Protecting Pollinators: What is going on with pollinators, what role do pesticides play, why should you care, and what can you do?

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*Note from the authors: This article was originally written in April of 2014 for the members of the green industry to inform them of current issues associated with bee pollinators and pesticides. We have revised the article somewhat with the publication of new research-based information and to address the readers of **The Azalean**. Azaleas are one of the most commonly grown shrubs in residential and commercial landscapes. They produce flowers that are present for specific times of the season, and the newer everblooming varieties flower for most of the season. Moreover, azaleas are visited by bees that feed on their floral resources, and azaleas are treated with pesticides to manage lacebugs and other pest problems. There is potential for these treatments on azaleas to pose a threat to pollinators. Anyone who gardens, maintains, and/or produces plants should be conscious of protecting pollinators.*

What is the problem?

Pollinator health has recently been the focus of popular media, environmentalists, apiary specialists, scientists, farmers, horticulturists, and the public in general. Unusually high honeybee colony losses were reported by beekeepers in the United States in 2006, and in other countries over the last decade. This syndrome became known as Colony Collapse Disorder. In addition to issues with honeybee health, research on bumblebees and other solitary bees has raised concerns of declines in the number of species and abundance of these pollinators. Most data on bee decline is on honeybees, less so on bumblebees, and even less on solitary or wild bees. However, the consensus is that pollinators are at risk.

What is causing the problem?

Numerous scientific studies, both laboratory and to a lesser extent field studies, have been conducted to identify causal factors relating to declines in honeybee and bumblebee populations. Causal factors likely vary in their impact between honeybees and bumblebees. In recent reviews of the data, scientists have identified multiple factors or "stressors" that affect honeybee or solitary bee health, including parasites (Varroa mites), pathogens (fungi, viruses), poor nutrition, habitat loss (limited floral resources and nesting sites), management stress, and pesticides. Native bee declines and honeybee colony loss may be the result of the above stressors working independently, but most evidence demonstrates that these factors interact in combination or synergistically to impact the health of bees. For example, exposure of bees to certain fungicides can increase the toxicity of pyrethroids to bees; poor diet due to limited floral resources can compromise a bee's immune system, making it more susceptible to parasites and pathogens; and pesticide exposure can affect a bee's disease tolerance and susceptibility to disease.

Data suggest that pesticides in general and neonicotinoids in particular are not primary factors in honeybee decline or "colony collapse disorder." For bumblebees, pesticides may play a larger role, but there is still a need for more field studies evaluating impacts on bees. Little is known about the effects of pesticides on solitary bees. There are many issues associated with the interpretation of the data from research studies. For example, laboratory studies sometimes evaluate levels of pesticides that are greater than bees would likely be exposed to under field conditions. Bee biology and behavior can influence the actual levels of pesticide exposure that bee or bee colonies encounter. This questions the accuracy of inferences from lab to field situations and emphasizes the need for more field studies with field-relevant exposure levels.

What about neonicotinoid insecticides?

Some groups have focused on the class of insecticides called neonicotinoids, citing them as a major cause of problems with bee health.

Regulations restricting the use of neonicotinoid insecticides in Europe have been implemented. In the U.S. large box stores have responded to pressure from environmental groups by requiring all flowering plants treated with neonicotinoids be labeled as such. The EPA has accelerated reviews of neonicotinoid insecticides and mandated the addition of a "bee advisory box" on all products containing neonicotinoids. There is pressure from various groups to remove or further restrict the use of neonicotinoids, especially from ornamental and turfgrass systems.

What are neonicotinoid insecticides and their potential risks?

