

Why are the bees dying? Northern Alberta scientists are helping find the answer



[Ainslie Cruickshank](#) [More from Ainslie Cruickshank](#)

Published on: August 26, 2016 | Last Updated: August 26, 2016 11:58 AM MDT

Clad in a white bee suit, Carlos Castillo kneels over a plastic tub filled with hundreds of squirming, disoriented honey bees. Using a measuring cup he scoops out some of the writhing insects and pours them into a funnel. With a few shakes, they slide through the opening and disappear into a cardboard box.

With metal-screen sides so the bees can breathe and enough food and water to last them for days, it's much more than they need to survive their overnight trip with Canada Post.

The buzzing box is headed to the National Bee Diagnostic Centre, located 40 kilometres outside Grande Prairie and one of Canada's most important lines of defence in what has become a global fight to save one of the world's most important creatures.

Beekeepers have to be "proactive," says Castillo, a molecular biologist and the Centre's lead scientist. "It's important to know if the bees coming into the winter are healthy enough to survive."

Over the last several years, bees have been dying and disappearing at dizzying rates around the world. In Canada, some colonies have lost up to 40 per cent of their population during the winter, while in some parts of the world, colonies have simply disappeared without a trace. While a definitive cause has not been determined, various pests and diseases, worsening queen health, and [pesticide use](#) are just a few of the factors raising alarms.

Research is being conducted in many parts of the world, and the bees analyzed at the Alberta lab as part of the four-year National Honey Bee Health Survey play a big part in finding solutions.

And there's more at stake than just honey. Without bees, many of the world's main food crops wouldn't produce sufficient yields. Statistics Canada estimates that honey bee pollination contributes between \$3.15 to \$4.39 billion per year to the harvest value of crops.

Alberta centre a hive of activity



Bees from one of Craig Toth's hives in Morinville are collected on Aug. 11, 2016 for the National Honeybee Health

Survey. Shaughn Butts / Postmedia

In Alberta 1,000 beekeepers manage about 295,000 colonies. In 2015, the industry produced about 19,394 tonnes of honey worth roughly \$93 million. The year before, Alberta accounted for 42 per cent of all honey production in Canada and 29 per cent of exports.

The Alberta diagnostic centre has been a hive of activity since opening in 2013.

“It’s working out better than ever anticipated,” says Don Gnatiuk, president of Grande Prairie Regional College which operates the centre with support from Agriculture Canada.

“We’re honoured to be part of something that is so important, to mankind actually, when you think about it,” he says.

In its first year, the five-person staff at the centre conducted about 1,800 tests. By 2015, they were running close to 20,000.

Today, the lab just meets the demand from beekeepers, researchers, and government for its services and the college is negotiating with the federal government for a possible expansion that would triple the lab’s size — from 200 to 600-square metres — and double its staff.

“It’s proven to be a major tool in our tool box for monitoring our hive health,” says Grant Hicks, the president of the Beekeepers Commission of Alberta.

The health survey was launched in response to a proposal by beekeeping associations in Alberta and Manitoba in 2014. The survey aims to provide a clearer picture of honey bee health in Canada, including baseline data about the pests, diseases, and parasites affecting the country’s precious pollinators.

The results of the survey will be critical for developing regional health management plans and will help identify “exotic” threats to Canadian bees before they become established, the diagnostic centre notes in material provided to participating beekeepers.

Suiting up for science



Morinville beekeeper Craig Toth opens a hive so bees can be removed for testing on Aug. 11, 2016. Shaughn Butts / Postmedia

Initially, samples were only collected from hives in Alberta and Manitoba. Now in its third year, the team collects samples from 325 bee yards across nine provinces, Castillo says. The lone exception is Saskatchewan, which has declined to join the initiative.

At each bee yard the sampling process begins the same way — with beekeepers and scientists suiting up.

With a decade of experience, beekeeper Craig Toth knows not to let the suit’s netting, which covers his face and neck, touch his skin, which would give the bees and their stingers easy access.

Toth has four bee yards, but Castillo and his intern Matthew Oldach are collecting a sample from just one.

The yard is located on Toth’s parents’ property in Sturgeon County, about 35 km from Edmonton. Separated from

the house by a wheat field, the bees and the surrounding environment operate in a symbiotic relationship where nearby canola fields and Toth's orchard of apple, cherry, and chokecherry trees provide nectar for the bees and are pollinated in return.

At each bee yard samples are collected from 10 randomly selected hives.

A cloud of smoke is puffed into the first hive to calm the bees before its top box — known as the honey super — is moved aside.

Guards stand watch at the entrance to each hive and release alarm pheromones to warn their comrades of a possible threat, but the smoke prevents the rest of the hive from detecting their signal.

Castillo and Oldach are interested in the bottom boxes, or the brood chambers, where the queen lays eggs in individual honeycomb cells and worker bees raise the larvae.

Each chamber holds nine or 10 frames of honeycomb. Castillo checks a few of the frames for any visible signs of disease before pulling one with “open brood” — eggs and larvae in uncovered honeycomb cells. In the later stages of development the cells are covered and the larvae transform into pupa before emerging as adult bees.

After double-checking to make sure the queen isn't on the selected frame, Castillo shakes it over a white plastic tub, sending adult worker bees tumbling.

Some of the bees are shipped alive in the cardboard box while another half-scoop is deposited into a bottle of ethanol. About 100 bees are collected from each colony for a total of roughly 1,000 bees per yard. Castillo is only interested in the female worker bees.

