

NEONICOTINOIDS AND BEE HEALTH

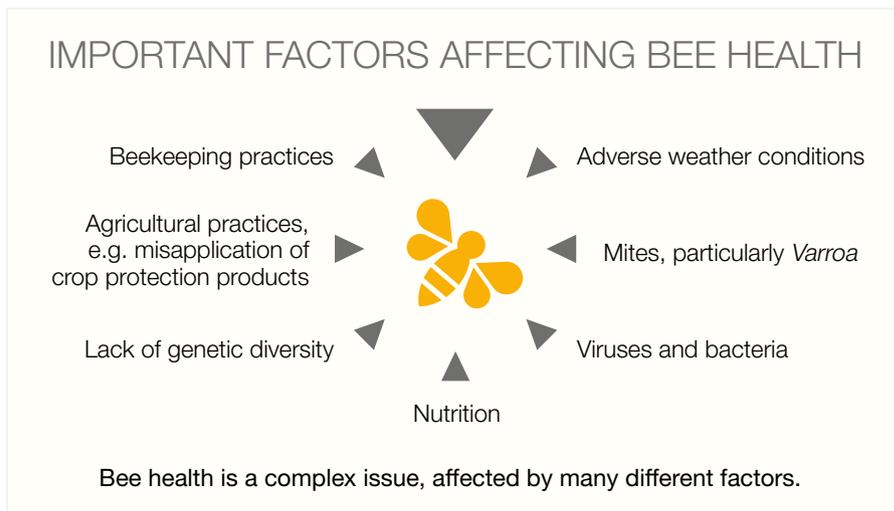
IS THE TIDE TURNING?

More and more bee scientists and specialists are now questioning whether neonicotinoids really are the cause of bee die-offs.

Restrictions on certain uses of neonicotinoids came into force in Europe in December 2013 as a result of the European Commission's concerns, that this group of crop protection products, which is used to control pests that damage field crops such as corn and oilseed rape, might pose a risk to bees. However, was the decision taken prematurely, based on non-conclusive scientific evidence? Since the restriction was imposed, more and more bee scientists and specialists have questioned this mono-causality approach.

"The recent suspension of certain uses of neonicotinoid insecticides was not imposed because they are the main threat to bee health but because they were the only factor that could be quickly regulated by the European Commission."

The author of this quote is not an employee of Bayer or Syngenta, the companies behind the neonicotinoids in question, but an independently minded



EU employee – none other than Dr Michael Flüh, who heads the chemicals unit in the EU Health and Consumers Directorate-General at the European Commission (EC). What he said in April 2014 sheds an interesting light on the decision:

"Pesticides are just one of several factors that are impacting bees. Others such as changing climate, biodiversity, food availability, pests and diseases cannot be tackled through a basic legal act."

So was the EC's decision a classic case of premature political activism? Last December, the restriction seemed to reflect the consensus of scientific and public opinion. But since then, doubts have arisen on many fronts.



The Evidence from Overseas

The uses of some neonicotinoids were restricted in Europe. But if we look at the bee health situation elsewhere, the picture is very different. In New Zealand, for example, a Report on Bee Health¹ published by a Parliamentary Committee in July 2014 stated that “There is currently no evidence of the disorder (ed. Colony Collapse) in New Zealand, although these pesticides (ed. neonicotinoids) are commonly used here as a seed dressing [and] as foliar sprays [...] there is no evidence that these pesticides, when used correctly, are affecting bees’ health in New Zealand [...] when anecdotal evidence of losses is investigated, the causes seem to be mainly *Varroa* or starvation, rather than pesticides.”

In Australia, where neonicotinoid insecticides are also in widespread use, the situation is little different. A symposium organised in April 2014 by Plant Health Australia² and sponsored, among others, by the Australian Pesticides and Veterinary Medicines Authority (APVMA) – a trustworthy government body – concluded that neonicotinoids are unlikely to be presenting any greater threat to honey bees and crop pollination than other pesticides that have been in use for many years. Australia has one of the healthiest bee populations in the world, and significantly the *Varroa* mite is not present in that country. In February 2014, an overview report on “Neonicotinoids and the Health of Honey Bees in Australia”³ published by the APVMA had this to say in the executive summary:

“The introduction of the neonicotinoid insecticides has brought a number of benefits, including that they are considerably less toxic to humans (and other mammals) than the organophosphates and carbamates they have significantly replaced [...]. On the basis of information available to it, the APVMA is currently of the view that the introduction of the neonicotinoids has led to an overall reduction in the risks to the agricultural environment from the application of insecticides. This view is also balanced with the advice that Australian honey bee populations

are not in decline, despite the increased use of this group of insecticides in agriculture and horticulture since the mid-1990s.”

