

**UNIVERSITI TEKNOLOGI MARA**

**PHENOTYPIC AND GENETIC  
ANALYSIS OF  $M_1V_2$  AND  $M_1V_3$   
GENERATION OF GINGER (*Zingiber  
officinale* ROSCOE) MUTANT LINES**

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**MSc**

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## AUTHOR'S DECLARATION

I declare that the work in this thesis was carried out in accordance with the regulations of Universiti Teknologi MARA. It is original and is the results 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 degree or qualification.

I, hereby, acknowledge that I have been supplied with the Academic Rules and Regulations for Post Graduate, Universiti Teknologi MARA, regulating the conduct of my study and research.

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Generation of Ginger (*Zingiber officinale* Roscoe)  
Mutant Lines

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## ABSTRACT

The effects of gamma rays on the morphological characteristics of twelve mutant lines of *Zingiber officinale* Roscoe from 2 varieties; namely Bentong and Tanjung Sepat were analysed for second and third generation. Mutant rhizomes that had previously been exposed with different doses (0, 5, 7, 9, 11, and 13) respectively under gamma ray radiation were propagated until the third generation ( $M_1V_3$ ). In the study, the genetic stability of mutant gingers was analysed from irradiated gingers that was first observed on the phenotypic characteristic and genetic diversity using RAPD-PCR. Similar parameters from the first generation such as plant survival, mutant plant height, average number of leaves and shoots, average length and width of leaves, flowering, somatic mutation, leaf chlorophyll mutation, and average weights of rhizomes per plant for both species were taken. It was observed that the increase of dosage had a negative effect on the growth performance of plants. The number of leaves and shoots, length and width of leaves and average weight of rhizomes for both generation showed significant decreases. The treatment at 5 Gy dose produced the highest ginger rhizome yields of  $65.45 \pm 1.35$  gram in the Bentong variety and  $165.0 \pm 2.30$  gram in the Tanjung Sepat variety after nine months of cultivation in the second generation. In the third generation, the rhizome yield at 5 Gy showed that the highest rhizome yields were reduced in both varieties of Bentong ( $45.45 \pm 1.25$  gram) and Tanjung Sepat ( $125.0 \pm 2.30$  gram). Chlorophyll mutations were observed from the leaves showing the symptoms of the spectrums of chlorophyll mutations which are albinism, xantha and chlorina. The PCR-based RAPD analysis showed 98.29% of polymorphism which indicated that there were high changes in genetic sequences in irradiated ginger genotypes. It also provides an important input into determining resourceful management strategies and helps the breeders in the improvement of gingers. The variation study of these mutant lines was continued with a genetic analysis using a molecular technique based on the RAPD-PCR method and it has been done in third generation. The data based on UPGMA has been observed and comparison between the first generation and third generation showed there were no differences and indicated that genetics of mutant lines from second and third generation are stable.

Keywords: *Zingiber officinale* Roscoe, Gamma radiation, Mutation breeding

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