Exploiting somaclonal variability to increase drought stress tolerance in grapevine

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Global warming has enhanced the frequency and severity of drought events, hence calling for a better management of water resources in the vineyard and for an improvement of breeding platforms. Somatic embryogenesis (SE) (i.e. the initiation of embryos from somatic tissues) can spontaneously generate new genetic variability, which results from genetic mutations, changes in epigenetic marks, or phenotypic alterations.

This study was tailored to test whether vines in vitro regenerated through SE (i.e. somaclones), can tolerate water deprivation better than the mother plant.

Physiological trials of water stress and recovery were conducted on two populations of different somaclone lines of *Vitis vinifera* 'Nebbiolo' and of 110R (*V. rupestris* x *V. berlandieri*) rootstock, respectively regenerated in absence and presence of in vitro selective pressure. During the experiments, dynamic changes in the main eco-physiological parameters were monitored on target somaclones and compared with those measured on plants of the corresponding mother plant lines. Alterations in biometric and anatomical traits were also inspected. The observed responses were further deepened by analyzing differences in the accumulation of defense secondary metabolites and hormones and in the transcription of stress-responsive genes. In parallel, genetic mutations potentially controlling specific physiological adjustments were searched, by sequencing the genomes of the best and worst performing lines.

The integration of physiological, biochemical and molecular data proved that grapevine somaclones are more tolerant to drought and that therefore the exploitation of somaclonal variability can represent an effective and ready-to-use genetic improvement strategy for implementing clonal selection and breeding programs in grapevine.

Keywords: *Vitis* Spp., water stress, somatic embryogenesis, genetic variability, gas exchange.