BACKGROUNDER:
Neonics, Honey Bees, and Food Security

Declining Populations of Insects and Birds in Europe

In Europe, scientists noted a steep decline in insect populations between 1990 and 2000. They also noted a severe decline in populations of birds that feed on insects. These observations led to the theory that the new generation of pesticides, introduced in the early 1990s, were responsible for these declines.[1]

New Generation of Pesticides: Neonics

This new generation of pesticides is called neonicotinoids or "neonics". They are now the most widely used insecticides in the world, representing more than a quarter of the global market share.[2] While they can be used on all types of field crops – except those used as forage – they are most frequently used on corn, canola, soybeans, dry beans[2], and small cereals.

Photo: Daniel Tobias, Weir's Lane Lavender & Apiary, Dundas. Ontario

These pesticides are called systemic pesticides because they spread throughout the entire plant so they can be found in the pollen, nectar, and all other tissues of the plant, such as the flesh of fruits and vegetables we eat. While they can be sprayed on foliage or added to the soil, they are most often applied directly to the seeds. Animals that pollinate flowering plants - such as bees - are exposed through nectar and pollen or by the dust that is created when neonic-treated seeds are planted.[2]

Findings of the Task Force on Systemic Pesticides

Concerns about the decline in animal populations in Europe led to the establishment of a Task Force on Systematic Pesticides. With a multi-disciplinary team of independent scientists from 15 nations on four continents, this Task Force spent four years reviewing over 1,121 peer-reviewed scientific studies to understand what was happening to the ecosystem and how neonic pesticides were involved.

This massive scientific literature review found that neonics and fipronil (a similar systemic insecticide) are:

- extremely toxic to most arthropods (i.e., insects, spiders, and crustaceans such as crabs)

- toxic, although to a lesser degree, to vertebrates such as fish and birds
- water soluble so they can leach into ponds, ditches, streams, and groundwater
- readily taken up by plant roots and leaves so they can be found in the nectar and pollen of treated crops and wild plants growing in farmland
- persistent so they can accumulate in the soil over time
- linked to large-scale acute losses of domestic honeybee colonies
- associated with impaired learning, increased mortality, reduced fecundity, and increased susceptibility to diseases in bees that have consumed contaminated food
- possibly linked to human health effects such as finger and hand trembling, short-term memory losses, headaches, general fatigue, chest and abdominal pain, palpitations, spasms, muscular pain and weakness.[3]

The Task Force concluded that: "**the wide-scale use of these persistent, water-soluble chemicals is having widespread, chronic impacts upon global diversity and is likely to be having major negative effects on ecosystem services such as pollination that are vital to food security and sustainable development**".[1]

Canada's Honey Bees and Neonics

Photo: Daniel Tobias, Weir's Lane Lavender & Apiary,

In recent years, concerns have been expressed about the dramatic increases in over-wintering deaths of honey bee colonies in Canada. Historically, over-wintering losses of bee colonies averaged around 10 to 15% in Canada but those losses have increased over the last nine years to reach 29%.[4] In certain regions of the country, bee colony losses sky-rocketed to alarming levels. Ontario beekeepers reported losing 58% of their colonies in the winter of 2013 and 38% of their colonies in the winter of 2014.[5,6] For its part, honey production decreased by more than one kilogram per colony between 1998 and 2013 in Québec.[7]

Bee colonies are known to be stressed by factors such as parasites, habitat loss and diminished food supplies, climate change and weather, as well as pesticides.[4] However, over the last three years, there were several reports of bee colony mortalities near fields planted with neonic-treated corn and soybean seeds in southern Ontario, Quebec, and Manitoba.[4] The Health Canada Pest Management Regulatory Agency (PMRA) investigated these incidents and **concluded that exposure to neonic pesticides contributed to the abnormally high domestic bee mortality rates**.[4]

Ontario, Honey Bees, and Neonics

Honey bees are important to Ontario's economy and agricultural sector. Honey production in Ontario is a market worth $26 million per year.[5] Ontario's managed honey bees and bumble bees pollinate agricultural crops

in Ontario that are worth about $897 million per year. This represent about 13% of the total crop value in Ontario.[5] Ontario's managed honey bees are also transported to eastern Canada to pollinate about $71 million in blueberry and cranberry crops.[5]

Corn and soybeans are the two largest crops in Ontario with approximately 2.4 million acres of farmland dedicated to corn and approximately 2.5 million acres dedicated to soybeans.[5] Ontario also grows almost two thirds of the corn and soy in Canada. Nearly all the corn seeds in Ontario and 65% of the soy seeds are treated with neonic pesticides.[6]

