

Honey bee genetics sheds light on bee origins

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Honey bees provide 'pollination services' worth billions of dollars to US agriculture. Understanding honey bee populations requires understanding their

origins in the Middle East and Africa. New work from UC Davis and UC Berkeley clears up some of the confusion around honey bee origins. Image: Honey bees collecting pollen Credit: Kathy Keatley Garvey

Where do honey bees come from? A new study from researchers at the University of California, Davis and UC Berkeley clears some of the fog around honey bee origins. The work could be useful in breeding bees resistant to disease or pesticides.

UC Davis postdoctoral researcher Julie Cridland is working with Santiago Ramirez, assistant professor of evolution and ecology at UC Davis, and Neil Tsutsui, professor of environmental science, policy and management at UC Berkeley, to understand the population structure of honey bees (*Apis mellifera*) in California. Pollination by honey bees is essential to major California crops, such as almonds. Across the U.S., the value of "pollination services" from bees has been estimated as high as \$14 billion.

"We're trying to understand how California honey [bee populations](#) have changed over time, which of course has implications for agriculture," Ramirez said.

To understand California bees, the researchers realized that they first needed to better understand honey bee populations in their native range in the Old World.

"We kind of fell into this project a little bit by accident," Cridland said. "Initially we were looking at the data as a preliminary to other analyses, and we noticed some patterns that weren't previously in the literature."

The new study combines two large existing databases to provide the most

comprehensive sampling yet of honey bees in Africa, the Middle East and Europe.

Unrelated Bee Lineages in Close Proximity

Previously, researchers had assumed an origin for honey bees in north-east Africa or the Middle East. But the situation turns out to be more complicated than that, Cridland said.

"You might think that bees that are geographically close are also genetically related, but we found a number of divergent lineages across north-east Africa and the Middle East," she said.

There are two major lineages of honey bees in Europe - C, "Central European," including Italy and Austria and M, including Western European populations from Spain to Norway - which give rise to most of the honey bees used in apiculture worldwide. But although C and M lineage bees exist side by side in Europe and can easily hybridize, they are genetically distinct and arrived in different parts of the world at different times.

M lineage bees were the first to be brought to north America, in 1622. The more docile C lineage bees came later, and today many California bees are from the C lineage, but there is still a huge amount of genetic diversity, Ramirez said.

"You can't understand the relationships among bee populations in California without understanding the populations they come from," Cridland said.

In the Middle East, the O lineage hails from Turkey and Jordan, and Y from Saudia Arabia and Yemen. The main African lineage is designated A.

At this point, the researchers cannot identify a single point of origin for honey bees, but the new work does clear up some confusion from earlier studies, they said. In some cases, diverged lineages that happen to be close to each other have mixed again. Previous, more limited studies have sampled those secondarily mixed populations, giving confusing results.

"We're not making any strong claim about knowing the precise origin," Cridland said. "What we're trying to do is talk about a scientific problem, disentangling these relationships between lineages, the genetic relationships from the geography."

The study is published online in the journal *Genome Biology and Evolution*.

More information: Julie M. Cridland et al, The complex demographic history and evolutionary origin of the western honey bee, *Apis mellifera*, *Genome Biology and Evolution* (2017). [DOI: 10.1093/gbe/evx009](https://doi.org/10.1093/gbe/evx009)

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