Science AMA Series: Hi Reddit! I'm Richard Pywell, Professor at the Centre for Ecology & Hydrology in the UK and I've just completed the largest field experiment ever to assess the impacts of neonicotinoids on the honeybee and two wild bee species. AMA!

Richard$_{P}ywell^{1}andr/ScienceAMAs^{1}$

[1]Affiliation not available

April 17, 2023

Abstract

Neonicotinoids are a group of pesticides that can be applied as seed coatings and are designed to protect crops such as oilseed rape (also known as canola), but were banned by the EU in 2013 due to concerns regarding their impact on bee health. The U.S. Environmental Protection Agency has issued a registration review for four neonicotinoids which is expected to be completed in 2018. We allowed bees to forage on winter oilseed rape crops treated with neonicotinoids seed coatings on farms in the UK, Germany and Hungary over an area equivalent to 3,000 full-sized soccer pitches. You can read the peer-reviewed paper as published in Science here. http://science.sciencemag.org/content/356/6345/1393 I am on the Sense about Science Plant Science Panel, where anyone can ask a question and get an answer from a scientist. The Panel is made up of over 50 independent plant science researchers. You can ask questions to them on Twitter (@senseaboutsci #plantsci) or Facebook. Answers are sent back within a couple of days and posted online. The Panel has answered over 400 questions during the last five years and it's a great way to cut through the noise around what can sometimes be a really polarised debate. I will be back at 12 pm EDT (5 pm GMT, 9 am PST) to answer all your questions.

the WINNOWER

REDDIT

Science AMA Series: Hi Reddit! I'm Richard Pywell, Professor at the Centre for Ecology & Hydrology in the UK and I've just completed the largest field experiment ever to assess the impacts of neonicotinoids on the honeybee and two wild bee species. AMA!

RICHARD_PYWELL R/SCIENCE

Neonicotinoids are a group of pesticides that can be applied as seed coatings and are designed to protect crops such as oilseed rape (also known as canola), but were banned by the EU in 2013 due to concerns regarding their impact on bee health. The U.S. Environmental Protection Agency has issued a registration review for four neonicotinoids which is expected to be completed in 2018. We allowed bees to forage on winter oilseed rape crops treated with neonicotinoids seed coatings on farms in the UK, Germany and Hungary over an area equivalent to 3,000 full-sized soccer pitches. You can read the peer-reviewed paper as published in Science here. http://science.sciencemag.org/content/356/6345/1393

I am on the Sense about Science Plant Science Panel, where anyone can ask a question and get an answer from a scientist. The Panel is made up of over 50 independent plant science researchers. You can ask questions to them on Twitter (@senseaboutsci #plantsci) or Facebook. Answers are sent back within a couple of days and posted online. The Panel has answered over 400 questions during the last five years and it's a great way to cut through the noise around what can sometimes be a really polarised debate.

I will be back at 12 pm EDT (5 pm GMT, 9 am PST) to answer all your questions.

CORRESPONDENCE:

DATE RECEIVED:
July 11, 2017

DOI:
10.15200/winn.149969.91046

ARCHIVED:
July 10, 2017

CITATION:
Richard_Pywell , r/Science , Science AMA Series: Hi Reddit! I'm Richard Pywell, Professor at the Centre for Ecology & Hydrology in the UK and I've just completed the largest field experiment ever to assess the impacts of neonicotinoids on the honeybee and two wild bee species. AMA!, *The Winnower*

Why was a positive effect found in Germany? Is there an underlying theory explaining how Neonicotinoids can cause lower reproduction in honey bees?

HivemindBuster

A key point to raise first is that the positive effect on HONEYBEES during the flowering period in Germany was short-lived (3-6 weeks) and did not persist through the key overwintering period during the crop flowering period.

We don't know why this temporary positive effect occurred but neonics are used to improve crop health and it may be the case that the crop had more flowers as a result of the protection it got from being treated with neonics.

