination services, falling from 70% in 1984. In spite of this decline, insect pollinated crop yields have risen by 54% since 1984. Future land use and crop production patterns may further increase the role of pollination services to UK agriculture, highlighting the importance of measures aimed at maintaining both wild and managed species.

Title: Contribution of Pollinator-Mediated Crops to Nutrients in the Human Food Supply

Authors: Elisabeth J. Eilers, Claire Kremen, Sarah Smith Greenleaf, Andrea K. Garber, Alexandra-Maria Klein

Journal: PLoS ONE (2011) Vol 6 no. 6: e21363.

DOI: 10.1371/journal.pone.0021363

Summary: This study evaluates the nutritional composition of animal-pollinated world crops. By calculating pollinator dependent and independent proportions of different nutrients of world crops, revealed that crop plants that depend fully or partially on animal pollinators contain more than 90% of vitamin C, the whole quantity of Lycopene and almost the full quantity of the antioxidants b-cryptoxanthin and b-tocopherol, the majority of the lipid, vitamin A and related carotenoids, calcium and fluoride, and a large portion of folic acid. On-going pollinator decline may exacerbate current difficulties of providing a nutritionally adequate diet for the global human population.

29 October 2012

Written evidence submitted by Rosemary Mason and Palle Uhd Jepsen

Rosemary Mason, MB ChB FRCA, Former Consultant Anaesthetist

- 1) Assistant Editor, Anaesthesia, Journal of the Association of Anaesthetists of Great Britain and Ireland from 1990-2000.
- 2) Familiarity with the actions of drugs and toxins on central nervous system receptors.
- 3) Noted that successive Governments had dismantled the Statutory Conservation Bodies, closed the Wildlife Research Stations and abolished pesticide committees that had one (or more) independent members to represent public interest.

Palle Uhd Jepsen, Former Senior Adviser to the Danish Forest and Nature Agency

- 1) In charge of Nature Reserve Network in Denmark
- 2) Represented Denmark at Wildlife Conventions such as IWC, Ramsar Convention, Chairman of Seal Group for ASCOBANS (Small cetaceans in the Baltic).
- 3) Gave advice on conservation projects such as in Thailand, Malaysia, Estonia, Lithuania and Northern Ireland.
- 4) Worked for several seasons at the Polar Research Institute in Svalbard.

Together

- 1) As environmentalists we have seen the disappearance of wildlife in the last 50 years. Acceleration of this has occurred in the last 15 years. In particular, amphibian, bees, bat and bird populations in the US have been wiped out by a variety of pathogens. Since about 2008 the same has been happening in Europe. News has been suppressed.
- 2) In 2006, we established a small reserve for bumblebees and birds in South Wales.
- 3) In 2008, I read Michael Schacker's book about neonicotinoids in the US. "*A Spring without Bees. How Colony Collapse Disorder has Endangered our Food Supply.*"
- 4) In November 2010, we read Dr Henk Tennekes' book: *The Systemic Insecticides – a Disaster in the making*. We linked up with him and a massive global network. We started to 'engage' with Environmental Protection Agencies around the world.
- 5) We discovered that it wasn't just bees that were affected. It was humans as well.

Executive Summary

We have divided the evidence into three parts.

- 1) Our communications with Defra, ACP, CRD and Ministers since 03/12/2010.
- 2) Our comments on the Defra website on 'Neonicotinoids and Bees'.
- 3) Contamination of surface and ground-water by the neonicotinoid insecticides which is not being monitored.

Paper 1 From our communications with Defra, ACP, CRD and Ministers, we have discovered that the pesticides industry (Syngenta and now Monsanto) is at the heart of the UK Protection Agencies. CRD has about 60% of its budget paid by industry. The staff may feel that their loyalty lies with the major employers, rather than with human health and the environment. Defra/Fera/CRD appears to have much of its 'science' done, either with industry scientists in the UK, or by Rapporteur Member States (RMS) in Europe (directed by EFSA and the EC). The RMS (they are relatively few in number) in turn obtain it from Draft Assessment Reports submitted by the applicant. These documents are "*commercially sensitive*", so it is difficult to obtain them. They dismiss independent research (see Defra's analyses of new papers) but not those from their own side (see Cresswell and Blacquièrè). That is why Defra, ACP and the CRD are refusing to ban clothianidin and thiamethoxam. They are using delaying tactics in demanding more research, taking their lead from EFSA

and the industry. Our question about contamination of water was ignored by CRD, Defra, Commissioner Dalli, the US EPA and the Australian Minister of Agriculture.

The domestic and public amenity places (including golf courses and playing fields) are possibly the biggest hazard to the public because the situation is not controlled. In the UK, much of the information has been suppressed by the media because of the Science Media Centre and its relationship with the BBC and with government Civil Servants. Thus, in the UK, the public has no idea. They are encouraged by the Royal Horticultural Society and the BBKA in endorsing the safe use of insecticides. In the end it was a French journalist in Le Monde who exposed the fact that James Cresswell's Department in Exeter was receiving funds from Syngenta. But UK journalists never even reported it.

Paper 2 Here we examined Defra's website on Neonicotinoids and Bees. We compared their claims about keeping the "*evidence on neonicotinoids under close and open-minded scrutiny*" with the minutes of committees and various Defra documents. In almost three years of the Healthy Bee Plan Management Board and SEAG meetings, the neonicotinoids were never mentioned as a cause of bee declines, only the *Varroa* mite.

[Dr Peter Campbell from Syngenta was on the Panel that chose the nine Pollinator Projects. Syngenta had donated £1m in 2009 for bee research. On the Committee on Toxicity of Chemicals in Food (COT) there is one member from Syngenta and two from AstraZeneca, Syngenta's parent company. None of them declared any conflict of interest. Syngenta had also applied to EFSA for GM maize. "*The UK Competent Authority and Syngenta have applied for placing on the market of a GM, herbicide tolerant (glyphosate) maize GA21 for food and feed uses, import, processing and cultivation.*" EFSA adopted it on 16/12/2011].

Paper 3 We report the absence of global monitoring of levels of neonicotinoid insecticides in surface and ground-water. An example had probably been set by the US when imidacloprid was introduced in 1991. It was the same year that water quality assessments were established for monitoring pesticides by USGS NAWQA (see para 1, doc 3) but only the old pesticides were (and still are) being monitored. Neonicotinoid insecticides and GMOs (which usually have the insecticides attached to the seeds) now occupy a dominant position in the global market and they are persistent in the soil (clothianidin in particular has an aerobic soil metabolism half-life of up to 1,155 days). Wherever they have been measured (para 2, in The Netherlands and para 5, New York State) alarming levels were found as early as 2003/2004. In para 6, bees in Indiana were exposed to clothianidin and thiamethoxam when they took pollen and nectar from wild flowers not just the maize pollen from the crop (Krupke *et al* 2012).

Post-script We included the US Kids Health Report (October 2012) because it contains crucial evidence against the current pesticides and shows how the US EPA is manipulating the statistics to avoid blame for human health effects.

A Generation in Jeopardy. How pesticides are undermining our childrens' health and intelligence "*From childhood cancers to autism, birth defects and asthma, a wide range of childhood diseases and disorders are on the rise. Our assessment of the latest science leaves little room for doubt: pesticides are one key driver of this sobering trend.*" On page 30, Pesticides industry well served by current policies the authors explain how it has happened. "*These multinational corporations wield tremendous control over the system, from setting research agendas to financing, crop selection and inputs throughout the production and distribution chain*" ... "*...investing millions of dollars every year to influence voters, lawmakers and regulators at both the state and federal level to protect the market for pesticides*" ... "*And the health of children across the country is compromised by exposure to*

pesticides used to control pests in agriculture and where they live, learn and play. In short, the system is broken.”

Yet, the Agrochemical Corporations even now appear to be protected from blame for this dramatic increase in birth defects, neurobehavioural disorders and brain tumours by the fact that the US EPA/USDA figures in **Appendix B** page 38 ‘Top pesticides used in agriculture and at home’ are fraudulent. They do not include either the neonicotinoid insecticides or GMOs. We have copied maps (pp34/35) on the USGS NAWQA website from 2002 for imidacloprid and thiamethoxam to show the extent of use on crops even 10 years ago.

Corruption. Para 13 paper 3 reports the state of corruption in some of the agencies at European level, with the ‘revolving door’ between industry and senior positions in Europe. This is precisely what happens in the US. Even now in the UK, the effects of pesticides are being seen both in children and adults.

Most mainstream UK journalists reported directly from the ‘Science Media Centre’. Most (apart from John Vidal in the Guardian) claimed that EFSA was right to dismiss Séralini’s recent work (Criigen, Caen) showing that rats fed GM food for 24 months (Monsanto and EFSA only test for 90 days) developed tumours, starting in males at 4 months, only 1 month beyond the time that EFSA recommends for testing (“*wrong sort of rats, not enough rats, bad statistics, fraudulent science, etc*” were the cries from the SMC). In fact Monsanto inadvertently did a ‘clinical trial’ on humans in South American countries in 1996, when they forced GM Maize and Roundup Ready soya on rural populations. The populations most exposed to pesticides experienced reproductive problems, had children with major congenital defects (neural tube, such as meningomyelocele in which the spinal cord is exposed), an increase in childhood and adult tumours, cell damage and genetic changes. Prof Andrés Carrasco and his team in Buenos Aires confirmed that Roundup® produced teratogenic effects in vertebrates.

Paganelli, A. Gnazzo, V., Acosta, H., Lo’pez, S. L., Carrasco, A. E. Glyphosate-Based Herbicides Produce Teratogenic Effects on Vertebrates by Impairing Retinoic Acid Signaling. *Chem. Res. Toxic.* 10.1021/tx1001749 (2010).

A new book (2012) has a chapter by Prof Carrasco and colleagues in Argentina and Paraguay which reviews the scientific literature on the health effects of the pesticides used in large amounts on GM soy and other GM crops: *Advances in Molecular Toxicology*, Vol. 6, published by Elsevier: ISSN 1872-0854 <http://www.amazon.com/Advances-Molecular-Toxicology-Volume-6/dp/0444593896> **Abstract:** *In South America, the incorporation of genetically modified organisms (GMO) engineered to be resistant to pesticides changed the agricultural model into one dependent on the massive use of agrochemicals. Different pesticides are used in response to the demands of the global consuming market to control weeds, herbivorous arthropods, and crop diseases. Here, we review their effects on humans and animal models, in terms of genotoxicity, teratogenicity, and cell damage. We also stress the importance of biomarkers for medical surveillance of populations at risk and propose the use of biosensors as sensitive resources to detect undesirable effects of new molecules and environmental pollutants. The compatibility of glyphosate, the most intensively used herbicide associated to GMO crops, with an integrated pest management for soybean crops, is also discussed.*

Monsanto suppressed it and the US never looks at research outside the US.

Dr Don M. Huber, Emeritus Professor of Plant Pathology, Purdue University, US, spoke to the All-Party Parliamentary Group on Agroecology about glyphosate on 01/11/2011. The title was: “The effects of glyphosate (Roundup®) on soils, crops and consumers: new diseases in GM corn and soy and animals fed with it” He later said: “*Future historians may well look*

back upon our time and write, not about how many pounds of pesticide we did or didn't apply, but by how willing we are to sacrifice our children and future generations for this massive genetic engineering experiment that is based on flawed science and failed promises just to benefit the bottom line of a commercial enterprise."

Conclusions

1. The UK must ban the neonicotinoids for the sake of our bee populations, for the health of both adults and children and for biodiversity.
2. Europe and the UK must be prevented from authorising GMOs (as Huber said: "*this massive genetic experiment*"). The experiences of Argentina and Paraguay, and now the US, have already demonstrated what happens to humans.

In addition, Monsanto has recently purchased a firm that specialises in growing GM crops to produce GE pharmaceuticals. This is the area of expertise of Prof Maurice Moloney, appointed in April 2010 as Director and Chief Executive of Rothamsted Research, UK.

According to the BBSRC website: "*Before moving to Calgary, Professor Moloney led the Cell Biology group at Calgene Inc. in Davis, California, developing the world's first transgenic oilseeds, which resulted in RoundUp Ready® Canola and other novel crops. He was previously a Royal Society European Postdoctoral Fellow at the University of Lausanne, Switzerland. Professor Moloney is currently Chief Scientific Officer of SemBioSys Genetics Inc, based in Calgary, Canada. He founded the company in 1994 and has maintained this role alongside a successful academic career at the University of Calgary, where he serves as NSERC/Dow AgroSciences Industrial Research Professor of Plant Biotechnology.*"

Prof Moloney was considered by experts in genetics in Canada to be '*reckless with the environment*'. His company SemBioSys focused on producing pharmaceuticals in the oil crops canola (rapeseed) and safflower.

One Canadian geneticist said: "*Currently safflower-grown human insulin has been open field tested in the state of Washington in a sagebrush wild area of the state which is the habitat for a number of threatened wild species that can be poisoned by ingesting insulin*" ... "*In Canada and the United States open field tests of crop bio-pharmaceuticals are undertaken with little or no respect for the environmental consequences of the open field releases.*"

Evidence to the Environmental Audit Committee Paper 1 Communications with Defra, ACP and CRD

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- 1) Letter to James Paice MP 03/12/2010
- 2) Response from Chemical Regulations Directorate (CRD) 24/12/2010
- 3) Our 11-page Open Reply to CRD 06/01/2011
- 4) Standard reply from Defra to MPs
- 5) We send 2 docs to Defra about neonicotinoid insecticides (12&13) 12/12/2011
- 6) Reply to our 2 docs from Defra Minister
- 7) Our docs to a member of the ACP in December 2011
- 8) ACP reply 12/01/2012

- 9) ACP minutes in 2002 when clothianidin was first registered. [US EPA in 2003]
- 10) The original assessment for clothianidin in 2002 was carried out in Belgium; (the Rapporteur Member State RMS). For thiamethoxam the RMS was Spain.
- 11) Defra document 13/10/2012 'Neonicotinoids and Bees. The state of the Science and the Regulatory Response'
- 12) Immune suppression from neonicotinoids associated with global wildlife declines
- 13) The truth about neonicotinoid insecticides
- 14) Domestic and public gardens are probably the biggest hazard to the public
- 15) Bayer expands its domestic market

1. **Letter to James Paice MP 03/12/2010.** We wrote to the then Minister of Agriculture to inform him about new work done in Holland by a Dutch toxicologist, Dr Henk Tennekes: The neonicotinoid insecticides: a disaster in the making. He reported progressive contamination of Dutch surface waters by the neonicotinoid imidacloprid which is toxic to all invertebrates and was causing declines in insect-dependent birds. We enclosed a copy of the photo-journal of our small nature reserve: The Year of the Bumblebee. This was a book about the importance of biodiversity in 2010, the year that the UN declared to be the International Year of Biodiversity, and the year by which 200 countries had promised to halt biodiversity loss. The front cover shows a pair of red-tailed bumblebees; the male is being carried round on the new queen's back like a small rucksack while she foraging on tufted vetch. In truth, she has probably forgotten he is there. In July 2010, we had many red-tailed queens and workers on the reserve.

