Nightshades' mating habits strike uneasy evolutionary balance

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Most flowering plants, equipped with both male and female sex organs, can fertilize themselves and procreate without the aid of a mate. But this may only present a short-term adaptive benefit, according to a team of researchers led by two University of Illinois at Chicago biologists, who report that long-term evolutionary survival of a species favors flowers that welcome pollen from another plant.

"We've shown that a strong, short-term advantage experienced by individuals that have sex with themselves can be offset by long-term advantages to plant species that strictly avoid self-fertilization," says Boris Igić, UIC assistant professor of biological sciences. The result is "an apparently unending competition between these two reproductive strategies," he said, "contributing to disparities in species diversity observed among different groups of plants."

The findings are reported in the Oct. 22 issue of *Science* by Igić and lead author Emma Goldberg, postdoctoral research associate in biological sciences.

Their study focused on *Solanaceae*, the large and diverse plant family commonly known as nightshades. It includes such important crop plants as potatoes, tomatoes and tobacco. Just under half of the known nightshade species cannot self-fertilize.

Goldberg and Igić measured the long-term effects of self-fertilization, which is caused by frequent mutations and is difficult to lose once a

plant acquires it. The researchers applied a mathematical model to calculate the rate of accumulation of species, also called the diversification rate.

"We found those species that avoid self-fertilization diversify faster, giving them a long-term advantage," Goldberg said.

"It's a trade-off," Igić added. "The short-term benefits of mating assurance and ability to invade a new environment are pitted against long-term advantages of greater genetic diversity, allowing plants that avoid self-fertilization to have more offspring during unpredictable environmental changes."

Avoiding self-fertilization also allows plants to more easily keep beneficial mutations and provides a degree of protection against some harmful mutations, Igić said.

The findings underscore that both individual and species characteristics can strongly shape how a group of plants evolves and diversifies.

"The ability or inability to self-fertilize is subject to forces that act strongly, and in opposite directions," Goldberg said. "The balance between these opposing forces helps explain the diversity of plants within the nightshade family, and potentially many other plant groups."

Provided by University of Illinois at Chicago

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