



DISAPPEARING BEES



POLLINATORS IN PERIL

Buzz Kill: Deadly Pesticides Threaten Our Vital Pollinators



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The term “busy as a bee” takes on a new meaning when you realize that for just one pound of white clover honey, hardworking honey bees must make over 17,000 foraging trips to 8.7 million flowers.¹ Pollinators like honey bees not only work hard, they are the backbone of a healthy agriculture system, contribute billions to our economy and are responsible for one out of every three bites of food we eat.

But pollinators don't just provide services for agricultural purposes. They also enable the natural world to thrive – by helping plant communities reproduce and stay healthy, and by pollinating flowers that produce fruits, berries, nuts, vegetables and roots, which in turn feed wildlife ranging

from the mighty grizzly bear to the diminutive chickadee. Worldwide, a staggering 87.5 per cent of flowering plants are pollinated by animals², including bees, wasps, moths, ladybugs, hummingbirds and other species.

Pollinators are literally the stuff of life; without them, our food system would be in peril and much of the natural world would cease to function.

Understanding the importance of pollinators is essential because pollinators need our help.

Over the past 20 years, and particularly in the past decade, there has been a startling decline in honey bees, bumble bees and other pollinators around the world. Significant population declines in wild bumble bees – coupled with “colony collapse disorder” (CCD) and an increase in

Colony Collapse Disorder (CCD) is the term used by scientists since 2006 to describe the mass disappearance of honey bees in a colony. It can be caused by a variety of different stresses that lead to the abrupt disappearance of worker bees, which causes the hive to stop functioning.

parasites and bacterial infections that have targeted honey bees – has

scientists increasingly concerned. Canada has lost 35 per cent of its honey bee colonies annually for the past three years, and a huge die-off in 2013 led to the loss of 37 million bees in Ontario.³

Although loss of habitat, monoculture crops, mites and disease have all played a role in the decline, a deadly and commonly used class of pesticides called **neonicotinoids (neo-nicoteen-oids)** has been implicated in the frightening drop in pollinator numbers.

Read this paper to:

- ◆ Better understand the importance of honey bees and our native insect pollinators,
- ◆ Understand how a powerful class of pesticides is killing bees and other pollinators,
- ◆ Learn how the recent deaths of millions of bees in Ontario and Oregon have sparked calls for action across North America,
- ◆ Find out what Europe is doing to protect bees from bee-killing pesticides, and
- ◆ Learn how you can take action to protect bees and pollinators.



Photo top: Bumble bee (Gwen Barlee), **above:** Bee and pollen, Honey bee hive, Ladybug (Bug Lady/City Farmer).

Pollinators like bees are facing increasing threats – from disease to toxic chemicals – but with more knowledge we can take action to help protect these tiny creatures from further harm.



The Birds and the Bees

The gentle buzz of a bee moving from flower to flower is a welcome sound and a reassuring signal that spring has finally arrived. However, the ubiquitous little bee is not only a harbinger of spring – it is an essential pollinator and an integral part of the web of life. One third of the world's food crops depend upon pollination, and pollinators are needed for over 80 per cent of wild flowering plants.

In North America alone there are over 3,500 native bee species. Bumble bees, mason bees, squash bees, carpenter bees and alkali bees are just a handful of the bee pollinators found on this continent. You can even find a very hardy little bee, the boreal bumble bee, living within the Arctic Circle. However, many people are surprised to find that the common honey bee, our best known bee species, is actually non-native and was introduced to North America from Europe in the 17th century. Although bees do about 80 per cent of the world's pollinating, they aren't the only pollinators in the animal world. Butterflies, beetles, flies, wasps and moths also pollinate, as do some vertebrates including bats and hummingbirds.

Apples, almonds, squash, beans, coffee, tea, black pepper, mustard, nutmeg, canola, flaxseed, sunflower seed, celery, tomatoes, blueberries, peaches, pears, sesame seed, buckwheat, parsley, strawberries, eggplants, avocados, carrots, onions, lettuce, olives, oranges and grapes are just some of the food crops that are dependent upon or benefit from insect pollination.



Photos left to right: Syrphid fly (Bug Lady/City Farmer), Alpine flowers (Michael Wheatley), Produce from BC's Peace Valley (Larry Peterson), Tiger lilies (Michael Wheatley), Monarch butterfly (Don Johnston).

