Bee Aware –

The Use of Neonicotinoid Pesticides

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Finally…as mammals crawl out of their winter hibernation dens, birds make their way north to their breeding grounds, small buds on trees begin to appear and all those wonderful insects begin to hatch – the feeling of spring is in the air. But even as the warm breezes start blowing in, I would like to draw your attention to a somewhat chilling subject. Neonicotinoids, a relatively new chemical threat, have been embraced by more and more agricultural producers. Some refer to this new group of pesticides as the "new DDT." Neonicotinoids were introduced in the 1990s and have rapidly become the most widely used pesticide in the world. Plants readily absorb them via their seeds, roots or leaves and transport them throughout the tissues of the plant. They are most commonly applied as a seed dressing before planting occurs, so plants treated with neonicotinoids enjoy complete protection from all types of insects.

Regardless of many serious warnings from scientists, Health Canada's Pest Management Regulatory Agency (PMRA) has consistently allowed the registration of neonicotinoids for use on a variety of crops in Canada including corn, potatoes, canola, lettuce, and in seeds for home gardening plants. One such warning came from the US Environmental Protection Agency (EPA). The EPA concluded that thiamethoxam, a widely used neonicotinoid, was likely to have "direct adverse effects on freshwater invertebrates, birds and mammals." Despite this strong statement about thiamethoxam's likely harm this pesticide's extensive use continues in North America.

Despite their effectiveness as pest controls, pesticide fact sheets show that imidacloprid, clothianidin and fipronil – three other common neonicotinoids – are as toxic to non-target invertebrates as they are to their intended targets. Many of the insects that are collateral damage in the war on agricultural pests provide ecological services instrumental to crop health and longevity. Scientific studies have demonstrated that, because neonicotinoids are present throughout the plant, their toxins are passed to the pollen and nectar. This creates deadly problems for pollinators. Bees, both native and introduced species, have suffered a tremendous hit from neonicotinoids. Bees come into contact with these pesticides in several ways, the most obvious one being directly through pollen and nectar. But small portions of the active ingredient in a neonicotinoid seed dressing also aren't absorbed by the soil or crop and are lost in dust during sowing. This airborne dust is toxic enough to kill nearby flying pollinators; a good indication of the high level of toxicity found in only trace amounts of neonicotinoids. The Xerces Society for Invertebrate Conservation reported that "at least four wild species, formerly common in North America, have ex-

A bee paying a welcome visit to subalpine fleabane (Erigeron peregrinus). PHOTO: © J. HILDEBRAND

perienced catastrophic declines over the past decade – two of them may be on the brink of extinction."

Evidence also points to a strong correlation between neonicotinoid pesticides and the colony collapse disorder (CCD), where European honey bees are abandoning their hives and dying off in large numbers. Just last year, in response to rapidly dwindling global honey bee populations, environmental and food safety groups sued the EPA for approving neonicotinoids despite damning evidence of their effects. To add yet another twist, disorientation of bees that causes delay in foraging and hive abandonment is very similar to the abnormal neurological behaviour in bats affected by White Nose Syndrome (WNS); this syndrome has caused dramatic declines in bat populations. The potential connection between CCD and WNS warrants further research and may provide a compelling example of the possible pervasive and costly repercussions of neonicotinoids.

Many neonicotinoid suppliers have tried to marginalize scientific warnings by suggesting there could be multiple factors for this bee genocide – blaming disease rather than looking at the link to neonicotinoids. However, a recently published scientific study found a causal link between neonicotinoid exposure and the depression of a bee's immune system. This thwarts the pesticide industry's argument that diseases and neonicotinoids are mutually exclusive threats to bees.

Neonicotinoids are agonists at the insect nicotinic acetylecholine receptor (NAR). This causes receptor blockage, paralysis, and death. Fundamental differences between the NARs of insects and other animals give selectivity for the pesticide, which is why neonicotinoids were thought to be a selective, effective pest controls that would only target insect pests. Although these pesticides have been praised for having a low affinity for vertebrate relative to insect NARs, studies show that neonicotinoids also cause chronic toxicities in vertebrates. Insects are far from the only animals these pesticides negatively impact; other members of our kingdom are directly or indirectly harmed from coming into contact with neonicotinoids.