Unlike Hungary and the UK, where bee health wasn't as good, German hives were more healthy. It looks like they were simply more able to cope with exposure. By analogy, a person who is malnourished or weak is more likely to get sick, the same may be true for HONEYBEES.

4:e149969.91046 , 2017 , DOI: 10.15200/winn.149969.91046

Hello, and thanks for doing this AMA! I have three questions:

1) I hope you could shed some light on the statistics choices in your paper. In your supplemental materials you say: "We did not apply Bonferroni corrections as the lack of independence for the majority of the response variables (e.g. different life stages of honey bee) meant that there was no valid level for the correction."

My understanding is, that when you have this many measurements, it is very important to make appropriate statistical corrections, to avoid the inevitable scenario that some measurements will randomly turn up significant. In your results, you get mostly non-significant results, then a handful of significant differences to both, negative and positive directions. Isn't this what you would expect, when you do not correct for such a large number of measurements?

An agricultural virologist I know has pointed out just this concern:

"This is a serious issue that I'll explain below.

First it's important to understand why correction for taking multiple measurements is vital. The main reason why researchers do this is because when many things are measured, the likelihood of false positives being found increases as the number of measurements increases. To counteract this, researchers will adjust the P-value to limit the risk of false positives (called a Type I error in statistics). The Bonferroni correction is a common method for doing this. It adjusts the resulting P-value so that it is smaller when more measurements are taken. Some researchers do not like it because it tends to be more conservative; however, not using it, or other methods for correction of multiple tests, introduces false positives in research.

In the supplemental materials and methods, the researchers claim that they were not taking independent measurements. However, this is not entirely accurate. The best way to describe these measures is semi-independent. As an example, the number of brood and their health directly impacts the future number worker bees and the survival numbers the next winter. However, the number of workers the following winter does not impact the number of brood the previous spring. Furthermore, their reason for not using Bonferroni Correction does not make sense as the measurements are semi-independent. The Bonferroni Correction is only one method to reduce the rate of false discovery. This method may or may not be correct in this case, but there are other methods for correcting the false discovery rate of dependent data. It is very risky to not perform any correction of large data sets like this when there are so many measurements being taken. It really doesn't look like a statistician was consulted for this paper and the quality suffers as a result. "
http://themadvirologist.blogspot.ch/2017/07/bees-neonicotinoids-statistics-and.html

Did you have statistical consultation on the study when it was set up, or when you analysed your results? If you analyse them using Bonferroni or similar corrections, would you still see significant findings?

2) Connected question is, if you do think your results have causatively suggestive power on the specific effect of neonicotinoids, how do you explain the beneficial effects? Say, in the UK, clothiadinin appeared to negatively impact storage cell numbers, whereas thiametoxam appeared to boost them? Looking at the raw data table released from Syngenta, it also appears that clothiadinin was responsible for almost all the negative effect, whereas thiametoxam results returned mostly beneficial impacts. Do you think this a real effect, and if so, how do you think neonicotinoids might achieve such an effect?

3) The third question I am concerned about, is bee disease. There is a lot of research highlighting bee pests and pathogens as one of the largest, if not the largest factor negatively affecting bee health.

You report that some colonies were wiped out by the varroa mite entirely in the UK, where you found bee health was generally shakier. Did you monitor and treat your hives for Varroa? Did you track the presence of viral or bacterial infections? Wouldn't this be important information to have at hand,

considering the large impact of bee diseases, evidenced also by the colony losses of the study hives?

Thank you very much in advance for your answers.

Thoughtscapism

Firstly we have a professional statistician on this project, see his blog on some of the criticisms https://www.ceh.ac.uk/news-and-media/blogs/robust-statistics-explain-findings-neonicotinoids-field-experiment. This has been a carefully though out and study with a comprehensive and robust analysis. Ill answer your questions below.

