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Author: Dr. meng zhang
Dalian Maritime University, China, zmdlmu@dlmu.edu.cn

HEAVY-ION RADIATION INDUCES BOTH ACTIVATION OF MULTIPLE ENDOGENOUS TRANSPOSABLE ELEMENTS AND ALTERATIONS IN DNA METHYLATION IN RICE

Abstract

Space radiation represents a complex environmental condition in which several interacting factors such as electron, neutron, proton, heavy-ion are involved, which may provoke stress responses and jeopardize genome integrity. Given the inherent property of epigenetic modifications to respond to intrinsic aswell as external perturbations, it is conceivable that epigenetic markers like DNA methylation and transposition may undergo alterations in response to space radiation. Cytosine DNA methylation plays important roles in maintaining genome stability and controlling gene expression. A predominant means for Transposable elements (TEs) to cause genetic instability is via their transpositional activation. To find the detailed molecular characterization of the nature of genomic changes induced by space radiation, the seeds of rice were exposed to 0.02, 0.2, 1, 2 and 20 Gy dose of 12C heavy-ion radiation, respectively. We found that extensive alteration in both DNA methylation and gene expression occurred in rice plants after different dose of heavy-ion radiation. Here we shown that heavy-ion radiation has induced transposition of mPing and Tos17 in rice, which belong to distinct classes including the miniature inverted terminal repeat TEs (MITEs) and long-terminal repeat (LTR) retrotransposons, respectively. mPing and Tos17 mobility were found to correlate with cytosine methylation alteration detected by MSAP and genetic variation detected by AFLP. The result showed that at least in some cases transposition of TEs was associated with cytosine demethylation within the elements. Our results implicate that the heavy-ion radiation represents a potent mutagenic agent that can cause genomic instabilities by eliciting transposition of endogenous TEs in rice.