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ECOLOGY:

Plants can run but they can't hide from warming -- study

Niina Heikkinen, E&E reporter

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Plants don't have legs to run with, but that doesn't mean many aren't trying to flee from climate change.

Now scientists are showing experimentally how rapid evolution is a driving force that could enable plants' escape to cooler climates.

In a **study** published recently in the journal *Science*, researchers tested how evolution might help plants migrate into new areas as land became increasingly fragmented and harder to reach. The results suggest that evolution may be able to act much faster in some circumstances than previously thought. The study also brings scientists a step closer to predicting how readily plants could migrate into new environments.

"We were able to replicate this and isolate the effect of evolution so we can show that it is in fact a driving mechanism behind the speed of plant migration -- and that it can both accelerate the rate of spread and it can do so predictably," said Jennifer Williams, a plant ecologist at the University of British Columbia and lead author of the paper.

Williams and her colleagues focused on the migratory ability of the tiny flowering plant *Arabidopsis thaliana*. Starting with 14 different genetic variations, or genotypes, of the plant, the researchers tested how quickly generations of *Arabidopsis* were able to move across man-made landscapes made up of rows of rectangular pots.

They found that after six generations, evolving plants were able to move 11 percent farther over continuous landscapes (unbroken rows of pots) than the non-evolving control group. The difference was even more striking for the *Arabidopsis* that had to navigate the most fragmented landscape, where the researchers spaced the pots six times the distance that seeds normally traveled in one generation. These plants moved 200 percent farther than non-evolving plants.

The researchers noted that the farthest-traveling plants in the most patchy landscapes tended to be taller, enabling them to spread their seeds farther. The plants also tended to be more competitive, producing more seeds in crowded pots.

"Humans have fragmented the landscape so much, this work suggests if [species] have enough genetic variation, they may be able to make it across. But the downside of that is they may lose a great deal of genetic variability," said Bruce Kendall, a quantitative ecologist at the University of California, Santa Barbara, and author of the study.

The research is an important piece to understanding how plants migrate in response to climate change, and could help researchers figure out if they will one day be able to predict how plants and other species may be able to move. The research has implications for understanding the potential spread of both rare and invasive species, he said.

Tom Miller, an assistant professor of ecology and evolutionary biology at Rice University, described the research as "important" and "influential." His research, which will soon be published, focuses on how evolution is enabling flies to spread across continuous landscapes.

"We've had a lot of theory for the idea that evolution during population spread can be an important part of that process, but we don't really have, for now, any evidence for that," Miller said. "It is still very difficult for any ecologist to pinpoint quantitatively how much does evolution really matter in this system."

But what happens outside the lab?

This study was able to demonstrate experimentally how evolution was actually affecting how the plants were spreading and that it was happening a lot. The study is also interesting because it considers how evolution might be influential in fragmented landscapes, something researchers have ignored, he said.

"We generally think of evolution as a process that plays out over a very long time scale. If we have forests coming down very rapidly, we tend to think that species won't have an opportunity to evolve in response to that, and I think this study is actually showing that in fact they can," Miller said.

While the research suggests that species might be able to deal with fragmented landscapes better than previously thought, it

only tempers concerns about species being unable to migrate a little bit, he added.

The researchers are quick to acknowledge that studying the influence of evolution in a laboratory setting has its limitations. Traits that might make *Arabidopsis* successful at traversing a patchy landscape in the laboratory won't necessarily apply to other species. *Arabidopsis* may also behave differently in the wild. In the natural world, there are a lot more variables that can affect plants' ability to spread, including luck.

But eventually, scientists who continue to focus on this area may be able to point to three or four traits that are especially important for understanding migration, not just for plants but for a wide range of organisms, said Kendall.

"We are just starting to think about what traits we need to measure and what traits we have to look for," he said.

Twitter: **@nhheikkinen** | Email: **nheikkinen@eenews.net**