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Effects of exogenous 5-aminolevulinic acid on photosynthesis, stomatal conductance, transpiration rate, and PIP gene expression of tomato seedlings subject to salinity stress

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ABSTRACT. The effects of exogenous 5-aminolevulinic acid (ALA) on photosynthesis, plant growth, and the expression of two aquaporin genes in tomato seedlings under control and salinity conditions were investigated. Exogenous ALA application significantly improved net photosynthetic rate (P_n), total chlorophyll content, and plant biomass accumulation of tomato seedlings under salinity stress. As revealed by real-time PCR analyses, after treatment with ALA alone, expression of both *LePIP1* and *LePIP2* in the two tomato cultivars was up-regulated at 2 h and subsequently decreased to normal levels. Under salinity stress, transcript levels of *LePIP1* in both leaves and roots of salt-sensitive cultivars (cv. Zhongza No.9) increased significantly and were considerably higher than in cultivars exposed to ALA alone. In contrast, the expression levels of *LePIP1* and *LePIP2* in cvs. Jinpeng No.1 cultivars were slightly lower under salinity stress than under ALA treatment. In addition, transcript levels of both *LePIP1* and *LePIP2* in the roots of Jinpeng No. 1 cultivars were considerably lower than those

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in the roots of Zhongza No. 9 cultivars under salinity stress, regardless of ALA supplementation, implying that Jinpeng No. 1 cultivars had a better capacity to maintain membrane intrinsic protein stability. Further, ALA application distinctly counteracted the up- or down-regulation of *LePIP1* and *LePIP2* in both cultivars under salinity stress, in accordance with the improvements instomatal conductance, transpiration rate, and P_n of tomato leaves. The results presented here indicate that ALA controls aquaporin expression, thus, presumably ALA regulates water homeostasis and enhances salt tolerance of tomato seedlings.

Key words: Salinity stress; 5-aminolevulinic acid; Aquaporin; Tomato

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