Registered Nurses' Association of Ontario
L'Association des infirmières et infirmiers autorisés de l'Ontario

Neonicotinoid Backgrounder

The Ontario government has drafted a *Pollinator Health Action Plan*[1] to address the problem of heavy mortality among wild and managed pollinators. For example: winter losses of honey bees rose to 58 percent in 2014.[2] A major concern is the risk to crops reliant on pollinators. These crops are valued at about $897 million per year in Ontario, and are an important part of the province's food supply.

There are multiple factors contributing to high pollinator mortality. These include:[3]

- pesticide exposure (particularly to a relatively new class of pesticide, neonicotinoids ("neonics"))
- degradation of pollinator habitat and food sources
- diseases, pests and genetics
- climate change and weather

The government is proposing to greatly reduce neonics where they are used most: in corn and soybean production. The aspirational target is an 80 per cent reduction in acreage using seeds coated with three specified neonics (imidacloprid, thiamethoxam, and clothianidin) by 2017. This reduction would be achieved by a variety of measures, including licensing and a requirement to demonstrate the presence of pests above a specified threshold.[4] One concern is widespread preventive use in the face of limited evidence of need. The overall aspirational target is a reduction of winter honey bee mortality to 15 per cent.

Although the proposal is a significant step in the right direction, RNAO is calling for a complete ban that covers all neonicotinoids.

RNAO has been involved in a coalition promoting a ban on neonics. This very same coalition has helped to drive an advertising campaign warning of the dangers of neonics (see ad in the appendix). There has been considerable media interest in the campaign.[5] [6]

The Problem with Neonics

Neonics are insecticides. They work by attacking nerve receptors in insects. They are toxic to animals, but more toxic to insects than to mammals. Lethal and sub-lethal exposures are both problematic. We know that sub-lethal exposures can compromise the health of pollinators, which makes them susceptible to diseases and parasites. Neonics are water soluble, which means they can readily move into bodies of water. They are also persistent, which means they can, over time, continue to compromise animal and insect health. Biodiversity suffers not only due to the direct effects on vertebrates and invertebrates; the removal of many pollinators from the environment affects the success of plants and removes a substantial source of sustenance from creatures further up the food chain. There is strong consensus that neonics can harm pollinators and other invertebrates and vertebrates. The research has been summarized by the *Task Force on Systemic Pesticides* which examined more than 800 peer-reviewed scientific papers on the topic over the past 20 years and published its conclusions in 2014 (see appendix).[7] The Environmental Commissioner of Ontario has provided a brief summary of science on neonicotinoids (see appendix).[8] Both conclude that neonics harm pollinators and that action is necessary. In the face of the evidence and the concern that use of neonics adds to the toxic load we all carry, a precautionary approach is warranted. The onus to prove safety and effectiveness ought to rest with the proponent of a given toxic. The evidence on adverse effects was sufficiently compelling that the European Commission voted to restrict the use of the three neonics listed above for two years.[9] [10] [11] This happened after the European Food Safety Authority identified that neonics represented significant risks to bees.[12]

Appendix

Coalition Advertising Campaign

Environmental Commissioner of Ontario (ECO): ***A look at the science on neonicotinoids***[13]

In the ECO's latest Annual Report, we examined the environmental effects of neonicotinoids – a class of pesticides used throughout Ontario. New research on neonicotinoids is being published at an astounding rate, demonstrating an overwhelming level of concern within the scientific community. While much of this research initially focused on the effects of neonicotinoids on pollinators, serious issues are being raised surrounding the broader ecological implications of neonicotinoid use.

The use of neonicotinoids has increased significantly since their introduction in the 1990s. They are now the most widely used insecticides in the world. Neonicotinoids act systemically, meaning that they diffuse throughout the tissues and sap of treated plants, and are found in pollen, nectar and guttation droplets (i.e., small drops of liquid exuded by some plants). They are most commonly used as seed treatments, but they can be applied in other ways, such as foliar sprays and soil additions. Pollinators are primarily exposed to neonicotinoids through nectar and pollen and, notably, through contaminated dust generated during the planting of treated seeds.

