NEONICOTINOID INSECTICIDES

Harmful to Birds and Bees

FOUND in CONGRESSIONAL CAFETERIA FOOD

A Report by American Bird Conservancy

July 2015

AMERICAN BIRD CONSERVANCY

Neonicotinoids are the most widely used insecticides in the nation. Unfortunately, they are highly toxic to birds, invertebrates, and other wildlife.

As this report reveals, these insecticides are also pervasive in the foods we eat, including in the dining halls of the U.S. Congress.

Photo: American Kestrel by Cynthia Kidwell, Shutterstock

Study led by Cynthia Palmer, Director of Pesticides Science and Regulation at ABC.

Cover photos, left to right: Ruby-throated Hummingbird by Kelly Nelson, Shutterstock; honeydew melon from Congressional dining hall by Aditi Desai; Grasshopper Sparrow by Steve Byland, Shutterstock

EXECUTIVE SUMMARY

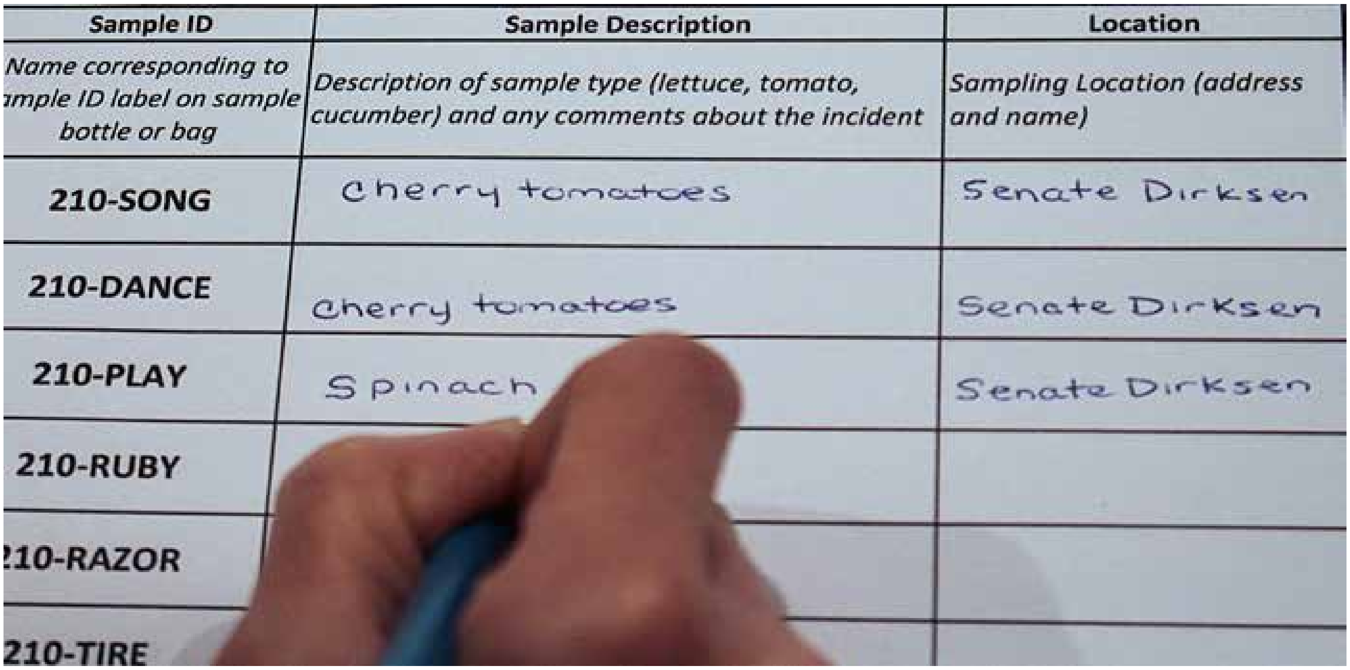
Neonicotinoids are the most widely used insecticides in the nation. Unfortunately, they are highly toxic to birds, invertebrates, and other wildlife. As this report reveals, these insecticides are also pervasive in the foods we eat, including in the dining halls of the U.S. Congress.

