A UVB-hypersensitive mutant in Arabidopsis thaliana is defective in the DNA damage response

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Abstract: To investigate UVB DNA damage response in higher plants, we used a genetic screen to isolate Arabidopsis thaliana mutants that are hypersensitive to UVB irradiation, and isolated a UVB-sensitive mutant, termed suv2 (for sensitive to UV 2) that also displayed hypersensitivity to γ-radiation and hydroxyurea. This phenotype is reminiscent of the Arabidopsis DNA damage-response mutant atr. The suv2 mutation was mapped to the bottom of chromosome 5, and contains an insertion in an unknown gene annotated as MRA19.1. RT-PCR analysis with specific primers to MRA19.1 detected a transcript consisting of 12 exons. The transcript is predicted to encode a 646 amino acid protein that contains a coiled-coil domain and two instances of predicted PIKK target sequences within the N-terminal region. Fusion proteins consisting of the predicted MRA19.1 and DNA-binding or activation domain of yeast transcription factor GAL4 interacted with each other in a yeast two-hybrid system, suggesting that the proteins form a homodimer. Expression of CYCB1;1:GUS gene, which encodes a labile cyclin:GUS fusion protein to monitor mitotic activity by GUS activity, was weaker in the suv2 plant after γ-irradiation than in the wild-type plants and was similar to that in the atr plants, suggesting that the suv2 mutant is defective in cell-cycle arrest in response to DNA damage. Overall, these results suggest that the gene disrupted in the suv2 mutant encodes an Arabidopsis homologue of the ATR-interacting protein ATRIP.

Author Keywords: ATR; Cell cycle; Checkpoint; DNA damage; Hydroxyurea; Ultraviolet light

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