



entomology
today

BROUGHT TO YOU BY THE
ENTOMOLOGICAL SOCIETY OF AMERICA



☆ **Topics:** Research News • The Entomology Profession • Amazing Insects • Science Policy and Outreach

Glyphosate and Acetamiprid Have Relatively Low Toxicity for Honey Bees

ENTOMOLOGY TODAY | OCTOBER 13, 2015 | 36 COMMENTS

By **Andrew Porterfield**

Honey bees are crucial for pollination and crop production worldwide. But since episodes of Colony Collapse Disorder began arising in the mid-2000s (and have subsided somewhat), the causes of costly



deaths of adult bees have focused on mites, viruses, and a number of pesticides.

One group of pesticides, the neonicotinoids, has been singled out for regulatory action in several European countries, and regulation is under consideration in the United States. Most of the studies that were conducted previously gathered their data from topical applications of the test chemicals, by testing only the active ingredients, or by using artificial feeders with the pesticide in a sugar solution, none of which provide appropriate measures of the amounts of pesticide exposure in the field.

In September, however, researchers from the U.S. Department of Agriculture's Agricultural Research Service and Mississippi State University reported that they tested 42 commonly used pesticides in a more realistic field setting on cotton row crops. They essentially mimicked a situation where an adult bee in a cotton field accidentally gets sprayed. Furthermore, the researchers used pesticides that were in the actual commercial

formulations that would be used by farmers in their fields. This is an important distinction because most previous research tested the active ingredients only, which did not include other chemicals that influence the distribution, absorption, and overall exposure of the pesticides to plants and bees. Their work appears in the *Journal of Economic Entomology* (<http://dx.doi.org/10.1093/jee/tov269>).

Using a modified spray tower to simulate field spray conditions, the researchers found that 26 pesticides, including many (but not all) neonicotinoids, organophosphates, and pyrethroids killed nearly all of the bees that came into contact with the test pesticide sprays. However, seven pesticides, including glyphosate and one neonicotinoid (acetamiprid), killed practically no bees in the tests.

The pesticides tested included 40 insecticides and miticides, one herbicide (glyphosate, better known by its trade name "Roundup"), and one fungicide (tetraconazole). What made this study more realistic was not only the field spray application of each pesticide, but also the interpretation of data. The researchers determined the lethal concentration and lethal dose of each pesticide (to determine chemical toxicity), and then matched those numbers with the amounts of pesticide actually used in agriculture. In this way, they could rank pesticides by individual chemical toxicity as well as by how much they are used in the field. Chemicals that were not used as much ranked lower despite toxicity, while chemicals that were used more tended to rank higher.

The majority of row crops in the U.S., such as cotton, soybeans, and corn, are transgenic, which has reduced the harm from chewing insects, but has refocused pesticide applications to target sucking insects. These pests include the tarnished plant bug (*Lygus lineolaris*) and various species of stink bugs. This refocus, together with an increase in resistance to insecticides by some targeted insects, led to more widespread use of leaf sprays of insecticides. That practice, in turn, has boosted the risk of honey bee exposure to these pesticides.

The new data show that a number of pesticides are available, including the neonicotinoid acetamiprid, that could be used to control tarnished plant bugs, stink bugs, aphids, and mites, without causing much (if any) harm to bees. It also calls into question some regulatory measures that focus only on neonicotinoids, since organophosphates, pyrethroids, and carbamates together comprise the 26 commercial pesticides that pose a significant threat to honey bees. Also significant was the low-toxicity ranking of glyphosate, the world's most-used pesticide, which has been targeted for its use on fields with genetically modified "Roundup-ready" crops that can resist the herbicide.

A number of surprises also appeared in the study. First, an insecticide called sulfoxaflor was found to be near the middle in terms of toxicity. This is important because the EPA's approval of sulfoxaflor was recently overturned by the U.S. Ninth Circuit Court of Appeals.

In fact, it was found to be less toxic to bees than permethrin, a pyrethroid insecticide that is used in agriculture, household pesticide products, flea shampoos for pets, and in head lice products for people.

