Arbuscular mycorrhizal colonization alleviates oxidative stress in tomato plants under high-temperature stress

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Introduction

Tomato (*Solanum lycopersicum* L.) is one of the most important vegetables, widely grown optimally in a range of temperature between 20◦C and 30◦C. High-temperature stress is one of the major threats to agricultural areas around the world, depressing yield and the quality of tomato. Arbuscular mycorrhizal (AM) fungi, a ubiquitous soil microbe, can associate with the roots of most terrestrial plant species. Our objective was to study how arbuscular mycorrhizal symbiosis responds to oxidative stress in tomato plants under high-temperature stress.

Materials and methods

Solanum lycopersicum var. MoneyMaker seedlings were placed in 0.5-lit plastic pots filled with an autoclaved mixture of sand and soil (4:1, v/v). Seedlings were either inoculated with *Septoglomus constrictum* or non-inoculated (Control). Then, pots were distributed randomly and grown in a growth chamber (EKOCHIL 1500) at 26/20°C with 16/8 h photoperiod. After six weeks, AM and non-AM plants were put in normal conditions above and high-temperature conditions (42°C for 6h). Each treatment had ten replicates. Hydrogen peroxide accumulation (Alexieva et al., 2001), oxidative damage to lipids (Malondialdehyde) (MDA) (Heath and Packer, 1969), peroxidase (POD, EC 1.11.1.7) (Rathmell and Sequeira (1974), superoxide dismutase (SOD, EC 1.15.1.1) (Beyer and Fridovich, 1987), catalase (CAT, EC 1.11.1.6) (Aebi, 1984) activities were tested by U-2900 UV-VIS spectrophotometer (Hitachi). The soluble protein level of all extracts was determined according to the method of Bradford (1976). All data were evaluated by one-way analysis of variance (ANOVA). Means were compared by Tukey's post-hoc test at $P < 0.05$.

Results and discussion

Under high-temperature stress, mycorrhizal colonization significantly reduced levels of MDA and H_2O_2 in plants in comparison to non-AM plants (Figure 1). Activities of antioxidant enzymes, POD, CAT in the leaves of inoculated plants were significantly enhanced when compared to non-AM plants under high-temperature stress (Figure 2A, C). Mycorrhizal inoculation did not change enzyme SOD activity under high-temperature stress conditions (Figure 2B).

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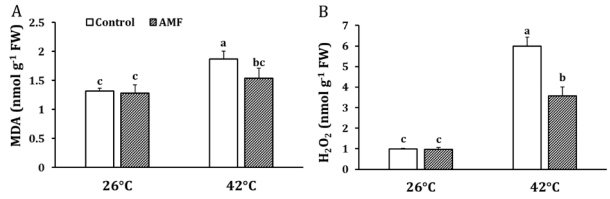

*Figure 1: Malondialdehyde (MDA) (A) and H_2O_2 (B) accumulation in leaves of non-AM plants and plants inoculated by S. constrictum subjected to non-stress (26°C), high-temperature stress (42°**C**) conditions. Each bar represents mean ± standard deviation (n = 4).*

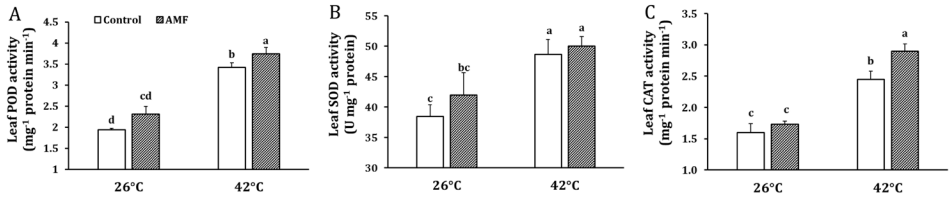

Figure 2: Activity of peroxidase (POD) (A), superoxide dismutase (SOD) (B), catalase (CAT) (C) in leaves of non-AM plants and plants inoculated by S. constrictum subjected to non-stress (26°C), high-temperature stress (42°C) conditions. Each bar represents mean ± standard deviation (n = 4).

Conclusions

Mycorrhizal colonization could alleviate oxidative stress and enhance the effectiveness of enzymatic antioxidant systems (POD and CAT) under high temperature stress.

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