On the back cover was the photograph of a pollen-covered bumblebee emerging from a crocus: "*In October 2010, a pioneering report The Economics of Ecosystems was published by the UN, which sought to put values on nature's free resources to human society, in the hopes that governments will save threatened ecosystems that are a vital source of food, water and income. The economic value of insect pollinators to global crop production was estimated to be £134bn each year.*" On page 59 was a 12-page postscript: '*A history of the UK Governments' responses to the Biodiversity Crisis.*' It was far from complimentary. We also enclosed a photocopy of Dr Tennekes' conclusions. At the end of the letter we referred to Michael Schacker's book published in 2008 in the US. "A spring without bees. How colony collapse disorder has endangered our food supply". We sent out about 60 copies of our journal. It was acknowledged by Prof John Beddington and Lord Chris Smith, both of whom said that Defra was responsible for regulation of pesticides. Defra and the Defra Ministers were in total denial (as were the regulatory agencies in Europe and the US). It was a uniform reply; that there was no evidence that the neonicotinoids were harmful to bees. By this stage we were in communication with beekeepers all over the world. The UK ones wrote to all their MPs; but only a small proportion of MPs signed the EDM put forward by Martin Caton MP.

It was a waste of effort. Two years later the disaster is upon us. In July 2012, our red-tailed bumblebee populations had crashed; we found only one queen. She was on the ground and clearly dying. There were no workers, only a handful of males. Defra has rejected the Whitehorn 2012 study as not being "*field realistic*." Defra has a study PS2371 in hand and says it will be complete it by the end of 2012. No-one has told Defra that the bumblebee lifecycle is different from that of the honey bee. The colony dies at the end of the season. Only the new queens survive the winter in hibernation, ready to start a new colony the following spring. The Whitehorn study showed that 85% of the new queens failed to survive. We have no arable crops in the immediate vicinity; but there are

gardens (and a golf course within 2 km). We have no idea which of our neighbours is using Bayer Garden products for their Vine Weevils, their lawn grubs or their ants. The Royal Horticultural Society website recommends neonicotinoids to treat Vine Weevils.

2. **Response from Chemical Regulations Directorate.** On 24/12/2010 we received a 2-page reply from the CRD on behalf of James Paice. It only talked about bees and nothing about contamination of water. The letter stated: *“that the neonicotinoids are primarily used as commercial and horticultural pesticides and that the Directorate routinely restricts the ways in which products can be used (e.g. specifying dose rates, timing and place of application) to ensure protection of human health and the environment”* It went on to talk about bee incidents and research on bees.
3. **Our reply to CRD.** On 06/01/2011, we sent an 11-page open letter to the CRD: Extract: *‘Dr Tennekes says that his book: “catalogues a tragedy of monumental proportions regarding the loss of invertebrates and subsequent losses of the insect-feeding (invertebrate-dependent) bird populations in all environments in the Netherlands. The disappearance can be related to agriculture in general, and to the neonicotinoid insecticide imidacloprid in particular, which is a major contaminant of Dutch surface water since 2004. The relationship exists because there are two crucial (and catastrophic) disadvantages of the neonicotinoid insecticides: They cause damage to the central nervous system of insects that is virtually irreversible and cumulative. There is no safe level of exposure, and even minute quantities can have devastating effects in the long term. They leach into groundwater and contaminate surface water and persist in soil and water, chronically exposing aquatic and terrestrial organisms to these insecticides. So, what, in effect, is happening is that these insecticides are creating a toxic landscape, in which many beneficial organisms are killed off.”* Amongst other things, we asked, if was so important that neonicotinoids are applied correctly, who instructs the public on their use on garden plants, on lawns, in greenhouses, on golf courses, on sports fields, on amenity grasslands, on pets, and horticulturalists who apply it to plants and bulbs and some composts that are sold to our nurseries (but without being obliged to label that they are so treated)? We received no reply.
4. **Defra responses to MPs.** Many people wrote to their MPs about neonicotinoids and bees. The standard reply that the MPs forwarded from Defra (or a Minister) was that there was no evidence that the neonicotinoid insecticides were harmful to bees (we received similar answers from the US EPA, Commissioner John Dalli in Europe, and later from the Minister for Agriculture in Queensland, Australia to whom we had also forwarded evidence).
5. **Two documents sent to Defra 12/12/2011.** One was about neonicotinoids in general (The truth about neonicotinoid insecticides 23 pages) and the other with the hypothesis that they were causing global immune deficiency in wildlife (Global wildlife AIDS 19 pages) Graham White, a beekeeper and Philipp Mimkes CBG network had gone as witnesses to the Permanent Peoples’ Tribunal in Bangalore 3-6/12/2011 where they gave evidence on behalf of European Beekeepers against the Trans-National Agrochemical Corporations. Both documents were registered by the Tribunal.
www.agricorporateaccountability.net
6. **The reply from the Defra Minister 24/12/2011.** We received a brief reply to these two documents from Lord Taylor of Holbeach: *“I understand that HSE's Chemicals*

Regulation Directorate has previously explained the position on the US Environmental Protection Agency (EPA) hazard assessment on Clothianidin. There is nothing further to add to this, and your other documents raise no new information which requires a change to the Government's position on this."

7. **The same docs to the ACP.** We had sent both documents to a member of the ACP, an expert in aquatic ecotoxicology, who had told us that the effects of clothianidin on aquatic ecosystems were acceptable. We had informed him that they were "highly toxic". He passed our documents to Jayne Wilder. Jayne.Wilder@hse.gsi.gov.uk

8. **The ACP replied 12/01/2011.** I received an 11-page reply signed by Dr Andy Povey. Dr Povey was the only doctor on the ACP. He is an expert in cancer genetics. He signed as deputy chairman of ACP in the absence of the newly appointed chairman due to illness (She died 7 months later. Her colleagues established a post for a researcher to continue her molecular work on cancer research). The reply included the following extracts: "*The ACP considered an application for first approval of clothianidin for use as a seed treatment on fodder and sugar beet in 2002. You can find a summary of our findings in our annual report 2002*" "*Immune effects of clothianidin The ACP evaluation in 2002 identified some findings in mammalian toxicity studies suggesting compromise of the immune system. These findings were all at high doses, mostly in short term studies and we were satisfied that there were clear no observed adverse effect levels (NOAEL) derived from which we could recommend regulatory risk assessments.*" "...*the ACP did not consider there was a need for any further clarification of the immunotoxic effects of clothianidin as we were satisfied there were clear No Observed Adverse Effect Levels (NOAEL).*"

"Toxicity in the aquatic environment of clothianidin: As you might expect the ACP considered environmental data that were specifically relevant to the UK situation as well as the basic data on the chemistry of clothianidin. In the UK (as in EU) Predicted Environmental Concentrations in surface and groundwater (PEC_{sw} and PEC_{gw} respectively) are derived based on the environmental fate data and the use proposed."

And in conclusion the ACP said: "*Having reviewed the information you have provided in these areas and compared it with the data we have evaluated we conclude that there is no additional information that would suggest we need to review the current approval, as the concerns you have highlighted have all been specifically evaluated during the initial consideration of approval. The risks arising from each new use proposed are identified and evaluated by CRD*".

From this letter, and from the 2002 minutes, ACP/CRD gave the impression that all the work had been done in the UK. There was no mention of Belgium (see para 10).

9. **ACP Minutes from 2002.** We found the ACP Annual Report ("*although very persistent in the environment...groundwater contamination is unlikely*") and Minutes from 2002. "*First evaluation of Clothianidin in the UK*". It consisted of four short paragraphs in which the ACP commended the quality of the application and agreed that Ministers should be advised to approve it for 3 years (attached). It is of interest to note, this was before the Conditional Registration in the US, relevant extracts of which are seen below. On May 30, 2003, Daniel C Kenny of the US EPA Registration Division granted conditional registration for *clothianidin* to be used for seed treatment use on corn and canola (oil seed rape) to Bayer Corporation. In the 19-page document, the EPA scientists had assessed the risks as: "*Clothianidin is highly toxic to honey bees on an acute contact basis. It has the potential for toxic chronic exposure to honey bees, as well as other non-*

target pollinators, through the translocation of clothianidin residues in nectar and pollen. In honey bees, the effects of this toxic chronic exposure may include lethal and/or sub-lethal effects in the larvae and reproductive effects in the queen. The fate and disposition of clothianidin in the environment suggest a compound that is a systemic insecticide that is persistent and mobile, stable to hydrolysis, and has potential to leach into ground water, as well as run-off to surface waters. There is evidence of effects on the rat immune system and juvenile rats appear to be more susceptible to these effects.”

Summary of Data Gaps. (Page 18). There were gaps in **Toxicology; Residue Chemistry; Environmental Fate Data and Ecological Effects Data**. These included: Additional studies on *Developmental Immunotoxicity and Mutagenicity. Data on aerobic aquatic metabolism and a Seed leaching study. Whole sediment acute toxicity to freshwater invertebrates. Field test for pollinators.* There is no evidence that these were done. Nor was the life cycle study on bees ever completed. The Cutler and Dupree Study 2007, originally submitted by Bayer as a field study (Cutler 2006 was rejected by the Canadian Pesticides Management Authority). The 2007 version had subsequently to be downgraded by the US EPA (the test area was only 2 ha and bees often forage for miles). After clothianidin has been on the market for nine years (ten in UK/Europe), there is still no proper field study that shows that clothianidin is safe bees. ‘Conditional’ registration is granted by the Registration Division of the US EPA, regardless of what the US EPA scientists have said; after this Bayer (or any other company) can put it on the market. Once a product is on the market, registration is unlikely to be revoked (see next page). On 13/12/2010 the US EPA Office of Pesticide Programs had run a workshop: **Streamlining the Risk Assessment Process**. Robert Schulz had designed an electronic programme (e-Builder Dossier) to facilitate the registration of pesticides by the applicants. The prime benefits were stated to “*reduced cost to the EPA*”, and “*quicker processing*”. One slide boasted that they hadn’t revoked a licence in the last 10 years.

Minutes from 2005 UK Environmental Risk Assessment [ACP7(311/2005)] This was for use of clothianidin on wheat and barley seed. There were two short paragraphs before giving approval: “*following the normal procedure for extended use if the active substance has already commercial approval in the UK.*” ... “*The Committee confirmed that the environmental risk assessment was acceptable and advised that provisional approval could be recommended for this new seed treatment.*”

10. **The original registration document for clothianidin in 2002** was recently requested from the CRD. It was carried out, not in the UK as we had been led to believe from all our correspondence. Belgium was the Rapporteur Member State (RMS) for clothianidin, which accounts for the sparse documentation in the UK. We would have to request Belgium to send it. The RMS for thiamethoxam was Spain. Would the Select Committee consider this as a suitable question for CRD/Defra? Did the UK, or the Belgium RMS, ever conduct a life cycle study on bees?
11. **‘Neonicotinoids and Bees. The state of the Science and the Regulatory Response’.** On 13/09/2012 Defra published the above document with which the EAC will be familiar. It stated: “*this work has been carried out by Government and independent experts, taking account of parallel work in Europe.*” The Independent newspaper reported that the UK Government Scientists had concluded that nerve agent pesticides, clothianidin and thiamethoxam: “*should not be banned despite four independent studies strongly linking them to sharp declines in bees around the world. The reports were reviewed by the Chemical Regulation Directorate and the Advisory Committee on Pesticides (ACP), the*

independent statutory body that advises ministers. Following the line taken by the European Food Safety Authority (EFSA), all bodies said that more research was needed.”

About the same time, we received notification from our US colleagues that Environmental and Public Interest Groups in the US were ready to take legal action against the US Environmental Protection Agency (US EPA) over its approval of pesticides which endanger wildlife. These were the very same pesticides that the European Commission (EC), EFSA and UK Scientists claimed “*needed more research.*” The US notification stated: “*The 60 Day Notice of Intent to Sue follows a previous legal petition filed by several environmental organizations and many beekeepers, which demanded that EPA immediately suspend use of the pesticide clothianidin, which poses a grave threat to pollinators. The EPA refused to issue an immediate suspension of clothianidin, but did agree to open a public comment docket to review additional points raised in the legal petition.*”

In the legal petition in March 2012 Pesticide Action Network North America had presented the EPA with a State of Science document about the Systemic Insecticides. http://www.panna.org/sites/default/files/CFS%20Petition%20App%20B_Science.pdf

12. **Immune suppression in wildlife associated with global wildlife declines**

This paper was accepted for publication (in press) on 17/07/2012 for the first issue of the new *Journal of Environmental Immunology and Toxicology* (Nov/Dec 2012): Mason, R.A., Tennekes, H.A., Sanchez-Bayo, F., Jepsen, P.U. ‘Immune suppression by neonicotinoid insecticides at the root of global wildlife declines’. Abstract: ‘*Outbreaks of infectious diseases in honey bees, fish, amphibians, bats and birds in the past two decades have coincided with the increasing use of systemic insecticides, notably the neonicotinoids and fipronil. A link between insecticides and such diseases is hypothesised. Firstly, the disease outbreaks started in countries and regions where systemic insecticides were used for the first time, and later they spread to other countries. Secondly, recent evidence of immune suppression in bees and fish caused by neonicotinoids has provided an important clue to understand the sub-lethal impact of these insecticides not only on these organisms, but probably on other wildlife affected by infectious diseases. While this is occurring, environmental authorities in developed countries ignore the calls of apiarists (who are most affected) and do not target neonicotinoids in their regular monitoring schedules. Equally, scientists looking for answers to the problem are unaware of the new threat that systemic insecticides have introduced into terrestrial and aquatic ecosystems.*’

In May 2011, we sent our original hypothesis (fully referenced) to the following people: Caroline Spelman MP the then Environment Minister, Sir John Beddington the Chief Scientific Officer for the Government and Sir Robert Watson the Chief Scientific Officer for Defra. All said that they had read it, but they thought we did not have enough proof. We sent the final version of the documents (which had been submitted by our two delegates who were witnesses to the PPT in Bangalore, which took place Dec 3rd to Dec 6th 2011.) On 14/12/11 we forwarded these versions to Defra. By the brevity of his email, Lord Taylor of Holbeach clearly did not read it. You can also see that Dr Helen Thompson Bee Scientist at Fera must have read it. In her ‘*expert assessment*’ of my letter to Dr Shugart, Editor-in-Chief of *Ecotoxicology* advising that it should be rejected, she made the mistake of mentioning it, even though there had been nothing about it in my letter (see Doc 2). We also sent it to Eric Poudalet, Safety of the Food Chain Directorate in the European Commission. He replied likewise. It was sent to Dr Andy Povey and

Peter Matthiessen, both members of the ACP. PM forwarded it to Jayne Wilder the ACP Secretary. In para 8 the ACP claimed to have done further studies on immune suppression but found no evidence. Later we sent it to the Queensland Government when they had flooding and wildlife disasters.