1) Bonferroni corrections are an issue that often causes debate in science. The idea is that is you find a result that is significant you have a 1/20 change that the significant result may be non-significant. The more tests you do the more likely by chance a significant results may in fact be non-significant. Bonferroni corrections create a more strict threshold for significance that increase with the more tests that you do. The problem is that in many studies lots of tests are undertaken though the life of an experiment, and this does not include those presented in the paper. Exploratory analyses, model simplification, analyses in reports, what you present in the paper. All of these involve tests. Even when you think about a single paper in a journal should Bonferroni corrections be applied to all the tests in that paper, all the tests undertaken in that issue of the journal or if you wanted to extend this to perhaps silly levels all the tests ever done. In a quote form Morran (2003) the issue is 'The irony of the sequential Bonferroni correction (and multiple tests in general) is that as one performs more detailed work, the probability of finding anything significant declines dramatically. It therefore produces a paradox (one could call it a hyper-Red Queen phenomenon): the more research one does, the lower the probability that a significant result is discovered'. Particular in ecological studies Morran makes the argument for interpreting each result individually so that 'researchers should use the accepted $p < 0.05$ cut-off and make reasonable interpretations based on experimental design, power analyses, differences between control and treatment groups, and basic logic'. We believe that particularly in the case of impacts of pesticides it would be very easy to discredit significant effects of pesticides using a Bonferroni approach, while a sensible case by case interpretation of the result provides the public and policy makers with the information that is relevant and pertinent to the issue in question. They are then free to interpret our findings in combination with the large amount of other evidence out there. It is right that these issues should be raised but we feel that the alternative of effectively ignoring impacts on key metrics of honeybees (as identified by the regulatory body EFSA) need to be weighed against the strict application of such multiple test criteria. From an industry perspective it's a very convenient way of ignoring key results on primary measured of honeybee colony success by simply asking for lots of tests to be undertaken in their report. (Ref: Moran M.D. (2003) Arguments for rejecting the sequential Bonferroni in ecological studies. Oikos, 100, 403-405.) 2) It does appear that clothianidin has a worse effect than thiamethoxam. Label application rates (i.e. what they recommend to the farmer to apply) which we used in the study for clothianidin are generally much higher than thiamethoxam, and indeed clothianidin was the only product we found to be expressed clearly in the crop more often in those sites treated with this product. It is outside of the scope of the study, but application rates may have an important effect in determining expression in the crop and impacts on bees. Lower application rates of thiamethoxam may also mean that its expression when the crop is flowering may be very low or absent, and so while it has a positive effect in general on the crop its subsequent effect on bees under real world conditions may be negligible. Indeed a healthier crop may benefit bees if the expression of the pesticide has reduced to a very low level. This study builds on a mountain of research that has gone before. We don't answer all the questions, but rather we aim to identify what happens in real world situations at scales relevant to bees. The research that has gone before has been crucial in identifying the mechanisms by which neonicotinoids can negatively impact on bees, although as much of this is not based on field studies this has often been criticism by industry as being unrealistic. Together our work and the previous research compliments each other. 3) Ultimately we can only make inferences based on our work about why countries were different in the way they responded to neonicotinoids. Our study was not set up to test for effects of bee disease, however we did identify

between country differences that provide a potential explanation of why we find negative effects in some countries (Hungary and the UK) and no or even positive effects elsewhere (Germany). We did monitor viral infections although this is to be considered in a subsequent paper. The strongest between country differences however related to Nosema and Varroa. Some interesting papers on the impacts of disease and pesticides to look at are : Sanchez-Bayo F., Goulson D., Pennacchio F., Nazzi F., Goka K. & Desneux N. (2016) Are bee diseases linked to pesticides? - A brief review. Environment International, 89-90, 7-11; Moffat C., Pacheco J.G., Sharp S., Samson A.J., Bollan K.A., Huang J., Buckland S.T. & Connolly C.N. (2015) Chronic exposure to neonicotinoids increases neuronal vulnerability to mitochondrial dysfunction in the bumblebee (Bombus terrestris). Faseb Journal, 29, 2112-2119; Fairbrother A., Purdy J., Anderson T. & Fell R. (2014) Risks of neonicotinoid insecticides to honeybees. Environmental Toxicology and Chemistry, 33, 719-731.