Neonicotinoid insecticides are insect neurotoxicants. In the green industry, these include imidacloprid, thiamethoxam, clothianidin, acetamiprid, and dinotefuran. They have many desirable features such as broad-spectrum activity, low application rates, low mammalian toxicity, systemic movement upward in plants, and multiple application methods (soil drenches, foliar sprays, or injection into plants). They have proven very effective and generally safe in controlling many sucking, plant boring, and turf-feeding insects. Their distribution throughout the plant and their long residual activity have contributed to effectiveness in controlling plant-damaging insects. Because of these benefits neonicotinoids are widely used in the green industry (and agriculture) for managing many potential pest insects. Neonicotinoids are especially useful for tree conservation and invasive insect species management. For invasive species such as emerald ash borer, Asian longhorned borer, and hemlock wooly adelgid, neonicotinoids are one of the most effective tools for preventing massive loss of trees in urban forests and landscapes. Neonicotinoids have been effective in controlling numerous landscape and turf pests.

However, neonicotinoids, like several other classes of insecticides, are toxic to bees. Misapplication to trees in bloom when bees are foraging (against label directions) has resulted in massive bee death. Laboratory studies have indicated that acetamiprid is less toxic to bees than the other neonicotinoids. In general, application rates are higher for ornamental plants than for agricultural crops. Statements have been made that the higher rates and the systemic activity of neonicotinoids increase the likelihood that toxins will end up in pollen and nectar at levels toxic to bees--a concern is when neonicotinoids are sprayed on open flowers of insect-pollinated plants. Also, neonicotinoids have the potential to move systemically into pollen, nectar, and guttation fluids in some plant species, posing particular concern for exposure to pollinators. There is still a lot we do not know about the effects of pesticides, including neonicotinoids, on pollinators and other beneficial insects, and movement of the pesticides into and residual activity in various plant parts. Also, bee behavior can affect actual exposure of bees on these plants. Therefore, more research is necessary before it can be said how pesticide residues in ornamentals and turf affect pollinator health.

What course of action and factors should be considered when managing potential pests in ornamental and turf systems?

First, neonicotinoid insecticides are in the spotlight as a major factor affecting bee health, regardless of what the data suggests. In addition, complete information is still lacking on their impacts on pollinators, especially for bumblebees and solitary bees. Second, the green industry tends to rely on products that contain neonicotinoids for managing a wide array of pests. In some situations, these are the best or only choices; for other pests there are alternatives management tactics that could be used. Third, there is the potential for EPA, or even specific counties within states to remove or greatly restrict the use of neonicotinoid insecticides, especially their use in ornamental and turf systems. Therefore, it would be wise for the green industry to reduce the use of and reliance on neonicotinoid insecticides and to be sure employees are aware of potential risks to pollinators and non-targets in general of the insecticides they are applying. Many other insecticides are also toxic to pollinators and non-targets. Be sure to READ THE LABEL thoroughly and follow the directions.

Consider the following when making plant and pest management decisions. Implement Integrated Pest Management (IPM) practices. Choose non-chemical management tactics whenever possible. Select pesticides that have low impact and risk to pollinators. Only use neonicotinoids when other effective products do not exist (reduce reliance on neonicotinoids). Avoid prophylactic use of neonicotinoids (i.e., do not make applications unless you have an insect at levels likely to cause damage to the plant or turf). Know which plants are wind-pollinated vs. insect-pollinated. Avoid using neonicotinoids on insect-pollinated plants in general. Similarly, try to avoid trunk and soil injection of neonicotinoids on insect-pollinated plants (not enough is known about residual levels of neonicotinoids in the nectar and pollen over time to assess risk). Do not apply foliar sprays to flowering plants until after petal drop. If a neonicotinoid is needed, use a product with acetamiprid before other active ingredients. Be sure to mow turfgrass to remove flowers from weeds (i.e., .clover) immediately before or after an application of a neonicotinoid.

What can you do towards conserving pollinators?

We need to conserve pollinators to ensure that pollinator populations are diverse and abundant enough to meet food crop pollination needs and ensure the integrity of natural ecosystems. Plant a diversity of flowers that are known to provide adequate floral resources to pollinators in flower beds or conservation strips. Maintain natural areas. Provide nesting habitat for solitary bees such as bundles of hollow reeds or canes, or commercially purchased bee tubes or "hotels," and bare patches of soil. Reduce exposure of bees and flowering plants to pesticides.

Information and comments provided in this article are based on scientific information currently available to the best of the author's knowledge (written May 2015).
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