13. **The truth about the neonicotinoid insecticides.** This is the first third of the first page. “The pesticides industry stands accused of failure to investigate the hazards of systemic neonicotinoids fully and of failure to establish standard tests and protocols. The protection agencies stand accused of failing to protect human health and the environment, with reference to the Executive Summary of the Workshop on Pesticide Risk Assessment for Pollinators January 15-21, 2011, SETAC, Pellston, Florida”
Authors: David Fischer from Bayer CropScience & Thomas Moriarty from the US EPA Office of Pesticide Programs and Team Leader, US EPA Bee Unit set up 22/06/2009.
http://www.setac.org/sites/default/files/executivesummarypollinators_20sep2011.pdf
This summary proves that the pesticides industry and all of the environmental protection agencies were aware of the following, which up until now, they had consistently denied:
- a) *That the systemic neonicotinoid pesticides are harmful to bees.*
 - b) *That the tests and protocols that had allowed registration of the systemic pesticides were not adapted to assess potential hazard and risk from this type of pesticide.*
 - c) *Despite knowing all this, the Protection Agencies have allowed the pesticides industry to keep neonicotinoids on the market.*
 - d) *That many of the projects suggested for the future have already been done by independent scientists.*
14. **Domestic and public gardens may be the biggest hazard to the public.** They are an environment from which beekeepers cannot protect their bees and in which the pregnant woman cannot protect her foetus (see doc 2). There is an absence of training for gardeners. They are not trained by Defra/CRD: *“the Directorate routinely restricts the ways in which products can be used (e.g. specifying dose rates, timing and place of application) to ensure protection of human health and the environment”* but only for the commercial use. The public has no idea of the dangers of applying pesticides. Information has been completely suppressed, in a conspiracy between Defra/CRD, the industry, newspaper journalists and the BBC (via the Science Media Centre). There are many television and radio programmes on gardening; it has become a national obsession. The BBC had a public row with Monty Don in which they criticised him for not mentioning *“chemical alternatives”*. He defended his rights by pointing out that when he was appointed they knew he was an organic gardener. On the Royal Horticultural Society website, members are told that it is safe to use pesticides, provided that the instructions are strictly followed. Advice on Vine Weevil treatment recommends either Bayer or Scott’s neonicotinoid preparations. It suggests that treatment should be continued even when the Vine weevil has apparently gone. In Kew Gardens if one tries to find a bird or an insect it becomes apparent (and by admission of staff) that there is widespread use of neonicotinoids on trees and in greenhouses. The pesticides industry cooperates with agricultural colleges on research, so they able to influence farmers, horticulturalists and gardeners from the beginning of their careers.
15. **Bayer expands its domestic market.** Now that some of their commercial markets are potentially under threat, Bayer is cynically trying to expand its Bayer Garden market. (From a trade forum on garden produce in 2012.).
<http://www.gardenforum.co.uk/tradeforum/peoplenews/?artid=2382>

Consumer specialist appointed Head of Bayer Garden. Darren Brown, an individual with a strong track record in both consumer marketing and business growth, has been appointed Head of Bayer Garden. His appointment builds on the company's recent investment in the development of the Bayer Garden brand. *"Last season Bayer Garden introduced new packaging designed to create a 'family' feel across its products. The aim was to make sure gardeners would know the product they were about to purchase was manufactured by a company they already knew and trusted through favourite products, including Provado Ultimate Bug Killer, Bio Slug & Snail Killer and Super Strength Glyphosate. The company also returned to the television, running a high profile advertising campaign that focused on its unique Simple Soluble Sachets. Speaking on his appointment, Darren said: *"The marketing team have already made great progress in building a strong Bayer Garden brand here in the UK. My aim is to advance this momentum and work hard on delivering excellent products for our customers: "I hope I can also bring some of the best practices from my Consumer Healthcare experience and am excited by the potential ahead for Bayer Garden in the UK."* Prior to this appointment, Darren was based in New York, working as the Vice President for Global Brand Management for the Bayer Diabetes Care Division. He helped the division deliver year on year growth and make the company the fastest growing in the market. Prior to working the US he held a number of senior sales and marketing roles in Bayer's UK Consumer Health division, where he again helped deliver growth ahead of the market. He began his career in product management at Smith and Nephew plc.*

Evidence to the Environmental Audit Committee Paper 2 Comments on Defra website on 'Neonicotinoid insecticides and bees'

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1. **Statements by Defra:** *"We have kept the evidence on neonicotinoids under close and open-minded scrutiny...working in partnership with beekeeping groups on a 10-year plan to protect and improve the health of honey bees in England and Wales"*

We have found very little to support these statements by Defra. We submit the following evidence.

2. **Early Day Motion** in Westminster Hall 25/01/2011. Martin Caton MP for Gower requested suspension of neonicotinoid pesticides whilst doubts remained about their effects, not only on honey bees, but on many other invertebrates. He questioned Mr Paice's assurances, and those that Lord Henley had made previously, about the 2009 Buglife Report. (This was a 45-page report written by Buglife, The Invertebrate Conservation Trust: *The impact of neonicotinoid insecticides on bumblebees, Honey bees and other non-target invertebrates*). Mr Paice had said: "*The then Government fully reviewed that Report and took advice from the independent Advisory Committee on Pesticides... conclusion drawn at that time was that the Buglife Report did not raise new issues...and did not require changes to pesticide approvals.*" When Mr Caton revealed that the ACP had not conducted a review and the CRD had not completed its report and had not even completed collecting the data, Mr Paice said: "*His assertion is news to me.*" This led to a flurry of activity in the ACP and Defra. Eventually, an undated, 4-page document written by Helen Thompson (ICPBR secretary) appeared on the Fera Website. Subsequently, the ACP did conduct a review of the Buglife Report. They decided that there was no need for a ban, but that a study on over-wintering bees should be undertaken to assess the effects of neonicotinoid insecticides on colonies.

3. **Defra website: 'Myth-busting' section.** January 2011. *US Study on neonicotinoids. The myth: The Independent claimed that the findings of an unpublished US Scientific Report suggested neonicotinoid pesticides could be killing bee colonies all over the world.* February 2011. *Bob Watson and the neonicotinoids. The myth: The Independent claimed that Defra's Chief Scientific Adviser had ordered a review of the evidence used to justify the safety of neonicotinoids to bees. Fera: Neonicotinoids and honey bees.* An update February 2011: *A recent US memo and various articles published in the UK media, on the risks of neonicotinoids, provide NO NEW EVIDENCE (sic) on this issue.*" The 'US memo' they are referring to was a 101-page document from US EPA scientists on the assessment of *clothianidin*. It is a memo from the ecologists of the Environmental Risk Branch to the Registration Branch of the USEPA, dated 02/11/2010.

4. **The UK National Ecosystem Assessment** This was published by Defra in June 2011. Page 8 of the Synthesis was entitled: *Changes in the past 60 years*. Defra managed to rewrite the whole post-war history of the destruction of the countryside by industrial farming, without any mention of insecticides or herbicides.

5. **The EU Directive (2009/128/EC) on the Sustainable Use of Pesticides:** The UK Consultation and Government Decisions, published December 2010 The government voted every time on the side of industry. Article 10 concerns Protection of Water Courses from pesticide pollution, including establishing buffer zones to protect aquatic environments, surface and ground water. The government rejected the EU Directive Advice. Instead it said that it would "*primarily seek to work with the pesticides industry*" to enhance voluntary measures. It also rejected EU Directive advice to ban aerial spraying: "*We do not consider that the responsible application of pesticides by aerial spraying poses an unacceptable risk to human health or the environment and, consequently, we will use the derogation.*" In fact, in July 2012, the Defra website issued a guidance document for aerial spraying. Article 11 Use of pesticides in specific sensitive areas: "*We do not consider it necessary to prohibit the use of pesticides in public spaces or conservation areas or to impose new statutory controls on pesticide use in these areas.*"

6. **Impossible to avoid exposure, either as a beekeeper, or during early pregnancy**
Neonicotinoid insecticides are so ubiquitous that beekeepers don't know how to avoid exposing their bees to them (Mark Clook, CRD, says there is no mitigation for systemic pesticides). There is no difference between plants from pesticide-coated oil seed rape and uncoated (although the paucity of insects might suggest a difference). In *The Butterfly Isles*, by Patrick Barkham (2010), on page 68 the author wrote the following, apparently unconnected (to the author, at least) observations. It was a hot day in late April 2009 and the author was admiring the field of yellow oilseed rape in full bloom. Further down the page, he said: "*it was 25 minutes before I saw any insects*". No insects? On a hot day in late April? In our time, that would have been unimaginable. Just from that small incident, one can see how people's baselines only relate to how it was in their own childhood, until suddenly a time of plenty turns into a collapse. Just as the beekeeper cannot protect his bees, how can the pregnant patient avoid exposure of her foetus to invertebrate-killing pesticides when the size of the foetal brain is no more than that of an insect? A member of the British Beekeepers' Association (BBKA) who had lost some hives recently suggested that farmers sowing seeds with systemic pesticides should report the location to Defra, who could map the area on a GPS (the same way as some police authorities can alert communities to the location of crimes in their area). This proposal was rejected by Defra and Richard Benyon MP, the Defra Minister at the time.
7. **Healthy Bees Plan Project Management Board (HBPP PMB) Fera.** Initial meeting: 23/07/2009. [*The Board will guide the work to deliver the desired outcomes in the Plan: Effective management of pests and diseases, improved husbandry standards through a coordinated beekeeper learning programme, effective biosecurity to minimise risks from pests, diseases and undesirable species, sound science and evidence to underpin bee health policy and its implementation, and coordinated and effective communications.*]

Up to 01/03/2011, the minutes of ten meetings had been published. BBKA representatives, Tim Lovett and Martin Smith, withdrew after first meeting and missed the four subsequent meetings. They only agreed to return provided they could have three members on the Board. Years 2009/2010, £285,000 spent and £179,000 returned to Fera unallocated. 23/07/2010 Insufficient samples from the Random Apiary Survey for diseases, poor uptake of training the trainers and poor partnerships working with bee associations to help in the delivery of the plan. The BBKA wanted 50% of the funding for training. 13/12/2010: According to Martin Smith BBKA, the survey of beekeeping husbandry practices and overwintering losses is being carried out in three different ways: Fera's is a self-selecting group of beekeepers; the BBKA is a random survey; National Bee Unit inspectors only make visits to high priority areas. Smith said he would make a proposal for options for a coordinated survey for consideration by the board. Medicines for *Varroa* had been raised by BBKA members on several occasions. Tim Lovett said there was a lack of progress on authorised medicines – this could have a large impact on bee health and needed to be considered fully. He said a new system of presenting bee medicines would be in place from 2012. Bees were food producers so medicines given to them needed to be via prescription. 10/03/2011: Still no unified survey method for overwintering bees so the **earliest** it could be started would be 2011/12. Draft proposals had gone to the National Bee Unit, but no feedback. There were still no courses being run in Wales.

8. **Science and Evidence Advisory Group (SEAG)** [*The work of the SEAG included ensuring that honey bee health policy underpinned by sound science, translation of scientific developments into practical beekeeping to advance knowledge and skills and identify gaps in evidence base.*] 12/02/2010 was the first meeting and there were five meetings to the PMB's ten (Tim Lovett BBKA at a HBPP PMB on 10/03/2011 had said: "*The SEAG has been in existence for 2 years, but had met infrequently – yet the need for scientific input into the Healthy Bees Plan was as great as ever.*" 10/01/2011 Management and control of *Varroa* was identified as the most urgent research priority. 27/07/2011 With reference to Fera's data on '*Management and control of Varroa*', the Chairman said there was an opportunity for the first piece of work to be done at Fera. She invited comments on the specification, and what the outputs should look like. Norman Carreck BBKA had said: "*We need to avoid doing a literature review, which covers both 'good' and 'bad' literature*". The Colony Loss Survey was raised, but the Chairman pointed out that it was not due for discussion until the next meeting. Neither of these Defra/Fera Committees mentioned neonicotinoid pesticides as a possible cause of bee declines, only *Varroa*.
9. **The British Beekeepers' Association (BBKA)** At the Annual Delegates' Meeting 16/01/2011, the BBKA Executive *agreed to cease any commercial relations with the agrochemical companies or associated companies relating to the use of the BBKA logo, for the endorsement of pesticides (for money or any other form of remuneration) as soon as contractually possible.* On 20/06/2011, Tim Lovett, Chairman of the Public Affairs Committee of the BBKA, appeared as a panellist on a 4-minute Bayer video extracted from an evening event on Bee Care, hosted by Bayer in the European Parliament. Link: http://www.youtube.com/watch?v=8PfabP6ipm4
- It also featured Julie Girling MEP and John Stewart Agnew MEP who were endorsing Bayer's products for treating *Varroa*. Tim Lovett said: "*The principal problem in the decline in bees clearly has to be the Varroa mite*". Agnew said: "*it's not just the damage done by the mite, but apparently the viruses, all 20 of them, which it can inject into them.*" Lovett said: "*The competence of the beekeeper needs to be maximised...It is not adequate if you don't give them the tools.*" Julie Girling, MEP talked about the urgency to get these medicines authorised globally to solve the honey bee crisis. "*We need to get the information out...get them authorised...create a critical mass of use to get enough money into the system to get new products developed.*" According to Lykele van der Broek (Bayer scientist) they had been developing medicines to "*prevent bees from getting sick.*" Klemens Kreiger said "*we were very lucky to have developed Bayvarol® and Perizin®, which are very efficacious against the Varroa mite and, at the same time, safe for the honey bee.*" Dr Julian Little said that Bayer had been making products for bees for well over 20 years. Lovett said: "*whenever I meet a politician or an official... I like to stimulate them to get on with the job.*" Tim Lovett was speaking as a representative of the BBKA. He had disregarded the ADM resolution. Not only that, but the video must have been 'set-up'. Some of it must have been recorded afterwards because when Julie Girling is speaking, people are talking in the background. As far as we can ascertain, John Stewart Agnew, the UKIP MEP, who so expertly pronounced on *Varroa* and 20 viruses, knows nothing about bees and was not on the panel. This is Agnew's reply on 15/11/2011 to a constituent who asked him to vote for the alternative Resolution, to ban the neonicotinoids: "*You may be interested to know that we have not merely followed this topic with interest but, with my colleague and policy adviser, Tony Brown, we have privately sought expert scientific testimony (Presumably Tim Lovett).*"

10. **The Tabajdi Report 06/10/2011 and Alternative Resolution 15/11/2011**

Julie Girling MEP was co-rapporteur of the Tabajdi (Csaba Sándor) own-initiative report on Honeybee health and challenges of the beekeeping sector. This was adopted by the Committee on Agriculture and Rural Development on 06/10/2011. Section (1) contains the perennial calls for research, national surveillance systems, reference hives and support for training. Section (2) Veterinary products: for effective treatments against Varroa mites, was new. End of paragraph: *“It highlights, in particular, the need to offer the pharmaceutical industry incentives for the development of new medicinal products designed to combat bee disease.”* This was almost identical to Julie Girling’s statement on the Bayer promotional video in June. *“We need to get them authorised...create a critical mass of use to get enough money into the system to get new products developed.”* According to the expert panel on the Bayer video, the products against the Varroa Mite, Bayvarol®, Perizin® are ready and just waiting for authorisation. An Alternative Resolution to the Tabajdi Report was debated on 15/11/2011. There were a significant number of MEPs who were unhappy with the Tabajdi Report which had been adopted on 06/10/2011. So an alternative Resolution was proposed by Jill Evans MEP. *This called for the European Parliament to ban the Neonicotinoid Pesticides and Fipronil under the Precautionary Principle, since the existing committee report does not address the crucial issue of the hyper-toxicity of the Neonicotinoid Pesticides, nor does it address the vast body of peer-reviewed evidence which links the use of Neonicotinoids to the death of over 5 million bee colonies in America, France, Germany, Italy, Slovenia and the UK... Points out that special attention must be paid to the use of pesticides of the neonicotinoid family that could cause digestive, hormonal and neuronal disruption; Calls on the Commission to comply with the precautionary principle and to impose an EU-wide ban on the use of neonicotinoid pesticides until independent scientific studies prove that there is no chronic exposure to toxins for honeybees and no danger to the environment and public health originating from their use; the conclusion is that the new generation of neonicotinoid pesticides and fipronil, have never been properly tested or licensed, and have been used illegally since the early 1990s - because the tests used were simply unable to detect their effect on bees and pollinators.* Debated 15/11/2011. Votes: 170 in favour, 454 against. This defeat was not surprising in view of the presence in the EU of pesticide lobbyist’s such as Tim Lovett. But it signified that the global campaign was reaching more people. In 2010, few people had even heard about neonicotinoid insecticides.

