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研究论文

转甜菜碱醛脱氢酶基因提高烟草抗旱及耐盐性

司怀军[1, 2, **], 张宁[1, 2, **], 王蒂[2, *]

1甘肃农业大学生命科学技术学院，甘肃兰州730070 2甘肃省作物遗传改良与种质创新重点实验室，甘肃兰州730070

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摘要 将甜菜碱醛脱氢酶（BADH）基因与组成型启动子CaMV 35S启动子融合，构建了植物表达质粒pBIBB。通过根癌农杆菌介导将BADH基因导入烟草，经PCR、Southern杂交、Northern杂交证明BADH基因已整合到烟草基因组中并在转基因植株中转录和表达。测定转基因植株叶片中甜菜碱醛脱氢酶活性，结果显示对照植株没有BADH酶活性，转基因植株的各个株系间甜菜碱醛脱氢酶比活力差异较大，范围在0.1~1.0 U mg^{-1}间。转BADH基因的烟草在盐胁迫和聚乙二醇（PEG）胁迫条件下生长状态良好，生长势强于未转基因植株，说明BADH基因能在异源植物中正常翻译、表达和用于植物抗旱、耐盐基因工程的研究。

关键词 甜菜碱醛脱氢酶基因 烟草 转化 抗旱 耐盐

分类号

Enhancement of Drought and Salt Resistances in Tobacco by Transformation of Betaine Aldehyde Dehydrogenase Gene

SI Huai-Jun[12**], ZHANG Ning[12**], WANG Di[2*]

1 College of Life Science and Technology, Gansu Agricultural University, Lanzhou 730070, Gansu; 2 Gansu Key Laboratory of Crop Genetic & Germplasm Enhancement, Gansu Agricultural University, Lanzhou 730070, Gansu, China

Abstract Drought and salinity are the most important abiotic stresses affecting the normal growth and development of plants. One of the fundamental physiological mechanisms of higher plant to cope with environmental stresses is osmotic adjustment, and glycine betaine is one of the most important osmolytes. Glycine betaine is regarded as one of the most promising osmolytes because it possesses simple biosynthesis pathways, non-toxic to cells, and non-osmotic functions in stabilizing enzyme activities and membrane structures.

In order to establish a glycine betaine biosynthetic pathway in glycine betaine-deficient crop plants through genetic engineering, which can enhance drought and salinity tolerances of crop plants, a betaine aldehyde dehydrogenase (BADH) gene which is the key gene for glycine betaine synthesis was isolated from spinach (Spinacia oleracea L.) (GenBank accession No.AY156694). The expression plasmid pBIBB was constructed by fusing the BADH gene with the constitutive promoter CaMV 35S. The transgenic tobacco plants were obtained by transformation of the expression plasmid pBIBB and mediation of Agrobacterium tumefaciens. PCR, Southern and Northern blot analyses indicated that the BADH gene has been integrated into genome of tobacco, transcribed and expressed in transgenic tobacco plants. The testing of BADH activity of transgenic plant leaves showed that the BADH specific activity ranged from 0.1 to 1.0 U mg^{-1}, while it was not detectable in the control plants. The growth of the transgenic tobacco plants was normal and better than the untransformed plants under salt and polyethylene glycol (PEG) stresses. Plant height and fresh weight per plant of transgenic plant lines had a significant increase compared with those of untransformed control plants. This result proves that the BADH gene can express accurately in the exogenous transgenic plants and can be used in genetic engineering for plant drought and salt resistances.

Key words Betaine aldehyde dehydrogenase gene Tobacco Transformation Drought resistance Salt tolerance

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通讯作者 王蒂 wangd@gsau.edu.cn