

**UNIVERSITI TEKNOLOGI MARA**

**GAMMA RADIATION AND METHYL  
JASMONATE EFFECTS ON  
REGENERATION AND PHYTOCHEMICAL  
CONSTITUENT OF *Vanilla planifolia*  
CULTURES**

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Thesis submitted in fulfillment  
of the requirement for the degree of  
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## AUTHOR'S DECLARATION

I declare that the work in this thesis dissertation was carried out accordance with the regulations of Universiti Teknologi MARA. It is original and is the result of my own work, unless otherwise indicated or acknowledged as referenced work. This thesis has not been submitted to any other academic institution or non-academic institution for any other degree or qualification.

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## ABSTRACT

Vanilla is a commercially valuable plant that produces vanillin, an aromatic compound that is widely used in cosmetics, foods, beverages and pharmaceuticals. The high demand of vanilla is caused by the difficult propagation of 'hand-pollination' method that is hard labor and time consuming. The objective of this study was to determine the effect of gamma radiation and methyl jasmonate on the regeneration of vanilla tissue culture and its chemical constituents. The tissue culture technique started with sterilization method by using different combinations of fungicide, alcohol and commercial bleach. Then, the vanilla explants undergone gamma radiation (0 Gy, 10 Gy, 20 Gy, 30 Gy) and planted in different concentrations of methyl jasmonate (0  $\mu$ M, 10  $\mu$ M, 20  $\mu$ M, 40  $\mu$ M, 80  $\mu$ M). The ten weeks vanilla cultures were harvested and their shoot height, leaf number, root length and root number were measured and analyzed using ANOVA (SPSS 18). Then the vanilla explants were oven dried at 40 °C, ground and soaked in methanol for 48 hours. GC-MS analysis was done to the ten vanilla cultures with highest shoot length. The results showed that 1 % fungicide, 10 % commercial bleach and 70 % alcohol were the best combination to sterilize vanilla explants without harming the explants. The gamma radiation results showed that 10 Gy gamma irradiated vanilla culture had the highest regeneration of vanilla, shoot height was  $13.40 \pm 0.33$  cm, while 30 Gy gamma irradiated cultures showed the lowest. Ten Gy gamma irradiated culture be higher regeneration in 20  $\mu$ M methyl jasmonate, shoot height of  $14.5 \pm 0.4$  cm, compared to other methyl jasmonate concentrations. This may due to the enhancement of photosynthesis and metabolites that was promoted by gamma ray and jasmonic acids inside the mesophyll cells of vanilla explants. The GC-MS analysis showed higher production of acetovanillone and ethyl vanillyl methyl, derivatives of vanillin in 10 Gy irradiated cultures as well as other metabolites such as phenols, fatty acids and siloxanes. A higher methyl jasmonates also stimulated the production of phytochemicals in vanilla explants. In conclusion, a low gamma radiation and methyl jasmonate concentration promote the regeneration of vanilla in plant tissue culture and induced the secondary metabolite within the plants.

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“Allah helps those who persevere.” ~ Quran Nul Karim

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