“Kind” hives and killer bees



Carlos Castillo and intern Matthew Oldach examine a frame from a hive before taking samples from Craig Toth's beehives near Morinville on Aug. 11, 2016. Shaughn Butts / Postme



Beekeeper Craig Toth opens a hive on Aug. 11, 2016, to extract bees which will be sent for analysis to the National Bee Diagnostic Centre. Shaughn Butts / Postmedia



Bees, to be sent to the National Bee Diagnostic Centre near Grande Prairie, are collected from hive frames at Craig Toth's property near Morinville on Aug. 11, 2016. Shaughn Butts / Postmedia



Bees from one of Craig Toth's hives in Morinville are collected on Aug. 11, 2016 for the National Honeybee Health Survey. Shaughn Butts / Postmedia



This bee, collected from Craig Toth's hives near Morinville on Aug. 11, 2016, is being preserved for testing back at the lab. Shaughn Butts / Postmedia



Larvae is collected from the hive, to be taken back to the National Bee Diagnostic Centre for testing, on Aug. 11, 2016. Shaughn Butts / Postmedia



Beekeeper Craig Toth drives his equipment out to his hives near Morinville, on Aug. 11, 2016. Shaughn Butts / Postmedia



Beekeeper Craig Toth, photographed on Aug. 11, 2016. Shaughn Butts / Postmedia



Morinville beekeeper Craig Toth opens a hive so bees can be removed for testing on Aug. 11, 2016. Shaughn Butts / Postmedia



Reporter Ainslie Cruickshank was safely garbed on Aug. 11, 2016 while observing the collection of bees to be analyzed at the National Bee Diagnostic Centre. Shaughn Butts / Postmedia



Coated with wax and honey, the gloves of Morinville beekeeper Craig Toth are enticing to his bees on Aug. 11, 2016. Shaughn Butts / Postmedia



Carlos Castillo is the applied science manager at the National Bee Diagnostic Centre near Grande Prairie. He was collecting samples from Craig Toth's bee hives near Morinville on Aug. 11, 2016. Shaughn Butts / Postmedia

Castillo then knocks the frame over a metal dish, flips it and knocks it again, dislodging white eggs and larvae into the pan. He is looking for *Tropilaelaps* mites, which establish themselves in the honeycomb cells with the eggs and larvae. So far, there has been no sign of the mites in North America, Castillo says, but they're a big problem in South Asia.

The process is repeated for nine more hives and by the end of the process, the entire bee yard is abuzz. It may seem threatening to the untrained eye, but Castillo knows better.

Most bees in Alberta are "very kind," he says. "Some beekeepers don't even wear gloves."

Toth agrees — except when it comes to the fourth hive in his bee yard. That colony is "just evil," he says, with a chuckle.

Usually Toth handles troublesome bees by "squishing" the queen and overthrowing the monarchy.

Next time, Castillo wants him to send a few worker bees for testing instead. They could be killer bees — a name taken from a 1980s-era movie that exaggerated the issue.

The correct term is Africanization, Castillo says — that is, African bee species that have interbred with western honey bees resulting in extremely defensive hybrids that tend to sting more frequently.

Today Africanized bees are found in most of Latin America and parts of the Southern U.S., including California, the source of thousands of queens for Canadian beekeepers.

"It is important to be sure we do not import Africanized queens," Castillo says.

Back at the lab, the live bees shipped in the mail will be flash frozen and Castillo and team will start the diagnostic process. They'll look for signs of Africanization as well as diseases, viruses, and pests such as American Foulbrood, Nosema, Varroa mites, Acute and Chronic Bee Paralysis Virus, and Black Queen Cell Virus. Next year, the final year of the survey, they'll also look for chemical residues.

The diagnostic centre doesn't provide treatment advice for the various maladies, but accurate diagnoses are a boon for beekeepers especially when the chemical treatments for some pests have the potential to harm bees if applied improperly.

One of Castillo's main concerns is backyard beekeepers and hobbyists — [a growing trend, including in Edmonton](#) — who don't understand the hard work that's involved with keeping bees.

"It's cool to have hives, but it's not good enough to put hives in your backyard and forget about it," he says.

Poorly managed hives are breeding grounds for infection that have the potential to spread. They won't save the bees, they'll put them at greater risk, says Castillo.

Alberta bees by the numbers (2015 data)

- 1,000 beekeepers
- 295,000 bee colonies
- 19,394 metric tonnes of honey produced in Alberta.
- \$93.4 million Total value of honey produced in Alberta.
- 42 per cent Alberta's share of honey produced in Canada in 2014
- 29 per cent Alberta's share of Canada's 2014 honey exports

National Bee Diagnostic Centre research projects

- **National honey bee health survey:** Over four years, the NBDC is analyzing samples from apiaries across the country to establish a baseline of honey bee health in Canada.
- **Queen health evaluation:** Queen bees purchased from Canadian and leading foreign producers are being assessed for sperm count and viability to investigate the decreased longevity of queens in hives.
- **Honey bee viruses in the Peace Country:** Work to examine the prevalence of seven honey bee viruses affecting the Peace Country, one of Canada's key honey producing regions.
- **BeeOMICS:** The NBDC is assisting with diagnostics for a project developing new tools that will allow beekeepers to rapidly and cost-effectively breed healthy, disease resistant, and productive bee colonies that are better able to survive harsh Canadian winters. Leonard Foster, a professor in the University of British Columbia's department of biochemistry and molecular biology, and Amro Zayed, a professor in York University's department of biology, are leading the Genome Canada project.

acruickshank@postmedia.com