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Effects of Glyphosate on Bees Signal a 'Bug Apocalypse'

Big Ag promotes widespread neonicotinoid and glyphosate spraying. Can technology provide a way out?

By **Robert Turner**

A new class of pesticides known as neonicotinoids and the effects of glyphosate on bees may be leading pollinators toward what scientists call a "sixth extinction."

This article is also in audio form for your listening enjoyment. Scroll down just a bit to find the recording.

I remember as a child riding in the truck with my father and counting the bugs that hit the windshield. Bright greens, reds, and yellows splattered like a Jackson Pollock painting. Very few insects hit my windshield today when I drive that same stretch of road. Where have all the bugs gone?

I realize my observation is not scientific proof of a bug apocalypse. I could've conducted a more methodical experiment over the years, recording the species of bugs hitting my windshield after a specific number of miles on the same stretch of road, traveling a designated speed, and so on. My scientist friends might be impressed by my rigorous "bug windshield" experiment, but I'm not certain any journal would publish the findings.

Still, the drop in insect numbers is apparent. A 2014 study of 452 species of insects found that 45% fewer of them flit across North America than did in the 1960s. Another study showed 81 species of butterflies declining by one-third over the past two decades. Related research suggests 30% fewer birds fly over our heads than did 50 years ago, and given that birds eat bugs, I believe these trends are related. The root causes appear to be many, including changing weather, habitat destruction, and pesticides. None of it bodes well for humans.

Problems for Pollinators

Renowned entomologist E.O. Wilson said that without insects, “the rest of life and humanity with it would mostly disappear from the land and within a few months.” At least one-third of our fruit and vegetable crops depend on bees, syrphid flies, moths, and other pollinators, and yet, we’ve let industrial agriculture in the United States become nearly 50 times more toxic to pollinators over the past 25 years.

Much of America's farmland toxification during this time frame can be attributed to a newer class of pesticides known as "neonicotinoids." Starting in the 1990s, pharmaceutical company Bayer pressed farmers to use the chemical imidacloprid to treat corn kernels and other seeds to ward off early season thrips. By 2011, industry doused over 80% of U.S. corn with it, and today, neonicotinoids are among the most widely used insecticides in the world. Mounting evidence shows their proliferation closely corresponds to a sharp decline in pollinators.

More lethal than DDT, neonicotinoids can remain toxic for two and a half years in the environment. They're considered systemic insecticides, which means plants absorb them and incorporate the toxin into their tissues — stems, leaves, and all (in other words, the parts we eat). Because neonicotinoids readily dissolve in water, and plants can only absorb about 5% of what's sprayed on cropland, the rest contaminates soils and washes into streams, ponds, lakes, and wetlands.

The European Union banned neonicotinoids for field use in 2018. Canada restricted use of most neonicotinoids a year later. In the U.S., they continue to be widely used.

Effects of Glyphosate on Bees

Big Ag showers the globe with another chemical perhaps even more harmful to humans than it is to insects. Glyphosate, the active ingredient in Roundup, is the most-used herbicide in the world. The World Health Organization has identified it as "probably carcinogenic" to humans, and the Centers for Disease Control and Prevention (CDC) found **glyphosate in the urine of 4 out of 5 children and adults** sampled from across the U.S. Exposure to Roundup has also been linked to an increased risk of Parkinson's disease, elevated risk for autism, serious neurological diseases, and documented effects on reproduction.

Especially worrying for me is that children in the U.S. are regularly exposed to glyphosate through the foods they eat every day. A series of tests commissioned by the Environmental Working Group found glyphosate in all samples of popular oat-based cereals marketed to children. This is unsurprising, given that **glyphosate has been found in nearly every food product** tested by the U.S. government, from baby food to beer, and it makes even more sense when you learn Roundup is used as a "desiccant," sprayed on plants to dry them out in a final step just before they're harvested and shipped to the grocery store. We're eating the stuff, and it's poisoning us.

The good news is that the effects of glyphosate on bees and humans is increasingly unpopular with regulators, who are pushed by consumers to act. Roundup and its knockoff brands are banned in Germany and Mexico, while local governments in Australia, Canada, India, and Europe have either banned them or restricted their use. An outright glyphosate ban has not come to the U.S., despite a vocal and educated movement calling for it. Bayer is also the maker of Roundup and has agreed to settle nearly 100,000 U.S. lawsuits totaling $10.9 billion, all the while denying that its product causes cancer.

Mother Earth News and Friends

Audio Article: Outrunning a Bug Apoc

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Oct 12, 2023

Reluctant to wait for a ban, I choose organic foods when possible. A major study published in *JAMA Internal Medicine* found a significant reduction in cancer risk for thousands of individuals who ate a lot of organic food. Many consumers look for healthier, more nutrient-dense food that has less impact on ecosystems and the climate. Food conglomerates know it's good business to give us what we want.