11. **The Agrochemical Industry spreads disinformation** via multiple lobbyists, not only in the UK Parliament, but in the EU and US too.

Lord Henley, Under-Secretary of State for Defra: in a debate with Nick Mole, UK and European coordinator of Pesticides Action Network (PAN-UK& EU) conducted on Radio 4’s Farming Today, 13/12/2010, said that the British had an *“ideological dislike of legislation,”* there were *“dangers of over-legislating.”* He said that all decisions on the EU Directive (2009/128/EC) were based on: *“robust scientific evidence.”*

US EPA website: January 2011: Advertising the Workshop on Pollinator Protection: Advancing the Science. *“Sound science is the basis for EPA’s regulatory decisions. Data used for regulatory purposes must be of the highest quality.”*

Administrator Lisa P Jackson US EPA: Mission statement January 2011: *“The EPA is about human protection. It’s about community protection. It’s about family protection.”*

Rt. Hon James Paice MP, Minister of State for Agriculture: During the Westminster EDM debate 25/012011: *“The then Government fully reviewed that Report and took advice from the independent Advisory Committee on Pesticides... conclusion drawn at that time*

was that the Buglife Report did not raise new issues...and did not require changes to pesticide approvals.” (At that time, the ACP hadn’t even seen it).

Dr Julian Little of Bayer CropScience said: *“I am sure there are some very interesting effects Dr Pettis has seen in the laboratory, but in reality, when you get to what’s important to everybody, which is what happens in the field, you don’t see these things happening.”* This was a comment on Dr Pettis’ (at that time) unpublished work showing that minute doses of imidacloprid were associated with a weakening of bee immunity, such that they became more susceptible to bee diseases. This was despite the fact that subsequently the levels of the neonicotinoids in the bees were below the limit of detection using the researchers’ own equipment. (Quote;The Independent: 20/01/2011, Michael McCarthy).

Pettis managed to get it published a year later. (Pesticide exposure in honey bees results in increased levels of the gut pathogen *Nosema*. *Naturwissenschaften*, 2012 Feb; 99(2): 153-8 Epub 2012 Jan 13). He and his colleagues showed that at a concentration of only 5 ppb, imidacloprid was exposing bees to infestation by *Nosema ceranae* and thus a much greater chance of dying prematurely.

Dr Helen Thompson: Bee scientist, National Bee Unit, York, denied that Colony Collapse Disorder in honey bees was present in the UK. She told Channel 4 News on 04/04/2011: *“the Government has reviewed all the data on a link between insecticides and bees, and concluded they are not the primary cause of the decline... There have been a lot of studies undertaken, across Europe and here in the UK and there's been no strong evidence they are linked to bee losses at all.”*

Tim Lovett, BBKA: 20/06/2011: *Bayer promotional video expert panel: “The principal problem in the decline in bees clearly has to be the Varroa mite... The competence of beekeepers needs be maximised... It is not adequate if you don’t give them the tools.”*

Julie Girling MEP: *“The bees’ immune system is based on its social activities, so if that reduces, immunity goes down and they are subject to all kind of other pressures.”* Strasbourg. Bee Care Panel Debate. Bayer promotional video for *Varroacides*.

Dr Julian Little, Bayer: *“If it is Varroa, well, we are very pleased that we are going the right way when it comes to researching products for bee health because that’s what Bayer has been doing for... for well over 20 years now.”* Bee Care Panel Debate on a promotional video for Bayvarol® and Perizin®. 20/06/2011.

Norman Carreck BBKA: Senior Technician at the University of Sussex Department of Apiculture, Scientific Director of the International Bee Research Association and Senior Editor of the Journal of Apicultural Research. Minutes of meeting: Scientific Evidence Advisory Group to the Defra Healthy Bee Plan, 27/07/2011. With reference to Fera’s data on: *‘Management and control of Varroa’*, the Chairman said there was an opportunity for the first piece of work to be done at Fera. She invited comments on the specification, and what the outputs should look like. Norman Carreck said: *“We need to avoid doing a literature review, which covers both ‘good’ and ‘bad’ literature”*.

Bayer CropScience: *“Australian Bees are the healthiest in the world”*. Comment in Sunday Times: 1/11/2011 Article by Charles Clover. *Bee colonies are diminishing.....*

12. **A Study of Beekeeping Practices**; influences and information sources. Final Report 11/05/2010. 60 pages. This seemed to be a particularly pointless report; one that might appear in a Women’s Weekly magazine. There were only 30 telephone interviews with amateur beekeepers and an internet survey of 906. It did not state how they were selected and there was no mention of neonicotinoid pesticides either. Someone must have been paid a lot for analysing and writing about a few cosy chats and opinions. Not the sort of ‘sound science’ that Defra is always boasting about.

13. **Science Advisory Council to Defra** – remodelled in 2011. Finally, on 26/06/2012 SAC-12-24-neonicotinoids were discussed. The newly constituted Committee, on its third meeting, asked for a briefing from Defra/CRD. *“This paper is in response to SAC’s request to be briefed on the effect of neonicotinoids on bees, and Defra’s position. The SAC will wish to consider the current Defra position and the thinking and evidence behind that position – and to challenge that position if appropriate. Bee health para 5. Honey bee colonies have good years and bad years – honey bee loss is not a new phenomenon. Their health is influenced by a number of factors – particularly pests and pathogens, bee husbandry, nutrition and the weather. The population of each bee colony fluctuates naturally throughout the year from around 50-60,000 at the summer peak to around 10-20,000 in winter when the colony slows down. The whole colony can be lost either over the winter or during the beekeeping season. Recent data for both periods indicate lower losses for honey bees over the last 2-3 years. The figures are outlined at **Annex 1**. “Defra takes the success of bee populations very seriously. That is why, despite the tough controls already in place, we are not complacent. We carefully assess new studies as they emerge and consider with an open mind whether they alter the overall picture.” “We carried out a comprehensive assessment of the evidence last year, culminating in a challenge session led by the Chief Scientific Adviser in August, and found that the total body of evidence supported the conclusion that neonicotinoids do not threaten honey bee populations.”* In 2010, ACP had asked, (as a result of examining the 2009 Buglife Report) for overwintering losses associated with systemic neonicotinoids to be undertaken by Fera. There is no evidence that these have been done. That is why the numbers in Annex 1 are so vague. In one of the Pollinator Initiative projects headed by Dr Chris Connolly from Dundee, in partnership with the Scottish Beekeepers’ Association (SBA), a three year survey of the impact of chemicals on colony performance in Scotland would be undertaken. Although the project was 3 months behind time (Dr Connolly’s bees were “rustled” from a secure area of Dundee University) preliminary results from the first year have just been published in the Journal of the SBA. He said: *“In summary, the presence of oil seed rape (OSR) correlated with a 2-fold increase in over-wintering failure in Scotland 2011-2012. This finding supports the hypothesis that neonicotinoid-treated OSR may be contributing to the honey bee decline in the UK.”* There was an east/west divide, with a clear increase in bee losses in the East (intensive agriculture). In fact Dr Connolly, being an honest scientist, excluded results from one beekeeper whose bees were in the non-OSR group who had no losses from 70 hives. Had he included it, the increase in over-wintering losses would have been 3-fold in the East of Scotland. In addition, they have also found the microsporidian *Nosema ceranae* present in over 80% of Scottish hives, suggesting that pesticides are lowering the immune system of the bees leaving them susceptible to attack from this and other pathogens and parasites such as the *Varroa* mite. Defra has been silent about these results.

Graham White is a beekeeper in the intensively-farmed area of the east of Scotland. Since 2006 he has not harvested a single pound of honey, despite the fact that he now has ten hives rather than six; the reason is that his apiary stands in the centre of many square miles of arable crops - oilseed rape mainly - that have been treated with neonicotinoids. He says: *“The result is that, like most British bee-keepers, I have lost from 30-50% of my hives every winter since 2005 - whereas from 1995 to 2005 I rarely, if ever, lost a single hive in winter.”* This year (2011-2012) his overwintering losses are close to 80%. The Chief Bee Researcher at Fera, Dr. Helen Thompson, denied the existence of Colony Collapse Disorder on Channel 4 on 04/04/2011. Presumably Fera hasn’t been looking;

possibly because it doesn't want to know. The most recent data we have seen by Fera on overwintering bee losses only reached as far 2008; we have no idea of who they surveyed.



Dead queens and workers. This is a photograph of a dead colony taken on 11/12/2010 by beekeeper Graham White, who lives in the eastern half of Scotland. He has kept bees since 1994. He says it is a typical dead colony from an area dominated by intensive arable crops, oilseed rape, wheat and barley, where first imidacloprid, and now clothianidin, is used. He said *“It is clear from the photos that there was plenty of sealed honey and pollen within easy reach of the bees. The reason they died was not from starvation; there were simply not enough bees to generate sufficient heat to keep the colony alive. This phenomenon is what beekeepers in the US had termed in 2006 'Fall Dwindling' - when a colony that appears to have been fine during the summer, suddenly weakens and dies - largely because it stopped rearing brood in the Fall and as such did not have sufficient 'winter bees' to carry it through the winter.”*

Page 9 of the briefing for SAC: *“Pesticides that are applied as a seed treatment: It says “some pesticides are applied directly to the seed”. In the UK it is approximately one third of all arable crops (Defra’s own statistics) and in addition to the seed being coated with chemicals an area may have up to four additional sprayings during the season. It omitted to include the Bayer Garden domestic market, or any of the other places where they are used.*

Thiamethoxam usage in the UK

Between 2009 and 2010, thiamethoxam usage went up more than ten times.

Year	Region	Crop Group	Active Substance	Total Area Treated (ha) ¹	Total Weight Applied (kg)
2010	Great Britain	All Crops	Thiamethoxam	298,007	9,105
2009	Great Britain	All Crops	Thiamethoxam	22,567	938
2008	Great Britain	All Crops	Thiamethoxam	21,909	940
2007	Great Britain	All Crops	Thiamethoxam	1,333	5.6
2006	Great Britain	All Crops	Thiamethoxam	1,213	5.4
2005	Great Britain	All Crops	Thiamethoxam	1,213	5.4

CRD budget is paid, in part, by the industry. Is it a safety agency or a service agency?

Instead of employing independent scientists, it is presumably easier and cheaper for the UK Government to allow industry to pay a proportion of the Chemical Regulation Directorate's

costs (about 60%). It is evident that the loyalty of the Defra/Fera staff lies with the industry that pays them, rather than the protection of Human Health and the Environment. (Defra told us that the exact amount each year is based on a formula enshrined in the recent European Legislation on Plant Protection Products. It depends on work done).

Extracts from the CRD Annual Report 2008/2009 will support our point: *"This has been a very busy year in the approvals group. Applications for product approvals were 9% over business estimates with a total of 1,767 applications received and 1,622 applications completed this year, 96% of which were completed within published targets. Importantly 100% of 'fast track' applications identified by industry as high priority to their business needs were completed within published targets. Achieving this demanding target despite the increase in applications has required diligent application and commitment of evaluating staff and their managers and represents a significant achievement. We continue to support growers and we have completed the first stage of the conversion exercise for the 'Long Term Arrangements for Extension of Use' on non-edible crops. Of the 401 uses requested by growers, the 131 products containing active substances that have already been fully reviewed in the EU review programme, and included on Annex I of Council Directive 91/414/EEC have been completed. The remaining product/uses identified by growers will be automatically included in the on-going re-registration process minimising the impact on industry. We also assisted in the evaluation of new products by helping companies work towards the completion of appropriate dossiers through the provision of detailed advice. This advice has covered both chemical pesticides and biopesticides that we continue to support under our biopesticides scheme. We submitted completed evaluation reports for 5 new active substances where the UK was the EU Rapporteur Member State and issued 3 UK provisional authorisations in advance of Annex I inclusion. In addition we completed 8 'partial dossier' submissions.*

14. Critiques of two of the papers mentioned in the Defra Report These are two that David Fischer from Bayer Crop Science (and Defra) has put the most weight on. Both state that: *"they prove that the neonicotinoid insecticides cannot possibly be the cause of honey bee declines."* In fact, neither is 'sound' science.

'Dietary traces of neonicotinoid pesticides as a cause of population declines in honey bees: an evaluation by Hill's epidemiological criteria' James E. Cresswell, Nicolas Desneux, and Dennis van Engelsdorp. Pest Management Science.

"...we employ Hill's epidemiological 'causality criteria' as a structured process for making an expert judgement about the proposition that trace dietary neonicotinoids in nectar and pollen cause population declines in honey bees. Conclusion: We conclude that dietary neonicotinoids cannot be implicated in honey bee declines, but..."

I had the following correspondence with the Editor of Pest Management Science and James Cresswell to take issue with their use of Hill's criteria.

Sent: 06 March 2012 13:08

To: Pest Management Science

Subject: Re: Gerald T Brooks

Dear Simon

Thanks so much for getting in touch.

Re: 'Dietary traces of neonicotinoid pesticides as a cause of population declines in honey bees: an evaluation by Hill's epidemiological criteria' James E Cresswell, Nicolas Desneux and Dennis vanEngelsdorp. Accepted article in Pest Management Science: doi: 10.1002/ps.3290.

Having served as Assistant Editor to a medical journal in the UK for 10 years, I would challenge the authors' use of Hill's criteria in a non-occupational medicine context. They have used it incorrectly to

support a very contentious conclusion in the honey bee world: that dietary neonicotinoids cannot be implicated in honey bee declines. At the end they state: ‘*we commend the use of Hill’s criteria. Since their inception over 40 years ago and subsequent widespread use, no criterion has been abandoned and none added, which means that they provide a stable and well-established infrastructure in which to process scientific evidence.*’

They omit to say that in 40 years it has always been used in a medical context, not to supply scientific evidence. If they had read the three papers fully they should have observed that Hill's criteria have never been used other than in relation to man and occupational exposure.

Sir Austin Bradford Hill was an eminent medical epidemiologist and statistician. His classic paper ‘*The Environment and Disease: Association or Causation*’ was given to the Section of Occupational Medicine in the Royal Society of Medicine in 1965. These criteria were developed to enable physicians and surgeons to test the relationship between occupational exposure and occupational diseases in man. Following on from this, he and Sir Richard Doll went on to prove the relationship between smoking and lung cancer.

