

# Exogenous salicylic acid alleviates effects of long term drought stress and delays leaf rolling by inducing antioxidant system

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**Abstract** Salicylic acid (SA) is one of the important signal molecules modulating plant responses to environmental stress. In this study, the effects of exogenous SA on leaf rolling, one of drought avoidance mechanisms, and antioxidant system were investigated in *Ctenanthe setosa* during long term drought stress. The plants were subjected to 38-day drought period and they were treated with or without SA ( $10^{-6}$  M) on the 25th, 27th and 29th days of the period. Leaf samples were harvested on the 30th, 34th and 38th days. Some antioxidant enzyme activities (superoxide dismutase, catalase, ascorbate peroxidase, dehydroascorbate reductase, monodehydroascorbate reductase, glutathione reductase), reactive oxygen species (hydrogen peroxide and superoxide) and lipid peroxidation were determined during the drought period. Treatment with SA prevented water loss and delayed leaf rolling in comparison with control leaves. Exogenous SA induced all antioxidant enzyme activities more than control leaves during the

drought. Ascorbate and glutathione,  $\alpha$ -tocopherol, carotenoid and endogenous SA level were induced by the SA treatment. Levels of reactive oxygen species were higher in SA treated plants than control ones on the 34th day. Their levels on the 38th day, however, fastly decreased in SA treated plants. SA treatment prevented lipid peroxidation while the peroxidation increased in control plants. The results showed that exogenous SA can alleviate the damaging effect of long term drought stress by decreasing water loss and inducing the antioxidant system in the plant having leaf rolling, alternative protection mechanism to drought.

**Keywords** Antioxidant enzymes · *Ctenanthe setosa* · Drought stress · Leaf rolling · Salicylic acid

## Abbreviations

APX	Ascorbate peroxidase
ASC	Ascorbic acid
CAT	Catalase
DHA	Dehydroascorbate
DHAR	Dehydroascorbate reductase
$g_s$	Stomatal conductance
GR	Glutathione reductase
GSH	Reduced glutathione
$H_2O_2$	Hydrogen peroxide
MDA	Malondialdehyde
MDHAR	Monodehydroascorbate reductase
NBT	Nitro blue tetrazolium
$O_2^{\bullet-}$	Superoxide anion radical
ROS	Reactive oxygen species
RWC	Relative water content
SOD	Superoxide dismutase
$\Psi_{leaf}$	Leaf water potential

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