Research shows entire group of genes vanishing in the evolution of flowers

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(PhysOrg.com) -- Lena Hileman sought to discover how related plants could have developed vastly different flowers and pollination strategies.

Imagine entering a field of study that Charles Darwin called an "abominable mystery."

Yet, the origin and diversification of flowering plants is the puzzling research area that attracted Lena Hileman, and she's just made a breakthrough important enough to be featured on the cover of one of the most-respected journals in the world.

Hileman, assistant professor of ecology and evolutionary biology at the University of Kansas, sought to discover how related plants — snapdragon and Plantago — could have developed vastly different flowers and pollination strategies.

"Plantago's flowers look nothing like a snapdragon flower," said Hileman. "They weren't considered to be closely related. So this was really striking to me."

Indeed, snapdragon's showy flowers evolved to attract bees that pollinate the plant, whereas its close cousin Plantago has small, unremarkable flowers that are pollinated by the wind — even though DNA sequencing shows that the two share the same ancestry of bee-pollinated flowers.

By looking at snapdragon and Plantago and their near relatives Veronica

and Aragoa on the molecular level, Hileman and her co-authors have made the startling discovery that an entire set of genes needed to create bee-pollinated flowers at some point disappeared from Plantago.

“This is a unique example where reduction of the petals in a transition from bee pollination to wind pollination has actually evolved though the complete loss of that genetic program — instead of having evolved though slight modification or tinkering with a genetic program,” said Hileman. “Not only one gene, but we’ve identified three genes. We’ve found that this suite of genes has been lost entirely from Plantago.”

The KU research appeared in the Feb. 8 issue of *Proceedings of the National Academy of Sciences*. Hileman’s co-authors were postdoctoral researcher Jill C. Preston and Ciera C. Martinez, who came to KU to pursue the research thanks to the Post-Baccalaureate Research Education Program offered by KU’s Office for Diversity in Science Training.

Although some of the DNA work on snapdragon and Plantago previously had been accomplished, the loss of the genes hadn’t been discovered until Hileman and her colleagues performed additional DNA sequencing at KU’s DNA Sequencing Laboratory.

“Basically what we’re generating are phylogenies, which are trees that show the relationship among species,” said Hileman.

What drove the evolutionary changes that brought about a humble, wind-pollinated flowering plant like Plantago from a common ancestor of the showy, bee-pollinated snapdragon?

“Organisms adapt to their local environments and what resources they have available to them,” said Hileman. “ If a lineage of plants finds itself in an environment where bee pollinators or any type of biotic pollinators are limited, then an alternative strategy, and under those conditions a

better strategy, might be wind pollination."

Provided by University of Kansas