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Enhanced Tolerance to High Temperature Stress in Transgenic Potato Plants Expressing Multiple Stress-tolerant Genes

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Objectives

To develop transgenic potato plants with enhanced tolerance to high temperature stress, multiple stress-tolerant genes such as NDPK2 or SOD/APX genes under the control of a stress-inducible *SWPA2* promoter were introduced. The protection effect of transgenic potato plants (cv. Atlantic) against high temperature stress was evaluated.

Materials and Methods

1. Plant materials: potato (*Solanum tuberosum* L.) cv. Atlantic
2. Vectors: E35S pro::NDPK2/pCAMBIA2300/EHA105 (EN vector)
SWPA2 pro::NDPK2/pCAMBIA2300/EHA105 (SN vector)
SWPA2 pro::mSOD1+SWPA2::APX/pCAMBIA2300/EHA105 (SSA vector)
3. Methods: *Agrobacterium*-mediated transformation, Southern blot analysis, high temperature treatment, ion leakage measurement, PSII activity assay

Results and Discussion

In the previous study, transgenic potato plants (cv. Atlantic) expressing multiple stress-tolerant genes such as NDPK2 and SOD/APX genes under the control of a stress-inducible *SWPA2* promoter were developed by an *Agrobacterium*-mediated transformation system. The transgenic potato plants (EN, SN and SSA plants) showed an enhanced tolerance to methyl viologen-mediated oxidative stress. In this study, the effects of high temperature stress in combination with illumination were investigated. The leaf discs from transgenic plants showed about 50% reduction in membrane damage relative to non-transgenic (NT) plants after 48 h of the 37°C stress. The root growth of NT plants exposed at 30°C for 14 days was completely inhibited, whereas transgenic plantlets showed a little growth inhibition with normal root. Furthermore, NT plants were wilted after 10 h of heat shock at 42°C, whereas transgenic plants appeared to remain healthy. Transgenic plants also showed a little reduction in PSII activity after 20 h of heat shock at 42°C and almost recovered to the initial level at 3 h recovery following the stress. The results suggested that the transgenic potato plants have enhanced tolerance to diverse environmental stresses including high temperature.

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