The paper by Cresswell *et al.* quotes two other references to Bradford Hill. *The Bradford Hill considerations on causality: a counterfactual perspective* by Michael Höffler, an epidemiologist and psychologist. This was published in *Emerging Themes in Epidemiology*. All the references are from medical journals. The third one by Swaen and van Amelsvoort is from the *Journal of Clinical Epidemiology*, discussing the relationship between toxic agents and human cancers. I am surprised that your reviewer did not spot this error; or perhaps they were misled by the use of the word ‘environment’ in the title and assumed that these were ecological papers. I think that so far this paper has only appeared on line. In order to maintain the reputation of Pest Management Science and the John Wiley Journals in particular I hope that this will be removed from being accepted on-line (perhaps with a note to say why). I hope that I am not too late to stop it going into print. Kind regards

Personal email to James Cresswell, sent 07/03/2012, with further objections to his selection and interpretation of papers, in addition to challenging the use of Hill’s criteria.

Dear James

Did you find and read all these papers yourself and personally interpret them? If you did, I would question your judgement at applying scores or “weighting”.

Reference 24: You dismiss this document as claims by French beekeepers; but it was a 108-page document, by the *Comité Scientifique and Technique* in France. It took several years to review all the **independent** scientific evidence on systemic pesticides. Their findings were that “*the treatment of sunflowers is a significant risk to bees in several stages of life*”

Reference 26: Maxim & van Sluijs: “*there was no consensus about the potential impact of trace dietary impact of imidacloprid on honey bees*”. It was obvious why there was no consensus; it was just a questionnaire from different bodies. “*The method makes use of expert elicitation of the perceived strength of evidence regarding each of Bradford Hill’s causality criteria, as regards the link between each of eight possible causal factors identified in attempts to explain each of five signs observed in honeybee colonies. These judgments are elicited from stakeholders and experts involved in the debate, i.e., representatives of Bayer Cropscience, of the Ministry of Agriculture, of the French Food Safety Authority, of beekeepers and of public scientists.*” It was performed by means of a questionnaire (meeting or telephone) which was then analysed. The concluding remarks were: *Often, in controversial situations (such as the one described here), the political positions and the arguments of the stakeholders involved become polarized and immovable.* Bradford Hill’s criteria are mentioned. The paper is complete rubbish.

Reference 31: this is the infamous Cutler and Dupree Study 2007; originally submitted by Bayer as a field study (Cutler paper alone in 2006, was rejected by the Canadian Pesticides Management Authority). The next version had subsequently to be downgraded by the US EPA, (The test area was only 2 ha and bees often forage for miles.) After nine years on the market, there still is no proper field study that shows that clothianidin is safe; yet you mention it on at least three occasions. On one occasion you describe it as “*The largest field trial to date*” and give it a weighting of minus 2. Page 6

“field tests found no detrimental effects on honey bee colonies due to either imidacloprid or another neonicotinoid, clothianidin”. You refer to it again on page 13: “One experimental investigation has investigated the effect of exposure to neonicotinoid-treated crops on colony health under field conditions, and it found no effect on either overwinter survival and its proxy variables (e.g. gain in colony mass) or on mortality rates of individual bees.” Not surprisingly, the recent Purdue Study showed that bee-fed pollen had 10 times the amount of clothianidin in it than the Cutler & Dupree study showed.

Reference 38 Girolami *et al.* “Guttation is a particularly valuable source of water for bees in spring when the plants are small” (Italy is hot). This paper showed that leaf guttation drops of all the corn plants germinated from neonicotinoid-coated seed contained amounts of insecticide constantly higher than 10 mg/l, with maxima up to 100 mg/l for thiamethoxam and clothianidin, and up to 200 mg/l for imidacloprid. The conclusion of the authors was that “*When bees consume guttation drops, collected from plants grown from neonicotinoid-coated seed, they encounter death within a few minutes*”.

Indeed, if you enter “guttation drops” into Google, there are several YouTube videos of these lethal events taking place between the corn seedlings.

You then say: “*The critical question of whether bees commonly consume the fluid under field is currently unresolved.*” (Reference 37, is: Recent developments and ‘new issues’; in Pest Management Science 2010 and written by Helen Thompson).

Helen Thompson from Fera/Defra has worked on Defra’s SID5A Systemic Pesticide Risk Assessment (2007-2009) with three pesticide scientists from Bayer, Dow and Syngenta.

She was among the group of global ‘experts’ invited to the SETAC Pesticide Risk Assessment for Pollinators in January 2001: SETAC Pellston Workshop January 2011 whilst independent researchers were excluded. http://www.setac.org/sites/default/files/executivesummarypollinators_20sep2011.pdf

So she knew that previous risk assessments had been flawed. On page 12 of the SETAC Executive Summary: Fischer (Bayer CropScience) and Moriarty US EPA OPP) admit that previous risk assessments for the systemic neonicotinoids had been flawed: “*Many who are familiar with pesticide risk assessment recognize that the methodology and testing scheme for foliar application products (where exposure may be primarily through surface contact) is not adapted to assess potential hazard and risk from systemic pesticides.*” In particular, the authors of the report also admitted that they still had no suitable standard tests for chronic toxicity to either adult honey bees or their larvae.

On Channel 4 Television in April 2011, she denied that the UK had CCD.

In 2009, The Buglife Report on the: “*Impact of Neonicotinoid Insecticides on Bumblebees, Honey bees and other non-target Invertebrates*” was published. Defra was of the opinion that it contained nothing new.

The Advisory Committee on Pesticides concluded that the “*Buglife report highlighted a need in the risk assessment process for data on the impacts of neonicotinoid pesticides on overwintering of bees.*”

In July 2009, Fera set up the Healthy Bees Plan Project Management Board (HBPMB) which included three members of the British Beekeeping Association (which for 10 years had been accepting money from the Agrochemical Industry for “*endorsing safe pesticides*”). **This study has never been done.** In fact in 12 meetings of the HBPMB, neonicotinoid insecticides were never mentioned once, only *Varroa* mites and expediting registration of Bayer’s bee medicines for treatment.

The £10 million Pollinator Initiative funded nine projects. None of these were on the systemic neonicotinoid insecticides.

Have you seen the US EPA conditional registration document for clothianidin from 2003?

Fischer and Moriarty will know all about it.

It says on page 13: *Clothianidin is highly toxic to honey bees on an acute contact basis (LD₅₀ > 0.0439 µg/bee). It has the potential for toxic chronic exposure to honey bees, as well as other nontarget pollinators, through the translocation of clothianidin residues in nectar and pollen. In honey bees, the effects of this toxic chronic exposure may include lethal and/or sub-lethal effects in the larvae and reproductive effects in the queen.*

<http://www.epa.gov/opprd001/factsheets/clothianidin.pdf>

The Technical Sheet for Imidacloprid states that it is highly toxic to honey bees; as does the Australian PVMA.

James, do you have any idea the devastation that these chemicals have caused in the US?

On 13/01/2012, the Guardian Environment reported the crisis in the US: "*We are inching our way toward a critical tipping point,*" said Steve Ellis, secretary of the National Honey Bee Advisory Board (NHBAB) and a beekeeper for 35 years. Last year he had so many abnormal bee die-offs that he'll qualify for disaster relief from the U.S. Department of Agriculture (USDA).

Helen Thompson says there is no CCD in the UK?

Graham White, one of our campaign team, lives on the Scottish Borders. He became a beekeeper in 1994. Since 2006 he has not harvested a single pound of honey, despite the fact that he now has ten hives rather than six; the reason is that his apiary stands in the centre of many square miles of arable crops that have been treated with neonicotinoids. He said: "*It was in 2006 that I became aware that I was living in the centre of a vast area of arable crops - oilseed rape mainly - that were treated wall to wall with Imidacloprid. In 2010 I first became aware that Clothianidin was being used on all of the wheat and barley fields around my apiary - and that the drainage of the entire area was being fed into a large pond in my quarry - 50 feet below the level of the surrounding fields. So I strongly suspect that Clothianidin, Imidacloprid and several different fungicides are all contributing to the decline of my bees.*" He said: "*The result is that, like most British bee-keepers, I have lost from 30-50% of my hives every winter since 2005 - whereas from 1995 to 2005 I rarely, if ever, lost a single hive in winter.*" According to Graham, in Scotland in 2010 *clothianidin* was used on all crops in an area of about 25,000 acres, and *thiamethoxam* on an area of about 47,000 acres.

In England, the figures are much higher. In 2010 according to Defra total neonics was well over 3 million acres (some fields would have been sprayed up to 4 times).

I could go through many others of the papers you document, particularly the ones written by Scientists from the pesticides industry. If I were to put in many of the papers you missed out, it would prove they were responsible for bee deaths, which they are.

However, it just seemed simpler to use the medical statistics argument. The papers that have used Bradford Hill on complex environmental issues are talking rubbish. It depends on interpretation and weighting, not on fact, as Hill's criteria connecting smoking and lung cancer do. I think that Sir Austin Bradford Hill and Sir Richard Doll would be turning in their graves, to know that their statistics were being used to maintain the sales of a neurotoxin that is not only poisonous to invertebrates, but to humans as well, for the benefit of the pesticides industry and their shareholders.
Yours sincerely

When I finally heard from the Editor, it was to say that they had no intention of taking it off line! Of course I realise why. Pest Management Science has five industry representatives on their Editorial Board. Helen Thompson had published four papers in PMS, one of which was to refute the findings of Girolami about guttation drops being an important source of water for bees during springtime and from which they were exposed to high doses of pesticides.

We note that James Cresswell and Helen Thompson applied another statistical model on Henry's paper: "*A Common Pesticide Decreases Foraging Success and Survival in Honey Bees*" in a commentary in Science, to cast doubt upon Henry's findings (which Henry adequately pulled apart, also in Science.) It took a French journalist, Stéphane Foucault in Le Monde, in an article: "*Le Chercheur, l'agrochimiste et les abeilles*" (*The researcher, the agrochemical company and the bees*) to discover advertisements for an assistant to Cresswell which were being funded by Syngenta, the manufacturer of Cruiser® (thiamethoxam).

The second paper with which I took issue, and by which the industry and Defra placed great store, was published in Ecotoxicology. In fact Blacquière had published a paper with Mommaerts in 2010 which had shown negative effects of sub-lethal doses of imidacloprid on *Bombus terrestris* worker foraging behaviour. It is therefore extraordinary that he should be induced to partake in a paper (presumably commissioned) that purported to show the reverse.

Neonicotinoids in bees: a review on concentrations, side-effects and risk assessment Tjeerd Blacquiere • Guy Smaghe • Cornelis A. M. van Gestel • Veerle Mommaerts.

“This review summarizes, for the first time, 15 years of research on the hazards of neonicotinoids to bees including honey bees, bumble bees and solitary bees.”

The following letter was sent to the Editor of Ecotoxicology asking for it to be published as a comment.

Editor-in-Chief

Ecotoxicology

Dear Dr Shugart

I find it extraordinary that the paper published in Ecotoxicology by Blacquiere *et al.* ‘*Neonicotinoids in bees: a review on concentrations, side effects and risk assessment*’ can refer to the Summary by Fischer (Bayer CropScience) and Moriarty (US EPA) of the Pesticide Risk Assessment for Pollinators: Summary of a SETAC Pellston Workshop January 2011, and not discuss the crucial admissions made in that report.

http://www.setac.org/sites/default/files/executivesummarypollinators_20sep2011.pdf

On page 12 of the SETAC Report, Fischer and Moriarty admit that previous risk assessments for the systemic neonicotinoids had been flawed: *“Many who are familiar with pesticide risk assessment recognize that the methodology and testing scheme for foliar application products (where exposure may be primarily through surface contact) is not adapted to assess potential hazard and risk from systemic pesticides.”*

The authors of the report also admitted that they still had no suitable standard tests for chronic toxicity to either adult honey bees or their larvae. Chronic toxicity tests on adult and larval bees *“require further development”*. Delegates (by invitation only) agreed that when these were developed they should be required as part of Tier 1 testing. At the end, there were 12 items for future research. Many of the studies they suggested had already been published in peer-reviewed journals by independent scientists, all of whom confirmed the acute and chronic toxic effects of systemic neonicotinoid pesticides on bees.

The paper by Blacquiere *et al.* is deficient and cannot possibly claim to be a comprehensive review of risk assessment of neonicotinoids for honey bees.

Yours sincerely

Dr Shugart

I am grateful to you for forwarding the critique by your Ecotoxicology Assessor on the Editorial Board. I would like to make a few corrections to her “negative comments.”

First of all, did Dr Helen Thompson (since I assume it was her) admit to you that she and I have crossed swords before?

She claimed that my comments were: *“very definitely base on an advocacy position and not science.”*

I find this accusation extraordinary considering their origins; from US SETAC.

The first three paragraphs were quoted directly from the Executive Summary of the SETAC Pollinator Conference in Florida in January 2011. This was a workshop to which she had the privilege of being invited as an expert on bees, so she can hardly deny the truth of them. The Executive Summary was published on the SETAC website in September 2011.

The fourth paragraph was taken straight from the US EPA conditional registration document for Clothianidin in 2003. Again this is factual, rather than advocacy.

The fifth paragraph was also factual; about the current state of US beekeeping. The US Honey National Bee Advisory Board Secretary said their industry was at a critical tipping point. There is nowhere in the letter that CCD or immune deficiency is mentioned, so I find it rather curious that she says: *“we won’t be depriving the journal readership of an important hypothesis about CCD by not publishing the letter.”*

The website she quotes is not my website, but that of Bee Culture, the Magazine of American Beekeeping, whose members have experiences devastating losses in the last few years.

When Dr Thompson was appointed to the Editorial Board of Ecotoxicology, did she declare any

competing interests? Her work for the UK government on neonicotinoids (Defra's SID5A Systemic Pesticide Risk Assessment) was done in conjunction with three scientists from BayerCrop Science, Syngenta and Dow Agroscience. Four of her papers about bees and neonicotinoids have been published in Pest Management Science, a pesticide journal, the Editorial Board of which has three members of Syngenta, one from BayerCrop Science and one from Dow Agrosciences.

Her views on the neonicotinoids are well known in the UK. As a Bee Scientist working in Fera, she is one of the government chief advisers on Bees. She told Channel 4 news on 04/04/ 2011 that the UK Government had reviewed all the data on a link between insecticides and bees, and concluded they are not the primary cause of the decline. She added that the UK had no CCD. However, many of our beekeepers are having significant overwintering losses, but the Healthy Bees Plan Management Board (HBPMB), set up by Fera in 2009 to look at honey bee health and causes of bee declines in the UK, does not yet appear to have established a UK database with which to confirm or refute this.

In 2009, after publication of the Buglife Report, (Kindemba, V., 2009, *The impact of neonicotinoid insecticides on bumblebees, Honey bees and other non-target invertebrates*), the UK Advisory Committee on Pesticides asked Defra/Fera to study the effects of neonicotinoids on overwintering bee losses. There is no evidence that this has been done; in twelve meetings of the HBPMB over nearly 3 years, neonicotinoids were never once mentioned as a possible cause of bee declines. The Committee was fixated on the *Varroa* mite and expediting registration on anti-*Varroal* medicines, two of which have already been manufactured by another arm of Bayer. In 2010, a £10 million Insect Pollinator Initiative was announced in the UK to study reasons for devastating declines in pollinators. None of the nine projects involve a study of neonicotinoids on honey bees.

I suggest Dr Thompson's reason for recommending that my letter is rejected is to protect the pesticides industry from the embarrassment of having their deliberations at the SETAC Conference and the truth about the EPA Registration Document for Clothianidin being revealed to the public, for the very first time.