Exposure to neonicotinoids has been linked to both lethal and sublethal effects on pollinators. There is now clear evidence that acute exposure to neonicotinoid-contaminated dust is linked to mass bee deaths observed during the planting of seed treated crops. In fact, Canada's Pest Management Regulatory Agency (PMRA)'s investigation into the 2012 and 2013 bee kills in Canada concluded that neonicotinoids were a contributing factor in many cases. Accordingly, in 2013, the PMRA declared that "current agricultural practices related to the use of neonicotinoid treated corn and soybean seed are not sustainable." (.pdf)

Furthermore, a number of studies have concluded that neonicotinoids can also cause adverse sublethal effects on bees, such as:

- impaired memory and learning;
- interference with foraging;
- reduced reproduction and queen production; and
- impaired immune function and increased susceptibility to pathogens.

Even with lower concentrations, cumulative and/or synergistic effects may cause impaired colony function or even failure. For example, one recent study concluded that chronic sublethal stress can be a cause of honey bee colony failure, noting that if many bees in a colony become impaired, it may lead to a cumulative effect on normal colony function.

In recent years, substantial declines in honey bee populations have been observed, notably in North America and Europe. This decline includes colony losses in Ontario: over the last eight years, the average overwintering loss of bee colonies in Ontario has been approximately 34 per cent – more than double the 15 per cent winter loss rate that is considered to be acceptable by apiculturists. In fact, last winter, Ontario lost 58 per cent of its honey bee colonies. In addition to these overwintering losses, a number of other large-scale bee deaths have been reported in Canada. In the spring and summer of 2012 and 2013, the PMRA received numerous reports of honey bee mortalities (.pdf) from beekeepers in Ontario, Quebec and Manitoba. The resulting Health Canada report concluded that the planting of corn seeds treated with neonicotinoids contributed to the majority of the bee mortalities that occurred in the corn growing regions of Ontario and Quebec.

Signs are emerging that many wild pollinators, particularly bumble bees, are in decline as well. For example, the Committee on the Status of Pollinators in North America has stated that long-term population trends are demonstrably downward for several wild bee species, as well as for some butterflies, bats and hummingbirds.

Although the impact of neonicotinoids on bees has received a great deal of attention, honey bee declines may be a visible warning sign of a larger ecological problem. Troubling questions are being raised about the broader environmental effects. Only a small portion of the active substance is taken up (.pdf) by plants in seed-treated crops, while the rest enters the environment. This is of great concern because neonicotinoids are not only persistent in soil and water, but are also water soluble and highly mobile within ecosystems.

As a result, neonicotinoids can accumulate in soil, potentially having adverse effects on soil ecosystems (.pdf) and creating a likelihood of uptake by subsequently planted crops and wild plants. They also have the potential to migrate into ground and surface water. Runoff and spray drift can impact aquatic invertebrates in streams and ponds. For example, in one study conducted in California, imidacloprid was detected in 89 per cent of surface water samples – with 19 per cent of samples exceeding toxicity guidelines. Another recent study in the Netherlands demonstrated that aquatic macro-invertebrates are less abundant in surface water with higher imidacloprid concentrations, suggesting potential consequences for the food chain and ecosystem functions.

Neonicotinoids may also be posing serious risks to birds and mammals. For example, a July 2014 study found that declines in insectivorous birds are associated with high neonicotinoid concentrations. The researchers state that their "results suggest that the impact of neonicotinoids on the natural environment is even more substantial than has recently been reported and is reminiscent of the effects of persistent insecticides in the past." Questions are also being raised regarding the potential human health effects of neonicotinoids.

In June 2014, the Task Force on Systemic Pesticides released the most comprehensive review of the effects of neonicotinoids to date. The Worldwide Integrated Assessment of the Impact of Systemic Pesticides on Biodiversity and Ecosystems examined over 800 scientific studies spanning the last five years, including studies sponsored by industry. Among the study's main conclusions is that "The combination of prophylactic use, persistence, mobility, systemic properties and chronic toxicity is predicted to result in substantial impacts on biodiversity and ecosystem functioning."

As a result of this rapidly evolving body of research, the ECO recommended that the Ministry of Agriculture and Food and the Ministry of the Environment undertake monitoring to determine the prevalence and effects of neonicotinoids in soil, waterways and wild plants. The Ontario government needs to develop an effective action plan on neonicotinoids. We cannot ignore the problem and accept the risk of an ecological catastrophe.

