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# A novel synthetic *Cry1Ab* gene resists rice insect pests

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**ABSTRACT.** A few insect control genes of *Bacillus thuringiensis* have been modified successfully to increase the expression in plants by replacing rare codons, increasing GC content, and avoiding the DNA elements that could cause premature transcription termination, mRNA instability, and potential methylation. However, the modification process was intricate and often confused researchers. In this study, we adopted a simple method to modify *Cry1Ab* only by individually replacing its amino acid sequence with corresponding rice-preferred codons based on analysis of 92,188 coding DNA sequences. Unexpectedly, all elements of A+T richness, which terminate or destabilize transcription in plants, were avoided in the newly designed *mCry1Ab*. However, *mCry1Ab* had 2 notable features: less synonymous codons and high GC content. *mCry1Ab* only employed 22 of the 61 codons to encode protein and had an enhanced GC content of 65%. The increase in GC content caused abundant potential methylation signals to emerge in *mCry1Ab*. To test whether *mCry1Ab* could be expressed in rice, we transferred it into *Oryza japonica* variety

 

Wanjing97. Insect bioassays revealed that transgenic plants harboring this gene driven by 2 promoters, *CaMV35S* and *OsTSP I*, were highly resistant to rice leaffolder (*Cnaphalocrocis medinalis*). Analysis of $R_0$ to $R_2$ generation plants indicated that the *mCry1Ab* was inherited stably by the progeny. Our study provided a simple modified method for expressing exogenous genes in rice and confirmed that less synonymous codons and high GC content do not affect transgene expression in rice.

**Key words:** Gene modification; GC content; Synonymous codons; *Cry1Ab*; Insect resistance

 