American Bird Conservancy teamed with scientists at the Harvard T.H. Chan School of Public Health and the Pesticide Research Institute to test 66 food samples from Congressional dining halls. The laboratory analysis revealed neonicotinoids in 91% of foods tested. Foods with the highest residues were cherry tomatoes, honeydew melons, and yellow squash. Most foods contained multiple different insecticides, with up to five different insecticides detected in fresh-squeezed orange juice and green bell peppers. It is not possible to remove these residues by washing, as they are integrated throughout the plant tissue.

While none of the levels of neonicotinoid residues in the foods sampled in this study exceeded the U.S. Environmental Protection Agency's Reference Doses (the dose U.S. EPA considers acceptable based on laboratory studies), clinical research from Japan indicates that adverse effects may be observed at doses lower than U.S. EPA's reference doses.

The use of neonicotinoid sprays and soil drenches on fruit and vegetable crops is widespread, but the chemicals' presence on fresh produce represents only a small fraction of the total pounds applied in the U.S. These insecticides also are used as seed coatings on hundreds of millions of acres of commodity crops such as corn, soybeans, cotton, canola, and sunflowers, to the detriment of birds, bees, and other pollinators. Yet studies show there is often little or no increase in agricultural yields.

By harming pollinators like bees and butterflies, and natural pest control agents like birds and beneficial insects, neonicotinoids are sabotaging the very organisms on which farmers depend. American Bird Conservancy urges U.S. Representatives to cosponsor the Saving America's Pollinators Act of 2015, H.R. 1284, suspending the use of neonicotinoids pending an independent review of the products' effects on birds, terrestrial and aquatic invertebrates, bats, and other wildlife.



We evaluated 66 food samples from Congressional dining halls, with roughly half purchased from the House Longworth Cafeteria and half from the Senate Dirksen Cafeteria.

Photo: Aditi Desai

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Eastern Bluebird by Tom Reichner, Shutterstock

Neonicotinoids are used as a pre-emptive strike on hundreds of millions of acres, even though studies indicate there is often little benefit to farmers. It is a story of marketing success overruling common sense, to the detriment of our ecosystems.

INTRODUCTION

A study by American Bird Conservancy (ABC) finds bird- and bee-killing insecticides in nearly every mouthful of food eaten by the nation's Senators, Representatives, their staff, and visitors who eat in the dining halls of the United States Congress. These pesticides, called neonicotinoids, are the most widely used insecticides in the nation. Unfortunately, they are highly toxic to a broad range of invertebrates and to birds and other wildlife.[1, 2, 3] They persist in the soils (for months to years), can be taken up by succeeding crops in years following application, and readily leach into surface waters.

As ABC reported in 2013, a single seed treated with neonicotinoids is enough to kill a songbird.[4] Neonicotinoids also harm bees, butterflies, and other wildlife.

Neonicotinoids are sprayed onto many fruit and vegetable crops or injected into the surrounding soils. They are also used as seed coatings on corn, soy, canola, and other commodity crops. No matter how they are applied, the insecticides move throughout the entire plant—roots, leaves, stems, pollen, nectar, and fruits. They are used as a pre-emptive strike on hundreds of millions of acres, even though studies indicate there is often little benefit to farmers.[5, 6] It is a story of marketing success overruling common sense, to the detriment of our ecosystems.

This report brings the neonicotinoids' persistence and ubiquity home to Congress—those with the power to fix federal pesticide regulations, adjust incentives, and encourage market approaches that enable farmers to more finely target their pest management activities.

STUDY DESIGN

ABC teamed with scientists at the Harvard T.H. Chan School of Public Health and the Pesticide Research Institute to test 66 food samples from Congressional dining halls. We evaluated 38 samples in the winter and 28 in the spring of 2015. Roughly half of the food was purchased from the House Longworth Cafeteria and half from Senate Dirksen Cafeteria, in addition to samples of strawberry topping from the Dirksen frozen yogurt bar.

Round one of sampling took place on January 28, 2015. Round two samples were purchased on May 4, 2015. Where possible, ABC took multiple food samples to ensure the representative validity of results.