Switching continents to Latin America and the 7th Beekeeping Symposium⁴ held in Temuco, Chile, in July 2014, the microbiologist and bee specialist Dr Karina Antúnez from the Department of Microbiology at the Clemente Estable Institute for Biological Research in Uruguay referred to FAO data⁵ showing that in South America (+86%) and other Southern Hemisphere continents, such as Asia (+426%), Africa (+130%) and Oceania (+39%), there have been huge increases in the numbers of managed honey bee colonies. Moreover, she categorically stated that most of the world’s beehive losses are not due to bee colony collapse but to other factors such as insect diet, increasingly restrictive monocultures, mishandling of hives, pesticides, internal and external contamination, and climate change (e.g. drought). But the number one enemy, she emphasized, was the *Varroa destructor* mite.

Rebounding Bee Colony Numbers

Over the past decade, the trend in the Northern Hemisphere seemed to be exactly the reverse of the Southern Hemisphere – until most recently that is. Recent figures from the USA and Europe indicate that honey bee colony numbers are currently rebounding. An US Federal report⁶ published in May 2014, based on a survey on thousands of beekeepers by the US Department of Agriculture and the Bee Informed Partnership (BIP), found that overwintering losses had fallen by 24% during the winter of 2013-14 and the overall population had increased by 13% since 2008. Dennis vanEngelsdorp, a BIP director and entomologist at the University of Maryland, pointed out that

*“[...] beekeepers that are treating for *Varroa* mites lose significantly fewer colonies than beekeepers who are not [...].”*



Mortality rate of
bee colonies in the
2013/2014 winter
was on average:

(COLOSS)

9%

In July 2014, the independent honey bee protection network COLOSS announced the preliminary results of an international study⁷ to investigate honey bee colony losses in the winter of 2013-14. This study is statistically significant since the 21 countries covered (19 in Europe plus Algeria and Israel) and the 17,135 respondent beekeepers, manage at least 376,754 colonies. The average overwintering loss for all 21 countries was some 9%, the lowest figure since this international working group started collecting data in 2007. The coordinator of the COLOSS Monitoring and Diagnosis Working Group, Dr Romée van der Zee from the Dutch Centre for Bee Research, commented that “the contribution of many factors which are correlated to colony losses seems to be very dependent on weather conditions”.

Doubts About Validity of Lab Tests

In April 2014 a report⁸ published in the journal *Environmental Toxicology and Chemistry (ETC)* reviewed bee health over multiple years and reached this conclusion:

“The epidemiological evidence from Europe shows no correlation of honey bee losses to pesticide use and indicates the presence of causal factors other than pesticides.”

So how come so many previous scientific studies saw a clear causality between neonicotinoids and bee mortality? The ETC study gives us an answer, noting a disjunction between controlled experiments and reports from the field. When force-fed or injected with neonicotinoids, bees have shown disturbing effects. But most entomologists are now cautious about how meaningful such research is. Two studies headed by the Harvard biologist Chensheng Lu, which are often cited by activists, fed bees doses of neonicotinoids that were 10 - 100 times higher than what they encounter in the fields on farms, and for much longer timespans too. Studies monitoring bees in fields, in contrast, have shown little or no adverse effects

of neonicotinoid usage. In an article⁹ published in *The British Bee Journal* in July 2014, Tjeerd Blacquière, Plant Research International of Wageningen University and Research in the Netherlands, had this to say about the neonicotinoid exposure issue:

“Exposures in the field are, in general, at least one but generally a few orders of magnitude lower than the laboratory estimated LD50s (ed. the lethal dose for 50% of the individuals). Surprisingly, the majority of testing is done with dosages close to the LD50s (Walters, 2013). This may be one important cause for discrepancies experienced between laboratory studies and field studies.”

He concluded the article with some important advice for beekeepers and scientists:

“Beekeepers should concentrate on good beekeeping practice firstly, which includes proper Varroa control. And we should, scientists as well as beekeepers and citizens, take care to do proper experiments at relevant exposure rates, and to keep up sober reasoning.”

Professor Ian Boyd, the Chief Scientific Advisor to the Department for Environment, Food and Rural Affairs (DEFRA), the body that oversees pesticide regulation in the UK, also pointed to the lack of rigorous evidence in the neonicotinoids' debate: “The scientific community needs to build a much more rigorous evidence base than it has hitherto seemed capable of providing. It needs to face up to the challenge that there is no real substitution for properly controlled experimental studies carried out at appropriate scales.”¹⁰

In the end, the rhetoric and near witch hunt against the use of these insecticides does not bear close scrutiny.



