

Rapid evolution within single crop-growing season increases insect pest numbers

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This image shows a female Green Peach Aphid clone with a line of her clonal daughters soon after live birth (older clones are bigger). Credit: M. Turcotte.

New research by scientists at the University of California, Riverside shows that evolution – genetic changes in populations over time – can occur so rapidly in organisms that its impact on population numbers and other aspects of biology can be seen within just a few generations.

The research, published online Aug. 9 in *Ecology Letters*, the highest ranked journal in the field of ecology, can improve scientists' ability to predict the growth and spread of endangered species, invasive species, and disease epidemics.

Working on aphids, considered the world's most important crop pest, the researchers experimentally tested the impact of [rapid evolution](#) on wild populations within a single crop-growing season. To accomplish this, the researchers set up an experiment that prevented evolution by natural selection from occurring in some aphids while allowing it in others. They then compared the rate at which the non-evolving and evolving populations grew.

Each fall, aphids undergo one generation of sexual reproduction. The following spring, they begin multiple generations of asexual reproduction. During this period multiple clonal lineages compete, leading to changes in gene frequencies and mean trait values in the population in the process.

In their field experiment, the researchers compared replicated aphid populations that were non-evolving (single clone, thus genetically identical) to aphid populations that were potentially evolving (two clones genetically different from each other and with dissimilar growth rates).



This image shows aphids attacking a wild mustard plant at the UC Motte

Rimrock Natural Reserve. Credit: M. Turcotte.

As the populations grew, the researchers tested whether the mixed populations evolved. Counting aphids repeatedly, they found that clones rapidly changed in frequency, within 30 days or 4-5 aphid generations. They then tested the impact of this evolutionary change on the ecology of the aphids. They found that evolving populations grew in number up to 42 percent faster than non-evolving populations.

"This shows that even without human interference natural selection acting on aphid populations causes rapid evolution," said Martin M. Turcotte, who led the research as a graduate student in ecology, evolution and organismal biology at UC Riverside. "Even stronger effects might be expected when pesticides are in use. For decades, evolution was deemed too slow and, hence, it was not considered when studying population growth – an oversight that needs to be corrected. Ignoring this evolution, as is not currently uncommon, can lead to predictions that greatly underestimate pest densities and outbreaks."

Rapid evolution could have important untested impacts in many other applied areas. For example, rapid evolution is important in fisheries where intense fishing causes fish to evolve traits that let them escape fishing nets. Antibiotic resistance and increased virulence in pathogens are examples where rapid [evolution](#) impacts human health..

The study was conducted at the University of California Motte Rimrock Reserve where the researchers collected multiple clonal lineages from a wild aphid [population](#) feeding on mustard plants. They identified clones and characterized their intrinsic per capita growth rates in a greenhouse at UCR.

Provided by University of California - Riverside

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