

Wild ground-nesting bees might be exposed to lethal levels of neonics in soil

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A female squash bee. Credit: University of Guelph

In a first-ever study investigating the risk of neonicotinoid insecticides to ground-nesting bees, University of Guelph researchers have discovered at least one species is being exposed to lethal levels of the chemicals in

the soil.

Examining the presence of these commonly used pesticides in soil is important given the majority of bee species in Canada make their nests in the ground.

This study focused on hoary [squash](#) bees, which feed almost exclusively on the nectar and pollen of squash, pumpkin and gourd flowers.

Researchers found that the likelihood that squash bees are being chronically exposed to lethal doses of a key neonicotinoid, clothianidin, in soil was 36 per cent or higher in squash fields.

That means 36 per cent of the population is probably encountering lethal doses, which is well above the acceptable threshold of 5 per cent, in which 95 per cent of the bees would survive exposure.

"These findings are applicable to many other wild bee species in Canada that nest on or near farms," said U of G School of Environmental Sciences professor, Nigel Raine, who holds the Rebanks Family Chair in Pollinator Conservation and worked on the study with Ph.D. student and lead author Susan Chan.

"We don't yet know what effect these pesticides are having on squash bee numbers because wild bees are not yet tracked the same way that honeybee populations are monitored. But we do know that many other wild bee species nest and forage in [crop fields](#), which is why these findings are so concerning."

Published in *Scientific Reports*, the study began with Chan collecting [soil samples](#) from 18 commercial squash fields in Ontario. Pesticide residue information from these samples and a second government dataset from field crops was used by Chan and colleagues Prof. Ryan Prosser, School

of Environmental Sciences, and Dr. Jose Rodríguez-Gil to assess the risk to ground-nesting squash bees.

The research comes as Health Canada places new limits on the use of three key neonicotinoids, including clothianidin, while it decides whether to impose a full phase-out of these pesticides. Neonics have been linked to concerns about honeybee colony health, with research showing these bees can ingest dangerous amounts through nectar or pollen.

"Current risk assessments for insecticide impacts on pollinators revolve around honeybees, a species that rarely comes into contact with soil," said Raine. "However, the majority of bee species live most of their life in soil, so risks of pesticide exposure from soil should be a major factor in these important regulatory decisions."

"Until now, no one has examined the risk to bees from neonics in soil despite the fact these pesticides are applied directly to seeds planted into the ground, or sprayed directly onto soil at planting, and can persist for months after application," said Chan.

"Only about 20 per cent of the neonicotinoid insecticide applied to coated seeds is actually taken up into the crop plant; the rest stays in the soil and can remain there into subsequent seasons."

Squash bees are at particular risk because they prefer the already-tilled soil of agricultural fields for their elaborate underground homes. And as they build their nests, they move about 300 times their own body weight worth of soil.

Since the bees don't eat soil, it's difficult to know exactly how much pesticide residue enters the bees. But the researchers calculated that even if they are conservative and assume only 25 per cent of the clothianidin

enters the bee, the risk of lethal exposure in pumpkin or squash crops is 11 per cent—still above the widely accepted threshold of 5 per cent.

The team also examined the exposure risk in field crops, since many ground-nesting bee species live near corn and soybean fields, which use neonics as well. They found that 58 per cent of ground-nesting bees would be exposed to a lethal dose of clothianidin while building their nests even if only 25 per cent of the clothianidin in the [soil](#) enters the bee.

"Pumpkin and squash farmers face a dilemma in that they want to protect pollinators, such as the squash bee, because they are vital to crop production, but at the same time need to protect their crops from pests," said Chan.

"New approaches are needed that allow farmers to control pests and protect pollinators simultaneously. My advice to farmers is if you find an aggregation of squash bees nesting on your farm, protect these key pollinators from exposure to neonicotinoids by either not using them at all, or at least not using them near the aggregation. Creating pesticide-free places to nest will help your population of squash bees to grow over time."

More information: D. Susan Willis Chan et al, Assessment of risk to hoary squash bees (*Peponapis pruinosa*) and other ground-nesting bees from systemic insecticides in agricultural soil, *Scientific Reports* (2019). [DOI: 10.1038/s41598-019-47805-1](https://doi.org/10.1038/s41598-019-47805-1)

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