Also, four pesticides (methoxyfenozide+spinetoram, carbaryl, indoxacarb, and 1-cyhalothrin+chlorantraniliprole) that had been considered moderately toxic to bees were found to be higher risk when field-application concentrations were considered. Finally, one pesticide, gamma-cyhalothrin, which was considered to be a high-risk chemical, was found to be only an intermediate risk because its field use rate was relatively low.

Field spraying of insecticides and other pesticides may effectively kill insects, including valuable honey bees, and the risk to honey bees can be reduced by selecting pesticides with lower toxicity in field applications. This study determined that a number of pesticides, including a neonicotinoid, showed little to no toxicity to bees, meaning they could be effective alternatives to organophosphates, carbamates, and other neonicotinoids.

According to the authors, "Our data, particularly the ratios of field application rates to lethal concentrations of each pesticide, provide a quantifying scale to help extension specialists and farmers with pesticide selection to maintain effective control of target pests and minimize the risk to foraging honey bees as well."

Read more at:

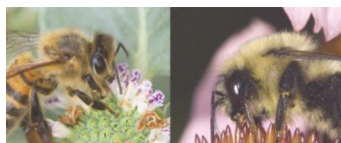
– [Spray Toxicity and Risk Potential of 42 Commonly Used Formulations of Row Crop Pesticides to Adult Honey Bees \(Hymenoptera: Apidae\)](http://dx.doi.org/10.1093/jee/tov269) (<http://dx.doi.org/10.1093/jee/tov269>)

Andrew Porterfield is a writer, editor and communications consultant for academic institutions, companies and non-profits in the life sciences. He writes frequently about agriculture issues for the [Genetic Literacy Project](http://www.geneticliteracyproject.org/) (<http://www.geneticliteracyproject.org/>). He is based in Camarillo, California. Follow him on Twitter at [@AMPorterfield](https://twitter.com/AMPorterfield) (<https://twitter.com/AMPorterfield>) on Twitter, or visit his [Facebook page](https://www.facebook.com/andreweditor) (<https://www.facebook.com/andreweditor>).



Andrew Porterfield

Related





[Neonics, Mites, and CCD](#)

April 15, 2013



[How Do Pesticides Affect Wild Japanese Honey Bees?](#)

March 2, 2017



[More Research Needed to Better Balance Honey Bees and Native Bees](#)

June 18, 2018

[📁 Research News](#)

[🔍 acetamiprid](#), [Andrew Porterfield](#), [apis mellifera](#), [ccd](#), [colony collapse disorder](#), [glyphosate](#), [honey bees](#), [Neonicotinoids](#), [Roundup](#), [sulfoxaflor](#)

36 Comments »

Nice article. It's good to see some reliable 3rd party studies on these molecules and bees.

One small edit – rice in the US is not transgenic. There have been field trials but there are no commercial varieties of GMO rice in the US.

[Reply](#)

Thanks, good point. There have been field trials of course, but there are no commercial varieties.

[Reply](#)

Actually, two GM varieties of rice (with an inserted herbicide resistance gene) are approved in the US, but have never been used commercially.

<http://cera-gmc.org/GmCropDatabaseResult/results?events%5B%5D=&hosts%5B%5D=14&traits%5B%5D=&genes%5B%5D=&types%5B%5D=&countries%5B%5D=41&developers%5B%5D=&from=&to=&save=Search> (<http://cera-gmc.org/GmCropDatabaseResult/results?events%5B%5D=&hosts%5B%5D=14&traits%5B%5D=&genes%5B%5D=&types%5B%5D=&countries%5B%5D=41&developers%5B%5D=&from=&to=&save=Search>)

[Reply](#)

I sure wish this had some peer reviewed information.

[Reply](#)

The Journal of Economic Entomology is a peer-reviewed journal.

[Reply](#)

Are any of the pesticides studied approved for use in organic ag? I ask mainly b/c it seems “natural” pesticides are seldom studied & we therefore know much less about the risks (if any) they pose.