ABC urges U.S. Representatives to cosponsor the Saving America's Pollinators Act of 2015, H.R. 1284, suspending the use of neonicotinoids pending an independent review of the products' effects on birds, bats, and other wildlife.

Photos, left to right: Assorted vegetables by Mike Parr; golden delicious apples by Svetlana Lukienko, Shutterstock; honeydew melon by Pixtural, Shutterstock

Testing took place at Harvard T.H. Chan School of Public Health under the direction of Dr. Chensheng Lu and Dr. Lin Tao using methods described in reference 7.

All food samples were analyzed for seven distinct neonicotinoid insecticides: acetamiprid, clothianidin, dinotefuran, imidacloprid, nitenpyram, thiacloprid, and thiamethoxam. The method detection limit for all pesticides was 0.1 microgram per kilogram (µg/kg).

CONGRESSIONAL DINING HALL FOOD SAMPLES

Foods sampled in January 2015:

Grilled zucchini with sage
Partially peeled fresh cucumbers
Steamed broccoli
Raw green bell peppers
Red delicious apples
Fresh cilantro
Grape tomatoes
Romaine lettuce
Honeydew melon
Cantaloupe
Fresh-squeezed orange juice
Fresh-squeezed grapefruit juice
Dried cranberries, or "craisins"

Foods sampled in May 2015:

Raw green bell peppers
Golden delicious apples
Cherry tomatoes
Lightly seasoned steamed broccolini
Steamed yellow squash
Steamed zucchini squash
Cantaloupe
Honeydew melon
Fresh spinach
Steamed kale
Corn kernels from salad bar
Edamame, removed from shells
Red grapes
Strawberry topping

Photo by Aditi Desai

A Congressional dining hall food sample being packaged to be sent for testing.

The testing revealed neonicotinoids in nearly every food sample, in 60 out of a total of 66 food samples, or 91%.

Foods with the highest number of different neonicotinoid residues detected included fresh-squeezed orange juice and green bell peppers.

Zucchini by Maks Narodenko, Shutterstock

RESULTS

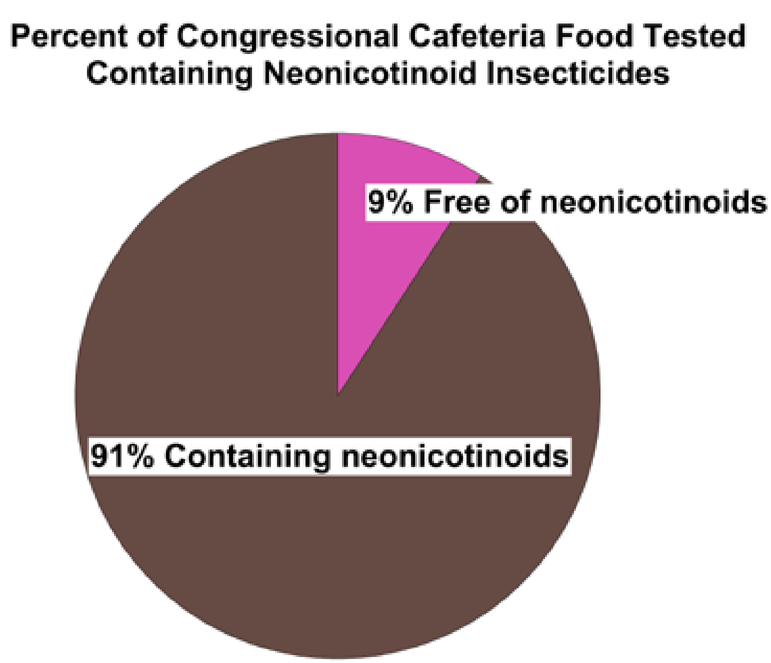
Nearly All Cafeteria Food Tested Contained One or More Neonicotinoid Insecticide Residues

The testing revealed neonicotinoids in nearly every food sample, in 60 out of a total of 66 food samples, or 91% (see Figure 1). Thiamethoxam was the most detected neonicotinoid overall, with 25 detections (66% of the samples) in January and 18 detections (64%) in May. Imidacloprid was the most commonly detected neonicotinoid in winter foods. Thirty-one (82%) of the January samples and nine of the May samples (32%) contained imidacloprid. The relative number of detections for each pesticide is consistent with use patterns in the U.S.

