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Extending the Life of Flowering Plants

Sarah Negley and Dr. Michelle Jones (right) are studying molecular and biochemical ways to delay the degradation of plant organs.

Flowering plants are most eye-catching when healthy and in full-bloom vigor. But something always happens to them in the pot at the nursery or in the vase on someone's kitchen table - leaves wilt; the blooms eventually die. And for many, this death tends to occur sooner rather than later.

Ohio State University researchers with the Department of Horticulture and Crop Science are studying molecular and biochemical ways to delay the degradation and death (also known as senescence) of plant organs, such as leaves and flowers. By understanding the regulators that control senescence, researchers hope to identify genes that could be inhibited to delay the process and increase the quality and shelf-life of flowering plants.

"Senescence is a naturally occurring process for plants, but there are environmental stresses during sales and in the consumer's home and garden that can accelerate the process," said **Dr. Michelle Jones**, an Ohio State floriculture molecular biologist with the Ohio Agricultural Research and Development Center. "Creating plants with delayed senescence is a potential benefit to floriculture and nursery professionals, as well as consumers, because the plants will last longer, keep their blooms longer and will be hardier in the retail store or in the garden."

OSU researchers hope to identify genes that could be inhibited to delay senescence and increase the shelf-life of flowering plants.

Dr. Jones and her colleagues used petunias to study the effects of ethylene on senescence. Petunias are popular and important bedding plants that are highly sensitive to ethylene - a plant hormone and naturally occurring gas produced by many plants. Environmental stresses tend to trigger the release of ethylene, which causes premature degradation and death of both leaves and flowers.

"The release of ethylene is a signal to a specific plant organ that it's time to die," said Jones. Altered plants that resist the effects of ethylene are available to researchers. While they produce flowers that last twice as long as normal flowers, the plants have decreased seed germination, decreased rooting and increased susceptibility to disease, making them of limited value to the floriculture industry.

"In order to delay senescence without affecting other aspects of plant development, a better understanding of how ethylene influences the processes specific to senescence is necessary," said Jones. "We have investigated ethylene's role in senescence by comparing the senescence program in ethylene-sensitive and ethylene-insensitive petunias." The final stage of senescence involves the degradation of the building blocks of the plant, such as DNA, RNA, proteins and organelles in dying plant cells. This allows the plant to remobilize nutrients, like phosphorus and nitrogen, to developing and actively growing parts of the plant.

Michelle Jones' Floriculture Molecular Biology Lab is using petunias to study senescence because they are very sensitive to ethylene.

"Our research has focused on this very late stage of the senescence program, and the activity of enzymes involved in degrading DNA, RNA and proteins was investigated in both ethylene-sensitive and ethylene-insensitive plants," said Jones. Researchers in Jones' Floriculture Molecular Biology Lab found that certain enzymes, most specifically nucleases and proteases, were only detected during the later stages of petal senescence in both ethylene-sensitive and ethylene-insensitive plants. The findings indicate that those enzymes are tied to ethylene production and have a specific role in the senescence process.

"These studies provide evidence for a role of the plant hormone ethylene in regulating the timing of petal senescence, and have led to the identification and cloning of genes that are specific to the senescence program," said Jones.

Jones plans to continue to identify genes involved in flower senescence using a petunia microarray developed at Ohio State. The petunia microarray will allow researchers to identify hundreds of genes that increase in abundance as flowers senesce based on 4,400 petunia genes already identified and stored. The array was developed in collaboration with Tony Stead from Royal Holloway, University of London, and was funded by the D.C. Kiplinger Floriculture Endowment in the Department of Horticulture and Crop Science.

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Watch a narrated slideshow of this story with additional photos here: Extending the Life of Flowering Plants Slideshow. Quicktime software is required to view the slideshow.

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