

# Neonicotinoids in Your Garden

*Jennifer Hopwood and Matthew Shepherd*

Gardens can be of great value for bees and other pollinators, providing nectar, pollen, caterpillar host plants, and bee nest sites. In recent years an increasing number of researchers and citizen scientists have surveyed bees in suburban and urban gardens across the United States and consistently they come back with records of dozens of species, even from community gardens in the Bronx and East Harlem in the heart of New York City. While usually they find common species, sometimes they've been surprised—the imperiled rusty-patched bumble bee (*Bombus affinis*), for instance, has been spotted by citizen scientists several times over the past three years in rural and suburban gardens in

Illinois. Gardens can clearly support significant communities of bees, and, although they comprise only a small fraction of most landscapes, the benefits from these garden bees can spill over onto nearby farmland. Scientists in Britain have found that agricultural crops within half a mile of gardens are more likely to receive visits from bumble bees than are those further away.

Unfortunately, the value of gardens for sustaining pollinator populations can be drastically limited by the use of pesticides, insecticides in particular. While there are a number of ways to manage garden pests, commonly used garden pesticides can kill the “good” insects, even when applied according



Gardens can provide valuable habitat for a wide variety of insects. Metallic sweat bee (*Agapostemon*), photographed by Mace Vaughan.



The common buckeye (*Junonia coenia*) is one of a wide range of butterfly species that regularly frequent gardens. Photograph by Bryan E. Reynolds.

to the instructions on the label. Faced with well-stocked shelves of pesticides at stores and garden centers, many gardeners discover that deciding which one to pick can be tricky. For the health and wellbeing of pollinating insects, avoiding pesticides altogether may be the best option, but the fact is that many gardeners do employ pesticides.

Among the most widely used garden insecticides are the neonicotinoids, a group of seven chemicals that have recently been the subject of media scrutiny. Lauded by some as a breakthrough in pest control, neonicotinoids are denounced by others as the cause of a new “silent spring.”

These insecticides with the tongue-twisting name are a synthetic modification of nicotine, a highly toxic plant compound once commonly used as a pesticide. First introduced into the U. S. market in the mid-1990s, neonicotinoids were rapidly adopted for agricultural use

as well as for ornamental plants growing in commercial nurseries, and they have become a ubiquitous presence on store shelves as the number of garden products containing them has expanded.

Neonicotinoids are systemic chemicals: taken up through various plant parts, they may then be distributed throughout plant tissues. This systemic action means that the chemicals can be applied to plants in a variety of ways—as a seed coating, as a soil drench around the base of a plant, by trunk injection, dissolved in irrigation water, as a spray to leaves. Whichever method is used, the pesticide is absorbed by the plant as it grows, making the plant tissues themselves toxic to sap-sucking insects such as aphids or plant bugs and to leaf-chewing caterpillars or beetles.

One oft-touted advantage of neonicotinoids over older pesticides is their lower toxicity to humans and other mammals (although unlike nonsystem-



Systemic insecticides are absorbed by a plant and spread through all its parts, including the nectar drunk by butterflies. American lady (*Vanessa virginiensis*), photographed by Bryan E. Reynolds.

ic products, they cannot be washed off of the fruit you eat). Another advantage is that they may be applied in a very targeted manner, reducing potential exposure to many types of non-target insects that would contact a broadcast spray. In one example of such an application, growing corn plants absorb the insecticide from coated seeds rather than the field of corn being sprayed, thus eliminating a broadcast spray that could expose non-pest insects in the process (although, on the other hand, dust released from equipment during planting poses a risk to bees and other non-target insects). Unfortunately, although sys-

temic applications may be claimed to be “safe” for non-target insect life, the toxins are present in pollen and nectar as well as in the rest of the plant, posing a threat to such flower-visiting insects as bees, wasps, butterflies, beetles, and flies.

Neonicotinoids are toxic to a number of beneficial insects, but the danger they pose to honey bees has drawn the most attention, given the recent large-scale losses of these domesticated pollinators. Some beekeepers and many in the environmental community consider neonicotinoids to be responsible for the phenomenon known as “colony collapse disorder.” In recent years a variety of journalists, documentary film makers, and organizations have expressed this opinion, often in quite strong terms, despite the fact that numerous scientific studies implicate a range of factors, including several pathogens and a lack of floral diversity in the landscape. In order to better understand the scientific evidence, the Xerces Society recently undertook a review of the research, both that which has been published in high-profile journals and internal studies produced by insecticide industry scientists. *Are Neonicotinoids Killing Bees?*, a summary of our review, was released by Xerces this spring.

