Juvenile-to-adult vegetative phase transition in grapevine

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Abstract

The sequential activity of miR156 and miR172 controls the juvenile to adult phase transition in many plant species, where miR156 abundance decreases while miR172 increases along plant development. Very little is known about phase transition in horticultural woody species, which show substantially long vegetative phases. In grapevine, phase transition seems to be dissociated, displaying a first transition from juvenile to adult vegetative state in the first year, coincident with tendril differentiation and a subsequent induction of inflorescences in place of some of tendrils in later years under flowering inductive environmental conditions. Since grapevine is a highly heterozygous species, the generation of genetically homogeneous material for replicated transcriptomic analyses from seed-derived plants was a main challenge. Here, we present a detailed global gene expression analysis of the juvenile-to-adult phase transition during the development of grapevine plantlets grown from seeds. The RNA-seq analysis demonstrated that miR156 was significantly repressed in the grapevine's adult phase, where the appearance of tendrils acts as a marker of the transition. Consistent with the results reported in other species, we observed the activation of several SPL genes, known to be targets of miR156, and providing evidence for the conservation of the regulatory module miR156-SPLs in grapevine. However, no variation was detected in the expression of miR172, a key determinant in the transition to flowering in other species. This could be explained considering that grapevines do not flower during the first years of growth. Interestingly, we were still able to observe the overexpression of several genes known to be involved in the floral meristem identity transition which were also been detected along tendril development, consistently with the proposed common ontogenetic origin of tendrils and inflorescences in the Vitaceae family.

Keywords: phase change, juvenile phase, flowering transition, tendril development, miRNA, RNA-seq.