BEYOND PESTICIDES
INFORMATION FOR ACTION

Pesticides & Pollinators

ChemicalWATCH Stats — Neonicotinoids

CAS Registry Number:

- 105827-78-9 (imidacloprid)
- 210880-92-5 (clothianidin)
- 153719-23-4 (thiamethoxam)
- 111988-49-9 (thiacloprid)
- 165252-70-0 (dinotefuran)
- 135410-20-7 (acetamiprid)
- 150824-47-8 (nitenpyram)

Chemical Class: Chloro-nicotinyl or nicotinoid

Use: Broad spectrum insecticide in liquid, granular, and dust formulations, and seed coatings used for a wide range of insects, including soil insects, in agricultural, garden, turf, and residential pest control.

Toxicity Rating: Moderately toxic

Signal Words: Caution, Warning

Health Effects: Linked to reproductive and mutagenic effects and is neurotoxic.

Environmental Effects: Highly toxic to bees and other beneficial insects, and toxic to upland game birds. Generally persistent in soils and can move into waterways and leach to groundwater.

There are a number of pesticides that when applied—either through seed coating, drenching of the soil, or sprayed—enter the plant, move through the vascular system and are expressed through pollen, nectar, or guttation droplets. These "systemic" pesticides cause indiscriminate poisoning to insects, particularly pollinators, that forage through gardens, farms, roadsides, parks, or meadows where these pesticides have been used on the seed, seedling, or plant.

Neonicotinoids[1]

Neonicotinoids (neonics) are insecticides similar to nicotine –that activate neuronal receptors and disrupt many sensory and cognitive processes in invertebrate organisms. The binding of neonicotinoids to the receptor is irreversible in arthropods.[2,3] Thus, they are highly toxic to insects and other invertebrates. Neonics include the insecticides imidacloprid, thiacloprid, clothianidin, thiamethoxam, acetamiprid, nitenpyram, and dinotefuran. A chemical cousin, sulfoxaflor, is similar to neonicotinoid pesticides—it acts on the nicotinic acetylcholine receptor (nAChR) in insects, and like neonicotinoids, it is a "systemic" insecticide.

REGULATION & USE

Seeds of corn, soybeans, canola and others are widely coated with pesticides before they are planted in an effort to poison soil pests, including insects and fungus, before and after germination. The neonics are also applied to vegetable and flower seedlings and plants, including turf, as a soil drench, spray, granule, or dust. Whether applied as a seed coating or to the plant, these systemic pesticides translocate throughout the plant, essentially making the entire plant a pesticidal agent.

NONTARGET EFFECTS & POLLINATORS

Neonics are linked with the dramatic decline of pollinators and other wildlife. U.S. beekeepers lost an unsustainable 33% of their hives between 2016 and 2017. Bees, butterflies, birds, and a range of soil and aquatic organisms essential to healthy ecological systems are imperiled by the use of these systemic and persistent pesticides. While several classes of pesticides introduced since the outset of the chemical-intensive agricultural era are systemic, neonicotinoids have attracted substantial scientific and public scrutiny because their appearance and proliferation in the market coincided with dramatic die-offs and decline of honey bees throughout the world. This decline has occurred, not only through immediate bee deaths, but also through sublethal exposure causing changes in bee reproduction, navigation, and foraging.[4]

CONTAMINATION OF WATERWAYS

Neonics are detected regularly[5] in sampling of the nation's waterways at concentrations that exceed acute and chronic toxicity values for sensitive organisms.[6] Scientific knowledge concerning the aquatic impacts of neonicotinoids is growing, and research finds that neonicotinoids have direct and indirect impacts on aquatic communities. Neonic contamination, detected in rivers, streams, and lakes in 29 states,[7] poses detrimental effects to keystone aquatic organisms, resulting in a complex cascading impact on ecosystems.

Fipronil

Fipronil belongs to a chemical class known as phenylpyrazoles and inhibits the aminobutyric acid (GABA)-gated chloride channel, resulting in selective neurotoxicity in insects compared to mammals.[8]

REGULATION & USE

Fipronil is registered for use in the U.S. to control a variety of insects, both indoor and outdoor, as well as for in-furrow root coating, seed treatment, soil injection, and bait treatment, and spot treatment on pets. In an effort to mitigate ecological risks, the U.S. Environmental Protection Agency (EPA) converted the major outdoor use products to restricted use classification, which takes it off retail store shelves, but allows commercial applicators and farmers to continue to apply it.[9]

NONTARGET EFFECTS & POLLINATORS

Although EPA states that fipronil is non-systemic, evidence has found the chemical to undergo root uptake and transport within plants.[10] Fipronil and its metabolites have also been detected in the pollen of plants.[11] Fipronil is relatively mobile in soils, degrades to form persistent metabolites, and is a pervasive water contaminant.[12,13] It has been found to be toxic to nontarget organisms, including honey bees[14] and various aquatic species.[15]

Chemical WATCH Stats — Fipronil

CAS Registry Number: 120068-37-3

Chemical Class: phenylpyrazole

Use: Broad-spectrum insecticide for pest control in gardens, turf, agriculture and buildings in a range of liquid, granular, dust, and gel formulations and seed coatings.

Toxicity Rating: Toxic

Signal Words: Caution, Warning

Health Effects: Endocrine disruption, possible carcinogen, neurotoxic, and reproductive effects.

Environmental Effects: Toxic to fish, aquatic invertebrates, and other nontarget organisms, such as bees.

Other Insecticides

Synthetic pyrethroids have also been shown to impair bee learning and foraging behavior. These include bifenthrin, deltamethrin, fluvinate, and permethrin. Studies also implicate endosulfan and spinosad in bee decline and colony collapse disorder (CCD).[16]

The Decline of Pollinators: Economic Effect

The economic impact associated with the decline of bees and other insect pollinators is also significant. Insect pollination has been shown to enhance crop yield, thus contributing to agricultural productivity by up to 71%, depending on the crop.[17] The total global economic valuation of pollination services is estimated to be 9.5% of global food production value in 2005, or about $190 billion.[18] In the U.S., the value of crops directly reliant on insect pollinators is $15.12 billion (2009), with the value attributed to honey bees alone at $11.68 billion.[19] Pollinator-dependent crops are also a source of nutrients critical for human health, accounting for one-third of the human diet in the U.S.[20,21] The continuation of the pollinator decline therefore threatens the stability of ecosystems, the economy, human health, and the food supply.[22]

ENDNOTES

1 See Cultivating Plants that Poison Bees, Butterflies, and Birds. 2016. http://beyondpesticides.org/assets/media/documents/SystemicsCited.pdf; Poisoned Waterways. http://beyondpesticides.org/assets/media/documents/bp-37.1-PoisonedWaterways-cited3.pdf; and What the Science Shows. http://beyondpesticides.org/programs/bee-protective-pollinators-and-pesticides/what-the-science-shows.

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