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GENOTYPE-DEPENDENT DIFFERENCES IN REACTIVE OXYGEN SPECIES PRODUCTION IN TOMATO

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As part of plant interactions with the surrounding environment, plants continuously generate basal levels of reactive oxygen species (ROS), which function as essential signaling molecules involved in the regulation of various physiological processes, including defense mechanisms against pathogens and herbivorous organisms, programmed cell death, and stomatal regulation. Under favorable growth conditions, ROS homeostasis is maintained through a dynamic equilibrium between ROS generation and their elimination by the antioxidant system. However, biotic or abiotic stress factors can disturb this balance, resulting in increased ROS accumulation and triggering the activation of an oxidative burst.

The aim of this study was to identify differences in the capacity for reactive oxygen species production among different tomato genotypes. In this context, ROS production was quantified using a luminol-based chemiluminescence assay in three tomato genotypes: Cerasus, Desteptare, and Marry Gratefully. Leaf discs (8 mm in diameter) were collected from 4–5-week-old plants and placed individually into a 96-well plate containing 150 µL of water. Samples were incubated overnight at room temperature. The following day, the water was replaced with 200 µL of assay solution containing luminol, horseradish peroxidase (HRP), and flagellin peptide (flg22). Luminescence, corresponding to ROS production, was measured using a plate reader.

Analysis of three independent technical replicates revealed clear and reproducible differences in ROS production among the studied genotypes. The kinetic profiles demonstrated that Desteptare exhibited the highest ROS generation rate throughout the measurement period, whereas Marry Gratefully showed the weakest oxidative response, and Cerasus displayed an intermediate level of ROS production. In addition to kinetic analysis, the cumulative chemiluminescence signal recorded during the entire measurement period was calculated for each genotype, confirming the same trend: Desteptare accumulated the highest total amount of ROS, Cerasus

showed an intermediate level, and Marry Gratefully produced the lowest amount. The consistency between kinetic and cumulative analyses indicates genotype-dependent differences in oxidative burst capacity, which may be associated with variation in early immune responses, pathogen susceptibility, and the comparatively higher field resistance observed in Cerasus.

Keywords: Reactive oxygen species; tomato genotypes; oxidative burst; chemiluminescence; plant defense response.

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