Study reveals which genes are critical to a plant's response to drought

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Because plants cannot relocate when resources become scarce, they need to efficiently regulate their growth by responding to environmental cues. Drought is the most important cause of reduced plant growth and crop yield, which makes insights into a plant's drought response highly valuable to agriculture. A team of VIB and Ghent University researchers set out to shed more light on this vital topic through a research initiative led by Professor Dirk Inzé. The study provided major insights into how plants cope with water-limiting conditions, which can direct advanced breeding and genome engineering efforts to create high-performing, drought-tolerant crop plants. The findings are published in the leading academic journal *The Plant Cell*.

Scientists predict that climate change will cause widespread agricultural problems, mainly in the form of drought – especially when fresh water and irrigation infrastructure are not available. Extreme food shortages could be the result, making it very important for scientists to find new ways to protect crop plants against drought on a genetic level. *But* before they can do this, they need to understand more about which genes are responsible for the changes in a plant's growth rate under drought conditions.

Large-scale study uses the latest genetic analysis technologies

Before this study – the largest of its kind - conducted by a team led by

Professor Dirk Inzé, scientists had little insight into the genes and genetic processes that drive some plants to limit their growth under drought conditions while others grow normally. To learn more about these growth-regulating genes, Dr. Inzé's team, in close collaboration with Dr Arthur Korte of the GMI (Austria) and the University of Würzburg (Germany), looked at the genetic variability of 100 types (accessions) of the Arabidopsis thaliana model plant. While growing these plants under mild drought stress, they performed in-depth cellular and molecular analyses of each plant's responses. The results surprised them.

Prof Inzé (VIB-Ghent University): "We observed huge differences in drought tolerance across the 100 accessions: some grew normally, while others stayed very small. This large-scale analysis allowed us to identify exactly which genes play a pivotal role in a plant's defense mechanism against drought. It was an astonishing journey to unravel the vast complexity of these mechanisms – the diversity of nature is a great learning environment."

Core genes affected by drought stress identified

At a molecular level, even though the diversity in the drought responses of the different accessions was huge, only a small number of genes was affected in virtually all 100 types of Arabidopsis. These genes are the core of a plant's drought defense response.

Prof Inzé (VIB-Ghent University): "This study provided major insights into how plants cope with water-limiting conditions, which can direct advanced breeding and genome engineering efforts to create high-performing, drought-tolerant crop plants. In the next phase of the study, we will examine and categorize the functions of the genes that we identified – not only in model organisms, but also in agriculturally and economically important crops such as corn."

More information: Pieter Clauw et al. Leaf Growth Response to Mild Drought: Natural Variation in Arabidopsis Sheds Light on Trait Architecture, *The Plant Cell* (2016). DOI: 10.1105/tpc.16.00483

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