Our CEH paper can be found at http://science.sciencemag.org/content/356/6345/1393

[removed]

[deleted]

Our study has shown the value of multi-country studies on this issue and may explain the inconsistencies seen from previous single country experiments. We would therefore agree that studying impacts of neonicotinoids on bees colonies that don't really winter would be an interesting addition to the knowledge base.

At the moment no plans or funding to extend the study to consider bee health and differences between bee races, though these may have important effects on resilience to disease and pesticides.

My question is why did this study ignore the 238 results that found no effect of the neonics on bees to focus on the 9 that found a negative one? Aren't these 238 results pretty significant considering they're in line with what other field studies of neonic effects on bees have found?

Thanks for doing this AMA! Super important research.

emrducks

That's a really good question. EFSA (who are the governing body that regulate pesticides in Europe) have very specific ways of assessing whether pesticides have an effect on bees. They consider three things that are of key importance (their primary assessment endpoints). These key factors are: 1) colony strength (number of bees), we present this in the paper and show a negative effect on honeybees; 2) overwintering success, we present this in the paper and show a negative effect of neonicotinoids on honeybees; 3) forager mortality. This is the only thing we don't look at as you need to use small microchips (rfid tags) on bees to look at their movement in and out of hives which was beyond the scope of our study (we had too many sites to use this method). However, Henry in a paper in Nature in 2012 conclusively showed neonicotinoids negatively affect forager mortality using this approach. In our paper we focus on the key measure of honeybee hives which the regulatory body identify as being crucial, this is not cherry picking results but focusing on what is important to understanding impacts on honeybees.

Some of this is discussed on our blog, along with other 'criticisms' of the study. https://www.ceh.ac.uk/news-and-media/blogs/robust-statistics-explain-findings-neonicotinoids-field-experiment

Also have a listen to a BBC programme called INSIDE SCIENCE where we discuss this http://www.bbc.co.uk/programmes/b08wmk5x

The basics of our experimental design is illustrated in an infographic at https://www.ceh.ac.uk/impacts-neonicotinoids-honeybees/impacts-neonicotinoids-honeybees

The paper to our study can be found at http://science.sciencemag.org/content/356/6345/1393

What can I, as a regular Jill with a garden and a yard, do to help out the bees?

Rhizoma

It's great you're thinking of this. We have a great guide for farmers and land managers that you can download for free at https://www.ceh.ac.uk/book-habitat-creation-and-management-pollinators

Here's our some simple tips for you: 1. plant bee friendly flowers such as lavendar, 2. Give bees shelter and hibernation sites by letting the grass grow and installing bee hotels 3. Plant a mix of bee-friendly seeds and grow plants, fruit and veg such as hazel, holly and pussy, or willow, apples, pears, borage, strawberries and loads of others. A nice summary can be found here https://www.rhs.org.uk/science/conservation-biodiversity/wildlife/encourage-wildlife-to-your-garden/plants-for-pollinators 4.Plant through the seasons to provide year-round bee habitat

Thanks for doing this AMA! I really enjoyed the coauthored study. I think it adds to this ongoing discussion; however, I was wondering if you would like to reply to some of the criticism to this study that is floating around the popular news sites and blogs.

Namely, the critics who have looked at the raw data do not think the conclusions made to popular news sites by you and some of the other authors are backed up by your data.

I know this is typically not how legitimate major scientific criticism is levied against peer reviewed papers, especially a Science pub, but that does not mean they are necessarily wrong.

Or is this image from the Slate article accurate? "What patterns emerged when examining the entire data set? Here is a chart assembled from data supplied to the research funders by the CEH (but not released in the published study) with the findings summarized (light green indicates “no impact,” red points to “negative impact,” and dark green suggests neonics had a positive impact)."

Criticism links here:

Do Neonics Hurt Bees? Researchers and the Media Say Yes. The Data Do Not.

