Scientists unravel plants' natural defenses

A team of researchers, led by the University of Sheffield and Queen Mary, University of London, has discovered how plants protect their leaves from damage by sunlight when they are faced with extreme climates. The new findings, which have been published in *Nature*, could have implications both for adapting plants to the threat of global warming and for helping man better harness solar energy.

Photosynthesis in plants relies upon the efficient collection of sunlight. This process can work even at low levels of sunlight, when plants are in the shade or under cloud cover for example. However, when the sun is very bright or when it is cold or very dry, the level of light energy absorbed by leaves can be greatly in excess of that which can be used in photosynthesis and can destroy the plant. However, plants employ a remarkable process called photoprotection, in which a change takes place in the leaves so that the excess light energy is converted into heat, which is harmlessly dispersed.

Until now, researchers hadn't known exactly how photoprotection works. By joining forces with their physicist colleagues in France and the Netherlands, the UK team have determined how this process works. They were able to show how a small number of certain key molecules, hidden among the millions of others in the plant leaf, change their shape when the amount of light absorbed is excessive; and they have been able to track the conversion of light energy to heat that occurs in less than a billionth of a second.

Many plant species can successfully inhabit extreme environments where there is little water, strong sunlight, low fertility and extremes of temperature by having highly tuned defence mechanisms, including photoprotection. However, these mechanisms are frequently poorly developed in crop plants since they are adapted for high growth and productivity in an environment manipulated by irrigation, fertilisation, enclosure in greenhouses and artificial shading. These manipulations are not sustainable, they have high energy costs and may not be adaptable to an increasingly unstable climate. Researchers believe that in the future, the production of both food and biofuel from plants needs to rely more on their natural defence mechanisms, including photoprotection.

Professor Horton, of the University of Sheffield's Department of Molecular Biology and Biotechnology, who lead the UK team, said: "These results are important in developing plants with improved photoprotective mechanisms to enable them to better cope with climate change. This may be hugely significant in our fight against global warming. It is a fantastic example of what can be achieved in science when the skills of biologists and physicists are brought together."

Moreover, there are other global implications of this research. Dr Alexander Ruban of Queen Mary's School of Biological and Chemical Sciences, comments: "As we seek to develop new solar energy technology it will be important to not only understand, but to mimic the way biology has learnt to optimise light collection in the face of the continually changing intensity of sunlight."

Source: University of Sheffield