The Blacquièrè review paper is also biased towards the pesticides industry in its selection of papers, since many of the authors are pesticide scientists. I note that the paper references the Cutler & Dupree study. The granting of conditional registration to clothianidin in 2003 was contingent upon the subsequent submission of an acceptable field study, but nine years later this requirement has still not been met. I am therefore very surprised that the Cutler and Dupree study of 2007: "*Exposure to Clothianidin seed-treated canola has no long term impact on honey bees*" has even been referenced, since it was deemed by the US EPA to be inadequate as a field study.

The Editorial Board of Ecotoxicology will need to discuss my evidence against Dr Helen Thompson. Also, at this critical moment, the wisdom of publishing this controversial Blacquièrè study (that is so obviously biased towards the Pesticides Industry) should be reconsidered.

Yesterday an urgent legal petition was filed with the U.S. Environmental Protection Agency (EPA) by commercial beekeepers and environmental organizations, to suspend further use of a pesticide the agency knows poses harm to honey bees, and adopt safeguards to ensure similar future pesticides aren't approved by the agency. "*EPA ignored its own requirements and failed to study the impacts of clothianidin on honey bees,*" said Peter Jenkins, an attorney for the Center for Food Safety and co-competitor. "*The body of evidence against the chemical continues to grow, yet the agency has refused to take action.*"

Kind regards

I never received an answer and the letter was never published. It is evident that the industry places advocates on as many journal editorial boards as it can, either to reject, or delay, publications against these insecticides. I received a complaint from Prof Stefano Maini from Italy about a paper that he and Dr Porrini submitted to the Journal of Apiculture. Norman Carreck (BBKA, SEAG) was the assessor; he kept it for six months and then rejected it. This was the same Norman Carreck on SEAG who said: "*We need to avoid doing a literature review, which covers both 'good' and 'bad' literature*". It demonstrates that being an assessor on a journal doesn't require academic qualifications. He was presumably 'placed' by industry. See page 38 in Human health doc. A Witness to The Permanent Peoples' Tribunal held in Bangalore, December 3rd to 6th 2011. How the industry suppresses information.

<http://www.agricorporateaccountability.net/en/page/ppt/167>

Evidence to the Environmental Audit Committee Paper 3 Contamination of surface and ground-water by the neonicotinoid insecticides

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 - 10) Defra/Fera protect humans from dioxins but not from neonicotinoids
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 - 14) Commission Dalli resigns; corruption in Europe; revolving doors
1. **No monitoring in the US.** In the US, the neonicotinoid insecticides were authorised at the same time as water quality assessments were introduced for monitoring pesticides (1991). These insecticides did not feature in the 2009 US Geological Survey (USGS) National Water-Quality Assessment Program (NAWQA) Report: *Pesticide Trends in Corn Belt Streams and Rivers (1996-2006)*. They were absent from the 2008 US study of pesticides in ground-water. The authors of the studies said: *“The results of this study are encouraging for the future state of the nation’s ground-water quality with respect to pesticides...Despite sustained use of many popular pesticides and the introduction of new ones, results did not indicate increasing detection rates or concentrations in shallow drinking water resources over the 10 years studied”* That was simply because they were only measuring the older pesticides that had been phased out. These had been replaced by the systemic neonicotinoid insecticides, which were not present in the lists of pesticides monitored. I wrote to Bob Gilliom, Head of Pesticide Synthesis, USGS NAWQA, in April 2011 to point out this anomaly and sent him the Dutch documents about water contamination. He replied and said he would read them. We never heard any more.
 2. **No monitoring in Europe; only in The Netherlands.** The Chairman of the UK Environment Agency was also informed in December 2010 (identical letters went to many politicians and organisations to inform them about the neonicotinoid insecticides, with evidence that they were building up in surface water and having an impact on all invertebrates). Lord Smith said the EA had no authority to ban pesticides. He suggested we wrote to Defra and the Defra Ministers, who did have. He gave me the email address of one of his staff in Bristol. I wrote to ask if they were monitored in the UK. Response to enquiry from X re: neonicotinoid pesticides. *Monitoring of neonicotinoid pesticides by the Environment Agency.* “The Environment Agency’s current monitoring of pesticide products in surface waters is determined largely by the statutory requirements of the EU Dangerous Substances Directive and the Water Framework Directive (together

with its 'daughter' directive, the Environmental Quality Standards Directive). These Directives list chemical substances to be monitored in the environment, including a number of pesticides. However, none of the five neonicotinoid pesticides licensed for use in the UK is included under the current legislation. Our laboratory service is able to screen environmental samples for two of the neonicotinoid products, imidacloprid and clothianidin, using a chemical scanning technique (the GCMS scan). The limit of detection for these compounds is approximately 0.5µg/l. Although we have not specifically targeted neonicotinoids in our routine monitoring, we have been carrying out monitoring programmes using the GCMS scan technique for a range of projects. A review of results from the scans carried out between July 2009 (when we acquired the capability to detect these compounds) and January 2011 has shown there are no positive results for imidacloprid or clothianidin in surface waters. We have not undertaken any assessment of concentrations in soil. We are currently in discussion with the Chemicals Regulation Directorate (CRD) and Defra on the need for more targeted monitoring for these compounds. We would be happy to keep you informed of progress with this." From the Evidence - Monitoring Strategy Unit 04/02/2011.

Our comments: The GCMS scan would not have been sensitive enough to detect the limits in the previous Regulation on Plant Protection Products 91/414/EEC which was 0.1µg/l. It is unfortunate for us (but lucky for the pesticides industry), that the current one in use, EC/1107/2009, no longer specifies a limit. In actual fact, the chemicals cause immune suppression to bees in such low doses that are subsequently impossible to detect, even with the most sophisticated equipment (Pettis *et al.* 2012). We have just heard from the European Parliament that clothianidin was not registered illegally, despite its length of action and persistence in the soil. It was registered under the old regulations 91/414/EEC, which apparently made no reference to any such limits on registered pesticides.

3. **The European Commissioners.** We wrote on a number of occasions to all three Commissioners in Europe. We only had replies from Commissioner Dalli's staff. Neither Michael Flüh nor Eric Poudalet commented on our point about water contamination. We thought it strange that we never had a reply from Commissioners Ciolos or Potocnik. Vice-President Ashton always sent our documents on to Dalli. We suspect that there is some mechanism in the EC that diverts all correspondence about pesticides and GMOs to a central point. This may be significant. One of Commissioner Dalli's first actions on taking office was to lift a 13-year ban on BASF's GM potato Amflora. However, Dacian Ciolos, the Agriculture Commissioner, had expressed doubts about accepting GMOs into Europe at the Oxford Farming Conference in 2011. Recently, when a friend sent our document to Janez Potocnik, the Commissioner for Water, he was quite bemused. He said he would get back to her. When he got back to her, he said it was a different department.
4. **European Union Committee 33rd Report on Water Policy.** On 25/04/2012 a meeting was held in the EU. 'An indispensable resource: EU Freshwater Policy. The UK Environment Agency Chairman, members of Defra, CEH, and the Defra Minister were present at this meeting. All had been alerted to imidacloprid levels increasing in Dutch surface water and levels being inversely related to insect numbers. Dr Henk Tennekes had also shown that there were declines in insect-dependent birds throughout Holland, Germany, France and the UK.
http://ec.europa.eu/environment/water/water-dangersub/pdf/com_2011_876.pdf
The EC regulations on water quality state: "Priority substances are those identified as presenting a significant risk to or via the aquatic environment within the EU. These are listed in Annex X to the Water Framework Directive (WFD). Some substances are

identified as priority hazardous substances, because they have 'ubiquitous, persistent, bio-accumulative and toxic' properties. Bio-accumulation is the progressive increase in the amount of a substance in an organism or part of an organism which occurs because the rate of intake exceeds the organism's ability to remove the substance from the body". This is the EU definition of a priority substance that should be monitored. The chemical and ecological profiles are matched, very accurately, by the neonicotinoid insecticides. The dangerous substances that are being monitored at present include DDT, chlorpyrifos, aldrin and dieldrin; the majority of these should be obsolete. The neonicotinoid insecticides whose sales now dominate the global market are absent from the list. Those present at the meeting from the UK were silent on the matter.

5. **New York State never registered clothianidin.** The New York State Department of Environmental Conservation was demanding monitoring of imidacloprid by Bayer in the late 1990s, because it was protective of the aquifers in Nassau and Suffolk Counties. It did not register clothianidin and severely restricted the use of imidacloprid and thiamethoxam. In 2003, NYS wrote to Bayer CropScience, expressing concern about levels of imidacloprid found in clusters of private wells down gradient of farms (one contained 6 ppb imidacloprid), at a golf course monitoring well and at monitoring wells near trees that had been treated with imidacloprid injection.
http://pmep.cce.cornell.edu/profiles/insect-mite/fenitrothion-methylpara/imidacloprid/imidac_let_1003.html
http://pmep.cce.cornell.edu/profiles/insect-mite/fenitrothion-methylpara/imidacloprid/imidac_reg_1004.html

We are convinced that this is why sparrows have disappeared from London, but not from New York. As stated above, NYS did not register clothianidin and severely restricted the use of imidacloprid and thiamethoxam. On behalf of a charity for funding independent research on pesticides www.smallbluemarble.org we tried to claim The Independent newspaper's Sparrow Prize (unclaimed from 2000) for solving the disappearance of the House Sparrow from London. However, were informed that our application did not fulfil the criteria set out in 2000. It should be for a paper published in a peer-reviewed journal and judged by a panel of three: The Independent, Dr Summers Smith the expert on Sparrows, and the RSPB. The RSPB, a 'science-led' organisation, is using neonicotinoid insecticides on its Hope Farm Reserve. The Senior Scientist had been persuaded by the industry that these chemicals are environmentally-friendly and superior to the older ones.

6. **Clothianidin contamination of the environment.** Field and toxicological studies from independent researchers from Indiana (US) showed widespread clothianidin contamination of the environment and bees close to maize fields: 'Multiple Routes of Exposure for Honey Bees Living Near Agricultural Fields' Christian H Krupke, Greg J. Hunt, Brian D. Eitzer, Gladys Andino, Krispn Given PLoS ONE January 2012, Volume 7: e29268. *"In North America in 2010 maize planting reached 35.7 million hectares and is expected to increase."* Most maize is coated with neonicotinoid insecticides. Most is used for food, animal feed and ethanol. By sampling clothianidin, thiamethoxam and several other agricultural pesticides, bees close to maize fields were found to be exposed throughout the foraging period. Extremely high levels of clothianidin and thiamethoxam were found in planter exhaust material produced during the planting of treated maize seed. They were present in the soil of each field, including unplanted fields; in Dandelions foraged by bees; in dead bees collected near hive entrances; in pollen collected by bees and stored in the hive. Maize pollen with clothianidin and other

pesticides were fed to the new queens. The fact that they were found in wildflowers proves that they are being washed into aquatic systems and taken up by vegetation.

- 7. EFSA Scientific Opinions.** (EFSA provides the Science for the European Commission, but only the EC can grant authorisation for pesticides and GMOs, after EFSA has given a positive opinion). The European Food Safety Authority (EFSA) Panel on Plant Protection Products and their Residues published a 275-page document: “Scientific Opinion on the science behind the development of a risk assessment of Plant Protection Products on Bees.” 18/04/2012. Defra followed this with a similar document on 13/09/2012; Neonicotinoids and bees. The State of the Science and the regulatory response. In both cases the authors were only calculating exposure from a theoretical point of view, or extrapolating from original data before contamination (or sometimes from data on ‘similar’ species), rather than measuring actual levels. (For example; risks to bats, which are in dramatic decline, are not measured directly. The shrew is taken as a standard insectivorous species and the data are extrapolated to bats. The fact that shrews don’t fly and reproduce rapidly whereas bats forage insects in the air from orchards and are very slow reproducers seems to have been ignored). EFSA hasn’t taken into account the gross contamination already present in the environment from years of use/abuse from which all invertebrates, not just bees and bumblebees, are dying. Science is supposed to be about measurement. These Scientific Opinions by EFSA and Defra are a blatant distortion of science for the purpose of misleading the public. EFSA cannot be taken seriously as a scientific organisation when it has no knowledge of the baseline levels in soil, surface and ground-water with such a persistent chemical (half-life in soil up to 1386 days). We know that the toxins have been found in wild flowers foraged by bees, having been taken up from surface water. In addition, what genuine scientific document would have the following paragraph?

The final decision on protection goals needs to be taken by risk managers. There is a trade-off between plant protection and the protection of bees. The effects on pollinators need to be weighted against increase in crop yields due to better protection of crops against pests.

- 8. The Austrian Ombudsman challenged the European Commission** in April 2012. They complained that the EC had not taken into account the new research on bees and neonicotinoids. The EC had to reply by 30/06/2012. We decided to follow suite. We also noted that EFSA readily agreed to increase MRLs in neonicotinoids at the request of industry [Syngenta Crop Protection BV for thiamethoxam (clothianidin) asked the EFSA to grant an increase of MRL on carrots (Approved February 2010). Syngenta Agro SA asked for an increase in MRL of thiamethoxam (clothianidin) in strawberries and beans with pods from 0.05 mg/kg to 0.3 mg/kg (i.e. six times). (Approved: June 2010). Monsanto Europe asked the EFSA to set the import tolerance for glyphosate in lentils “*in order to accommodate the authorised desiccation use of glyphosate in lentils in the US and Canada*” from 0.1 mg/kg to 10 mg/kg (i.e. 100 times). (January 2012) The EFSA had granted similarly elevated MRLs for glyphosate on wheat and GM soya.] We received a 2-page reply from Michael Flüh on behalf of the EC and a 5-page reply from EFSA. Third para out of four of the EC letter: “The allegation as regards the illegality of the registration of clothianidin is strongly rejected. The assessment of clothianidin, carried out by a Rapporteur Member State (RMS) and peer reviewed by experts from all Member States, concluded that safe uses of this substance exist”.

- 9. The Ombudsman rejected our complaints** on 03/10/2012.

10. Defra/Fera protects humans from dioxins but not from neonicotinoids. Defra and Fera continue to protect humans from Persistent Organic Pollutants (POPs), such as aldrin, dieldrin and DDT and dioxins. *“They are a group of chemicals which persist in the environment, may bioaccumulate in food and human tissues and are toxic. The two remaining POPs (known collectively as dioxins) have never been produced intentionally but may be formed as a by-product during combustion or some industrial processes. In the UK, dioxins have been recognised as chemicals requiring action for many years and significant action has already been taken to reduce exposure to them. Overall UK environmental emissions reduced by around 70% between 1990 and 2005. The major route of human exposure to dioxins and dioxin-like PCBs is through the food chain. Over the past 10 years, there has been approximately a 70% reduction in levels of dioxins and dioxin-like PCBs in food. The Food Standards Agency continues to monitor the UK food supply and animal feeds for dioxins and dioxin-like PCBs to further reduce human exposure.”* In that case, why did EFSA publish a Scientific Opinion on the herbicide 2,4-D (one half of the infamous *Agent Orange*, a dioxin used as a defoliant during the Vietnam War) in November 2011? Its effects on human health are uncertain, but veterans exposed to this chemical had increased risk of non-Hodgkin’s lymphoma and the US EPA had suggested it has endocrine disruption potential in mammals. The answer may be because in the US, Dow has applied for a GMO corn that is tolerant to 2,4-D and glyphosate. The herbicide 2,4-D was re-registered in the EU in 2002 and Greece is in the process of revising the existing MRLs in crops and in meat; many have already been recommended for use.

