

P134

Physiological responses involved in reactive oxygen species (ROS) of rice plant under alone or multi artificial stress conditions

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Abstract

The Earth's climate is rapidly changing because of increasing carbon dioxide content in atmosphere so, climate prediction models anticipate that earth surface temperature will rise by 3 to 5 °C in next 50 to 100 years. Therefore, frequency of un-expected weather events such as drought, salinity, low or high temperature and flooding etc. will be increasing worldwide. Furthermore, increased atmosphere temperature can influence pests and pathogens spread as well. Therefore, to protect enormous grain loss from unexpected weather conditions, studies related with combine stress conditions like abiotic plus biotic stress condition are really required. Thus, our research focused on physiological responses under combined abiotic and biotic stress condition in rice plant. To induce uniform stress condition, we used NaCl (100 mM) and salicylic acid (0.5 and 1.0 mM SA) as each stress a stimulator. Each artificial abiotic and biotic stress inducer was applied to hydroponically grown rice seedlings alone or together for four day. The data were collected in a time-dependent manner [1, 2, 3 and 4 day(s) after treatment (DAT)] and were matched with our anticipation that shoot length and shoot fresh weight was decreased in solo and combined abiotic and biotic stress condition. The lipid peroxidation content was significantly increased (1.5 ± 0.2 to 2.7 ± 0.1 mg of MDA g^{-1} FW) in the first two days in both stress exposed plants, and showed the opposite trend (0.5 ± 0.01 to 0.1 ± 0.001 mg of MDA g^{-1} FW) in last two days under multi stress condition. Superoxide dismutase (SOD) activity did not showed difference in only biotic stress condition (alone 0.5 and 1.0 mM SA) as compared to control however, it was significantly increased in multi stress condition or solo abiotic stress condition whereas, catalase (CAT), and ascorbate peroxidase (APX) activities were significantly decreased in solo biotic and combined abiotic and biotic condition. In particular, both enzymes activities were more decreased in multi stress condition as compared to solo biotic stress condition. The results for relative mRNA expression level of CAT and APX enzymes were in agreement with results of spectrophotometric values. Correlation value between each stress condition and phenotypic data showed that biotic stress condition showed high correlation with activity of CAT and APX whilst, abiotic stress condition revealed significant correlation with SOD activity.

Keywords: Antioxidant activity, Multi stress condition, Salicylic acid, Growth simulation

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