Plants see the light to help beat the big freeze

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Plants use changes in light quality to make their own ‘antifreeze’, a new University of Leicester study has shown.

The research in the Department of Biology reveals that plants react to change in light quality in order to develop freezing tolerance. It has been published in *Nature Genetics* and was funded by the BBSRC and Royal Society.

The study has been described as a ‘harbinger of a new era of understanding regarding how plants grow and thrive in a dynamic and complex environment’ in the News and Views section of *Nature Genetics* (Kumar V and Wigge PA (2007) Nat. Gen 39, 1309-1310) and selected as a key article by Faculty of 1000.

This study, led by Dr. Kerry Franklin and Professor Garry Whitelam, will additionally be reviewed in the ‘Leading Edge: Molecular Biology Select Series’ section of the journal *Cell* (‘The Long Twilight Struggle of the Plant Cold War’- out on December 14th).

Dr Franklin said: “To survive the freezing temperatures of winter, many plants undergo a process termed cold acclimation. In response to the cooler temperatures that presage the onset of winter, plants increase the expression of a large number of genes which lead to the accumulation of proteins and sugars that confer ‘antifreeze’ properties to cells”.

“This new research at the University of Leicester has revealed that plants also react to another environmental signal, a change in light quality, in order to develop freezing tolerance.”

These findings demonstrate how plants can integrate very different environmental signals, in this case light quality and temperature to best prepare for changes in their environment.

More information:

The study has shown that a reduction in the ratio of red to far-red wavelengths (R:FR) of light increases the expression of freezing tolerance genes in the model plant species Arabidopsis thaliana. The ratio of red to far-red light, which is detected by specialized plant photoreceptors called the phytochromes, is highest in direct sunlight and lower in the shade of vegetation or at twilight, which is prolonged at higher latitudes.

The study also showed that expression of freezing tolerance genes in response to low R:FR ratio is tightly linked to the plant’s biological clock. This would ensure that maximum sensitivity of plants to the low R:FR ratio signal would coincide with the twilight reduction in R:FR ratio when plants are growing in the shorter days of autumn. In addition, the work has shown that the light quality-mediated freezing tolerance signalling pathway is uncoupled at higher growth temperatures, a strategy that would prevent the unnecessary accumulation of ‘antifreeze’ proteins in warmer conditions.

Source: University of Leicester