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VviSOC1a and VviAG1 act antagonistically in the regulation of flower formation

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Abstract

The SUPPRESSOR OF OVEREXPRESSION OF CONSTANS1 (SOC1) is a key floral activator that coordinates external and internal stimuli to ensure timely flowering. During early stages of flower formation, SOC1 represses floral organ identity genes such as *AGAMOUS* (*AG*) to prevent premature organ differentiation. In addition to floral organ specification, *AG* has been shown to regulate fleshy fruit expansion and ripening and, as such, is an important contributor to fruit quality traits. Currently, little is known about the function and gene regulatory network of the grapevine homologs *VviSOC1a* and *VviAG1*. As such, the aim of this study was to functionally characterise both genes by overexpressing them in tomato and performing phenotypic and gene expression studies. A dual luciferase (DL) assay involving putative target gene promoters was also conducted. Overexpression of *VviSOC1a* led to the development of leaf-like sepals, petals with increased chlorophyll content and plant sterility phenotypes. *VviAG1*-OE lines displayed hastened floral initiation, stamenoid petals, dwarfed fruit, as well as forming fleshy fruit sepals which gave the appearance of ripened pericarp tissue. The observed floral phenotypes were, in part, supported by the modulation of genes required for floral organ specification in tomato. *VviSOC1a* and *VviAG1* displayed opposite expression trends, while also repressing each other's expression in the DL assay. Collectively, the findings of this study supported a role for *VviSOC1a* in regulating floral organ specification, through the repression of the stamen and carpel identity gene *VviAG1*. An additional function for *VviAG1* in berry development and ripening is also suggested.

Keywords: SOC1, AG1, Flower, transcription factor, development