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First Observations on the Antiviral Properties of *Trichoderma harzianum* Strain T-22 in Tomato Plants

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The study of the biochemical and molecular mechanisms involved in the host-pathogen-antagonist interaction is essential to understand the dynamics of the infectious processes and can be useful for the development of new strategies to control phytopathogens, particularly viruses, against which chemical treatments have no effect. In this work, we demonstrate for the first time the antiviral activity of the rizospheric fungus *Trichoderma harzianum* strain T-22 (T22) against Cucumber mosaic virus (CMV) strain Fny. The molecular and biochemical aspects of the interaction between strain T22 and the tomato plant against CMV are discussed. A particular emphasis has been given on the substances and genes implicated in the plant defense pathways, such as reactive oxygen species (ROS), genes encoding antioxidant enzymes (Cu/Zn-SOD, Mn-SOD, CAT1, CAT2 and APX), and phytohormones responsible for mediating defense responses (salicylic and jasmonic acids). Interestingly, histochemical and morphological analysis revealed an increase in $O_2^{\bullet-}$ and H_2O_2 levels in all the leaf of the plants infected by CMV, indicating the involvement of ROS in plant defense responses. Gene expression analysis (q-PCR) pointed out a clear increase of the oxidative stress in all the plants treated with T22 after the inoculation with CMV. Finally, gene expression analysis of the Coi-1 gene seems to show the activation of a defense response similar to the systemic acquired resistance. The analysis of the results obtained suggests the possible use of T22 as a treatment rather than as a preventive measure.