It is clear that neonicotinoids fed to bees in laboratory settings can kill them outright, but it is unclear how often neonicotinoids reach lethal levels in pollen and nectar in the field or garden. As one might expect, though, the amount of chemical that can be found in pollen and nectar is related to the amount applied to the plant, and, in products intended for agriculture, restrictions limit neonicotinoid application to quantities

that typically result in sublethal levels being present in pollen and nectar. Still, although they don't kill, these smaller doses can affect the ability of bees to fly or navigate, impair their sense of taste, hamper their foraging activity, and reduce their ability to reproduce. These effects may impact individual solitary bees or combine to influence the overall health of bumble bee or honey bee colonies.

For example, recent research from France found that honey bees fed a sublethal dose had more difficulty finding their way back to their hive, and scientists in Britain found that bumble bee colonies fed very low doses of neonicotinoid-laced sugar water produced significantly fewer queens. While both of these studies were criticized for using doses higher than those that would be found in crops from treated seed, a

growing body of research indicates that harmful but sublethal levels are routinely applied to crops that bees visit and that these might be negatively affecting bee populations.

Even more worrisome, and far more overlooked, are the levels of pesticides that are permitted in home gardens. Particularly notable are industry studies that have found extremely high levels of neonicotinoids in ornamental flowering shrubs and trees that are attractive to bees. Home garden products containing neonicotinoids can legally be applied in far greater concentrations in gardens than they can be on farms—sometimes at concentrations as much as 120 times as great—which increases the risk to pollinators. Pesticide companies themselves found that, when applied in the amounts suggested on the labels, some neonicotinoids could continue



As adults, flower flies feed on nectar or pollen; as larvae, they may eat aphids or other soft-bodied insects that are often considered garden pests. They can be exposed to neonicotinoids through all of these food sources. Flower fly (*Eucesthes*), photographed by Rollin Coville.



All but one of these garden insecticides contain neonicotinoids, and none of the labels indicate that they are poisonous to bees and adult butterflies. Photograph by Matthew Shepherd.

to be present in flowers at lethal levels eighteen months after application. But homeowners may not even be aware of the risk the use of these products poses. The labels of many of the products now on garden center shelves do not mention the toxicity of the products to bees, nor do they suggest ways to limit exposure to bees, such as by applying them only to non-flowering plants or after the plants have bloomed.

Efforts are underway to change the way neonicotinoids are labeled and regulated. Xerces is working with the U.S. Environmental Protection Agency and other organizations to develop new methods for testing the effects of insecticides on native bees—creatures that have been routinely ignored throughout the history of the pesticide regulation process—and to establish better assessment protocols. Still, it will take some

years for any revisions to filter through the system and change the products that are for sale.

What you apply to your garden, though, is something that you have direct control over. To determine whether a pesticide contains a neonicotinoid, review the ingredients before you buy. Imidacloprid, dinotefuran, clothianidin, and thiamethoxam are all neonicotinoids found in home garden products. Much harder to control is the lingering presence of pesticides that have been applied to plants months before they reach your garden. There have been reports of dead bees—both honey bees and bumble bees—around commercially grown hanging baskets, and there is reason for concern about monarch caterpillars being affected by eating nursery-bought milkweed. Obviously, nurseries are applying pesticides to protect their

investment; most people don't want to buy a ragged-looking plant, in the same way that they choose spotless fruit over blemished. When, however, this preference harms wildlife in gardens separated by distance and time from where the plant was grown, it is clear that we must find new ways to nurture plants grown for sale. Again, before you buy, take a moment to ask the garden center staff if they know whether the plants were treated with neonicotinoids.

Wildlife gardening is a well-established movement. It seems that every neighborhood has people encouraging wildlife into their yards. Choosing the best plants to attract butterflies, building bird houses and bee blocks, and creating ponds or log piles to provide shelter for frogs and myriad other small creatures are all effective ways to support a wide range of wildlife, and generations of gardeners have enjoyed beautiful gar-

dens that are free of chemical threats. Systemic insecticides add an unfortunate additional layer of complexity for gardeners wanting to create a safe haven for insects and other wildlife, but with care the danger can be minimized or avoided.

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Are Neonicotinoids Killing Bees? A Review of Research into the Effects of Neonicotinoid Insecticides on Bees, with Recommendations for Action is available from the Xerces Society. Visit [www.xerces.org/neonicotinoids-and-bees/](http://www.xerces.org/neonicotinoids-and-bees/) to download a free PDF file or call 1-855-232-6639 to purchase a copy.



Gardens are being created across the country to provide habitat for butterflies and bees. The Xerces Society offers information about creating such plots, as well as signs to raise awareness of the importance of pollinator habitat. Photograph by Celeste Ets-Hokin.