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Enhanced tolerance of transgenic tobacco plants expressing CuZnSOD, APX and human DHAR in chloroplasts against oxidative stress

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Objectives

Oxidative stress is one of major damaging factors in plants exposed to environmental stress. In previous study, transgenic tobacco plants expressing both CuZn superoxide dismutase (CuZnSOD) and ascorbate peroxidase (APX) (CA plants) or human dehydroascorbate reductase (DHAR) in chloroplasts under the control of CaMV 35S promoter showed enhanced tolerance against methyl viologen (MV)-mediated oxidative stress (Kwon et al., 2002, 2003). In this study, we have introduced human DHAR genes into the CA plants (CAD plants) and analyzed its biochemical characters in terms of stresses such as MV-mediated oxidative stress and salt.

Materials and Methods

1. Plants: Tobacco (*Nicotiana tabacum* cv. Xanthi), transgenic tobacco (CA plant, CAD plant)
2. Stress treatments: 5 μ M methyl viologen (MV), salt (100 mM NaCl)
3. Method: *Agrobacterium*-mediated transformation, Southern blot analysis, analysis of antioxidant enzymes, ion leakage test, photosynthetic efficiency, growth rate

Results

Three CAD plants expressing CuZnSOD, APX and DHAR in chloroplasts were successfully developed by *Agrobacterium*-mediated transformation. The CAD plants had a 1.6-fold higher DHAR activity (units/g fresh weight) than NT plants and CA plants. The contents of reduced ascorbate in CAD plants were increased by 1.4-times than NT plants, whereas contents of oxidized ascorbate in CAD plants reduced by 1.5-times than NT plants. CAD plants showed more enhanced tolerance than NT plants and CA plants against oxidative stresses derived from MV and salt by increased activities of antioxidant enzymes and increased amount of reduced ascorbate. These results suggest that the simultaneous overexpression of CuZnSOD, APX and DHAR in chloroplasts may contribute to overcome the oxidative stress derived from various environmental stresses.

Referance

- Kwon SY et al. (2002) Enhanced tolerance of transgenic tobacco plants expressing both superoxide dismutase and ascorbate peroxidase in chloroplasts against methyl viologen-mediated oxidative stress. *Plant Cell Environ* 25: 873-882
- Kwon SY et al. (2003) Enhanced stress-tolerance of transgenic tobacco plants expressing a human dehydroascorbate reductase gene. *J Plant Physiol* 160: 347-353