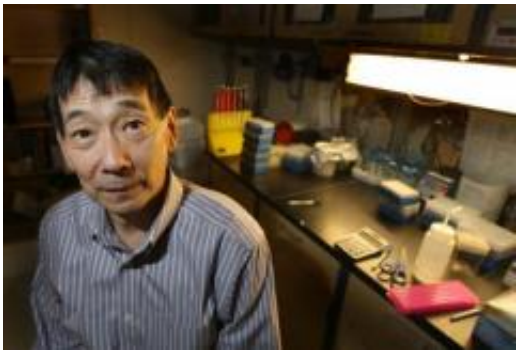
Researchers identify a process that regulates seed germination

March 11 2009



Mike Hasegawa discovered a process that regulates the genes in seeds that control germination and seedling development. When a peptide is attached to a particular protein in the seed, a process can begin that turns off the genes that are prohibiting germination. Credit: (Purdue Agricultural Communications photo/Tom Campbell)

Purdue University researchers have determined a process that regulates activity of genes that control seed germination and seedling development.

Mike Hasegawa, the Bruno C. Moser Distinguished Professor of Horticulture and Landscape Architecture, and Kenji Miura, a former Purdue postdoctoral researcher and now an assistant professor at Tsukuba University in Japan, discovered the step involved in keeping seeds from germinating in adverse conditions such as freezing temperatures or drought, a factor in the survival of plant species.

The work, which was published Wednesday (March 11) in the early online version of the Proceedings of the National Academy of Sciences, is part of ongoing research that has uncovered that similar processes affects a plant's freeze tolerance and absorption of phosphate.

"We've found the process, called sumoylation, is involved in the regulation of some major agricultural traits," Hasegawa said. "It is fundamental, basic research like this that allows us to understand how plants respond to hormones and environmental conditions."

Seeds produce a hormone called abscisic acid, or ABA, that prevents germination. When environmental factors such as temperature are not optimal for seed germination, ABA levels are high, which causes production of higher levels of a protein called ABI5. When the ABI5 protein is active, it switches on genes that prevent germination.

Hasegawa's research showed that when a SUMO peptide is attached to the ABI5 protein, the protein becomes inactive, switching off the genes that prevent germination and seedling development.

"A single stimulus such as ABA affects transcription factors, which are major controllers of genes involved in complex processes such as seed germination," Hasegawa said. "Sumoylation seems to be an important process in the control of significant plant characteristics."

Hasegawa said that the ABI5 protein can become active again, halting germination and seedling development if condition are no longer optimal. When conditions change to make plant development possible, the protein can once again be deactivated.

The National Science Foundation and the U.S. Department of Agriculture have funded the research in Hasegawa's laboratory. Hasegawa's next step is to determine how the sumoylation process leads

to gene suppression and expression.

Source: Purdue University