Experts reveal why plants don't get sunburn

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(PhysOrg.com) -- Experts at the University of Glasgow have discovered how plants know when to make their own sunscreen to protect themselves from the harmful rays of the sun. Scientists have speculated for decades that plants must have a 'photoreceptor' for UV-B wavelengths in sunlight, similar to those they use to detect other wavelengths which control other processes, such as triggering when they flower.

UV-B is the most powerful part of the daylight spectrum and is potentially damaging both to humans and plants.

Now, a paper published today in *Science*, explains how a protein, called UVR8, recognises UV-B light and then switches on changes in a plant's gene expression needed for it to produce its own sun block.

Plants need sunlight to harvest light energy and so, are constantly exposed to UV-B. However, plants rarely show signs of damage because they have evolved a way of protecting themselves from the sun's harmful rays by making their own sunscreen and depositing it in the outer tissues of leaves.

Gareth Jenkins, Professor of Plant Cell and Molecular Biology at the University of Glasgow and co-author on the paper, described the paper's findings as "groundbreaking".

"The search for this UV-B photoreceptor has been something of a Holy Grail for plant photobiologists. We have known for decades that plants

can sense the presence of UV-B and that this stimulates the production of sunscreen chemicals that protect plants in sunlight, but we didn't know how plants were able to recognise the presence of UV-B. Now we do. We have managed to identify the photoreceptor that does this," says Prof Jenkins.

The research opens up new directions for understanding how plants respond to UV-B.

In 2005, Prof Jenkins and his team in Glasgow showed that UVR8 orchestrates the changes in gene expression which underpin this production of plant sun block. Since then, they have been studying, with colleagues from the Universities of Freiburg and Geneva, how UVR8 works.

UVR8 is always present throughout a plant so it can respond immediately to sunlight. Normally in plants two molecules of UVR8 associate to form what is called a dimer.

This latest paper shows that UV-B light converts the dimer into single molecules of UVR8. It is this conversion of molecules which has a direct effect on the protein and ultimately the gene expression which leads to the production of the plant's sunscreen.

Prof Jenkins continues: "A key process in plants producing sunscreen is the interaction of UVR8 with another protein called COP1. This interaction results in UVR8 initiating the necessary gene changes to ensure the plant is protected from sunlight.

"When a plant detects UV-B light this light stimulates the synthesis of sunscreen compounds that are deposited in the outer tissues and absorb UV-B, minimizing any harmful transmittance to cells below.

“This is exactly what our sun creams do. In addition, exposure to UV-B stimulates the production of enzymes that repair any damage to DNA. And lastly, genes are switched on that prevent oxidative damage to cells and help to maintain the photosynthetic machinery in the leaves.”

Scientists at Glasgow work with the Arabidopsis plant because it is excellent for molecular biology and genetics.

Arabidopsis plants which are made to lack UVR8, to test its function in the laboratory, fail to show protection and hence are very sensitive to UV-B, they die when exposed to levels of UV-B typical of bright sunlight.

Provided by University of Glasgow

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