Scientific Evidence Ignored in Banning Insecticides

After publication in January 2013 of a dramatic risk assessment of the three insecticides by the European Food Safety Authority (EFSA), which concluded that they had found serious data gaps meaning that they could not properly assess if the three neonicotinoids could be used safely near bees, DEFRA decided to re-evaluate existing research and concluded, after an extensive review¹¹ in March 2013, that

“the risk to bee populations from neonics, as they are currently used, is low”.

Nevertheless, DEFRA’s analysis was largely ignored by the European Commission. This is underscored by a landmark study¹² published in May 2014 in the Proceedings of the Royal Society. A group of international scientists led by Professor Charles Godfray and Professor Angela McLean from the University of Oxford analyzed the natural science evidence base relevant to neonicotinoid insecticides and insect pollinators. Their conclusion was that

“there is poor geographical correlation between neonicotinoid use and honey bee decline”.

To cap it all, the most recent peer-reviewed field study on thiamethoxam¹³ (Elston et al., 2014) concluded that “at realistic (mean) exposure rates [...] no adverse impacts on brood production were found.”

Overwintering losses in the USA in 2013-14 declined by 24% from the previous year. Also most Canadian provinces had significantly lower losses than in 2013.

Sources: “The Bee Informed Partnership” and CAPA

A Scientific Beekeeper’s View

In view of the vacillating scientific debate on possible links between neonicotinoids and honey bee colony losses, it is useful to know what beekeepers think. Few beekeepers are themselves scientists, but California-based commercial beekeeper Randy Oliver is a biologist, describes himself as a lifelong environmental activist and writes a respected blog (scientificbeekeeping.com). He has spent a great deal of time investigating the neonicotinoid issue, “reading every scientific paper on neonics in full [...] (and) I often correspond with the authors [...] and visit beekeepers worldwide.” In an article¹⁴ written for The Sacramento Bee in August 2014, he concludes that the “evidence is questionable that pesticide is harming honey bees”. Having come of age shortly after the publication of “Silent Spring” (ed. the DDT issue), Oliver has always been sensitive to the pesticide issue for bees,

“but the truth is that although pesticides have always been an issue to pollinators and wildlife, the main problems that honey bees have to deal with are the viruses transmitted by the bloodsucking Varroa mite [...] and the loss of good forage habitat. Pesticides, though they get a great deal of public attention, are down the list of overall bee problems [...]. The calls for the banning of neonics are based purely on speculation, not good science [...]. The focus on neonics distracts us from more serious environmental issues.”



The eight-legged **Varroa mite** is only 1.6 mm in size but looks threatening under the electron microscope.



One can only hope that the tide is indeed turning towards a rigorous scientific appraisal of the bee health issue based on realistic field studies and sound science, and not just a few laboratory experiments.

What are the Alternatives?

The Commission's decision on the three neonicotinoids has raised the question of what alternatives there are to the restricted insecticides. Neonicotinoids were introduced over 20 years ago as a replacement for e.g. organophosphates, which had displayed some negative effects for the environment and wildlife. Will farmers in the EU be forced to use less user- and environmentally-friendly alternative insecticides for the 2015 season now that they cannot use the neonicotinoid-containing products? One thing is certain: seed-applied insecticides have some additional benefits, as the above-mentioned APVMA report points out: " (An insecticide coating) means that there is much less need for farmers to apply chemicals to the growing crops using in-field sprays [...] which have the potential to lead to a greater spread of the pesticide in the environment." And what would happen if EU farmers decided to do without insecticides entirely – for "environmental" reasons? Given the EU's agricultural surpluses, the majority of people in Europe would not go hungry. However, what may happen if farmers in the so-called Third World were forced to do without pesticides? As Richard Tren, director of Africa Fighting Malaria recently pointed out in the Wall Street Journal¹⁵:

"The relatively wealthy environmentalists in Europe and the USA who buy overpriced organic produce aren't going to feel the pinch soon. But for millions of people in the developing world and poorer consumers in industrialized states, no neonics may mean less food at higher prices."

Since the health of bees, and indeed all pollinators, is of existential importance to farmers as well, what are they saying? Chris Hartfield, the horticultural advisor to the UK's National Farmers' Union and one of their spokesmen, slammed the press in Britain for being "too simplistic in their approach" in "doom and gloom" reporting on neonicotinoids¹⁶.

"Everyone in bee and pollinator health wants a silver bullet but you can't point the finger of blame at a single factor."