Pollinators visit flowers for pollen collection, feeding and even warmth. When pollinators collect pollen they transfer it to another bloom or to a different part of the same flower, enabling the flowering plants to begin the essential process of seed and fruit production.

Rusty-patched Bumble Bee Going, Going...Gone?

For Canadians, the distinctive black and yellow bumble bee is one of the surest signs of spring. Cute to look at, the bumble bee is also an efficient pollinating machine. Its fuzzy coat and "central heating" system enable it to warm itself up and tolerate cooler temperatures, making it one of the first bee pollinators to arrive in spring and

one of the last to remain in the fall.

Bumble bees are also renowned for "buzz pollination," of which honey bees are incapable. Some flowers are more efficiently pollinated when they are vibrated. Bumble bees grasp the anthers (pollen-bearing parts) of such flowers and vibrate against them to shake pollen loose.

The rusty-patched bumble bee, known for the distinctive rust-coloured patch on its abdomen, is one of over 40 types of bumble bees found in North America. **Once one of southern Ontario's most common bumble bees, in the last 30 years this pollinator has undergone a**

catastrophic collapse. Just three individuals have been found in Ontario in the last five years – all within Pinery Provincial Park.⁷ Loss and fragmentation of habitat, climate change and pathogens from commercially reared colonies are all implicated in the decline, but there are concerns that bee-killing pesticides such as neonicotinoids have been a factor as well.

The plight of the rusty-patched bumble bee is not unique. In the late 1990's massive bumble bee declines were reported across North America. In Ontario – once considered a "hot spot" for bumble bees – three out of 14 different species found in the 1970s had completely disappeared in searches conducted between 2004 and 2006, and another five species were in sharp decline.⁸



Photo: Rusty-patched bumble bee (Christy M. Stewart).

DID YOU KNOW?

Just like humans, bees can be specialists in what they do. For instance, there are some types of flowers that honey bees don't know how to pollinate, such as tomato or eggplant flowers. These blossoms need native pollinators, like carpenter bees or Morrison's bumble bees. In other instances, certain bees are closely associated with namesake plants. The Cornell azalea bee, for example, has adapted to and is very proficient at pollinating azaleas and rhododendrons. Similarly, the squash bee, blueberry bee and globe mallow bee are highly specialized in pollinating their namesake plant species.⁹



Photo: Rusty-patched bumble bee (Johanna James-Heinz).

The Canadian Honey Council has reported a 35 per cent annual loss of bee colonies for the last three years.¹⁰



Photo: Bumble bee with a well-filled pollen basket (Creative Commons, Martin LaBar).

Honey bees and bumble bees carry their pollen in something called a "pollen basket." These baskets are found on the backside of each leg, and as the bees visit flowers they pack the pollen into these carriers. When the baskets are empty they are shiny, and when they are full of pollen they range from a deep yellow to a reddish colour.⁵

Neonicotinoids: Bee-killing Pesticides

Pronunciation: neo - nicoteen - oids

WHAT ARE NEONICOTINOIDS?

Neonicotinoids were introduced to the market in 1991 when Bayer CropScience released "imidacloprid," one of the first members of this group of pesticides.¹¹ Today, neonicotinoids have become global bestsellers and are now among the most widely used insecticides in the world, with licences for use in over 120 countries.¹² California alone has registered almost 300 neonicotinoid products.¹³ Neonicotinoids are widely used on a variety of crops including potatoes, tobacco, corn, wheat seed, tomatoes, blueberries, apples, lettuce, citrus fruit and cotton – as well as for cosmetic purposes on garden plants.

Neonicotinoids, derived from nicotine, disrupt the central nervous system of insects at lower doses, but at higher doses can cause paralysis and death.¹⁴ **These dangerous pesticides are known as "systemic" insecticides; they get absorbed by the treated plant and permeate all tissues of the plant including pollen and nectar.** These pesticides are often applied by coating seeds or drenching the soil, but they can also be applied to crop foliage.

