

Responses of Physiology, Photosynthesis and Related genes to Saline Stress in *Cornus. hongkongensis* subsp. *tonkinensis*

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Abstract

Key message *Physiological and photosynthetic analysis suggest that the moderate salt tolerance of C. tonkinensis mostly lies in a better photosynthetic system influenced by active photorespiration.*

Abstract *Cornus. hongkongensis* subsp. *tonkinensis* is a native evergreen species with high ornamental values for abundant variations in color of leaf, bract, fruit and the gesture of tree. To broaden its cultivation in coastal saline soil, salt damage and survival rate, physiology responses, photosynthetic performance and related genes were evaluated for annual seedlings exposed to 0.3% salt (ST) concentrations for 60 days. Syndromes of salt damage aggravated and survival rate descend with the prolonged stress duration; all stressed seedlings displayed salt damage, and 58.3% survived finally. Under short-term saline stress (5 d), the marked increase in malondialdehyde (MDA) and relative electrical conductivity (REC), decreases in superoxide dismutase (SOD), photosynthetic rate (P_n), stomatal conductance (gs), and internal carbon dioxide concentration (C_i) were recorded. The stable leaf water use efficiency (WUE) and chlorophyll content were the positive physiological responses to ensure water balance and photosynthetic performance. Meantime, the expression level of genes related to photosystem II (*psbA*) and photorespiration (*SGAT* and *GGAT*) were upregulated, indicating the role of photorespiration in protecting photosynthesis from photoinhibition. After 30 days of stress, the significant increasing tends in malondialdehyde (MDA), relative electrical conductivity (REC), soluble sugar (SS), soluble protein (SP) and C_i , whereas the descending patterns in P_n , gs, WUE, the maximal photochemical efficiency of photosystem II (F_v/F_m), and potential activities of PSII (F_v/F_0) occurred in salt-stressed seedlings, when compared with CK. Meanwhile, the expression levels of the genes related to photosynthesis (*psbA* and *LFNR*), photorespiratory pathway (*GGAT* and *GLYK*), and calvin cycle (*PGK*) significantly dropped, leading to photoinhibition and worse photosynthetic performance. Hence, these results provide a framework for better understanding the photosynthetic responses *C. tonkinensis* to salt stress.

Keywords: *Cornus. hongkongensis* subsp. *tonkinensis* · osmotic regulators · photorespiration · photosynthesis · salinity tolerance

Abbreviations: CK, no salt; ST, 0.3% salt; LRWC, relative water content of leaves; REC, relative electrical conductivity; MDA, malondialdehyde; SOD, superoxide dismutase; CAT, catalase; Pro, proline; SS, soluble sugar; SP, soluble protein; Chl a, chlorophyll a; Chl b, chlorophyll b; Caro, carotenoids; P_n , light saturated net photosynthetic rate; gs, stomatal conductance; T_r , transpiration rate; C_i , internal carbon dioxide concentration; WUE, leaf water use efficiency; AQY, sub-saturating light intensities; P_{max} , the maximum net photosynthetic rate; L_{cp} , light compensation point; L_{sp} , light saturation point; R_d , dark respiration rate; F_m , maximum fluorescence; F_0 , minimum fluorescence; F_v , variable fluorescence; F_v/F_m , maximal photochemical efficiency of photosystem II; F_v/F_0 , potential photochemical activities of PSII; SGAT, serine-glyoxylate aminotransferase; GGAT, glutamate: glyoxalate aminotransferase; GLYK, Glycerate kinase; Fd-GOGAT, Ferredoxin-dependent glutamate synthase; FNR, ferredoxin-NADP⁺ oxidoreductase; CHLG, chlorophyll synthase; PDS, phytoene desaturase; PGK, phosphoglycerate kinase; CYFBP, fructose-1,6-bisphosphatase.