Iranian Journal of Horticultural Science and Technology 18 (3): 237 - 250 (2017)

Leaf Gas Exchange and Chlorophyll Fluorescence in Yaghooti Grapevine under Heat Stress Conditions in Greenhouse and Vineyard

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This research compares leaf gas exchange behavior and chlorophyll fluorescence parameters of Yaghooti grapevine cultivar under three conditions for two years including severe heat stress in greenhouse (45±1 °C), greenhouse with normal conditions (28±1°C), and severe heat stress in vineyards of Ghir-o-Karzin (a semi-warm region in Fars province). Leaf gas exchange parameters including photosynthesis rate (A), stomatal conductance (g_s), sub-stomatal CO_2 concentration (Ci), transpiration rate (E), and chlorophyll fluorescence (Fv/Fm) were measured. Moreover, transpiration efficiency (A/E), intrinsic transpiration efficiency (A/g_s) and carboxylative efficiency (A/Ci) were estimated. Results showed significant differences among all treatments for all gas exchange and chlorophyll fluorescence parameters. The most photosynthesis rate (9.6 µmol CO_2 m^2s^{-1}) was found for vines grown under normal greenhouse condition. In vines subjected to heat stress in both greenhouse and vineyard conditions, a sharp decrease in photosynthesis rate and Fv/Fm was observed. Photosynthesis rate (3.34 µmol CO_2 m^2s^{-1}) in vines subjected to heat stress under vineyard conditions was significantly higher than that of potted vines (2.00 µmol CO_2 m^2s^{-1}) subjected to heat stress in greenhouse conditions. These results revealed that gas exchange behavior of Yaghooti vines against heat stress under vineyard conditions was different from gas exchange behavior in potted vines grown under heat stress in greenhouse conditions. It seems that the photosynthetic heat response of Yaghooti grapevine cultivar was acclimated to heat stress conditions during different growth stages. In other word, Yaghooti have an ability to acquire tolerance to heat stress (acquired thermotolerance).

Keywords: Acclimation, Acquired thermotolerance, Basal thermotolerance, Photosynthesis.

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[DOR: 20.1001.1.16807154.1396.18.3.2.9]