

New discoveries upend traditional thinking about how plants make certain compounds

May 26 2009

Michigan State University plant scientists have identified two new genes and two new enzymes in tomato plants; those findings led them to discover that the plants were making monoterpenes, compounds that help give tomato leaves their distinctive smell, in a way that flies in the face of accepted thought.

Such research could help researchers find new ways to protect plants from pests.

Based on years of research, scientists thought that plants always used a specific compound, geranyl diphosphate, to make monoterpenes. But MSU biochemistry and molecular biology scientists Anthony Schillmiller and Rob Last were part of a research team that has found that tomato plants use a different compound, neryl diphosphate, as the substrate for making monoterpenes. The difference is subtle, but the discovery will change the way terpene (compounds that are responsible for the taste and smell of many plants) research is done. The research is published in the May 25 issue of the [Proceedings of the National Academy of Sciences](#).

"Essentially, this work subverts the dominant paradigm about an important and widespread pathway in plants," Last explained. "For years it was known that monoterpenes are made in a specific way. But there were cases where that pathway likely wasn't involved, given the kinds of compounds found in specific plants. We showed that in tomato trichomes (small hair cells located mainly on the plant's leaves and

stems), the established pathway is wrong. In the tomato trichome, two enzymes work together to make the monoterpenes in a previously unsuspected way."

The two newly identified [genes](#), neryl diphosphate synthase 1 (NDPS1) and phellandrene synthase 1 (PHS1), cause the tomato plant to make the new enzymes that produce the monoterpenes.

As the team was sequencing the DNA of tomato trichomes, Schillmiller and Eran Pichersky, of the University of Michigan, noticed that there were many sequences from genes that weren't supposed to be involved in monoterpene production. Because the sequences were found so frequently, they hypothesized the genes must be making high levels of compounds in the trichome.

"We had to think outside the box to figure out what the function of NDPS1 and PHS1 were," Schillmiller said. "Our colleagues at the University of Michigan, Eran Pichersky and Ines Schauvinhold, were instrumental in coming up with theories and running the assays."

Terpenes are the largest class of molecules made by plants - tens of thousands of different terpenes have been identified. Some of the known functions of terpenes include attracting pollinators, repelling pests and protecting the plant from diseases, as well as giving many plants their smell and taste. The aroma of many leaf spices, such as mint and basil, come from terpenes.

These new discoveries will allow other scientists to look for similar genes in other plants and perhaps discover new enzymes that make monoterpenes, which could lead to new ways to protect plants from pests.

Source: Michigan State University ([news](#) : [web](#))

Citation: New discoveries upend traditional thinking about how plants make certain compounds (2009, May 26) retrieved 19 April 2024 from <https://phys.org/news/2009-05-discoveries-upend-traditional-compounds.html>

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