UNINTENDED CONSEQUENCES

The pesticide is targeted to kill sap-sucking insects and other "nuisance"

insects that chew on the plant. But pesticide fact sheets published by the U.S. National Pesticide Information Center (NPIC) show **they are as toxic to beneficial insects, such as honey bees and bumble bees, as they are to targeted "pests."**¹⁵ By volume these pesticides are 10,000 times as powerful as DDT, and half of bees exposed to a tiny amount – just five nanograms – will die.¹⁶

BEE DEATHS IN EUROPE

Concerns about neonicotinoids began to manifest shortly after their commercial use started. In 1994, farmers in France noticed that a "substantial number of their hives would collapse, as the worker bees flew off and never returned, leaving the queen and immature workers to die." These collapses were first observed after sunflower crops were treated with Gaucho, a brand new insecticide that contained the neonicotinoid imidacloprid.¹⁷

In 2008 there were serious declines in bee colonies in Italy, Germany and Slovenia during and after the sowing of maize seeds that had been coated with another neonicotinoid called clothianidin. Analysis in Germany showed a "causal connection" between the use of this seed dressing insecticide and the reported damage to honey bee colonies.¹⁸

DEADLY IMPACTS

It is widely recognized that neonicotinoids cause "acute toxicity" and can be lethal to bees, but independent scientific studies are now identifying worrisome sub-lethal impacts to pollinators as well. A 2012 report from the European Environment, Public Health and Food Safety Authority, which reviewed recent scientific papers, showed that even low doses of neonicotinoids can cause serious sub-lethal impacts including:

- ◆ Impaired memory and learning
- ◆ Disorientation and difficulties returning back to the hive (loss of homing ability)
- ◆ Reduced efficiency in foraging
- ◆ Less success in breeding
- ◆ Reduced resistance to disease
- ◆ Failure to communicate properly with other bees in the colony¹⁹

Sub-lethal impacts have been of particular interest to researchers since the advent of bee "colony collapse disorder" (CCD), a term first coined in the United States in 2006 when worker bees mysteriously disappeared from hives and never returned. This phenomenon has continued to escalate. Last winter in the United States, one third of

honey bees died or disappeared – a 42 per cent increase over the previous year, and well above annual average losses of 10 to 15 per cent.²⁰ The Canadian Honey Council estimates a 35 per cent loss in bee colonies annually for the past three years.²¹

"Although there may be a pesticide more toxic to honey bees, I am not aware of one."

- Professor Greg Hunt, entomologist and honey bee specialist at Purdue University, Indiana.²²

ACCUMULATING EFFECTS

There is growing concern over neonicotinoids not only for their proven harmful impact to bees and other pollinators, but also because they accumulate in soils. In addition, neonicotinoids are water soluble and cause aquatic contamination.²³

These pesticides are likely to be impacting a variety of non-target species such as aquatic insects and birds. Although initially considered less toxic to vertebrates than insects, **recent studies have revealed that just one corn kernel coated in the neonicotinoid imidacloprid can kill a songbird.**²⁴

Massive Bee Deaths Linked to Neonicotinoids

Canada: In 2012 a large number of honey bee mortalities were reported in Alberta, Manitoba, Saskatchewan, Ontario, Quebec and Nova Scotia, with a startling number of bee deaths coming from beekeepers in corn-growing regions of Ontario and Quebec. In southern Ontario alone, over 40 beekeepers from 240 different bee yard locations reported unusually high bee kills. The bee mortalities in Ontario occurred after nearby cornfields planted seeds using a neonicotinoid called clothianidin.²⁵

An investigation by Health Canada confirmed the link between bee kills in 2012 and the use of these pesticides on corn planted in Ontario. Neonicotinoid residue was found in 80 per cent of the 240 bee kill locations and on 70 per cent of the bees tested. Unaffected bees were also analysed "and clothianidin was only detected in one sample at very low levels."²⁶

This summer, bee deaths have continued. **In July of 2013, 37 million honey bees were found dead in Elmwood, Ontario.** Beekeeper and honey producer Dave Shuit lost 600 hives. Shuit believes neonicotinoids were responsible since they are widely used to coat corn seeds, and the massive die-off came shortly after nearby cornfields were planted.²⁷

United States: In June 2013 near a Target store in Wilsonville, Oregon, 55 flowering linden trees were sprayed to control aphids with a pesticide called Safari. **Within days, an estimated 50,000 bumble bees lay dead and dying beneath the trees:** victims of acute poisoning. The main ingredient in Safari is a neonicotinoid called dinotefuran. The death of the bumble bees, which were attracted to the flowering trees, was the largest bumble bee kill ever recorded in the United States.²⁸

As a result of the massive bee

kill – which the Oregon Department of Agriculture confirmed was caused by dinotefuran – Oregon is temporarily restricting the use of this toxic pesticide. However, products containing dinotefuran can still be purchased in U.S. stores by individual consumers.²⁹



Photos: Cornfield (Joe Foy).



