

Researchers find high-fructose corn syrup may be tied to worldwide collapse of bee colonies

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Honeybee. Credit: Adam Siegel

(Phys.org) —A team of entomologists from the University of Illinois has found a possible link between the practice of feeding commercial honeybees high-fructose corn syrup and the collapse of honeybee colonies around the world. The team outlines their research and findings in a paper they've had published in the *Proceedings of the National Academy of Sciences*.

Since approximately 2006, groups that manage commercial [honeybee colonies](#) have been reporting what has become known as [colony collapse](#)

[disorder](#)—whole colonies of bees simply died, of no apparent cause. As time has passed, the disorder has been reported at sites all across the world, even as scientists have been racing to find the cause, and a possible cure. To date, most evidence has implicated pesticides used to kill other insects such as [mites](#). In this new effort, the researchers have found evidence to suggest the real culprit might be high-fructose corn syrup, which beekeepers have been feeding bees as their natural staple, honey, has been taken away from them.

Commercial [honeybee](#) enterprises began feeding bees high-fructose corn syrup back in the 70's after research was conducted that indicated that doing so was safe. Since that time, new pesticides have been developed and put into use and over time it appears the bees' immunity response to such compounds may have become compromised.

The researchers aren't suggesting that high-fructose corn syrup is itself toxic to bees, instead, they say their findings indicate that by eating the replacement food instead of honey, the bees are not being exposed to other chemicals that help the bees fight off toxins, such as those found in pesticides.

Specifically, they found that when bees are exposed to the enzyme p-coumaric, their immune system appears stronger—it turns on [detoxification](#) genes. P-coumaric is found in pollen walls, not nectar, and makes its way into honey inadvertently via sticking to the legs of bees as they visit flowers. Similarly, the team discovered other compounds found in poplar sap that appear to do much the same thing. It all together adds up to a diet that helps bees fight off toxins, the researchers report. Taking away the honey to sell it, and feeding the bees high-fructose corn syrup instead, they claim, compromises their immune systems, making them more vulnerable to the toxins that are meant to kill other bugs.

More information: Honey constituents up-regulate detoxification and

immunity genes in the western honey bee *Apis mellifera*, Published online before print April 29, 2013, [doi: 10.1073/pnas.1303884110](https://doi.org/10.1073/pnas.1303884110)

Abstract

As a managed pollinator, the honey bee *Apis mellifera* is critical to the American agricultural enterprise. Recent colony losses have thus raised concerns; possible explanations for bee decline include nutritional deficiencies and exposures to pesticides and pathogens. We determined that constituents found in honey, including p-coumaric acid, pinocembrin, and pinobanksin 5-methyl ether, specifically induce detoxification genes. These inducers are primarily found not in nectar but in pollen in the case of p-coumaric acid (a monomer of sporopollenin, the principal constituent of pollen cell walls) and propolis, a resinous material gathered and processed by bees to line wax cells. RNA-seq analysis (massively parallel RNA sequencing) revealed that p-coumaric acid specifically up-regulates all classes of detoxification genes as well as select antimicrobial peptide genes. This up-regulation has functional significance in that adding p-coumaric acid to a diet of sucrose increases midgut metabolism of coumaphos, a widely used in-hive acaricide, by ~60%. As a major component of pollen grains, p-coumaric acid is ubiquitous in the natural diet of honey bees and may function as a nutraceutical regulating immune and detoxification processes. The widespread apicultural use of honey substitutes, including high-fructose corn syrup, may thus compromise the ability of honey bees to cope with pesticides and pathogens and contribute to colony losses.

[Press release](#)

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