Coping with extreme climatic events: some lessons from recent work on grapevine under heat peak

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Abstract

Climate change critically challenges viticulture. Among other threats, extreme and increasingly frequent heatwaves cause irreversible burns on leaves and bunches. A series of observations and experiments was conducted to better understand how leaf burns originate and whether genetics or management practices can mitigate them. In 2019, a panel of 279 potted cultivars of Vitis vinifera L. grown outdoors suffered a heat peak and a genetic origin of leaf burn variability was demonstrated. To deeper explore this variability, fourteen cultivars were selected for their contrasting responses to high temperatures, and detached leaves were submitted to a controlled increase in temperature up to 50 °C in a growth chamber. A significant genotypic effect on leaf burn was confirmed on detached leaves like on whole plants outdoors, although with a different ranking of the varieties. As the air temperature in the growth chamber and during the 2019 heat peak evolved similarly, we hypothesized that other conditions, including light or evaporative demand, may have differentially favored one or other of the different physiological determinants of leaf burn. Therefore, in parallel with the development of burns on detached leaves exposed to high temperature in the growth chamber, changes in leaf temperature, transpiration rate, membrane damages and chlorophyll fluorescence were monitored. Significant differences between cultivars in leaf temperature and in the reduction of maximum photosynthesis yield were highlighted. Genetic variation in leaf burns correlated with some of these physiological responses paving the way to the identification of genotypes or conditions with minimal symptoms.

Keywords: heatwave, genetic variability, leaf burn, chlorophyll fluorescence, hydraulics.