The challenges facing bees, he said, are pests and disease, loss of habitat and beekeeping practices.

"The two big losers in this debate," he claimed, "(are) science and bees. We have not found neonics causing harm to bees in real-life field situations."

A potential restriction on the use of neonicotinoids in North America would "devastate North American agriculture and the communities that depend on it", says Dr. Henry I. Miller, a renowned physician and molecular biologist who is a fellow at Stanford University's Hoover Institution and the founding director of the US Food and Drug Administration's Office of Biotechnology. In an article¹⁷ written for the Wall Street Journal in July 2014, Dr. Miller states that "[...] neonics are the last line of defense for Florida's citrus industry against the Asian citrus psyllid [...] (and) the first line of defense in Texas and California [...]. Without neonic protection tomatoes in Florida and vegetable crops in Arizona, California and the Pacific Northwest would be imperiled. If whitefly infestations weren't kept in check with neonics, much of the U.S. winter vegetable production would be lost." Other crops in danger of devastation if neonics were to be banned in the US include grapes in California and the Pacific Northwest, and cotton, rice and soybeans in the mid-South. In all the cases he mentions restrictions on the use of neonicotinoids would gravely endanger the commercial viability of farms in those regions.

In the end, the rhetoric and near witch hunt against the use of these insecticides does not bear close scrutiny. One can only hope that the tide is indeed turning towards a rigorous scientific appraisal of the bee health issue based on realistic field studies and sound science, and not just a few laboratory experiments.



Sources Referred to in the Text:

- ¹ Report on Bee Health, Parliamentary Primary Production Select Committee, New Zealand Parliament (July 2014)
http://www.parliament.nz/resource/en-nz/50DBSCH_SCR56864_1/34a0a5f2526c4db590c2b0330083d8af2313b150
- ² Press release on APVMA Neonic Bee Symposium, Plant Health Australia (April 2014)
<http://www.planthealthaustralia.com.au/experts-come-together-to-consider-pesticide-risks-to-honey-bees/>
- ³ Overview report on “Neonicotinoids and the Health of Honey Bees in Australia”, APVMA (February 2014)
http://archive.apvma.gov.au/news_media/docs/neonicotinoids_overview_report_february_2014.pdf
- ⁴ Report on 7th Beekeeping Symposium, Temuco, Chile (24-26 July 2014) quoted “Apicultura vive fin a su mala racha y presenta un futuro prometedor”, Detalles Publicado el Mertes (29 July 2014)
- ⁵ Aizen and Harder, The Global Stock of Domesticated Honey Bees Is Growing Slower Than Agricultural Demand for Pollination, *Current Biology* (2009), doi:10.1016/j.cub.2009.03.071
<http://www.coloss.org/documents/Aizen-et-al-2009-CurrentBiology.pdf>
- ⁶ US Federal report based on a survey on thousands of beekeepers by the US Department of Agriculture and the Bee Informed Partnership (May 2014) (http://www.ncsl.org/documents/standcomm/scnri/May_3_4.pdf)
- ⁷ Press release, COLOSS Institute of Bee Health, Vetsuisse Faculty, University of Bern, Switzerland (18 July 2014)
<http://www.coloss.org/announcements/losses-of-honey-bee-colonies-over-the-2013-14-winter>
- ⁸ “Risks of Neonicotinoid Insecticides to Honey bees”, *Environmental Toxicology and Chemistry*, Vol. 33, No. 4, April, 2014, quoted by Jon Entine in a *Wall Street Journal* article (5 June 2014)
<http://onlinelibrary.wiley.com/doi/10.1002/etc.2527/pdf> | <http://online.wsj.com/articles/attack-of-the-killer-regulators-1401998535>
- ⁹ “Neonicotinoids and Pollinators, Both in Service of Food Supply”, Tjeerd Blacquièrè, *BBKA News* (July 2014)
- ¹⁰ Blog entry (10 July 2014), Professor Ian Boyd, Chief Scientific Advisor, UK Department for Environment, Food and Rural Affairs (DEFRA)
<https://ianlboyd.wordpress.com/2014/07/10/more-is-sometimes-less-a-response-to-the-hollman-et-al-paper/>
- ¹¹ DEFRA reevaluation of existing research (March 2013)
https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/221052/pb13937-neonicotinoid-bees-20130326.pdf
- ¹² “A restatement of the natural science evidence base concerning neonicotinoid insecticides and insect pollinators”, Godfray et al., *Proceedings of the Royal Society* (May 2014)
<http://rspb.royalsocietypublishing.org/content/281/1786/20140558.full>