Multiple Neonicotinoids Were Found in Most Samples

Our January round of sampling found neonicotinoids in 100 percent of foods tested. Most foods had multiple neonicotinoids (see Figure 2). Of the 38 samples, one (fresh-squeezed orange juice), or 3%, was contaminated by five distinct neonicotinoid insecticides, 10 (26%) were contaminated by four distinct neonicotinoid insecticides, nine (24%) had three neonicotinoids, and eight (21%) had two neonicotinoids. The remaining 10 foods (26%) each had a single neonicotinoid detection.

Figure 1: The majority of samples tested had detectable residues of neonicotinoid insecticides



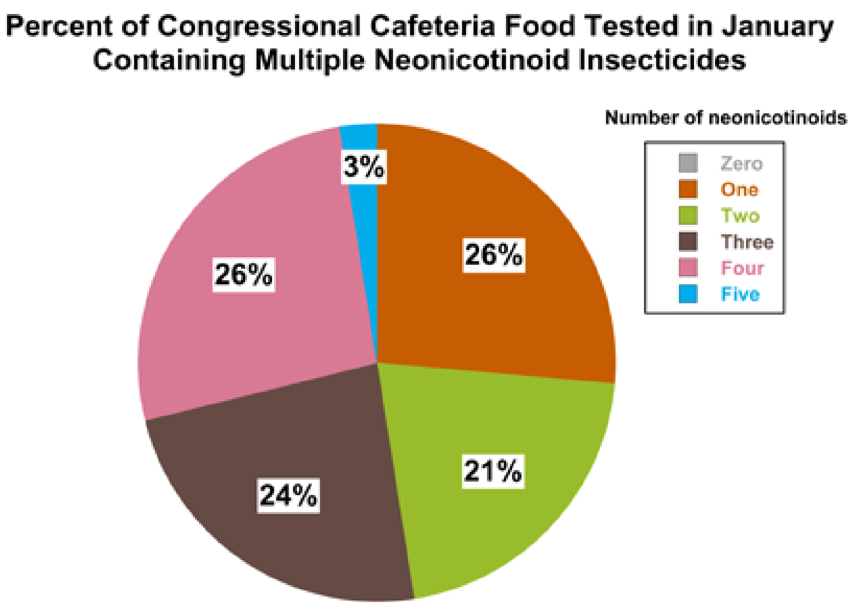
Our May round of testing revealed neonicotinoids in 22 out of 28 food samples. One (green bell pepper), or 4%, had five different neonicotinoids, four foods (14%) had four, six foods (21%) had three, eight foods (29%) had two neonicotinoids, and three foods (11%) had one.

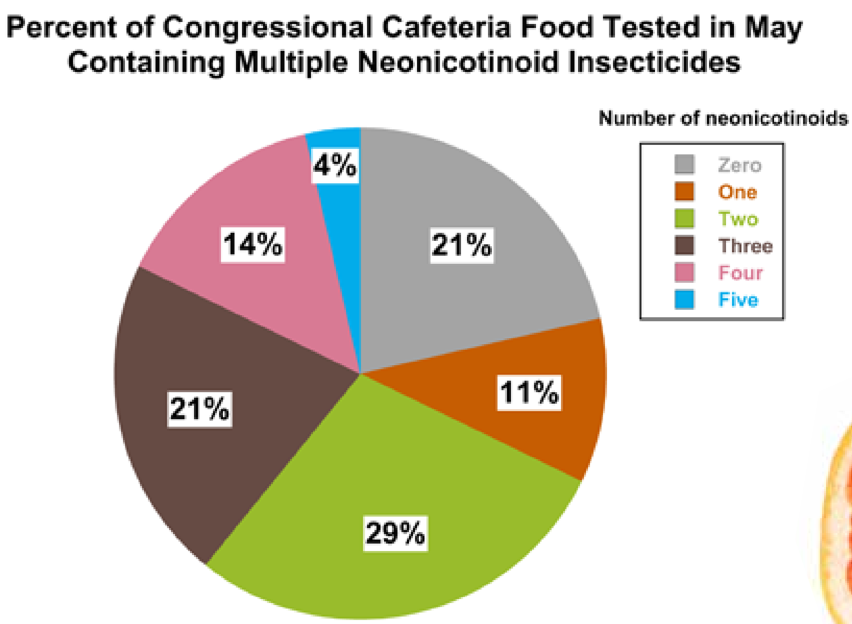
Foods with the highest number of different neonicotinoid residues detected included fresh-squeezed orange juice and green bell peppers.