Photo: Daniel Tobias, Weir's Lane Lavender & Apiary, Dundas, Ontario

The Ontario government has responded to the high rates of bee loss in Ontario by passing legislation that would decrease the number of acres planted with neonic-treated corn and soybean seed by 80% by 2017.[5] The pesticides targeted are imidacloprid, thiamethoxam, and clothianidin. The Ontario government is aiming to reduce honey bee hive mortality rates to 15% by 2020.[5]

Québec, Neonics and Domestic Bees

Domestic bees play an important economical role in Québec's agricultural sector. The commercial value of crop pollination by bees is estimated at $166 million per year for Québec,[8] and at more than $2 billion in Canada.[9]

Corn and soy are important crops for Québec, with approximately 425,000 and 315,000 hectares dedicated to these two crops.[10] Nearly all corn seeds and between 35 to 50% of soy seeds used in Québec are treated with neonicotinoids, which sums up to areas of over 500,000 treated hectares.[11] Neonicotinoids are also regularly found in rivers of Québec agricultural regions.[12]

The Québec government announced in November 2015 a new strategy on pesticides for 2015-2018 which aims at protecting the health of humans, pollinators and the environment, by reducing, amongst other actions, the use of neonicotinoids. By modifying the *Pesticide Act* and its affiliated regulations, the Québec government wishes to reduce the use of neonicotinoids by prohibiting their use for aesthetic purposes in lawns and flowerbeds, and by making agronomic prescriptions mandatory in all the cases where neonicotinoids are to be used.[13]

The European Union, Neonics, and Human Health

The European Food Safety Authority recommended reductions in the guidance levels for acceptable exposures for two neonic pesticides (acetamiprid and imidacloprid) because of evidence which suggests that these two pesticides may adversely affect the development of the human brain.[14] In 2013, the European Union imposed a moratorium on the use of neonics in agriculture to allow their impact to be further assessed.[14]

Neonics, Pollinators, and Human Food Security

Pollination, where pollen is transferred from the anther to the stigma of flowers, is needed to produce seeds and fruits. Wild pollinators include bees, wasps, butterflies, flies, and beetles. Pollinators are essential to the survival of native flowering plants and many crops, many of which representing important food sources for humans and animals alike, some even sheltering certain animals.[5] These cultures are essential for several commonly consumed food such as fruits, nuts, chocolate, wine and coffee.

Researchers at the Harvard TH Chan School of Public Health conducted a study to determine how people might be affected by the total loss of pollinators. They examined the nutrient composition and pollinator dependence of 224 types of food to estimate how food nutrition in 156 countries would be affected if animal pollinators were no longer present. Assuming the complete disappearance of animal pollinators, they estimated that global fruit supplies would decrease by 23%, vegetables by 16%, and nuts and seeds by 22%.[15]

They predicted that these changes in food supplies could increase global deaths from chronic and nutrition-related diseases by 1.42 million people per year.[15]

Neonics, Pest Control, and Economics

The United States Environmental Protection Agency's (US EPA) Biological and Economic Analysis Division analysed the effectiveness of neonic seed treatment on insect control for soybean production. It concluded that "***these seed treatments provide negligible overall benefits to soybean production in most situations.***" [16] It found that, in most cases, there was no difference in the soybean yield between situations where neonic-treated soybean seeds were used and situations where no insect control was used at all. [16]

An internal government report drafted by Health Canada's Pest Management Regulatory Agency (PMRA) estimated that a country-wide ban on neonics could result in a $91.3 million net loss in revenue for farmers or 1.9 per cent reduction in total revenue.[17]

A research center on grains (CÉROM inc.) demonstrated that systemic use of neonic treated seeds is unjustified, based on field studies in Québec.[13] Seed coats are often used as a preventive measure against seedling insect pests, without any demonstration that pests were present and threatening the crops economically. In corn, CÉROM studies showed that neonic seed coats did not significantly increase yields, even when seedling pests were present.[13]

Conclusions

There is robust body of literature which indicates that neonics are harming many species, decreasing biodiversity, and threatening the animal pollinators that are needed for plants and crops upon which humans and other species are dependent. In Canada, there are signs that neonics are contributing to the decline and vulnerability of managed honey bees. Given the experience in Europe, Canada's honey bees

Photo: Daniel Tobias, Weir's Lane Lavender & Apiary, Dundas, Ontario

should be viewed as an indicator of declines that may be occurring among wild bees and other species in the ecosystem. There are some studies which suggest that human health may be adversely affected by direct exposure to neonics. There are reasons to be believe that the world's food supply could be dangerously undermined by the loss of animal pollinators that appear to be adversely affected by neonic pesticides.

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