[Reply](#)

While it is a good step to test the actual commercial formulations, I do not see mention of testing the effect of the pesticide on the hive as a whole. The individual bee may not die as a result of being sprayed, but it may become disoriented and unable to return to the hive. Or it may return and the pesticide it carries may kill the larva. This problem has been shown in other studies of pesticides. I don't think that you can legitimately conclude that the pesticides are low in toxicity to the bees unless you monitor the entire super organism for the effect.

[Reply](#)

Here is an example of a study that found effects that are sub lethal for the individual bee, but harmful for the colony:

<http://jeb.biologists.org/content/218/17/2799> (<http://jeb.biologists.org/content/218/17/2799>)

[Reply](#)

Yes, many studies have been done on sublethal effects of insecticides, for example <http://entomologytoday.org/2015/05>

[/29/pyrethroid-insecticides-alter-honey-bee-behavior/](http://entomologytoday.org/2015/05/29/pyrethroid-insecticides-alter-honey-bee-behavior/) (<http://entomologytoday.org/2015/05/29/pyrethroid-insecticides-alter-honey-bee-behavior/>)

And other substances that are not even pesticides may affect them as well: <http://entomologytoday.org/2013/10/03/are-diesel-fumes-contributing-to-honey-bee-colony-collapse-disorder/> (<http://entomologytoday.org/2013/10/03/are-diesel-fumes-contributing-to-honey-bee-colony-collapse-disorder/>)

<http://entomologytoday.org/2013/10/04/selenium-may-be-another-contributor-to-honey-bee-health-problems/>
(<http://entomologytoday.org/2013/10/04/selenium-may-be-another-contributor-to-honey-bee-health-problems/>)

[Reply](#)

Why do you incorrectly refer to glyphosate as a pesticide? It is an herbicide that interferes with photosynthesis. Animals do not photosynthesize. You open the door for zealots to spread misinformation.

[Reply](#)

All herbicides are pesticides, Shelley. Insecticides, fungicides, and rodenticides are also pesticides. But you are right that glyphosate inhibits photosynthesis, and its mode of action does not affect mammals.

[Reply](#)

How was this study funded?

[Reply](#)

Good reliable info here. But in simple terms, can Triaicide with gamma-cyhalothrin be applied to my lawn that has lots of clover in it, in granular form without harm to the honey bees?

[Reply](#)

Even if the bees are not damaged, the big-eyed bugs, soldier beetles, fireflies, earthworms and other organisms that live in the soil will almost certainly be affected. What would you accomplish by blanket applying it to the lawn?

With money.

[Reply](#)

These studies are RIDICULOUS. You don't determine the toxicity of a pesticide on bees by counting how many of them die when exposed directly to it. In order to be LETHAL, it suffices for the pesticide to affect the bee's nervous system and disrupt its ability to find its way back to the hive. I am amazed that these studies are even considered scientific!!!

[Reply](#)

Very well said!!

[Reply](#)

Jorge Claverie, you misunderstand the goal of the study, then complain it doesn't test the hypothesis you made up in your head? A toxicity study addresses, not surprisingly, toxicity. This strikes me as a very useful, well thought out experiment. Scientists the world over welcome you to do one yourself.

[Reply](#)

Who paid for the research though?

[Reply](#)

The researchers are from the U.S. Dept of Agriculture, and the University of Mississippi, so their time and lab equipment would be from those institutions. In addition, the authors wrote that "Pesticides used for these bioassays were provided by the manufacturers or purchased from local agro-chemical suppliers."

[Reply](#)

The U.S. Dept of Agriculture is not to be trusted. It is headed by people who used to be employed by Monsanto.

Carol Schwers: Which USDA employees are the Monsanto skills. I'd be thrilled to see your research on this issue.

The research shows low ACUTE toxicity but says nothing about longer term exposure. Glyphosate can affect gut microbiota and thus can weaken the bees' immunity and overall health.

