P29 – Image-based phenotyping pipeline enabling an environment-independent screening for sunburn resilience of grapes based on a controlled heat stress-induction in the lab

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Abstract

Sunburn of grapes is an abiotic stress reaction triggered by high temperatures and solar radiation during berry ripening phase. Climate change with increasing risks for such high temperature events (> 40°C) may lead to sunburn with corresponding damages and yield loss. In 2019 and 2020, heat records were recorded in Germany and depending on the genotype, massive sunburn damages were observed in the experimental vineyards of JKI Geilweilerhof. Therefore, the present study aims at developing an environmental-independent, image-based tool with the capacity to objectively screen breeding material and mapping population regarding sunburn resilience and its application in QTL analysis. Berries from field grown plants were collected with intact pedicels (BBCH 75) and were placed on black grid boards providing space for 80 berries. RGB images were taken from each plate after a heat stress (HS)-treatment. From previous studies, it was known that the degree of brownish sectors on the skin of treated berries can be used as indicator for sunburn susceptibility. The proportion of healthy green tissue versus symptomatic tissue was extracted per berry image applying a semi-automated Matlab tool. The investigated genotypes showed significant differences in the appearance of browning, thus different degrees of sunburn susceptibility are expectable. For validation, results were compared with corresponding field scorings of sunburn damages (2019 and 2020). These data confirmed that genotypes with a susceptible phenotype in the field (high degree of grape sunburn) show high degree of browning due to HS. The other way around, genotypes with resilient phenotypes in the field showed no or very low degree of browning after the treatment. The screening of the mapping population Calardis Blanc x Villard Blanc, segregating for sunburn resilience, revealed one preliminary QTL (HS resilience) and thus is the starting point to identify genetic regions and regulators with influence on sunburn resilience. This opens the perspective to include an early selection by marker-assisted selection (MAS) for resilience of grapes towards abiotic damages in breeding programs. However, at present we do not exclude additional factors (e.g. water deficit, solar radiation) contributing to sunburn in the vineyard, but surly HS is one major contributor.

Keywords: abiotic stress resilience, climate change, objective screening, High-throughput phenotyping, QTL analysis, sunburn