¹³ “Sub-lethal effects of thiamethoxam, a neonicotinoid pesticide, and propiconazole, a DMI fungicide, on colony initiation in bumblebee (*Bombus terrestris*) micro-colonies”, Elston et al., (*Apidologie* September 2013, Vol. 44, Issue 5, pp. 563-574)
<http://rd.springer.com/article/10.1007%2Fs13592-013-0206-9>

¹⁴ “Another view: Evidence is questionable that pesticide is harming honey bees”, Randy Oliver, *The Sacramento Bee*, (3 August 2014)
<http://www.sacbee.com/2014/08/03/6594165/another-view-evidence-is-questionable.html>

¹⁵ “The Honey bees Are Just Fine”, Richard Tren, *The Wall Street Journal*, (16 July 2014)
<http://online.wsj.com/articles/neonicotinoids-and-honey-bees-1405537270>

¹⁶ “Hartfield blasts national media over bees”, *Fresh Produce Journal* (28 July 2014)
<http://www.fruitnet.com/fpj/article/162248/hartfield-blasts-national-media-over-bees>

¹⁷ “Why the Buzz About a Bee-pocalypse Is a Honey Trap”, Henry I. Miller, *The Wall Street Journal* (22 July 2014)
<http://online.wsj.com/articles/henry-i-miller-why-the-buzz-about-a-bee-pocalypse-is-a-honey-trap-1406071612>

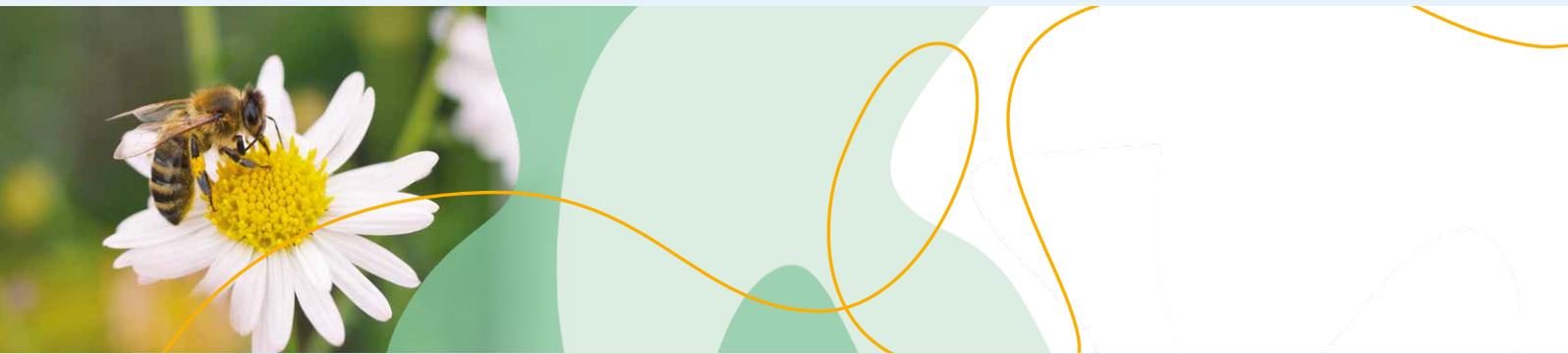
Author

Dr Julian Little, Bayer Bee Care Team

Julian has worked in plant science and crop production for over twenty years. With a PhD in Molecular Plant Pathology from the University of Wales, he joined Rhone-Poulenc as a plant biochemist working in both the UK and France, and then in research project management in Aventis CropScience.

Julian switched to communicating science in 2002 and is currently a Communications & Government Affairs Manager at Bayer CropScience UK. Based in Cambridge, he deals with media, political and public enquiries on the subject of crop production, innovative plant breeding, together with more general issues surrounding pesticide use and sustainable agriculture.





Impressum

HERAUSGEBER _ SEPTEMBER 2014

Bayer Bee Care Center
Alfred-Nobel-Straße 50
40789 Monheim am Rhein | Deutschland
beecare@bayer.com

GESTALTUNG

ageko . agentur für gestaltete kommunikation

DRUCK

HH Print Management Deutschland GmbH

ILLUSTRATIONEN

Bayer CropScience: Seite 1

FOTOS

Bayer CropScience: Seiten 1, 2 rechts, 4 unten, 8

Fotolia: Seiten 2 links, 3 rechts, 5

Shutterstock: Seiten 6, 7



www.twitter.com/bayerbeecare

www.facebook.com/bayerbeecarecenter

www.youtube.com/user/bayerbeecarecenter