Broccoli by jreika, Shutterstock

Cherry tomatoes, honeydew melons, steamed broccoli, and fresh-squeezed grapefruit juice also had consistently high numbers of detections.

Figure 2: Many of the foods tested contained more than one neonicotinoid residue





Grapefruit and juice by Svetlana Yefimkina, Shutterstock

Cherry tomatoes, honeydew melons, steamed broccoli, and fresh-squeezed grapefruit juice also had consistently high numbers of detections.

Photo by Aditi Desai

Cherry tomatoes, yellow squash, and honeydew melons stood out as the samples with highest levels of neonicotinoid residues.

Cherry Tomatoes, Squash, and Melons Had the Highest Concentrations of Neonicotinoid Residues

Cherry tomatoes, yellow squash, and honeydew melons stood out as the samples with highest levels of neonicotinoid residues. This result is consistent with the USDA Pesticide Data Program data and indicates that growers of these crops routinely treat with neonicotinoids.

How We Determined Total Residues

In order to sum the total neonicotinoid insecticides present in a food with multiple residues, we normalized all concentrations to imidacloprid using the ratio of human reference doses to express a single concentration in imidacloprid equivalents. Imidacloprid equivalents are calculated by multiplying the measured concentration of pesticide X (C_X) times the ratio of the U.S. EPA Reference Dose of imidacloprid (RfD_I) to that of pesticide X (RfD_X):

$$C_{XIE} = C_X * (RfD_I / RfD_X)$$

The individual pesticide concentrations in imidacloprid equivalents (C_{XIE}) were then summed to give an estimate of the total neonicotinoid concentration in a food with more than one residue. Table 1 and Figure 3 show the average and maximum of these values for the two sampling events (January and May).

DISCUSSION

Neonicotinoid Insecticides Are Ubiquitous in Our Food Supply

Most striking about our findings is the ubiquity of the neonicotinoid chemicals in the Congressional dining halls. Sixty of 66 samples (or 91%) contained residues at levels above the detection limits, 47 (or 71%) of them with two or more neonicotinoids.

The House and Senate cafeterias are run by a food service company that is committed to sustainability and that emphasizes organic food. And yet we still found neonicotinoids in nearly every food item sampled. Note that it is not possible to remove neonicotinoid insecticide residues by washing produce, as these chemicals are integrated into the plant tissue.

The results are consistent with those from an earlier study from Harvard T.H. Chan School of Public Health with similar detection

Table 1: Concentrations of Neonicotinoid Insecticides in Congressional Cafeteria Foods

Food	Number of samples	Average (μg/kg)*	Maximum (μg/kg)
Apples	6	16.2	42.6
Broccoli	4	1.2	1.5
Cantaloupe	6	7.4	14.9
Honeydew melon	6	29.1	45.5
Cherry tomatoes	4	34.5	65.9
Tomatoes	4	12.8	24.2
Cilantro	2	2.7	2.9
Corn	2	< LOD**	< LOD
Cucumbers	6	6.1	13.9
Cranberries, dried	2	0.2	0.3
Edamame	2	15.0	16.9
Grapes	2	< LOD	< LOD
Peppers	4	29.6	35.9
Kale	2	< LOD	< LOD
Lettuce	4	1.2	2.1
Spinach	2	5.5	5.7
Strawberries	2	7.8	8.2
Summer squash	4	59.8	207.2

Notes: See text for information on calculation of concentrations in imidacloprid equivalents.
*μg/kg is micrograms per kilogram, equivalent to parts per billion (ppb).
**LOD stands for Limit of Detection, the lowest concentration of a chemical that can be distinguished from the assay background. For all chemicals, the LOD was 0.1 μg/kg.

