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Genetic transformation and expression of transgenic lines of *Populus* x *euramericana* with insect-resistance and salt-tolerance genes

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ABSTRACT. We characterized new transgenic varieties of poplar with multiple insect-resistant and salt stress tolerant genes. Two insect-resistant *Bacillus thuringiensis* (*Bt*) genes, *Cry1Ac* and *Cry3A*, and a salt-tolerant gene, *Betaine aldehyde dehydrogenase* (*BADH*) were inserted into a vector, p209-*Cry1Ac*-*Cry3A*-*BADH*. The clone of *Populus* x *euramericana* was transformed by the vector using the *Agrobacterium*-mediated method. Three transgenic lines were assessed using genetic detection and resistance expression analysis. PCR revealed that exogenous genes *Cry1Ac*, *Cry3A*, *BADH* and selective marker gene *NPTII* were present in three transgenic lines. Quantitative real-time PCR (qPCR) showed significant differences in the transcriptional abundance of three exogenous genes in different lines. Results of assays

for Bt toxic proteins showed that the Cry1Ac and Cry3A toxic protein content of each line was 12.83-26.32 and 2108.91-2724.79 ng/g, respectively. The Cry1Ac toxic protein content of different lines was significantly different; the Cry3A toxic protein content was about 100 times higher than that of the Cry1Ac toxic protein. The insect-resistance test revealed the mortality rate of transgenic lines to *Hyphantria cunea* L1 larvae varied by 42.2-66.7%, which was significantly higher than non-transgenic lines. The mortality rate of L1 and L2 *Plagiodera versicolora* larvae was 100%. The insecticidal effect of transgenic lines to *P. versicolora* larvae was higher than that to *H. cunea* larvae. NaCl stress tolerance of three transgenic lines under 3-6% NaCl concentration was significantly higher than that of non-transgenic lines.

Key words: Transgenic poplar; Multiple transgenes; *Populus* x *euramericana*; Insect-resistance; Salt tolerance

