GULBENKIAN SCIENCE

PRESS RELEASE

How do plants grow in harsh environments?

Researchers from the IGC reveal a mechanism that allows plants to grow under harsh conditions. The study could help define strategies to ensure ecosystem sustainability and the world's food supply in the face of environmental threats, such as drought.

Oeiras, 04th January 2023 – As sessile organisms, plants must use other strategies to cope with environmental challenges that affect their growth and development, such as drought and extreme temperatures. The basis for adaptation to stress in these organisms lies ultimately on the genome.

When challenged by the environment, plants produce a hormone, abscisic acid (ABA), that inhibits their growth. This way, the plant saves energy to mount an efficient stress response and ensure survival, by expressing relevant genes. A recent study from the Instituto Gulbenkian de Ciência (IGC), published in **Plant Communications**, reveals how plants find this balance between growth and stress tolerance.

The conclusions come from studies in *Arabidopsis thaliana*, a small plant used as a model in several molecular biology laboratories, such as the one led by Paula Duque at the IGC. The group has a particular interest in a family of proteins involved in a mechanism that allows plants to generate multiple products from a same gene, which contributes to their developmental plasticity. In previous studies, the team had shown that a member of this family, the SR45 protein, inhibits stress responses mediated by the ABA hormone during early phases of plant development. Given that the addition or removal of phosphate groups regulates the activity of these proteins, the researchers wondered if phosphorylation controls plant growth when conditions are not the most favorable.

To mimic exposure to stress, the researchers treated new-born plants (about a week old) with the ABA hormone. When they did so, the plants accumulated the dephosphorylated form of the protein. Adding phosphate groups is a cell strategy to tag proteins for destruction. With the removal of these groups, the protein became more stable and was less destroyed.

With these observations, the researchers deciphered a new autoregulatory mechanism used by plants to grow, to some extent, when conditions are not ideal. "When the levels of the stress hormone increase, plant growth is inhibited, but so is the destruction of the SR45 protein", explains **Rui Albuquerque-Martins**, first author of the paper who recently finished his PhD studies at the IGC. "As the protein accumulates in the plant, it becomes less sensitive to the ABA hormone, alleviating the inhibition of growth", he concludes.

"These data might contribute to the development of novel efficient biotechnological strategies to improve crop productivity in the face of current and future environmental challenges", explains the principal investigator, **Paula Duque**. The next step will be to unravel the precise molecular mechanisms by which exposure to ABA reduces the phosphorylation levels of the SR45 protein.

The study also uncovers how cells control the activity of SR proteins, which are major modulators of gene expression regulation in both plants and animals. In humans, for example, these proteins are implicated in diseases such as cancer, which underscores the relevance of these findings.

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Original study: Rui Albuquerque-Martins, Dóra Szakonyi, James Rowe, Alexander M. Jones, and Paula Duque (2022). **ABA signaling prevents phosphodegradation of the SR45 splicing factor to alleviate inhibition of early seedling development in Arabidopsis.** Plant Communications.

More information

Ana Morais
Head of Institutional Communication
@: anamorais@igc.gulbenkian.pt
Contact: +351 965 249 488