

Bees adjust to seasons with nutrients in flowers and 'dirty water'

May 30 2018



Calcium spikes upward in the diet gathered by bees in preparation for winter.
Credit: Steffan Hacker, Tufts University

Researchers at Tufts University have discovered that honey bees alter their diet of nutrients according to the season, particularly as winter approaches. A spike in calcium consumption in the fall, and high intake of potassium, help prepare the bees for colder months when they likely need those minerals to generate warmth through rapid muscle contractions. A careful inventory of the bees' nutrient intake revealed shifting sources (from flowers to mineral rich 'dirty water') and how limitations in nutrient availability from these sources can have implications for the health of both managed and wild colonies.

The study, which is available in the May print edition of the *Journal of Insect Physiology*, examined [mineral](#) content gathered by and contained in adult bees and in their [sources](#) of food, exploring how they maintain the right nutritional balance of micronutrients. For most of the minerals tracked, it was found that the bees sought alternate sources to complement variation in the floral supply.

"We typically think of [honey](#) bees as gathering all the food they need for the colony from flowers, but in fact, our research showed that bees search strategically among different sources, including water, to boost their stores of calcium and maintain potassium levels in preparation for the cold season," said Philip Starks, associate professor of biology in the School of Arts and Sciences at Tufts. "Honey bee nutritional requirements are quite complex, and they can face limitations because of levels of micronutrients in their environment."

The study findings build on previous research led by Dr. Rachael Bonoan from the Starks lab that revealed that honey bees use water sources to complement, and sometimes supplement, the minerals in their floral diet. For example, as magnesium levels drop in pollen during the summer and fall, the bees pick up the difference from mineral rich water. Alternatively, calcium levels in gathered pollen increase in the fall, but so do the bees' preference for calcium in water, perhaps

reflecting a shift from brood rearing to overwintering, the researchers speculate. Ample calcium and potassium are useful for the muscle activity needed to generate heat in the hive during the winter months.

"These results have implications in the field," said Rachael Bonoan, lead author of the study and recent Ph.D. graduate from the Starks Lab.

"Ultimately, one of the goals of studying mineral needs of honey bees is to create season- or crop-specific supplemental diets for beekeepers. Beyond honey bees, we can support wild pollinators by planting diverse floral, and thus nutrient-rich, sources."

There are many factors that have been blamed for the recent decline of bee populations, including the use of pesticides, the emergence of parasites and pathogens, and climate change. While diversity in the food supply may be one factor, its relative impact on the honey bee crisis has not yet been determined. This particular study, however, expands our understanding of the dynamic nutritional needs of bee colonies and provides further insight as to how we might manage the health of [honey bee](#) populations that support the natural environment and our food supply.

Also contributing to the study was Tufts University undergraduate Luke O'Connor, whose work formed the basis of his senior honor's thesis.

More information: Bonoan R.E., O'Connor L.D., Starks P.T. Seasonality of honey bee (*Apis mellifera*) micronutrient supplementation and environmental limitation, *Journal of Insect Physiology*. (May-June 2016) 107:23-8; [DOI: 10.1016/j.jinsphys.2018.02.002](https://doi.org/10.1016/j.jinsphys.2018.02.002)

Provided by Tufts University

Citation: Bees adjust to seasons with nutrients in flowers and 'dirty water' (2018, May 30)
retrieved 24 April 2024 from
<https://phys.org/news/2018-05-bees-adjust-seasons-nutrients-dirty.html>

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