Neonic Study Makes A Splash In The Headlines But Trashes Science

New Study Finds Neonicotinoids May Have Harmful, Beneficial, or No Effect on Bees

http://i.imgur.com/PzwnAbc.jpg

albopictus

We reply to these criticisms in detail our blog and in the recent interview by my colleague Dr Ben Woodcock on BBC inside Science:

https://www.ceh.ac.uk/news-and-media/blogs/robust-statistics-explain-findings-neonicotinoids-field-experiment

http://www.bbc.co.uk/programmes/b08wmk5x

Please also see other responses in this AMA.

Finally, we would re-state that our findings were published in a high ranking, peer-reviewed journal. This can be found at http://science.sciencemag.org/content/356/6345/1393

Do you agree with a ban on neonicotinoid seed dressings, given that many farmers will just increase their use of insecticides and pesticides instead to combat pests such as flea beetle?

Would a ban help bees or make things worse for them?

Whatsoup

This question is one for regulators and policy makers in the EU. Our real-world study has added significantly to the evidence base available to regulators to inform this decision. We would also recommend that similar, detailed studies are undertaken on the impacts of alternative pesticides on pollinators and other non-target organisms. This would help balance any policy decision.

If neonicotinoids are banned they will be replaced by other insecticides. Are replacements better or worse? - David Bertioli on Twitter

senseaboutscience

We provide the evidence base to inform policymakers. It would be harder to grow oilseed rape without using insecticides where necessary. It is important to study the impacts of alternatives to neonicotinoid seed treatments on target and non-target organisms so that policy makers make the most appropriate choice.

As I understand it, you found no detectable neonic residues in your hives 95% of the time. Is that right? I don't think you even found many neonic residues in samples taken directly from the flowering crops.

If this is right, how could something that is virtually non-existent have the extremely powerful negative effect you ascribe to it. And don't your findings actually confirm what many have said before this, that by the time the plants are at flowering stage there isn't much neonic left from the seed treatments?

lizzietishthefish

Due to the cost of residue analysis and the scale of the study we took limited samples from individual honeybee hives. Also, hives can be huge, with up to 60,000 bees in them and it's likely that the distribution of neonicotinoids in them may be very spatially complex. We don't think the sampling we did was sufficient to understand this variability and may have failed to detect some residues in the hives. The biological impacts on the honeybees reflect whole hive usage of these resources, including potentially spatially aggregated neonicotinoid residues that we failed to pick up with our sampling. For the bumblebees and solitary bees the colonies were relatively much smaller. Our residue sampling from these two species was from a far greater proportion of their stored hive products than we achieved for the honeybees. It was for these two wild bees species that we found negative correlations with neonicotinoid residues in the nest.

Finally, we did detect clothianidin residues in nectar and pollen expressed by crops treated with this pesticide. It is worth noting that neonicotinoids can have toxic effects very close to the concentration where you cannot reliably detect them using analytical methods. It is quite possible that over the course of a whole season low concentrations of these pesticides may have a cumulative negative effect on honeybees.

What's behind the markedly different effect in each country? Are there differences in policy, nearby pesticide application, or Varroa mites that may be behind it?

Also, the outcomes were very different for each pesticide. Are some neonicotinoids more dangerous than others?

Imhotep_Is_Invisible

We did find country-specific effects. We suggest that the differences, at least in part, may be due to differences in disease pressure and the degree to which Honeybees forage on oilseed rape i.e. in Hungary and the UK pollen loads comprise 40-50% oilseed rape pollen, where as in Germany they comprised 14-15% oilseed rape.

We did find that clothianidin generally had more negative effects on honeybees and wild bees compared to thiamethoxam.

Hello Dr. Pywell!

I'm an undergraduate student in biology in the us and I just finished writing a term paper on honey bee losses throughout the world, it's potential causes, and future plans of action to reduce these winter die offs.

