

Production and evaluation of transgenic sweet orange (*Citrus sinensis* Osbeck) containing bivalent antibacterial peptide genes (*Shiva A* and *Cecropin B*) via a novel.

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Production and evaluation of transgenic sweet orange (*Citrus sinensis* Osbeck) containing bivalent antibacterial peptide genes (*Shiva A* and *Cecropin B*) via a novel *Agrobacterium*-mediated transformation of mature axillary buds

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Abstract

Transgenic plants of Jincheng orange (*Citrus sinensis* Osbeck) and Newhall navel orange (*C. sinensis* Osbeck) containing antibacterial peptide genes *Shiva A* and *Cecropin B* were successfully obtained by a novel *Agrobacterium tumefaciens*-mediated transformation of the mature axillary buds. PCR and Southern blot analysis of the transgenic plants verified that the *Shiva A* and *Cecropin B* genes were integrated into the citrus genome. The transgenic plants began to blossom and bear fruit in the 2nd year after grafting on trifoliolate orange (*Poncirus trifoliata* Raf.) rootstock in

and year after grafting on thornate orange (*Fortunella trichocarpa* Raf.) rootstock in greenhouse. Water-soluble extracts from transgenic citrus leaves exhibit *in vitro* suppressive effects on *Xanthomonas axonopodis* pv. *citri*, suggesting that the expressed products of *Shiva A* and *Cecropin B* in citrus retain their native antibacterial activities. Artificial inoculation in greenhouse and open field further indicates significantly increased resistance of transgenic plants to *X. axonopodis* pv. *citri* when compared with non-transgenic lines. No significant difference was found in the content of total soluble solids, total acidity, reduced sugar content and other fruit characteristics between transgenic and non-transgenic plants. In this present study, 11 transgenic lines were obtained from 40 transgenic lines, showing enhanced resistance to citrus canker disease.

### Research highlights

• A novel citrus transformation system for mature axillary bud has been established.  
• We obtained many transgenic plants containing *Shiva A* and *Cecropin B* via this system.  
• The resistance to citrus canker of these transgenic plants has been evaluated.  
• 11 transgenic lines were obtained and exerted enhanced resistance to citrus canker.



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### Keywords

Citrus; Citrus canker; Mature axillary bud; Transformation; Disease resistance

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