Monoterpene emission induces photoprotection under heat stress in grapevine

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Heat stress (HS) negatively affects crop productivity and quality and further increases in average annual temperature as well as greater accumulation of extreme weather are predicted to occur in the next years leading to unpredictable effects on the agricultural sector. Previous studies provided extensive evidence on the potential role of terpene emission on abiotic stress tolerance in several species and, yet, scant information is available on grapevine. In this work, two *Vitis vinifera* cv. 'Chardonnay' clones (SMA130 and INRA809) differing for a mutation (S272P) of the *VvDXS1* gene encoding for 1-deoxy-D-xylulose-5-phosphate (the first dedicated enzyme of the 2C-methyl-D-erythritol-4-phosphate (MEP) pathway) and involved in the regulation of isoprenoids biosynthesis were investigated. *In vivo* measurements of maximum photochemical quantum yield of PSII (F_v/F_m) and gas-exchange measurements in the field highlighted significant differences between the clones, with INRA809 maintaining higher F_v/F_m and CO_2 assimilation rate under developing HS compared to SMA130. Concurrent assessment of leaf monoterpene emission showed a marked increase in monoterpene emission for INRA809 under elevated temperature while this was not evident in SMA130. Our study suggests that monoterpene emission in *Vitis vinifera* can induce HS tolerance and provides further insights on the photoprotective role of isoprenoids under high temperatures. We therefore suggest monoterpene emission as a potentially preferable trait in grapevine to induce HS tolerance and further work is focusing at evaluating the potential interaction between monoterpenes emission, photosynthetic stability and leaf evaporative cooling under different environmental scenarios such as developing soil moisture deficit and increasing air vapor pressure deficit.

Keywords: leaf monoterpene emission, heat stress tolerance, chlorophyll fluorescence, photosynthesis.