11. Japanese field study on CCD, clothianidin and dinotefuran. A Japanese 4-month field study done on eight colonies of 10,000 bees per colony suggested that dilute solutions of neonicotinoids from paddy fields and in orchards can be carried back to the hive in pollen and over a period leads to collapse or over wintering failure. (Toshiro Yamada, Kazuko Yamada, Naoki Wada. *Influence of dinotefuran and clothianidin on a bee colony. Jpn. J. Clin. Ecol.* Vol.21 No.1 2012.) Conclusions: *A colony rapidly dwindled after the administration of dinotefuran or clothianidin and finally became extinct after taking on an aspect of CCD. That is, a queen bee did not disappear until adult bees became few and brood and foods existed in the colony at the point in time when a queen disappeared. Wax-moth larvae did not exist for some time after the extinction of colony. This means that the CCD is just one of situations where a colony dwindles away to nothing although it may look mysterious. These results strongly suggest that the neonicotinoid pesticides such as dinotefuran and clothianidin can most probably cause CCD whose mechanism is proposed as follows: In supposing that a pesticide is sprayed and diluted in water of a rice paddy or an orchard and its concentration becomes low, the low-concentration pesticide carried by foraging bees continues to affect a colony for a long time and finally leads to a collapse of a colony or the failure in wintering. Even if a colony does not collapse and looks active, it causes an egg-laying impediment of a queen and a decrease in immune strength of bees leading to the infestation of mites in a colony.*

12. Immune suppression confirmed in medaka fish in rice paddy fields in Japan Sánchez-Bayo and Goka, while studying Japanese medaka fish in experimental paddy fields, observed physiological stress in juvenile medaka and massive infections of the weaker fish by a *Trichodina* ectoparasite where rice was treated with imidacloprid, compared with medaka in control rice fields. This proved that imidacloprid causes immune suppression in fish as well as in honeybees. (Sánchez-Bayo, F, Goka, K.

Unexpected effects of zinc pyrithione and imidacloprid on Japanese medaka fish (*Oryzias latipes*). *Aquatic Toxicol.* **74** (4), 285-293 (2005.)

- 13. KidsHealthReportOct2012.pdf** *A generation in jeopardy. How pesticides are undermining our children's health and intelligence.* This is a new US Report from Pesticide Action Network North America (PANNA).

Executive Summary

“Children today are sicker than they were a generation ago. From childhood cancers to autism, birth defects and asthma, a wide range of childhood diseases and disorders are on the rise. Our assessment of the latest science leaves little room for doubt: pesticides are one key driver of this sobering trend. As the recent President’s Cancer Panel reports, we have been “grossly underestimating” the contribution of environmental contamination to disease, and the policies meant to protect us have fallen far short. Nearly 20 years ago, scientists at the National Research Council called for swift action to protect young and growing bodies from pesticides. Yet today, U.S. children continue to be exposed to pesticides that are known to be harmful in places they live, learn and play. This report reviews dozens of recent studies that examine the impact of pesticides on children’s health. Our analysis reveals the following:

- **Compelling evidence now links pesticide exposures with harms to the structure and functioning of the brain and nervous system.** Neurotoxic pesticides are clearly implicated as contributors to the rising rates of attention deficit/hyperactivity disorder, autism, widespread declines in IQ and other measures of cognitive function.
- **Pesticide exposure contributes to a number of increasingly common health outcomes for children, including cancer, birth defects and early puberty.** Evidence of links to certain childhood cancers is particularly strong.
- **Emerging science suggests that pesticides may be important contributors to the current epidemic of childhood asthma, obesity and diabetes.**
- **Extremely low levels of pesticide exposure can cause significant health harms,** particularly during pregnancy and early childhood.

Appendix B page 38 Top pesticides used in agriculture and at home.

Table B-1 “*Most commonly used pesticide active ingredient in agriculture*” and Table B-2 “*Most commonly used active ingredient at home*”; listed by volume of use.

The US pesticide figures don’t add up

On Table 4 page 27, Pesticide usage (in the US) in all market sectors in 2007 is stated to have been 857 million pounds of active ingredient.

This figure is at odds with the US EPA fact sheet published in January 2012 which says that: “approximately 5.1 billion pounds of pesticides are used each year in the United States”...

(The US billion has only nine ‘noughts’ whereas the UK billion has twelve). Even so, there is a huge difference between the 5.1 (US billion) pounds in 2012 and the 857 million pounds that the EPA claimed were used in the 2007 figures for the Kids Health Report. Presumably by only putting in the weights applied for the older pesticides, they could be exonerated from blame for effects on humans, particularly during fetal life, in infancy and in childhood when their organs are at their most vulnerable to toxins. In that case, where were all the other pesticides (and GMOs) hiding? The US EPA has a second list on which all these pesticides appear; the allegedly “*reduced-risk pesticides*” whose

concentrations in surface or ground-water water are not being monitored by any of the environmental protections agencies.

EPA Fact sheet Jan 2012 goes on to state: “A challenge for EPA is to ensure that pest control and pesticide use become increasingly safer each year. To meet this challenge, EPA is promoting safer pesticides and reducing risks through the re-registration process. EPA is also expediting approval of safer, [reduced-risk pesticides](#), and assessing more completely the potential risks of pesticide products, with special protections for infants and children.”

Absent from the list of monitored pesticides are the following neonicotinoid insecticides: imidacloprid, thiamethoxam, clothianidin, dinotefuran, thiacloprid, acetamiprid and all the GMO herbicide-tolerant seeds, most of which have insecticides applied to the seed. Only the old pesticides are being monitored. Lethal new insecticides are hidden from US public view. Similar concealment takes place in Europe. These are the silent killers.

Insecticides in homes and gardens in the US “In 2007, an estimated 78 million pounds of pesticides (measured by active ingredient) were applied in homes and gardens across the country, with the herbicides 2,4-D and glyphosate (RoundUp) topping the list. The household pesticide product industry has an estimated annual net worth of \$1.4 billion; according to US EPA, more than 78 million households—roughly 74% of all households in the U.S.—report using pesticides at home. Our current system of industrial agriculture and pest control relies on chemical inputs sold by a handful of corporations. These multinational corporations wield tremendous control over the system, from setting research agendas to financing, crop selection and inputs throughout the production and distribution chain.

Not surprisingly, these same corporations also hold significant sway in the policy arena, investing millions of dollars every year to influence voters, lawmakers and regulators at both the state and federal level to protect the market for pesticides.

The result is agriculture, food and pest control systems that serve the interests of these corporations well. It does not, however, serve farmers, who have lost day-to-day control of their operations and are putting themselves and their families in harm’s way. Farmworker interests are not served, as workers are continuously exposed to chemicals known to harm human health. And the health of children across the country is compromised by exposure to pesticides used to control pests in agriculture and where they live, learn and play. In short, the system is broken.”

The top six agrochemical corporations are being protected. Do they have an agreement with NAWQA not to monitor their products in surface and groundwater?

The link shows the distribution of imidacloprid on crops in 2002 from the NAWQA website and the maps are at the end of the document, pages 33 & 34.

http://water.usgs.gov/nawqa/pnsp/usage/maps/show_map.php?year=02&map=m3004

The second link shows the distribution of thiamethoxam on crops in 2002.

http://water.usgs.gov/nawqa/pnsp/usage/maps/show_map.php?year=02&map=m248

- 14. Commission Dalli resigns; corruption in Europe.** European Commissioner Dalli resigned on 16/10/2012 because of the results of an anti-fraud investigation (by OLAF). It was nothing to do with pesticides or GMOs, even though one of Dalli’s first actions on coming into office was to lift a 13-year ban on BASF’s GM potato Amflora.

The EU Press statement on 16/10/2012: *“The OLAF report showed clearly that the European Commission’s decision-making process and the position of the services concerned has not been affected at all by the matters under investigation.”*

In Europe, it is business as usual. With Dalli gone, there will still be other lobbyists left to take his place, all determined to get GMO crops and food into Europe.

Corporate Observatory Europe and many other campaigners have repeatedly complained to the European Ombudsman about European Commission’s failure to curb ‘revolving doors’. *‘A large number of senior staff have moved through revolving doors in industry, or vice versa, including as lobbyists, creating potential conflicts of interest’*. The complaint refers to 10 cases which highlight these concerns.

In October 2012, the European Court of Auditors criticised the Commission’s agencies for failing to take adequate action to tackle ‘revolving door’ type conflicts of interest.

(Special Report No 15/2012: Management of conflict of interest in selected EU Agencies). Transparency International has described the *“excessive and undue influence of lobbyists in the European Corridors of power”* as a form of *“legal corruption”*.

Dalli’s portfolio has temporarily been taken on by Vice-President Maros Sefčovič.

When in charge of transparency issues, Commissioner Sefčovič repeatedly rejected concerns from Civil Society Groups urging the Commission to take firmer action against revolving door cases.

29 October 2012

Written evidence submitted by Dr Christopher Connolly, University of Dundee

Summary

1. Pesticides are screened for safety on the basis of their ability to kill individual bees (LD₅₀) but no consideration is given to sub-lethal toxicity.
2. The LD₅₀ is determined for individual bees, not whole colonies.
3. Sub-lethal toxicity does not, necessarily, mean the death of the individual bee.
4. Sub-lethal toxicity may induce a vulnerability to other insults such as disease.
5. Many pesticides target the insect brain.
6. Sub-lethal toxicity in bees may lead to a dysfunction in the brain.
7. Many pesticides are used prophylactically by farmers and in combinations that are not reported.
8. Pesticides can act together by disrupting related targets.
9. All chemicals, be they medical therapeutics or pesticides, exert off-target activity. How this works is unpredictable and need to be tested empirically.
10. Lab tests versus 'realistic' field studies.

Detail

1. The level of pesticide required to kill a bee is important, but misses the real toxicity of compounds. Chemicals may cause chronic damage to insect pollinators (possibly even humans!) if exposed acutely (eg. Asbestos exposure in humans) or chronically (eg. Alcohol/smoking or therapeutic drugs like valium in humans). In both human cases, toxicity is only evident after long periods. Delayed toxicity has now been demonstrated in bumblebees (Whitehorn et al 2012, Gill et al 2012), where pesticide effects require many weeks.
2. For the social insect such as the bees, ants and wasps, it is the colony that is the breeding unit and so it is this that is most important. I accept that it is not reasonable to use whole colonies of honeybees for toxicity studies as this would be prohibitively expensive and flawed by their interaction with a complex environment that cannot be controlled.
3. Nevertheless, in the case of the social insects, individual weaknesses (non-lethal) may have a direct impact on the entire colony and poisons may even be taken back to the colony where they are stored (Mullin et al 2010) and fed to their developing young. As the neonicotinoids are based on nicotine, it is possible that the developmental toxic effects, observed in the human foetus of a smoking mother, predicts similar developmental deficits of bee larvae fed neonicotinoid contaminated food. Societal breakdown could occur at multiple levels, such as, learning (to be efficient in sourcing food), communication (sharing information regarding food resource availability/colony condition), navigation (negotiating their way in the environment)(Henry et al 2012), reproduction (queen only) and behaviour (colony dynamics).
4. Bees (or other pollinators) weakened by pesticide exposure may be more vulnerable to other threats such as disease or mite infestation. In fact the combined toxicity of a pesticide along with a disease is a common strategy of "Integrated Pest Management" as recommended by WHO to tackle malaria (using a fungus with Permethrin), cattle ticks (fungus plus deltamethrin) and maize rootworm (nematode plus tefluthrin). So, it is likely that such interactions occur in our pollinators that are facing multiple chemical and disease stresses. In support of this hypothesis, this possibility is starting to be reported (Alaux et al 2010, Aufauvre 2012, Vidau 2011, Pettis et al 2012, Wu 2012). The mechanistic basis for this is unknown.
5. We know that many pesticides target the insect brain, making the social insects more vulnerable to their exposure. The brain is a plastic structure that relies on changes to drive higher cognitive function, mood and social behaviour.

6. Dysfunction of the brain may not cause gross morphological changes. In fact, dysfunction is more likely to result in subtle changes to the structure and function of synapses (sites of information transfer between neurons and the sites of learning). Synapses can learn to become stronger, or weaker, and so directly impact the efficiency of information flow in that particular circuit. Disturbing this 'plasticity' can lead to alterations in their learning ability and/or affect mood/social interactions.
7. Pesticides are now used as preventative measures, in the absence of any threat to the crop (or pets – eg. Worming). Therefore, the risk to the environment and human health is much greater than necessary. We should not be killing all insects (and so the local ecosystem), only those that have become a problem. In fact, the situation is even worse as the information on what pesticides have been applied (and where and when) is not available. Therefore, should particular pesticide combinations be dangerous, we could never learn from such mistakes. Suppose 10% of local inhabitants are exposed to a cancer-causing combination of pesticides. Ten years later we may (or may not) identify a link with the local environment but would not have access to the information required to make that link. However, if the local use of pesticides were available, bioinformaticians/epidemiologists could correlate local bee losses (we saw a 5% overwintering failure in the west of Scotland and a 20% loss in the east, Fife was particularly bad) with local pesticide use. The identity of the farmers could easily be kept confidential as it is the correlation of pesticide use to pollinator losses that is important. Achieving this important policy change would have a major impact and could fast track scientific research by targeting it to potential causes of the pollinator declines. Such information may also inform on the causes of the many idiopathic, chronic human diseases like the neurodegenerative disease and Irritable Bowel Syndrome in humans.
8. Pesticides can work together at target sites to enhance toxicity. We have tested this hypothesis in our ongoing research programme "An investigation into the synergistic impact of sublethal exposure to industrial chemicals on the learning capacity and performance of bees" (funded by the IPI), with respect to the cholinergic synapse that is targeted by pesticides that; A. Alter the release of acetylcholine (eg. λ -cyhalothrin and τ -fluvalinate). B. Inhibit the removal of excess acetylcholine (eg. Chlorpyrifos and coumaphos). C. Directly stimulate the excitatory acetylcholine receptors (neonicotinoids). Together, chemicals targeting these sites are likely to work in concert to increase the neural deficits or lower the dose required to perturb the neural pathway. Our studies have shown interactions between imidacloprid and coumaphos, at both the level of brain activity (Dundee - manuscript under review, Palmer *et al*) and learning (Newcastle - manuscript under review, Williamson *et al*) in the honeybee, or with imidacloprid and λ -cyhalothrin on bumblebee colony performance (Gill *et al* 2012). Similarly, interactions between coumaphos and τ -fluvalinate have been shown to enhance toxicity to honeybees (Johnson *et al* 2009). Interactions at other synapses are also likely, as well as interaction at other sites (eg. Gut function or chemical detoxification).
9. In addition to the consequences of toxicity due to pesticide effects at target sites, significant off-target activity is also common. This is also true for therapeutic drugs where their use is determined according to their side effects. For pesticides, it is well known that many of the fungicides are much more toxic than anticipated, exhibiting unexpected synergy with other chemicals (Pilling *et al* 1995). We are, using *in vitro* models, researching a particular fungicide that appears to interact with cholinergic therapeutic agents used medicinally to treat Alzheimer's disease patients and women treated for bladder weakness (unpublished data – MRC grant application under review).
10. With respect to the criticism of the validity of all lab studies, past and future, in preference for the more relevant field studies, I consider this claim totally unprofessional and lacking all scientific credibility. Laboratory studies are the cornerstone of all therapeutic drug discovery as they provide a mechanistic description of events that can be controlled and tested experimentally. These studies

identify real and quantified threats. In contrast, field studies are performed in a particular context with an uncontrolled surrounding area. What may be found at one site could be irrelevant to that found at another site. This is especially important given the multiple stresses to which our pollinators are exposed and the likelihood that multiple threats contribute to the pollinator decline. It is true that a laboratory based mechanistic explanation does not confirm that these effects are largely responsible for the pollinator decline. This will require countrywide bioinformatics once we know what pesticides have been used. An isolated field study has limited value.

