Plant Biologists Find Protein that Enhances Plant Growth during Drought

A research team lead by Dr. Paul Verslues, Associate Research Fellow at the Institute of Plant and Microbial Biology (IPMB), recently reported the discovery of a novel protein in the model plant *Arabidopsis thaliana* that when overexpressed promotes continued plant growth when water is limited. The study was published in the *Proceedings of the National Academy of Sciences of the United States of America* (*PNAS*) on August 3.

Drought represents a serious threat to agricultural production globally and the need to find ways for plants to produce more with less water is well recognized. Efforts to do this are limited by lack of knowledge of how plants perceive a lack of water and the initial events that happen inside plant cells to respond to this stress. Research in other organisms has led to the idea that drought stress sensing and first responses should occur at the plasma membrane which forms the outer boundary of the cell. However, plant proteins are different enough from human or yeast proteins to preclude reliable prediction of which plant proteins have these stress functions.

In their study, members Dr. Verslues' laboratory tested the hypothesis that a novel type of plant protein, At14a like1 (AFL1), may have a role in drought resistance. Transgenic plants overexpressing AFL1 maintained greater growth under drought stress and contained higher levels of the stress-protective compound proline. Conversely, plants designed to have reduced AFL1 were more impaired in growth during stress. Further experiments revealed that AFL1 interacts with other proteins, Protein Disulfide Isomerase 5 (PDI5) and NAI2, which suppress growth during stress. AFL1 at the plasma membrane is likely to be involved in endocytosis, the process of selectively removing parts of the membrane and proteins embedded in the membrane to adjust to different conditions. This process is not well understood in plants.

"This is a significant study in part because AFL1 is different from other proteins that affect drought resistance; this opens up new directions in plant stress research," said Dr. Verslues. One direction is to test whether a similar effect of increased AFL1 expression on drought and stress resistance can be seen in other plants, and thus access the prospects of using AFL1 in plant biotechnology. Another direction is to learn more about how AFL1 works. AFL1 is a plant-specific protein and little is known about its cellular function and how it acts to affect plant growth. "Our laboratory is excited to pursue both directions with the excellent facilities and support available to us at IPMB and Academia Sinica" added Dr. Verslues.

The complete list of authors is M. Nagaraj Kumar, Yi-Fang Hsieh and Paul E. Verslues. Dr. Kumar and Ms. Hsieh contributed equally to the study and are co-first authors. Dr. Kumar is a recent graduate of the Molecular and Biological Agricultural Sciences Program of the Taiwan

International Graduate Program.

The full article entitled “At14a-Like1 participates in membrane-associated mechanisms promoting growth during drought in Arabidopsis thaliana” can be found at the *PNAS* journal website: http://www.pnas.org/content/early/2015/07/29/1510140112.full.pdf.

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