P61 – Identification and functional annotation of candidate genes for the control of phenotypic differences between early and late ripening 'Pinot' cultivars

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Abstract

Grapevine cultivars of the Pinot family represent in the broader sense clonally propagated mutants with clear-cut phenotypes, such as different colour or shifted ripening time, that result in major phenotypic and physiological differences as well as changes in important viticultural traits. Specifically, the cultivars 'Pinot Noir' (PN) and 'Pinot Noir Precoce' (PNP, early ripening) flower at the same time, but vary for the beginning of berry ripening (veraison) and consequently for the harvest time. Apart from the genotype, seasonal climatic conditions also affect ripening times. To reveal possible regulatory genes affecting the timing of the start of ripening, we investigated differences in gene expression profiles between PN and PNP throughout berry development with a closely meshed time series and during two separate years.

The difference in the duration of berry formation was quantified to be about two weeks under the growth conditions applied, using plant material with a proven clonal relationship. Clusters of co-expressed genes and differentially expressed genes (DEGs) were detected which reflect the shift in the beginning of ripening at the level of gene expression profiles. Functional annotation of these DEGs fits to phenotypic and physiological changes during berry development. In total, we observed between PN and PNP 3,342 DEGs in 2014 and 2,745 DEGs in 2017. The intersection of both years comprises 1,923 DEGs. Among these, 388 DEGs were identified as veraison-specific and 12 were considered as candidates for a regulatory effect on berry ripening time. The expression profiles revealed two candidate genes for Ripening Time Control, designated *VviRTIC1* and *VviRTIC2* , that may contribute to controlling the phenotypic difference between PN and PNP.

Many of the 1,923 DEGs identified show highly similar expression profiles in both cultivars as far as accelerated berry formation of PNP is concerned. Putative ripening time controlling genes differentially expressed between PNP and PN as well as veraison-specific genes were identified. We point out potential connections of these genes to molecular events during berry development and discuss potential ripening time controlling candidate genes, two of which are already differentially expressed in the early berry development phase. Several down-regulated genes are annotated to encode auxin response factors / ARFs. Conceivably, changes in auxin signaling may implement the earlier ripening phenotype of PNP.

Keywords: *Vitis vinifera*, 'Pinot Noir', 'Pinot Noir Precoce', grapevine, berry ripening, fruit development, differential gene expression, transcriptome profiling, ripening time control, veraison