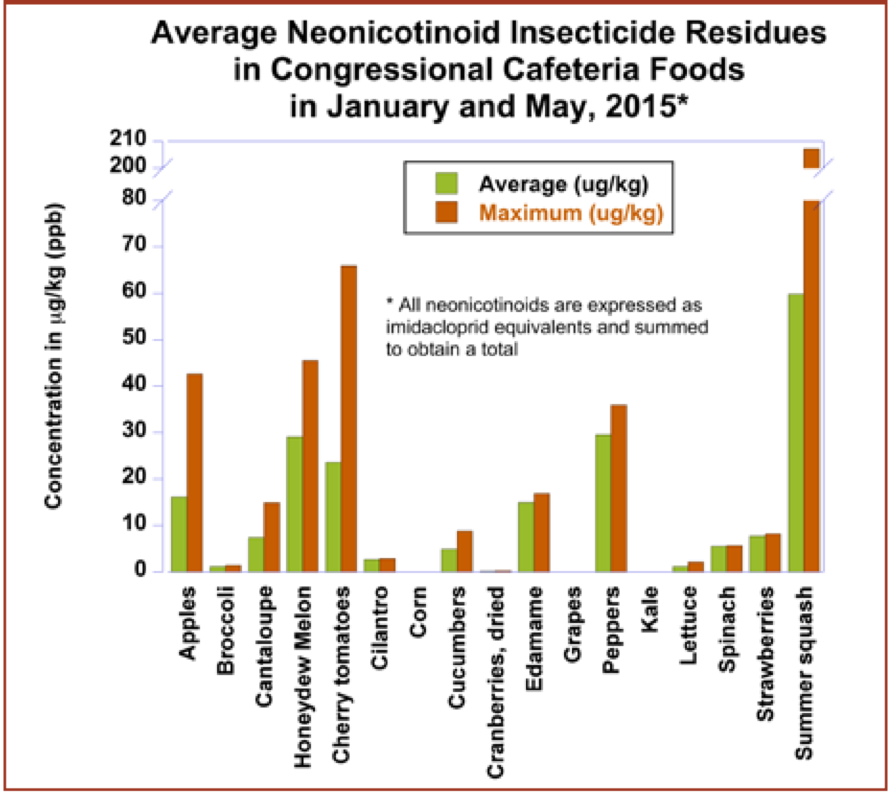

Photo by Aditi Desai

The House and Senate cafeterias are run by a food service company that is committed to sustainability and that emphasizes organic food. And yet we still found neonicotinoids in nearly every food item sampled.

limits[8] in which 92% of 25 fruit and vegetable samples and 90% of 10 honey samples of fresh fruit and vegetable samples purchased from neighborhood grocery stores in Boston, Massachusetts tested positive for at least one neonicotinoid. In that study, 72% of fruits, 45% of vegetables, and 50% of honey samples contained at least two different neonicotinoids in one sample.

The U.S. Department of Agriculture's Pesticide Data Program (PDP) findings have had a lower overall frequency of neonicotinoid detection, but in some cases even higher residues, than in our study.[9] The reason for this is that the Harvard lab technique used in our study is 10 to 30 times more sensitive than even the most sensitive techniques used by the labs providing the PDP data. In addition, because the USDA sample size was larger than ours, a wider range of detections was found.

Figure 3: Average and maximum total residues detected on different foods in Congressional cafeterias in terms of imidacloprid equivalents



See text for information on calculation of concentrations in imidacloprid equivalents.[7]

For example, in the 2013 USDA-PDP survey of foods, imidacloprid was found in 9.7% of 708 broccoli samples, with an average of 41 micrograms per kilogram (µg/kg) and maximum of 1,500 µg/kg; in 39.8% of 532 cauliflower samples, with an average of 7 µg/kg and maximum of 360 µg/kg; in 9.7% of 176 grape juice samples, with an average of 27 µg/kg and maximum of 41 µg/kg; and in 22.5% of 187 winter squash samples, with an average of 24 µg/kg and a maximum of 130 µg/kg.