[Reply](#)

Glyphosate disrupts the gut microbiota of bees. That is long-term damage and will not be seen as acute toxicity.

THIS TEST IS SEVERELY INCOMPLETE.

THIS TEST DOES NOT SHOW THE REAL HARM DONE.

IT'S A SCAM.

DO A 2-WEEK EXPOSURE TEST AND REPORT BACK.

[Reply](#)

sagerad: can you put some meat on the bones of your comments? What are the deficiencies, what is the real harm done, how is the study a scam? Maybe you should do the 2-week exposure test and report back. You wouldn't trust anyone else's results if they didn't conform to your deeply ingrained in your ideology. You can skip the all caps. You don't have to yell.

[Reply](#)

Quit yelling your bunk in all caps sage. Then explain how you came to this conclusion and provide evidence. You are the scam.

[Reply](#)

Since you wouldn't believe data from someone who doesn't share your strident ideology, did you have a chance yet to do that

2-week exposure test and report back? It appears you were shouting about the quality of others' data. Only your work could be trusted to be valid, in your opinion, I would assume?

[Reply](#)

I agree. you're full of it and spread it widely. Actual facts and data are rare and maybe unneeded in your world? You just like to dismiss others data, without compelling evidence, and play the part of bully with no facts of his own. You're a real peach.

A plum tree with a very severe aphid infestation is to be treated this winter with Vitax winter wash & Acetamiprid in the summer... following advice on this column. Whilst I have read the information on bee toxicity (low) using this product, I am now querying whether the plums (if any...none this year) would be affected. In other words would an application of this product in say July have a lingering effect for when we harvest the plums??

[Reply](#)

Maggie, as always, read the label of the pesticide product before using it. If it does not give the info you need, you should be able to call the manufacturer. And be sure to spray when bees are inactive and when flowers are not in bloom.

[Reply](#)

Glyphosate is very dangerous. <http://www.mdpi.com/1099-4300/15/4/1416> (<http://www.mdpi.com/1099-4300/15/4/1416>)

[Reply](#)

Before you read bad science like that, read this: https://www.huffingtonpost.com/tamar-haspel/condemning-monsanto-with-_b_3162694.html (https://www.huffingtonpost.com/tamar-haspel/condemning-monsanto-with-_b_3162694.html)

[Reply](#)

This article needs to be updated to include information about other effects of the chemicals on honeybees. It is focussed extremely narrowly on direct toxicity and ignores general but more important disruption of insect metabolism.

[Reply](#)

What I dont get about the study is how can you have a 4.62e+34 mg/l LC50. 4.62e+34 ml is 4.62e+31 ml or 4.62e+28 liters. Is that a typo?

[Reply](#)

This is from [Glyphosate.news](http://glyphosate.news) about a 2017 study out of Argentina:

"It should come as no surprise that the use of Roundup comes with many negative effects, not just on humans, but the environment. Things that live in our environment also cannot escape the consequences of Roundup. For example, a recent study published by The Journal of Experimental Biology found that Roundup actually causes honeybees to starve.

It is the first study to analyze both the short-term and long-term effects of the herbicide on honeybees, and the effects are quite damaging. The study, conducted by researchers from the University of Buenos Aires in Argentina, found that sub-lethal levels of Roundup still harmed honeybees. Sub-lethal means that the dose is not strong enough to kill, but apparently enough to maim. Using field-relative doses of the herbicide, researchers found that honeybees exposed to Roundup exhibited decreased sensitivity to sucrose — leading to a decreased ability to track and find food. Exposed bees also exhibited poorer learning

performance, a decreased ability to smell and poor memory. Bees exposed to glyphosate tend to exhibit higher frequencies of Colony Collapse Disorder most likely because they cannot remember how to get back to their hive.”

[Reply](#)

Post the actual link. One can't analyze your opinions without seeing the evidence.

[Reply](#)

This site uses Akismet to reduce spam. [Learn how your comment data is processed](https://akismet.com/privacy/) (https://akismet.com/privacy/).