Molecular anatomy of seedlessness in grapevine: the role of *VvAGL11* during seed morphogenesis

[1,2]Jaiana Malabarba, [2]Vanessa Buffon, [3]Jorge Ernesto de Araújo Mariath, [4]Marcelo Carnier Dornelas, [1]Márcia Maria Auxiliadora Nachenveng Pinheiro- Margis, [1]Giancarlo Pasquali[1], [2]Luís Fernando Revers

[1]Graduate Program in Cell and Molecular Biology, Centro de Biotecnologia, Universidade Federal do Rio Grande do Sul, Porto Alegre, RS, 91501-970, Brazil [2]Laboratory of Plant Molecular Genetics, Centro Nacional de Pesquisa de Uva e Vinho, Empresa Brasileira de Pesquisa Agropecuária, Bento Gonçalves, RS, 95700-000, Brazil.[3]Laboratory of Vegetal Anatomy, Centro de Botânica, Universidade Federal do Rio Grande do Sul, Porto Alegre, RS, 91501-970, Brazil [4]Graduate Program in Vegetal Biology, Universidade Federal de Campinas, Campinas, São Paulo, 13083-970, Brazil. E-mail: luis.revers@embrapa.br

Stenospermocarpic seedlessness is a desirable trait for table grapes. Thereby the understanding of genetic and molecular mechanisms that control this trait is justified by the demand of *in natura* seedless grapes. Our previous studies identified a candidate gene, *VvAGL11*, possibly involved in the control of seed development in grapevine. The purpose of this study was to evaluate *VvAGL11* in a pirenic cultivar, Chardonnay, and in an apirenic cultivar, Sultanina, in order to better understand its role during seed morphogenesis. Evaluation of transcriptional profiles of *VvAGL11* during different developmental stages, from flowers to mature fruits, showed a large accumulation of transcripts in seeds of 2, 4 and 6 weeks old compared to flower and pulp tissues in the Chardonnay cultivar. In ‘Sultanina’ the expression of *VvAGL11* was extremely low in all stages and tissues examined. Anato-morphological analyzes were performed in order to compare the seed and the seed trace. It was identified a loss of identity of the medium integument layer in the Sultanina seed trace since this layer neither elongated nor doubled in size as it should. The spatial-temporal expression pattern of *VvAGL11* was determined by *in situ* hybridization. Samples of ‘Chardonnay’ and ‘Sultanina’ in the same stages of development analyzed by RT-qPCR were employed. *VvAGL11* transcript levels were significantly increased in ‘Chardonnay’ seeds with 2 and 4 weeks of development, specifically in the dual layer medium integument of the seed. In 'Sultanina', gene transcripts were undetectable during all stages of development. The particular accumulation of *VvAGL11* transcripts in a specific layer of the seed coat in Chardonnay cultivar, combined with the morphological differences in this same layer when comparing Chardonnay and Sultanina cultivars, suggest that this gene is essential for the elongation and duplication of the medium integument of the seed coat. Taken together, our results allow us to propose that the absence of *VvAGL11* expression is responsible for the erroneous development of seeds. The extreme diminution of final seed size could be due to the non-differentiation of the medium integument seed layer, causing the cease of the elongation and duplication of the seed coat. Within this loss of identity, the endosperm would have no normal development as well, stopping its growth and causing the death of the embryo leading to the formation of a seed trace.

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