

A plant which acclimatizes with no exterior influence

November 25 2013

Plants have a love-hate relationship with sunlight. While some wavelengths are indispensable to them for performing photosynthesis, others, such as UV-B, are deleterious. Therefore, plants are equipped to detect these highly toxic rays and mount their defences. A team led by Roman Ulm, Professor at the Faculty of Sciences at the University of Geneva (UNIGE), Switzerland, has generated a transgenic plant which acclimatizes constitutively, regardless of the level of UV-B.

This plant possesses a constantly active receptor, which endows it with a higher UV resistance, associated with increased flavonoid production, substances which function as a 'sunscreen' and as [antioxidants](#). Flavonoid-rich [plants](#) also provide a powerful source of antioxidants for humans. As described in the journal *PNAS*, this transgenic plant is an excellent model system within the framework of basic research, as well as studies aiming at improving [crop plants](#).

Plants have an arsenal of receptors that enable them to benefit from all components of solar radiation. While the energy of some photons is captured by chlorophyll to produce sugar, other wavelengths regulate essential processes, such as flowering, seed germination, shade avoidance and phototropism. 'Even ultraviolet B rays, despite their harmfulness, are used by plants as an environmental stimulus and influence plant growth and development', points out Roman Ulm, Professor at the UNIGE Department of Botany and Plant Biology.

A maximal survival response

Ultraviolet B rays (UV-B), which account for 0.5% of light energy, are dangerous for living organisms as they lead to the formation of free radicals in cells and damage their DNA. Unable to escape them, plants are forced to find a way to protect themselves. They detect UV-B rays thanks to a receptor known as UVR8, thus triggering a biochemical chain reaction within the cells and allowing them to mount their defences. These are notably made up of flavonoids, which act as sunscreens and antioxidants, but also of enzymes which repair the damage caused to the DNA during light exposure.

In collaboration with his colleagues from the Universities of Ghent (Belgium) and Freiburg (Germany), Roman Ulm's team has generated a transgenic plant equipped with an UVR8 mutated receptor. 'The substitution of just one amino acid by another was enough for the receptor to remain constantly active, even without UV', describes Marc Heijde, postdoctoral fellow and one of the article's main authors. The fact that this receptor is always switched on results in a constant stimulation of the genes necessary for the development of survival responses'.

A complete UV shield

The [transgenic plant](#) acclimatises constitutively and does not suffer from over-exposure to UVB. This is also due to a high production of flavonoids, including anthocyanins, molecules with powerful antioxidant properties for both plants and humans. 'This plant is a variant of *Arabidopsis thaliana*, a model organism widely used in the laboratory. It allows us to explore in detail the intracellular processes involved in acclimatisation and makes for an excellent study model as part of the research aimed at improving crop plants', states Roman Ulm.

More information: Constitutively active UVR8 photoreceptor variant in Arabidopsis , www.pnas.org/cgi/doi/10.1073/pnas.1314336110

Provided by University of Geneva

Citation: A plant which acclimatizes with no exterior influence (2013, November 25) retrieved 23 April 2024 from <https://phys.org/news/2013-11-acclimatizes-exterior.html>

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