In writing my paper, I found that habitat destruction from the agricultural industry was actually having a significant effect and that encouraging integrated pest management or more ecosystem friendly farming practices had a significant positive effect on bee populations. The following is a small point from my paper on this topic:

"A recent study found that catch crops or brush gradients around farms where wild flowering plants are allowed to grow can significantly increase bee health, specifically vitellogenin levels, which are linked to higher over wintering survival rates (Alaux et al., 2017). Even more promising, it was found the bees of the bombus genus also significantly benefitted from high quality landscapes and habitat around farmland and that over wintering survival rates increase dramatically in these environments (Carvell et al., 2017). Therefore, if we could incentivize and educate farmers to restore the habitat around their farms or use catch crops, we could boost the local bee populations in agricultural regions. This restoration could also significantly boost the agricultural industry since a higher density of bee populations would likely lead to increased agricultural output."

My question is, given the difficulty of passing regulations on insecticides in the US, and other nations, do you believe that a focus on habitat protection and restoration of farmland areas, as I described above, would truly be beneficial for bees while waiting for legislation? Or do you believe that there are larger threats that we should focus on first?

Thank you for all your great research and your time in doing this AMA!

Bio_is_life

Hello,

you make some excellent points.

We believe that it is important to understand the causes of bee decline and how these factors interact. This knowledge should be the basis for formulating land management policies to benefit bees.

That said it is widely accepted that habitat loss (and the loss of floral resources) is one of the major causes of long-term pollinator decline that predate the introduction of neonicotinoids. Therefore creating habitat for pollinators is likely to be a good thing see Carvell et al. 2017

(http://www.nature.com/nature/journal/v543/n7646/full/nature21709.html).

I am not a beekeeper at the moment, but I hope to be one in the future when I am older with some money and land. What are some practices I can start now to help promote bee population growth? I have seen lists of plants to grow that help bees, but I wanted to know if there is anything else I can do!

21YearOldCaregiver

Please see our free to download book Habitat Creation & Management for Pollinators (free book): www.ceh.ac.uk/book-habitat-creation-and-management-pollinators

Thanks so much for dedicating your life to research like this.

Do you anticipate your research will lead to a change in attitudes or regulations regarding neonicotinoids in the USA? Why or why not?

beastcoin

Our role has been to provide the evidence base for policy-makers. Our research for example will be shared with the European Food Standards Authority which is due to make a decisions relating to the current moratorium on the use of neonics in Europe on mass-flowering crops at some point this year. I guess US policy-makers will also take note of our work too.

After reading the study summary in Science, I wondered whether it was possible that some of the other substances you used was what harmed the bees? Like, why did you use a pyrethroid in the clothianidin sites but not the control sites or the thiamethoxam ones? Could the pyrethroid be what harmed the bees in the clothianidin sites? Also why did you use different fungicides instead of the same ones everywhere?

I'm not a scientist but when I was in school they said that everything else had to be the same in an experiment so you knew what was possibly causing the differences between the control group and the others.

emrducks

Our study was as close to the real-world as possible and so we used formulations available to farmers. Hence the different seed treatment formulations. We did apply a fungicide to the untreated control seeds to account for this.

The pyrethroid applied in the Modesto seed treatment follows the commercial formulation and was to protect the seed from pest immediately following sowing. Unlike neonics it does not move into the plant tissue as it grows and won't be expressed in the nectar and pollen - the mechanism which exposes pollinators to risk from neonics.

We looked at two commercially available seed treatments that contained either one of 2 neonics as we were looking at the effects of these active ingredients under REAL_WORLD farming conditions.

We found effects.

In your opinion, would GMO plants engineered to produce BT pesticide be a better or worse option than using neonicotinoids? Why or why not?

EDIT Rephrased question

fire_snyper

Hard to say without proper comparative studies

Are there some pollinating insects that are better adapted to handle our pesticides than others?

berkarov

It depends on the degree to which the different pollinator species feed on crops treated with neonicotinoids compared with other flowers in the landscape. In a study published last year we showed that species feeding on oilseed rape were more impacted by neonicotinoids than than those that did not feed on this crop. https://www.nature.com/articles/ncomms12459

Can you summarize your findings in layman's?

jeradj

These are the four key findings from our study:

