Lack of pollinators limits worldwide food production, crop yield analysis finds

August 27 2024

Rutgers researchers detected inadequate pollination in 25 crop species, including sunflowers. More frequent visitation from bees like this Melissodes trinodis could reduce roughly two-thirds of observed yield deficits. Credit: Max McCarthy, Winfree Laboratory, Rutgers University

A team of researchers led by Rutgers University-New Brunswick

scientists has analyzed crop yields of more than 1,500 fields on six continents, and found that production worldwide of important, nutritionally dense foods such as fruits, vegetables, nuts and legumes is being limited by a lack of pollinators.

The results, detailed in *Nature Ecology & Evolution*, showed that across diverse crops and locations, one-third to two-thirds of farms contain fields that aren't producing at the levels they should be due to a lack of pollinators. The phenomenon of a low crop yield because of insufficient visits by insects is known as pollinator limitation.

The study is especially timely given recent concern about global declines in insect abundance.

"Our findings are a cause for concern and optimism," said Katie Turo, an author of the study and a postdoctoral fellow in the Department of Ecology, Evolution and Natural Resources in the Rutgers School of Environmental and Biological Sciences.

"We did detect widespread yield deficits. However, we also estimate that, through continued investment in pollinator management and research, it is likely that we can improve the efficiency of our existing crop fields to meet the nutritional needs of our global population."

The scientists reached their conclusions by conducting a statistical analysis of more than 200,000 "bee visitations" to crop flowers, contained within one of the most comprehensive databases on crop pollination in the world. Rachael Winfree, the senior author on the study and a professor in the Department of Ecology, Evolution and Natural Resources, collaborated with several colleagues from Europe and South America to compile the most comprehensive database of crop pollination studies in the world.

The open-source database incorporates three decades of field observations of bees and other pollinators visiting plants.

The recent Rutgers study doesn't apply to major food crops, such as rice and wheat, which don't require pollinators to reproduce. But pollination by bees and other animals is critical to the proliferation of what Turo describes as "nutrient-dense and interesting foods that we like and are culturally relevant," such as fruits, vegetables, nuts, and legumes.

"If you look through a list of crops and think about which fruits and vegetables you're most excited to eat— like summer berries or apples and pumpkins in the fall—those are the crops that typically need to be pollinated by insects," Turo said.

Pollination is the process of transferring pollen from the male part of a flower to the female part, which allows a plant to become fertilized and produce seeds, fruits and young plants. Pollen can be moved by wind, water or pollinators such as honeybees and wild bees and other insects and other animals, such as bats.

Pollinators support the reproduction of about 88% of the world's flowering plants and 76% of the leading global food crops, according to previous research by Rutgers professor Rachael Winfree and other scientists.

Bees are generally considered the most effective pollinators because Rutgers scientists identified that blueberry, coffee and apple crops were most frequently affected by pollinator limitations. They visit more flowers and carry more pollen than other insects.

Researchers found yield deficits for 25 unique crops and in 85% of the countries evaluated.

On the bright side, Turo said that scientists believe current yield deficits could be remediated with realistic increases in pollinator visitation across individual crop fields. The study revealed in some cases an adequate number of bees were already visiting some fields.

If field managers could improve consistency across high- and low-yield fields, much of the observed yield problems could be addressed, she said.

"The findings are significant because crop yields, which measure the amount of crops grown per unit area of land, are relevant to assessing the adequacy of the world's food supply relative to its population," Winfree said.

"Our findings show that by paying more attention to pollinators, growers could make agricultural fields more productive."

More information: Katherine J. Turo et al, Insufficient pollinator visitation often limits yield in crop systems worldwide, *Nature Ecology & Evolution* (2024). DOI: 10.1038/s41559-024-02460-2

Provided by Rutgers University