JAG THE FLOWER AND LEAF

Roles of Gene *JAGGED* in Sculpting Flowers and Leaves of Columbine (*Aquilegia*)

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How the elaborate morphologies of leaves and flowers are sculpted has always been a fascinating question. Although the enormous diversity of vegetative and floral morphologies exhibited in nature has left us many puzzles, it is believed that these architectures in different plants are built under conserved genetic frameworks. In other words, all the leaves or flowers share similar foundations in their genetic programs, since they have all derived and evolved from the very first leaves or flowers on earth millions years ago.

In order to explore the genetic basis of plant morphology, intensive research has been focused on some "model plants" such as a small flowering plant, Arabidopsis, and rice. These studies have identified many essential genes and provided us a starting point to understand the generation of the breathtaking beauty of nature.

Gene *JAGGED* (*JAG*) is one of the important factors in building floral and leaf morphologies in plants. At present, two major functions of *JAG* in Arabidopsis morphology development have been revealed: it promotes the initiation of floral organs (*e.g.* sepals, petals, stamens and carpels) from stems, and subsequently it promotes the lamina expansion of leaves and floral organs.

In this study, we attempt to investigate the roles of gene *JAG* in flower and leaf development of columbine (*Aquilegia*) by taking two different approaches. Firstly, we analyzed in which tissues and organs, and during which developmental stages of columbine flower buds, *JAG* has expressed. Investigating the expression patterns of *JAG* provides us information regarding its functions in columbine flower development in greater spatial and temporal detail. Secondly, we explored how would the columbine look like without the proper functions of *JAG* during its leaf and flower development. This is achieved by using a technique named VIGS to "knock down" the normal expressions of *JAG* in the plants. Our results have shown that gene *JAG* in columbine conserves similar functions as in Arabidopsis and rice from former studies, that it promotes floral organ initiations and lamina expansion in flowers and leaves. However, it seems that *JAG* also possesses novel functions in floral and leaf morphology development in columbine. For instance, when losing the functions of *JAG* during columbine leaf development, different degrees of invaginations on the leaf surfaces were observed, and sometimes the whole surface curved to the abaxial side, forming bowl-like structures. This is due to that *JAG* in columbine also participates in the genetic programs determining the shapes of the cells on one of the two leaf surfaces. Cell shapes on the *JAG*-controlled surface become abnormal when lacking proper expressions of *JAG*, whereas cells on the other leaf surface remained in the regular shapes, and thus the leaf lamina appeared to be curing to one side rather than being flat.

Degree project in biology, Master of science (2 years), 2014
Examensarbete i biologi 30 hp till masterexamen, 2014
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