1. First evidence of negative effects of a neonicotinoid on honeybees from a field experiment
2. Clothianidin was more often expressed in the crop and resulted in most negative effects
3. Variation among countries: suggesting effects are influenced by factors such as bee disease & diet
4. Negative effects on wild bees (bumblebee and solitary bee) linked to neonicotinoid residues from across the landscape

Have you thought or read at all about the possibility of probiotic use as a way of countering the effects of pesticides on honeybees. I'm a grad student from the university of western Ontario and a colleague of mine recently published a paper showing lactobacillus can prevent the death of drosophila due to infections after being exposed to neonictinoids (specifically imadocloprid). And actually increases survival time compared to those not exposed to pesticides at all.

dwatso94

That's an interesting idea. In our study we simply treated bee diseases to reflect typical husbandry in the study countries.

The whole way of better managing disease to make them more resilience would be an interesting are for further study.

Can better quality and location of pollinator strips offset the impact of neonicotinoids or their deadly successors?

senseaboutscience

Sowing a variety of flowers attractive to pollinators that provide season long forage resources may well help off-set the impacts of neonicotinoids - see https://www.ceh.ac.uk/book-habitat-creation-and-management-pollinators However, the degree that this would mitigate the risks to bees would require careful research and monitoring.

How does the seed of a plant being coated in an insecticide protect the plant once fully developed? Wouldn't the insecticide need to be reapplied?

berkarov

A common way of using neonics is as a seed treatment. Each seed is coated with neonics and once planted, the chemical is absorbed by the plant and distributes through all tissues at concentrations that can kill insects that eat the plant The problem is that, neonicotinoids can also move up to the nectar and pollen where they can be consumed by pollinating insects.

For oilseed rape, the neonic was looking to control cabbage stem flea beetle during the autumn (fall in USA!) growing season so it didn't need to be applied.

"Our results suggest that exposure to low levels of neonicotinoids may cause reductions in hive fitness that are influenced by a number of interacting environmental factors."

Are these interacting environmental factors known, or is this yet to be determined?

These results appear to suggest that the neonicotinoids themselves make the hive susceptible to these stresses, yet it is not clear in your research, what exactly it is that causes this vulnerability?

Is it possible that the bees themselves vary in behavior from country to country, thus changing how the pesticides effect them? For instance, Varoa mite research demonstrated that bees from different regions of the world have different hygienic behaviour. Though this may not have the same effect on particulate matter, it does demonstrate the potential for behavioral variation that could effect how they respond to the pesticides in question.

Are the pesticides effected by the honey making process? I.e. the dehydration and enzyme activity?

What are your plans for research going forward? Will it pertain to bees?

Finally, I'd like to thank you for sharing this information with Reddit, it's wonderful to see researchers such as yourself reach out to the public with your information and explanations. I appreciate your efforts and thank you for undergoing this research project!

DubiousDastard

From our study we inferred a number of possible factors likely to interact with neonicotinoids to cause negative effects on bees. These inferences were based on the literature but does not mean they are the only possible factors interacting with neoncs.

These include 1) honeybee diet (the degree to which the bees forage on oilseed rape and risk exposure to neonics - in the UK and Hungary pollen loads comprised 40-50% oilseed rape, in Germany only 15%) and 2) bee health - German bees were generally healthy, UK and Hungarian bees had relatively higher loads of bee parasites (Varroa mite and Nosema).

We did not undertake detailed studies of bee behavior so cannot comment on your point regarding this - though this certainly would be an interesting area of research.

Going forward we are looking into the development of sustainable farming practices that include the support and enhancement of pollinators within intensively farmed landscapes. See ASSIST project www.ceh.ac.uk/ASSIST

If this was the largest field experiment ever, whose record did you break? And was the size of your

experiment necessary to accomplish your goal? Do bees and their reactions to the environment really change that much over three countries?

Thanks for the AMA

ImOkayDontWorry

Our study only adds to the important work that has gone before (from lab, to field to landscape). The previous big field study was undertaken by Maj Rundlof in Sweden. this study also identified negative effects on bees, but was focused on only one country. What our study did was consider multiple countries under one common experimental framework.