The fact that we detected neonicotinoids in 91 percent of samples does not necessarily mean that all of these foods were treated with the pesticides. Soil and watershed contamination with neonicotinoids is widespread.[10] Even when used as a seed coating, only about five percent of the neonicotinoids are absorbed by the crop. The rest sloughs off the seeds, washes into the soil, and is transported to surface waters, which may be used as irrigation water for another field. The chemicals are relatively stable in the environment and can remain active for months to years. So if a neonicotinoid-treated crop is harvested, the next crop grown on that same field may be contaminated as well, even if it is never treated. And because the chemicals are "systemic," they penetrate the entire plant and cannot be removed by washing or peeling.

The three exceptions in our testing—where we did not find neonicotinoid residues—were grapes, kale, and corn. It is possible that residue levels were below the Harvard laboratory's detection limits. But it is also possible that the cafeterias are selling organically-grown grapes, kale, and corn, or that the growers are using other pesticides we did not test for.

At first glance, our corn results may appear surprising, since most corn in the United States is grown from neonicotinoid-treated seeds. It's worth noting, however, that the corn we eat (sweet corn) represents only a tiny subset of the corn grown in this country. Over 99 percent of corn is field corn used for ethanol, livestock feed, and processed food ingredients like corn syrup. Most field corn seeds were genetically engineered (GE) to produce a protein derived from bacillus thuringiensis (Bt) bacteria that can kill certain insect pests. Since the so-called Bt-corn seeds have encountered a severe resistance problem since 2004, the vast majority of the current GE field corn seeds are treated with neonicotinoids. By contrast, sweet corn—the type of corn we eat—constitutes less than one percent of the corn grown in this country. We do not have information on the proportion of sweet corn grown from neonicotinoid-treated seeds.[11]

What Do the Results Mean Beyond the Birds and Bees?

U.S. EPA's risk assessments note that in mammals, neonicotinoids are neurotoxic and are also associated with liver, kidney, thyroid, testicular, and immune system effects.[12] Thiacloprid has been designated as "Likely to be Carcinogenic to Humans," with thyroid tumors observed in male rats, uterine tumors in rats, and ovarian tumors in mice.

While none of the levels of neonicotinoid residues in the foods sampled in this study exceeded U.S. EPA's Reference Doses (the dose EPA considers acceptable based on laboratory studies), clinical research from Japan indicates that adverse effects not evaluated in animal studies may be observed at doses lower than U.S. EPA's reference doses.

In 2014, a study was published describing patients in Japan exhibiting symptoms of acute neonicotinoid poisoning suspected to be associated with dietary intake of fresh produce and tea.[13] A subgroup of 1,111 of the patients evaluated over the course of eight months showed symptoms of neonicotinoid poisoning, including heart arrhythmias, finger tremors, short-term memory impairment, and muscle weakness. All patients' symptoms were relieved by discontinuing their intake

Photo by Mike Parr

Neonicotinoids are toxic to birds as well as bees and other invertebrates. In mammals, U.S. EPA's risk assessments note that neonicotinoids are neurotoxic and are also associated with liver, kidney, thyroid, testicular, and immune system effects.

of domestic Japanese fruits and teas. The paper describes symptoms similar to those following neonicotinoid exposure from forestry spraying, and documents exposure by testing for urinary metabolites of the neonicotinoids. This work indicates that U.S. EPA's approach to assessing risk from pesticide exposure may not be sufficient to fully assess the human health implications.

Neonicotinoid Use is Widespread, But Often Unnecessary

While the use of neonicotinoid sprays and soil drenches on fruit and vegetable crops is widespread, their use on fresh produce represents only a small fraction of the total pounds applied in the U.S. Neonicotinoids also are used as seed coatings on hundreds of millions of acres of commodity crops such as corn, soybeans, cotton, canola, and sunflowers.[14] In their rush to register new products, regulators have approved more and more neonicotinoid pesticide active ingredients for an ever-growing number of uses without regard to the red flags raised by their own experts concerning the ecosystem effects of this toxic, systemic, and persistent class of pesticides.

Western Meadowlark by USFWS

By harming pollinators like bees and butterflies, and natural pest control agents like birds and beneficial insects, neonicontinoids are sabotaging the very organisms on which farmers depend.

