XIth International Symposium on

GRAPEVINE PHYSIOLOGY AND BIOTECHNOLOGY | 2021

31 Oct - 5 Nov | Stellenbosch, South Africa

Book of Abstracts

Oral & Poster Abstracts

ISHS
International Society for Horticultural Science

P16

Dissecting the genetic and physiological mechanisms of grapevine resilience to heat stress

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Grapevine (*Vitis* spp.) is one of the most widely cultivated perennial fruit crops in the world and its economic relevance is mainly related to wine production. In recent years, the increased frequency of extreme phenomena such as heat waves has been acknowledged as one of the most significant climate variables negatively affecting grape yield and berry composition, with consequences also on wine quality. Thus, studying the physiological, metabolic and genetic factors that are involved in grapevine response to high temperatures is essential to improve the knowledge of mechanisms underlying thermotolerance, aiming to support plant breeding innovation and the development of new management strategies in viticulture. Here, we report some preliminary results from the genetic and phenotypic characterization of a segregating population obtained by crossing 'Rhine Riesling' and 'Cabernet Sauvignon'. After genotyping 139 F1 individuals with the *Vitis*18K SNP chip and microsatellites, a high-density linkage map was developed that contained 3 459 representative markers with an average inter-locus gap of 0.78 cM. The progeny was evaluated in the field by investigating heat-responsive traits (such as phenology, berry ripening indexes and physiological parameters), for which wide variability was observed among genotypes and also between temperature regimes in the case, for instance, of chlorophyll fluorescence parameters. This information, together with the data that will be obtained from the metabolomic analysis of leaves collected under control/heat stress conditions, will finally be used to identify QTLs (Quantitative Trait Loci) for thermotolerance. Selected individuals with contrasting response to high temperatures will be further investigated in controlled conditions, where the analysis of volatile organic compounds (VOCs) emitted from leaves will additionally be included. To this purpose, preliminary assays were conducted to optimize the experimental settings.

Keywords: Grapevine; Thermotolerance; Linkage map; Phenotyping; QTLs;