Most bird species at risk are insectivorous, feeding their young and themselves with insects potentially covered in pesticides. Others at risk would diet mainly on seeds, which can easily be neonicotinoid-treated seeds planted shallowly in the ground or spilled by farm machines. If birds do not die immediately they may suffer less obvious sub-lethal consequences including partial paralysis, decreased reproduction rates, and behavioural changes. Because these debilitations are not fatal or easily detected, they slip through the monitoring cracks and lead us to underestimate the risk posed by neonicotinoids.

A recent study showed a connection between rat respiration and behavioural symptoms and neonicotinoid insecticide exposure. Another study demonstrated that gestational exposure in rats to a single, non-lethal dose of imidacloprid produced neurobehavioral problems and pathological alterations in their offspring. This raises the possibility that neonicotinoids could have effects on mammals, including our own health.

And, of course, what lands on land is bound to end up in our waterways. Major risk concerns about these pesticides regarding their persistence and mobility, features likely to cause surface and ground water contamination, have been ignored. Most neonicotinoids are stable in water, not easily biodegradable, and can accumulate in soil and sediments where they may persist for months, even years. Water contamination concerns led the State of New York to refuse to register clothianidin and to severely restrict the use of imidacloprid and thiamethoxam. In Alberta, we do not even know the extent of the harm done on aquatic organisms by neonicotinoids, but there have been studies suggesting that we should take note. Are we going to continue to allow water contamination from these pesticides in Canada? Considering the amount of land under the plough in Alberta and the regularity of flood events we should be extra concerned about neonicotinoid runoff.

The widespread adoption of neonicotinoids as seed dressings has led to a move away from integrated pest management (IPM). IPM is a planning approach to pest management that minimizes the use of chemical pesticides by monitoring pest populations, making maximum use of biological and cultural controls, applying chemical pesticides only when needed, and avoiding broad-spectrum, persistent compounds. Abandoning IPM is a significant step backwards from the goal of making agriculture more sustainable. Here profit and convenience seem to once again overrule the overwhelming evidence of serious side effects to all ecosystem players.

There is some good news. At the end of last year, the European Commission restricted the use of three commonly used neonicotinoids for a two-year period. The US EPA is currently conducting a regulatory review of this class of insecticides. In Canada the PMRA acknowledged last year in a 'Notice of Intent' that the majority of examined pollinator mortalities were the result of exposure to neonicotinoids. This branch of Health Canada has admitted that current agricultural practices related to the use of neonicotinoid seed treatments are unsustainable. There has been a North American wide call from a range of organizations for a ban on neonicotinoid seed treatments and a suspension of all neonicotinoid applications pending an independent review of the products' effects on aquatic and terrestrial invertebrates, birds, and other wildlife.

These pesticides are being called the "new DDT" because, like DDT, neonicotinoids were registered for use without acknowledging the many red flags raised by scientists. Why are we repeating the past instead of learning from it? Joni Mitchell's plea sadly remains applicable "Give me spots on my apples; just leave me the birds and the bees."

What can you do?

On March 4, Gus Yaki, a life-long naturalist, captivated an audience at the AWA building with his talk on neonicotinoids and biodiversity loss. To inspire action, he suggested several things individuals could do in their own yards to take a stand against neonicotinoids and help out our native wildlife. So as we head into spring

and your dusting off those gardening gloves, keep the following suggestions in mind:

- A lawn is a farce; instead plant small native trees, shrubs, grasses and perennial flowering plants. This will attract native pollinators as well as birds and other small wildlife to your yards.
- Only buy seeds and plants that are guaranteed to be neonicotinoid free. This is no easy task considering there are no neonicotinoid labelling regulations currently in place. Talk to nursery employees and don't buy the plants or seeds if they are unsure. Your best bet is to source seeds and plants from small local suppliers of native plant seeds.
- Increase the awareness of this issue to friends, family, coworkers, etc.
- Write to your MLA, provincial and federal governments, and PMRA to voice your concerns.

Of course, bees are not the only insect pollinators. Note the flecks of pollen on the bee and the other, much tinier insect on the flower. PHOTO: Benson Kua, licensed under the Creative Commons Attribution-Share Alike 2.0 Generic license.

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