What are the most common misconceptions that you feel like you have run into regarding colony collapses?

sandernista_4_TRUMP

Sorry, we didn't look at colony collapse as part of the study.

What can we do to help save the honeybees?

WeirdoWithABeardo-

t's great you're thinking of this. We have a great guide for farmers and land managers that you can download for free at https://www.ceh.ac.uk/book-habitat-creation-and-management-pollinators

Here's our some simple tips for you: 1. plant bee friendly flowers such as lavendar, 2. Give bees shelter and hibernation sites by letting the grass grow and installing bee hotels 3. Plant a mix of bee-friendly seeds and grow plants, fruit and veg such as hazel, holly and pussy, or willow, apples, pears, borage, strawberries and loads of others. A nice summary can be found here https://www.rhs.org.uk/science/conservation-biodiversity/wildlife/encourage-wildlife-to-your-garden/plants-for-pollinators 4.Plant through the seasons to provide year-round bee habitat

Since you've found the neonicitinoids have slightly different impacts depending on the country, do you think this will prompt more studies in other countries, or even comparing different regions within a country?

Also in your opinion, what would be the best way to move forward in the UK - is an immediate full ban on neonicotinoids needed, or would a gradual phase out be enough to make a difference if combined with pro-bee schemes like wildflower planting?

AlonsoQuixano

this is a good question. Its important to say first of all that the bees of Germany which were not affected by neonics are not special in themselves. Rather the sites we used in Germany happened to be in good landscapes for bees providing lots of non-crop flowers and the hives we sourced from a commercial dealer in Germany were just more healthy than those in other countries. It's reasonsable to assume that sick bees in poor landscapes lacking flowers would, in any country, be likely to show negative responses to exposure to neonioctinoid treated oilseed rape. However, more studies in more countries would always help.

Did your study look at the effects of neonicotinoids on other invertebrate pollinator species? I'm sure you're aware that bee species are only one part of the pollinator community and I'd be really interested on the more widespread effects of neonicotinoids. Thanks for doing this AMA, I'm a graduate biologist and ecologist and I find it really satisfying to see work like yours get the publicity it deserves.

DeezNewtsBruh

In this study we only looked at honeybees, buff-tailed bumblebees and red-mason bee. This is because all these three species can be easily manipulated. In a study we undertook last year we did look at impacts on whole communities of wild bees in the UK. Have a look at this https://www.nature.com/articles/ncomms12459. Also Dave Goulsons group has looked at impacts on butterflies https://peerj.com/articles/1402/). However, hoverflies do remain one of the key groups of pollinators impacts of neonicotinoids have not been considered in any detail.

What is it about this group of pesticides that causes colony collapse disorder?

azahran1790

their are many theories on what cases colony collapse disorder, neonicotinoids may be one of these but they are unlikely to be the only cause. The systemic nature of neonicotinoid seed dressings results in the expression of their residues in nectar and pollen. Neonicotinoids can be expressed in the flowers of crops thought the growing season, so bees can be exposed to these pesticides for long periods of time. The accumulation of these residues in honeybee hives over long periods of time (potentially in combination with other stresses) and may affect colony survival.

As a layperson in terms of ecology, what is the single most useful thing I can do to help save the bees (besides voting for people who want to ban neonictinoids)? I live in the US.

SerenityNow312

t's great you're thinking of this. We have a great guide for farmers and land managers that you can download for free at https://www.ceh.ac.uk/book-habitat-creation-and-management-pollinators

Here's our some simple tips for you: 1. plant bee friendly flowers such as lavendar, 2. Give bees shelter and hibernation sites by letting the grass grow and installing bee hotels 3. Plant a mix of bee-friendly seeds and grow plants, fruit and veg such as hazel, holly and pussy, or willow, apples, pears, borage, strawberries and loads of others. A nice summary can be found here https://www.rhs.org.uk/science/conservation-biodiversity/wildlife/encourage-wildlife-to-your-garden/plants-for-pollinators 4.Plant through the seasons to provide year-round bee habitat