How effective are honey bees as pollinators?
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Honeybees are celebrated as effective plant pollinators, but just how effective are they? Newly published UC Davis research in the *American Journal of Botany* yields some surprising results.

Honeybees are effective pollinators, but when compared to other pollinators, including wild bees, they are rarely the most effective plant pollinators, according to a meta-analysis project led by doctoral candidate Maureen Page and postdoctoral researcher Charlie Casey Nicholson of the Neal Williams laboratory, UC Davis Department of Entomology and Nematology.

Page and Nicholson are the co-leading authors of "A Meta-Analysis of Single Visit Pollination Effectiveness Comparing Honeybees and Other Floral Visitors," the cover story of the current edition of the journal, published Nov. 30.

"Although high visitation frequencies make honeybees important pollinators, they were rarely the most effective pollinators of plants and were less effective than the average bee," said Page. "This suggests that honeybees may be imperfect substitutes for the loss of wild pollinators and ensuring pollination will benefit from conservation of non-honeybee taxa. In the future, we hope other researchers will use the data we have collected to further investigate the factors that influence pollination effectiveness."

Page and Nicholson originated the idea for the project during a graduate seminar led by UC Davis professor and community ecologist Louie Yang in the winter of 2020. While the COVID-19 pandemic shut down or postponed many other research projects, Page and Nicholson forged ahead and organized fellow graduate students and postdoctoral students to collectively read and extract single visit-effectiveness data from more than 468 papers. The two then analyzed the data from a subset of these papers (168) to ask whether honeybees and other floral visitors differed in their single visit pollination effectiveness.

Page and Nicholson began with the premise: "Many animals provide ecosystem services in the form of pollination including honeybees, which have become globally dominant floral visitors. A rich literature documents considerable variation in single visit pollination effectiveness, but this literature has yet to be extensively synthesized to address whether honeybees are effective pollinators."

The researchers conducted a hierarchical meta-analysis of 168 studies and extracted 1564 single visit effectiveness (SVE) measures for 240 plant species. "We paired SVE data with visitation frequency data for 69 of these studies," they wrote. "We used these data to ask three questions: (1) Do honeybees (Apis mellifera) and other floral visitors differ in their SVE? (2) To what extent do plant and pollinator attributes predict differences in SVE between honeybees and other visitors? (3) Is there a correlation between visitation frequency and SVE?"

They compared honeybees to multiple pollinator
groups, including ants, bees, beetles, birds, butterflies, flies, moths and wasps.

"Surprisingly, honeybees were less effective than other bees as pollinators of crop plants, suggesting that the importance of honeybees as crop pollinators derives largely from their numerical abundance rather than the quality of their floral visits," Page said.

"Honeybees were significantly less effective than the most effective non-honeybee pollinators but were as effective as the average pollinator," they wrote in their results section of the paper. "The type of pollinator moderated these effects. Honeybees were less effective compared to the most effective and average bird and bee pollinators but were as effective as other taxa. Visitation frequency and SVE were positively correlated, but this trend was largely driven by data from communities where honeybees were absent."

The researchers concluded that "Although high visitation frequencies make honeybees important pollinators, they were less effective than the average bee and rarely the most effective pollinator of the plants they visit. As such, honeybees may be imperfect substitutes for the loss of wild pollinators, and safeguarding pollination will benefit from conservation of non-honeybee taxa."

Also contributing to the project were Ross Brennan, Anna Britzman, Jessica Greer, Jeremy Hemberger, Hanna Kahl, Uta Müller, Youhong Peng, Nick Rosenberger, Clara Stuligross, Li Wang, and Professors Louie Yang and Neal Williams.

"Honeybees are as effective as the average pollinator, but rarely the most effective pollinators of plants," according to the caption. "Surprisingly, honeybees are less effective than other bees as pollinators of cultivated plants, suggesting the importance of honeybees as agricultural pollinators derives largely from their numerical abundance. Their study confirms a widely held belief that honeybees are not the best pollinators of plants globally and substantiates the growing concern that honeybees may be imperfect substitutes for the loss of wild pollinators."


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