Moreover, EPA scientists concluded last fall in their benefits assessment of treated soybean seeds that neonicotinoids are not increasing agricultural yields.[5] Other scientists have come to that same conclusion.[6] By harming the pollinators like bees and butterflies, and the natural pest control agents like birds and beneficial insects, the neonicotinoids are sabotaging the very organisms on which farmers depend. A growing body of research suggests that these biologically depleted, neonicotinoid-laden agricultural lands are becoming more vulnerable to pest pressures, thus requiring large inputs of organophosphates and other pesticides later in the growing cycle.

For many crop seeds these neonicotinoid coatings are the default—it is almost impossible to buy uncoated seeds, so farmers end up using them even in the absence of pests. The pre-emptive use of these chemicals is dialing back progress toward integrated pest management systems that rely on predatory beneficial insects as a major part of the strategy to control pests. These systemic insecticides have become a one-size-fits-all approach to pest management. And yet the reality is more like one-size-fits-none, because they are wreaking havoc on entire ecosystems. Neonicotinoids are killing the diverse wildlife that pollinates our crops and controls our pests for free.

Neonicotinoid Insecticides Harm Ecosystems

As mentioned, the extent of human health impacts of the neonicotinoids is not fully understood. However, scientists have found that neonicotinoid insecticides are a primary driver in the bee declines of the past decade.[15] The European Union placed a moratorium on the use of several neonicotinoids on bee-attractive crops in 2013, and the province of Ontario, Canada restricted use of these chemicals in 2015 because of their connection to the large-scale disappearance of pollinators. The pesticides are acutely toxic to bees even in minute amounts. A single corn seed coated with the neonicotinoid clothianidin can kill over 80,000 bees.[16] When these pesticides don't kill bees outright, they weaken them, making them more susceptible to other threats such as parasites, diseases, and nutrition deficiencies from habitat loss. Sub-lethal effects include reduced memory and learning ability, developmental shortcomings, impaired foraging ability, diminished navigation and homing ability, and the vastly reduced production of queen bees. [17]

Hundreds of recent studies detail concerns regarding the effects of neonicotinoid pesticides on other wildlife as well, including birds, butterflies, earthworms, and a wide range of terrestrial and aquatic invertebrates—effects that occur when the chemicals are applied as directed. As little as a single corn kernel coated with a neonicotinoid insecticide can be deadly to a songbird. Just one-tenth of a coated seed per day during the egg-laying season is enough to impair reproduction.[4]

Much of the harm is indirect. Elevated levels of these chemicals in many surface and ground waters are already high enough to kill the aquatic invertebrate life on which so many birds, bats, and other pollinators depend. [10, 18] Beneficial terrestrial invertebrates such as earthworms are also killed by the neonicotinoids at extremely low doses. [3, 19]

Honeybees by Jessica Lawrence, Bugwood.org

We urge Congress to pass the Saving America's Pollinators Act, H.R. 1284, for the benefit of people and the wildlife on which we depend: the unsung but indispensable birds, bees, bats, and beetles that support production of food for people everywhere.

CONCLUSION

The high frequency of detection of neonicotinoid insecticides in foods from the dining halls of the U.S. Congress gives us a snapshot of the ubiquity of neonicotinoid insecticide use in American agriculture. These insecticides are poisoning the birds and other organisms that farmers rely on for pollination and pest control. They are blanketing our croplands, contaminating watersheds, and poisoning birds, bees, earthworms, butterflies, and other organisms.

ABC urges the Congress to pass the Saving America's Pollinators Act, H.R.1284. The Act would suspend the use of neonicotinoid insecticides pending independent review of their effects on birds, terrestrial and aquatic invertebrates, bats, and other wildlife—the unsung but indispensable farm workers that support production of food for people everywhere.

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reactions and digestive problems. But since the EPA considers the Bt toxins to be "non-toxic," there is no regulation and no testing on their possible health effects.

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Bobolink, a grassland bird whose population decline may be linked to the prevalence of insecticides on agricultural crops.

Photo: Bobolink by Paul Sparks, Shutterstock