Findings of the Task Force on Systemic Pesticides

"The side effects of the current global use of pesticides on wildlife, particularly at higher levels of biological organization: populations, communities and ecosystems, are poorly understood (Köhler and Triebskorn, 2013). Here, we focus on one of the problematic groups of agrochemicals, the systemic insecticides fipronil and those of the neonicotinoid family. The increasing global reliance on the partly prophylactic use of these persistent and potent neurotoxic systemic insecticides has raised concerns about their impacts on biodiversity, ecosystem functioning and ecosystem services provided by a wide range of affected species and environments. The present scale of use, combined with the properties of these compounds, has resulted in widespread contamination of agricultural soils, freshwater resources, wetlands, non-target vegetation and estuarine and coastal marine systems, which means that many organisms inhabiting these habitats are being repeatedly and chronically exposed to effective concentrations of these insecticides"[14]

"Neonicotinoids and fipronil are among the most widely used pesticides in the world. Their popularity is largely due to their high toxicity to invertebrates, the ease and flexibility with which they can be applied, their long persistence, and their systemic nature, which ensures that they spread to all parts of the target crop. However, these properties also increase the probability of environmental contamination and exposure of nontarget organisms. Environmental contamination occurs via a number of routes including dust generated during drilling of dressed seeds, contamination and accumulation in arable soils and soil water, runoff into waterways, and uptake of pesticides by nontarget plants via their roots or dust deposition on leaves. Persistence in soils, waterways, and nontarget plants is variable but can be prolonged; for example, the half-lives of neonicotinoids in soils can exceed 1,000 days, so they can accumulate when used repeatedly. Similarly, they can persist in woody plants for periods exceeding one year. Breakdown results in toxic metabolites, though concentrations of these in the environment are rarely measured. Overall, there is strong evidence that soils, waterways, and plants in agricultural environments and neighboring areas are contaminated with variable levels of neonicotinoids or fipronil mixtures and their metabolites (soil, parts per billion (ppb)-parts per million (ppm) range; water, parts per trillion (ppt)-ppb range; and plants, ppb-ppm range). This provides multiple routes for chronic (and acute in some cases) exposure of non-target animals. For example, pollinators are exposed through direct contact with dust during drilling; consumption of pollen, nectar, or guttation drops from seed-treated crops, water, and consumption of contaminated pollen and nectar from wild flowers and trees growing near-treated crops. Studies of food stores in honeybee colonies from across the globe demonstrate that colonies are routinely and chronically exposed to neonicotinoids, fipronil, and their metabolites (generally in the 1–100 ppb range), mixed with other pesticides some of which are known to act synergistically with neonicotinoids. Other nontarget organisms, particularly those inhabiting soils, aquatic habitats, or herbivorous insects feeding on noncrop plants in farmland, will also inevitably receive exposure, although data are generally lacking for these groups. We summarize the current state of knowledge regarding the environmental fate of these compounds by outlining what is known about the chemical properties of these compounds, and placing these properties in the context of modern agricultural practices."[15]

No Silent Spring Again (The Appeal of Notre Dame deLondres, signed in 2009 by entomologists and ornithologists, cited by the Task Force on Systemic Pesticides)

"The disappearance of honey bees is only the most visible part of a phenomenon now generalized in all of Western Europe. The brutal and recent collapse of insect populations is the prelude of a massive loss in biodiversity with foreseeable dramatic consequences for natural ecosytems, the human environment and public health.

The systematic use of persistent neurotoxic insecticides in intensive agriculture and horticulture (neonicotinoids such as imidacloprid and thiamethoxam, and fipronil as a phenylpyrazole), which now form an invisible, widespread, toxic haze on land, in water and in the air, is regarded as a principal cause of this collapse observed by entomologists beginning in the middle of the 1990s and followed by the decline of insectivorous and other bird species by the ornithologists.

"For this reason, the undersigned raise an alarm and demand a much stricter adherence to the Precautionary Principle as enshrined in the E.U. Commission's Directive 91/414, and defined by UNESCO in 2005 as "When human activities may lead to morally unacceptable harm that is scientifically plausible but uncertain, actions shall be taken to avoid or diminish that harm."[16]

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[2]Ibid, 1.

[3]Ibid, 6-7.

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