Photos above: Dead bees, Crop spraying, Dead bee (Creative Commons).

DO YOU KNOW WHAT'S IN YOUR GARDEN PLANTS?

A recent pilot study by Friends of the Earth and the Pesticide Research Institute found that seven of 13 samples of garden plants purchased at top retailers in Washington D.C., the San Francisco Bay Area and Minneapolis were already contaminated with neonicotinoids, which studies have shown are very toxic to bees.³⁰

When purchasing plants, ask nursery staff if the plants, seeds or soil were treated with neonicotinoids.



Photos: Home garden plants (Joe Foy).

TOP NEONICOTINOID PRODUCERS

- ◆ Bayer
- ◆ Syngenta
- ◆ DuPont
- ◆ Valent

Keeping the Hives Alive

Integrated Pest Management, Organic Farming

A transition to organic farming is needed to best protect our pollinators, but studies have shown that “integrated pest management” – an agricultural practice that tries to minimize pesticide use by monitoring “pest” insects, implementing better crop rotation and planting pest-resistant plant species – is also a step in the right direction. Researchers found that banning corn seeds treated with neonicotinoids significantly reduced bee mortality, and when integrated pest management was used and crops were rotated, agricultural yields were maintained and pests were kept under control.³¹



Photo: Honey bee hives (Joe Foy).

Banning Bee-killing Pesticides

The threats to bees and pollinators go beyond bee-killing neonicotinoids – loss of habitat, monoculture plantations, other insecticides, parasites, disease and genetics have all played a role in the decline of pollinators.

But what we are sure of is that there are lethal and serious sub-lethal impacts to bees from very low exposure to widely-used neonicotinoid pesticides. If we want to help bees we can start by banning these known bee-killing pesticides now. This ban would also be very helpful to other pollinators, aquatic insects and birds, and would protect our soil and waterways from the toxic accumulation of neonicotinoid pesticides.



Photo: Admire and Arena, two neonicotinoid pesticides licensed for use in Canada (WC files).

When researchers exposed bumble bees to “field-realistic levels” of the neonicotinoid imidacloprid, the bee colonies suffered “significantly reduced growth rates” and a massive decline in the production of new queens. Researchers observed “a reduction of 85 per cent in the production of new queens,” which “accounts for the massive declines (and some extinctions) reported in the US and Canada from the late 1990s onwards.”³⁷

Give Bees A Chance: A Lesson from Europe

There is a growing body of scientific evidence exposing the clear dangers of neonicotinoids not only to pollinators, such as honey bees and bumble bees, but to a wide array of wildlife and ecosystem services.

So what are other countries and jurisdictions doing to address the problem?

- On April 29, 2013 the European Union implemented a continent-wide two-year suspension on three types of neonicotinoids – thiamethoxam, clothianidin and imidacloprid – citing the “unacceptable risk” they posed to bees.³² Top garden retail stores in the U.K. have also stopped selling “neonics.”

- In July 2013 the Oregon state government issued a temporary suspension on 18 insecticides containing the active ingredient dinotefuran. This suspension came after the largest bumble bee kill in U.S. history was directly linked to dinotefuran – a neonicotinoid that

had been applied to 55 trees in a parking lot in Wilsonville, Oregon.³³

- In August 2013 the U.S. Environmental Protection Agency called for better pesticide labeling and clearer directions for use of bee-killing pesticides.³⁴ Despite calls for immediate action to protect bees, and despite continuing bee declines and compelling scientific research, the Canadian and U.S. governments have only committed to review the use of neonicotinoids.^{35,36}



Photo: Beekeepers protest outside Britain's Parliament (Creative Commons).

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TAKE ACTION!

Please take a moment to write to the powers that be! Tell Canada's Prime Minister to protect bees and other pollinators by enacting a **complete nation-wide ban on all bee-killing neonicotinoid pesticides.**



Photo: Bumble bee (Gwen Barlee).

Contact information:

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Ottawa, ON, K1A 0A2

☎ 613-941-6900
@ pm@pm.gc.ca

SHARE THIS WITH YOUR FRIENDS AND NEIGHBOURS!



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YES! I WANT TO HELP PROTECT BEES AND POLLINATORS!

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