How do we proceed to put in place more appropriate testing regimes? In the absence of knowledge regarding local pesticide use this will be difficult and should not be permitted. Nevertheless, more interaction of DEFRA with university laboratories is essential to determine these new risks. Key disciplines, such as pharmacology and neuroscience must be included in the assessment process (this is seriously lacking at present). All new compounds should be subjected to these higher standards (sub-lethal and chronic toxicity on both honeybees and bumblebees) before they are released for use. This will require the companies paying (indirectly to avoid any undue influence) for the independent university study.

In summary, we are playing 'Environmental Ker-Plunk', using pesticides to remove insect species (possibly also higher species) and we don't know which species will be lost and how many other species will collapse with them. Eventually, the entire ecosystem will collapse unless we monitor and regulate pesticide use appropriately. With the growing world population, with increasing appetites, we have to learn to live with pesticides, not just ignore them.

26 October 2012

Written evidence submitted by Bee the Change

Submitted on behalf of Bee The Change, Facebook Awareness Campaigners. The campaign has 82,636 members worldwide, including 8,153 new members in the seven days ending on October 29, 2012.

The group is campaigning for effective regulation under the Bees Act 1980 to restrict the import of 'Foul Brood' spore infected honey products and for the immediate ban of neonicotinoid pesticides (acetamiprid, imidacloprid, thiacloprid or thiamethoxam etc). These pesticides are closely linked to Colony Collapse Disorder and are not only available to farmers but can be purchased from Garden Centres, for entirely unregulated domestic (garden) use.

1. The British Bee Keeper's Association (BBKA) was until recently endorsing the use of neonicotinoid pesticides. The organisation was also receiving payment for this endorsement from Agro-Chemical Companies. (McCarthy, January 12 2011).

(a) It is possible to infer that the BBKA may have given erroneous advice, during the period of this paid relationship.

(b) Varroa (honey bee stock depletion) has become established wisdom, despite evidence that Varroa is manageable.

(c) Advice has been to date that the Varroa Mite is mostly responsible for the depletion of bee stocks. However, Varroa management is possible without chemical control and Memorandum #2 (Flores, Sept 11, 2009) shows honey bee adaptations, mitigating Varroa.

2. The use of Agricultural Pesticides is regulated in purchase and use. However Domestic Use (purchased from Garden Centre) is not regulated. Additionally, bees find diverse (flower) forage in urban environments, arguably better than in a (monocultural) Agricultural Environment.

(a) Does DEFRA have jurisdiction over Domestic Pesticide Regulation?

3. The Bees Act 1980 requires that Secretary of State for Environment, Food and Rural Affairs, the Secretary of State for Scotland and the Secretary of State for Wales to agree and decide jointly that a threat is posed to the health of bees. These are now individual powers and devolved to Assemblies

(a) The spirit of 1980 Act of Parliament is towards the protection of Bees from 'pests'. This does not explicitly exclude chemical pesticides, for instance sprayed on gardens/ agricultural areas and where forager bees are able to visit that area (freely). Foragers will pass (as stomach contents) throughout the colony. Chemical may thus be stored in honey, re-affecting the colony at a later time, reducing the statistical correlation of any colony reduction in relation to spraying.

(b) Paragraph 3 of the 1980 Act covers the revocation of licenses to sell chemicals that are a pest to bees.

4. Apiform Colonies, being an organic system, may recover more slowly than expected under removal of any pest threat. This is due to other factors, such as weather conditions which are not under human control.

(a) £1.8bn spending on human hand-pollination (Carrington, April 2012) indicates a financial saving available to the government in the removal

of detrimental factors to Honey Bee Stock.

(b) Pesticides are not the only potential contributory factor to Honey bee decline but it is a controllable one. Responsible agencies are therefore required to use this control as part of protection required due to the Bees Act 1980.

5. Public interest in the area of honey bee decline is increasing. The attached petition gives details on the call by signatories for the banning of neonicotinoid pesticides.

(a) The attached petition shows signatures filtered by country. Additional signatures indicate the worldwide concern over the use of neonicotinoids.

(b) Worldwide pesticide usage demonstrates that there may be no land areas of refuge for pollinator species. (eg. with spraying, seed coating, genetic modification and domestic garden use, many areas of application increases the likelihood of contact with Honey Bee Species, which are irreplaceable.

(c) Please note dangers of 'genetic bottleneck' where reduced numbers of colonies may cause total population crash in the event of colony islandisation, where unmated queens being out of range of male drones from unrelated colonies, if colonies become sporadic and spread out.

6. Petition (as of October 29 2012)

20,362 signatures	(Worldwide)
940	Australia (Commonwealth Country)
808	Canada (Commonwealth Country)
9,436	United Kingdom

To: Department for Environment - Food and Rural Affairs, Secretary of State for Scotland, and the Secretary of State for Wales

We the undersigned, Demand that neonicotinoid insecticides products be withdrawn from general sale in UK supermarkets, hardware stores, garden centres and farm supply stores according to the Bees Act 1980. Anything that contains acetamiprid, imidacloprid, thiacloprid or thiamethoxam must be banned.

Neonicotinoid is a widely used farm pesticide first introduced in the 1990s that has caused significant changes to bee colonies and removing it could be the key factor in restoring nature's army of pollinators, according to two studies released in March.*

Neonicotinoids are a class of insecticides chemically related to nicotine. Neonicotinoid imidacloprid is currently the most widely used insecticide in the world.* The use of some members of this class has been restricted in some countries due to evidence of a connection to honey-bee colony collapse disorder. The pesticide works as a neurotoxin by interfering with the transmission of stimuli in the insect nervous system.

29 October 2012

Written evidence submitted by Dr Robert Paxton

SUMMARY

- Drs Vincent Doublet and Robert Paxton of Queen's University Belfast/Martin-Luther-University Halle-Wittenberg have undertaken laboratory experiments on interactions between a neonicotinoid insecticide, thiacloprid, and pathogens for juvenile honey bee health.
- Both viruses and pesticides have a detrimental effect on honey bee brood development and survival.
- When viruses and pesticides are experimentally administered simultaneously to honey bee larvae at sub-lethal doses, they interact additively and sometimes synergistically, hindering larval development and enhancing larval/pupal mortality.

Reporting text:

As part of the BBSRC (Insect Pollinators Initiative) project 'Impact and mitigation of emergent diseases on major UK insect pollinators' (BB/1000100/1) and the EU funded research project BeeDoc (Bees in Europe and the Decline of Honeybee Colonies; 244956 CP-FP), Drs Vincent Doublet and Robert Paxton of Queen's University Belfast/Martin-Luther-University Halle-Wittenberg have undertaken laboratory experiments on the interactions between a neonicotinoid insecticide, thiacloprid, and pathogens for honey bee health.

Our aim was to examine experimentally and *in vitro* how viral infection and pesticides affect individual larval and pupal bees, and the interactions between viruses and pesticides, so as to identify the main 'driving processes' that cause honey bee mortality.

This research has become all the more relevant because two recent papers have highlighted the role of neonicotinoid pesticides, systemic plant insecticides of growing importance to agriculture, in bee mortality (Henry *et al.* 2012; Whitehorn *et al.* 2012). Other recent papers have also suggested a major role for pesticides, both neonicotinoids and acaricides commonly used by beekeepers to control *V. destructor* mites inside the hive, in exacerbating the effects of honey bee pathogens (Alaux *et al.* 2010; Vidau *et al.* 2011; Locke *et al.* 2012; Pettis *et al.* 2012).

This report details our research aimed at uncovering if and how two pesticides interact with the commonest viral pathogen of honey bees transmitted by *V. destructor* mites, deformed wing virus (DWV), to cause brood mortality and other developmental aberrations. As pesticides, we employed: (i) t-fluvalinate, a synthetic pyrethroid commonly used by beekeepers inside the hive to kill *V. destructor* mites; and (ii) thiacloprid, a neonicotinoid commonly sprayed on oilseed rape and the commonest of this class of insecticide found as a residue inside European beehives. In addition to DWV, we also extended our analyses to examine the effects of the second most common virus in honey bees, black queen cell virus (BQCV), and its interactions with pesticides for honey bee health.

Experimental Protocol

To examine the interaction between pesticides and pathogens, we inject DWV into white-eyed pupae as our DWV treatment. We also undertook a series of parallel experiments in which we fed DWV to larvae on day 2 of larval age as our means of DWV treatment. This had the advantage that DWV is naturally acquired by feeding and its natural site of infection is likely the alimentary canal (ventriculus) of bees. This treatment therefore adds an extra dimension to our experiments on the interactions between DWV and pesticides for honey bee health.

We additionally investigated the impact of BQCV on honey bee larval/pupal health in a further set of replicate experiments. In this case, we fed BQCV directly to 2-day old larvae. BQCV is relatively stable, compared to DWV, facilitating its experimental manipulation and use.

For all experiments described herein, we employed standard methods for honey bee larval/pupal rearing, as described in Aupinel *et al.* (2007). In short, honey bee eggs in brood combs were transferred to a 34°C incubator at 95% relative humidity. As they hatched, eggs were transferred to individual wells of a 48 well microtitre plate and kept in the same conditions as described above. For each treatment (including each control treatment), we used 48 larvae/pupae per treatment. We replicated entire experiments 3 times using honey bees derived from 3 colonies i.e. each replicate used bees from one colony (total 154 larvae/pupae per treatment). A statistical power analysis suggested that these sample sizes would allow us to detect more subtle effects of pesticide-viral treatments than would otherwise have been the case. Mortality of larvae was recorded every day.

After entering the prepupal stage one week after hatching from the egg (see Fig. 1), microtitre plates were held at 35°C and 80% relative humidity till the start of the pupal stage (see Fig. 1). Pupation success and mortality were recorded through to the end of pupal development and emergence of adults.

RESULTS

Experiment 1. Virus (BQCV) + neonicotinoid (thiacloprid) fed to honey bee larvae.

Figure 1 shows the % mortality of larvae/pupae when fed different doses of BQCV two days after hatching and transfer to 48 well microtitre plates. On the upper part of the figure we also give the developmental stage of honey bees to help interpretation. Figure 1 shows that a quantity of 10^9 BQCV causes high mortality. Lower doses of BQCV have no effect on larval/pupal mortality.

In Figure 2, we see the effects of BQCV on development (pupation success). In this case, 10^9 BQCV causes high developmental abnormality (lack of pupation); 10^7 BQCV causes moderate developmental abnormality (reduced pupation success); 10^4 BQCV does not cause developmental abnormality (pupation success is as good as control bees).

Varying doses of t-fluvalinate and thiacloprid were fed directly to larvae across the entire larval period (5 days). In summary, we found sublethal doses of these two pesticides to be:

t-fluvalinate: 1 mg/kg larval food

thiacloprid: 0.1 mg/kg larval food

and we used these concentrations in further experiment, both with BQCV and DWV.

In Figure 3 we show the effect of t-fluvalinate, thiacloprid, 10^9 BQCV and interactions among the three on larval mortality when one or other pesticide is administered with BQCV. There is a clear additive effect of a pesticide with BQCV on larval mortality. If lower doses of BQCV are used in treatments instead of 10^9 BQCV, there is a corresponding drop in larval mortality, as seen in Figure 1, with little additional effect of pesticide + BQCV on larval mortality beyond treatment with either pesticide or BQCV alone (Figure 4).

In Figure 5, we see a similar response of pupae (successful pupation) to treatment with BQCV and pesticides as we saw with respect to larvae and larval survival. In essence, both BQCV and pesticides reduce pupation success, and they seem to act additively. Additivity is particularly marked for the treatment 10^7 BQCV + thiacloprid (Figure 5).

Experiment 2. Virus (DWV) + neonicotinoid (thiacloprid) fed to honey bee larvae.

Figure 6 shows the % mortality of larvae/pupae when fed different doses of DWV two days after hatching and transfer to 48 well microtitre plates. A quantity of 10^9 DWV causes high mortality. Lower doses of DWV have no effect on larval/pupal mortality.

In Figure 7, we see the effects of DWV on development (pupation success). In this case, 10^9 DWV causes high developmental abnormality (lack of pupation); 10^7 DWV causes moderate developmental abnormality (reduced pupation success); 10^4 DWV does not cause developmental abnormality (pupation success is as good as control bees). We note that controls for this experiment exhibited slightly elevated mortality.

As explained above, t-fluvalinate and thiacloprid were fed directly to larvae (t-fluvalinate: 1 mg/kg larval food and thiacloprid: 0.1 mg/kg larval food). In Figure 8 we show the effect of t-fluvalinate, thiacloprid, 10^9 DWV and interactions among the three on larval mortality when one or other pesticide is administered with DWV. There is a clear effect of a pesticide with DWV on larval mortality, and the data suggest the effect is synergistic (more than additive) in relation to DWV + either pesticide. If lower doses of DWV are used in treatments instead of 10^9 DWV, there is a correspondingly lower larval mortality, as seen in Figure 6, with no effect of pesticide + DWV on larval mortality beyond treatment with either pesticide or DWV alone i.e. additive effect, if at all and interactive effect (Figure 9).

In Figure 10, we see a similar response of pupae (successful pupation) to treatment with DWV and pesticides as we saw with respect to the DWV treatment of larvae and larval survival. In essence, both DWV and pesticides reduce pupation success, and

they seem to act additively. Additivity is particularly marked for the treatment 10^7 DWV + t-fluvalinate.

Experiment 3. Virus (DWV) injected into + neonicotinoid (thiacloprid) fed to honey bee pupae.

Figure 11 shows the frequency of honey bees with wing deformity after emergence when injected with 10^3 viral particles of DWV and fed with or without pesticides during larval development. Pupae were injected at day 11 post-hatching. Honey bees were considered as emerged when ready to walk out of the experimental chamber (rearing plate). All treatments, including the injection of 10^3 viral particles of DWV, led to a high frequency of honey bees with deformed wings compared to treatments where bees were injected with a control solution. The effect of pesticides on the frequency of wing deformity when bees were injected DWV is low, though beyond that of controls. The interaction between DWV and pesticide is generally additive and never synergistic or multiplicative.

Conclusions with respect to the neonicotinoid: thiacloprid

BQCV and DWV have profound effects on their hosts, developing honey bee larvae, causing developmental abnormalities and mortality with increasing pathogen loads. A neonicotinoid pesticide (thiacloprid), when experimentally administered at sub-lethal doses to larvae or pupae, generally interacted additively with these two viruses, DWV and BQCV, to elevate mortality and developmental abnormalities. There is even a potentially synergistic interaction between DWV and the pesticide when the virus is fed at high but biologically realistic doses to larvae.

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