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**Genetic control of key defences**

*A new study shows how plants adapt to environmental changes, new ecological niches.*

Japanese scientists have released an important study that indicates a genetic mechanism which helps plants respond to environmental changes or occupy new ecological niches.

The researchers studied *Arabidopsis thaliana*, or thale cress, a plant related to cabbage and mustard that is often used in genetic studies because its characteristics are similar to many commonly-grown crop species. In particular, scientists study its epidermal, or outer-layer cells, to try to understand how cells develop into different types. This is known as a cell's developmental fate.

The scientists at RIKEN's Plant Science Center in Yokohama studied a gene called *CAPRICE-LIKE MYB3* or *CPL3*. It is similar to the so-called *CAPRICE*, which is known to be involved in the process of root-hair development in epidermal cells. They found the *CPL3* to be involved in the development of trichomes, the hairs found on the surface of most plant leaves. In addition, the gene helps control root hair formation and the flowering process, as well as cell size. Understanding the molecular processes involved has implications for future genetic engineering of plants with customized root and leaf hair characteristics, as well as advantageous flowering times.

Trichomes are an important part of the defences of many plants against insects. These hairs can make a leaf difficult to access for a pest, and many trichomes produce resins or oils, which are spread onto the surface of the leaf if the trichome is ruptured. Some of these are poisonous to insects, and in addition insects can get caught in sticky resins. The ability to engineer plants with designer leaf-hair characteristics is therefore important, since crops resistant to specific pests can then be created.

The ability to control flowering time also has important implications for adapting crops. As spring comes progressively earlier, crop varieties engineered to flower earlier could become commercially valuable. Crops can also potentially be engineered for specific local climates, giving the possibility of growing species that were previously not possible at a given location.
The discovery of CPL3 involvement in controlling root hair development is also significant. Root hairs, which are found in the mature part of a plant's root system, provide the main surface over which the plant absorbs its water and nutrients. The ability to control the characteristics of a plant's root hairs, such as their concentration and spacing, leads to the possibility of engineering crops for specific types of locations. For example, varieties suitable for particularly arid or moist conditions can be created.

CPL3 was also found to be involved in controlling the size of plant cells. It regulates a process known as endoreduplication, where a cell duplicates all the DNA in its nucleus without dividing to create a new cell. This leads to larger cells with more DNA than in a normal cell. The process occurs in certain types of plant. The RIKEN team also envisages plants engineered to have the most advantageous cell size for varying environmental conditions. In combination with the other roles that have been discovered for this gene, this study represents a significant advance in knowledge that can help create crops adapted for a time of changing climate and increased pressure on agricultural land.

**Original work:**
Tominaga, R., Iwata, M., Sano, R., Inoue, K., Okada, K., Wada, T. *Arabidopsis CAPRICE-LIKE MYB 3 (CPL3) controls endoreduplication and flowering development in addition to trichome and root hair formation*, *Development*, published online on Feb.27, 2008

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