Gene Therapy for Crops

AgTech companies are researching plant genetics, enabled by advancements in "CRISPR," a suite of techniques that make it easier for bioengineers to manipulate DNA and RNA by editing parts of the genome. RNA technology has been used for years to combat viruses and diseases in humans. It was used, for instance, to fight the Zika virus. In this case, scientists modified the DNA of male mosquitoes that transmit the virus so they couldn't reproduce. The altered mosquitoes transferred infertility back into the general mosquito population, and after a few generations (not a long time in mosquito lifetimes), their numbers collapsed. The technology now shows promise for its potential use against farm pests, as well as for improving crop resistance to heat and drought.

Applying gene-altering technology to pests scares a lot of people, and perhaps for good reason. Are we playing with fire?

Genetic engineering isn't new, of course. The first genetically modified bacterium was created 50 years ago in 1973; the first genetically engineered mouse in 1974. In 1984, the U.S. Food and Drug Administration (FDA) approved the first **genetically modified food**, the FLAVR SAVR tomato, though it's no longer on the market. Today, almost all corn and soybeans are genetically modified. Only a couple of Big Ag companies hold a monopoly on the Roundup-ready varieties sold, and the use of glyphosate has risen exponentially. Each of these corn and soybean plants is almost an exact genetic copy of the plant growing next to it.

Scientists have played with the technology to create such absurdities as ants that don't smell and coffee beans that contain zero caffeine. (You might ask, "What's the point?")

I can certainly see possible benefits to this technology, including creating plants that are resistant to fungus, superbugs, and drought, but I feel we must be wary of the corporate control that often accompanies such technologies. New biologics, or pesticides derived from natural materials, such as bacteria and minerals, offer a promising alternative to chemical pesticides and RNA technology, but there's still a lot we don't understand about their abilities.

Robots to the Rescue?

Artificial intelligence (AI) and even lasers could be safer for birds, bees, butterflies, and humans than either chemicals or RNA technology.

If these seem futuristic, know that AI “killer robots” are working in the vegetable fields of California right now. No need to freak out; they’re only killing weeds. At a cost of about $1.2 million, the new “LaserWeeder” built by Carbon Robotics has replaced about 30 workers who had been doing the back-breaking work of pulling weeds at Braga Organic Farms. The LaserWeeder zaps weeds with short bursts from a bank of lasers mounted underneath the machine, using AI to “learn” how to identify up to 40 crops and 80 types of weeds. The robot can even zap weeds too small for a human to grasp, vaporizing tiny sprouts into smoke.

Farm owner Rod Braga told NBC News in an interview this year that the machine will pay for itself in its first year. This is because his is a 2,000-acre organic vegetable farm, and unlike the massive corn and soybean fields of the Midwest, where a farmer with a small crew and a big combine can harvest thousands of acres, diversified vegetable production is labor-intensive. The U.S. has become dependent on produce imported from Central and South America because of cheaper labor costs in those regions. A recent U.S. Department of Agriculture (USDA) report predicted that we're on track for over three-quarters of fruit and half of vegetables to come from outside the United States in the next four years.

Depending on far-away places for our food introduces risks. The LaserWeeder could resolve organic farmers' persistent challenge of finding workers on a seasonal basis. If robots on the horizon also help Braga harvest crops, from broccoli to tomatoes, they could ultimately allow the U.S. to improve domestic food security while lowering the amount of harmful chemicals applied to fields.

Of course, Braga Organic Farms can afford the price tag of such a high-tech machine, but I doubt small farms can afford AI-equipped lasers — today. As the technology cost curve goes, prices could drop after more companies enter the space and the tech is adopted by more farmers.

And while technology may save on farm labor, there's a trade-off: High-tech methods are resource-intensive to create and operate. Low-tech solutions exist for resisting chemical inputs and reducing insect losses, including **cover crops**, **wildflower strips**, and natural pesticides.

Overrun with Superbugs

When I drive down my favorite country road these days, my windshield is an ever-sparser canvas with only a few small blotches of color. Just like a Pollock painting, I don't always know how to interpret the image, but it does make me think about where all this chemical-intensive pest control has gotten us.

In the 1950s, global crop loss due to pests was estimated at around 30%. Today, even after soaking our farmland in chemicals, the USDA estimates global crop loss from pests is *still* around 30%.

When we make such potent chemicals widespread, we invite pesticide resistance. The peach aphid (*Myzus persicae*), as one example, has apparently become resistant to more than 75 different chemicals — while at the same time adapting to eat more than 50 different plants. We've opened the farm gate to a few superbugs.

Could a robot one day learn to zap the peach aphid that's sitting on a plant leaf without harming the plant — or the butterfly sitting right next to it? I better keep conducting my experiment and give the question some more thought. Where are my car keys?

Robert Turner is a farmer and science writer residing in western North Carolina. He serves on the board for Organic Growers School and is the author of Lewis Mumford and the Food Fighters: A Food Revolution in America.

Originally published as "Outrunning a Bug Apocalypse" in the October/November 2023 issue of *MOTHER EARTH NEWS* magazine and regularly vetted for accuracy.

Updated on Sep 11, 2023
Originally Published on Aug 29, 2023
