UNIVERSITI PUTRA MALAYSIA

MORPHOLOGICAL EVALUATION OF MUTANT LINES OF TORCH GINGER (Etlingeraelatior)

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MORPHOLOGICAL EVALUATION OF MUTANT LINES OF TORCH GINGER (*Etlingeraelatior*)

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CERTIFICATION

This project entitled Morphological evaluation of mutant lines of torch ginger *(Etlingeraelatior*) is prepared by NorfaizahbintiAbd Wahid and submitted to the Faculty of Agriculture in fulfillment of the requirement of PRT 4999 (Final Year Project) for the award of the degree of Bachelor of Agricultural Science.

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LIST OF ABBREVIATIONS

BAP	=	N6-benzyl amino-purine
cm	=	Centimetre
µmol	=	micro mole
MS	=	Murashige and Skoog
M	=	Molar
mg	=	Milligram
L	=	Litre
TS	=	Tissue culture
PGR	=	Plant growth regulator
NaOH	=	Sodium hydroxide
HCL	=	Hydrochloric acid
mL	=	Millilitre
kPa	=	Kilo pascal
℃	=	Degree celcius
min	=	Minute(s)
h	=	hour
DNA	=	Deoxyribonucleic acid
RAPD	=	random amplification of polymorphic DNA
Gy	=	gray

ABSTRACT

Mutant lines of *Etlingeraelatior* have been established and early detection of mutation has been performed using random amplification of polymorphic DNA (RAPD) markers in earlier study in the laboratory. This study evaluated the morphological characteristics of the mutant lines after 8 weeks of acclimatization. The mutant lines which were earlier multiplied and rooted under *in vitro* condition were transferred into potting medium consisting of soil: sand: peat moss (1:1:1) and acclimatized in a misting chamber and the plants were watered daily and monitored to ensure healthy and good growth until 8 weeks. Each mutant line represented a treatment. Each treatment containedsix replications, with one plantlet per replication. Parameters recorded after 8 weeks of acclimatization were the mean height of plant (cm), mean number of leaves produced per plant, mean length of leaves, and mean width of leaves. Data were analyzed using the Analysis of Variance (ANOVA) (GLM procedure) and Duncan Multiple Range Test (DMRT) for mean separation. The survived plantlets showed different general growth rate and some showed abnormal morphological characteristics. Mutant line L2 exhibited among the highest mean plant height, mean length of leaves, mean number of leaves, and mean width of leaves after 8 weeks of acclimatization. Meanwhile, mutant line L4 produced among the shortest plant with some abnormality on the leaves and among the lowest number of leaves per plant, mean length of leaves, as well as mean width of leaves.

ABSTRAK

Garis mutant daripada*Etlingeraelatior*telahdibangunkandanpengesananawalmutasitelahdilakukandenganmenggunakanpetandapenguatanrawakpolimorfik DNA (RAPD) dalamkajiansebelumini didalammakmal.Kajianinimenilaiciri-cirimorfologigarismutanselepas 8 minggumelalui proses penyesuaian. Garismutan yang sebeluminidigandakandanberakarumbi di bawahkeadaan*in vitro*telahdipindahkankedalam medium pasu yang terdiridaripadatanah: pasir: gambut (1:1:1) danaklimatisasidalamkebukkabusdantumbuh-tumbuhantelahdisiramsetiapharidandipantauuntukmemastikanpertumbuhan yang sihatdanbaiksehingga 8 minggu. Setiapbarismutandiwakilirawatan.Setiaprawatanterkandungenamreplikasidengansatu anakpokoksetiapreplikasi. Parameter direkodkanselepas 8 minggumelalui proses penyesuaianadalahpurataketinggiantumbuhan (cm), puratabilangandaun yang dihasilkansetiaptumbuhan ,puratapanjangdaun, danpuratalebardaun. Data yang diperolehdianalisisdenganmenggunakanAnalisisVarians (ANOVA) (prosedur GLM) danUjian Multi Julat Duncan (DMRT) untukpemisahanpurata.Anakpokokyang terselamatmenunjukkankadarpertumbuhanumum yang berbezadanbeberapaanakpokok pula menunjukkanciri-cirimorfologi yang tidak normal. Garismutant L2 mempamerkanantarapurata paling tinggiuntukketinggiantumbuhan, puratapanjangdaun, puratabilangandaun, danpuratalebardaunselepas 8 minggu proses penyesuaian. Sementaraitu, garismutan L4 menghasilkanantaratumbuhan yang paling singkatdenganbeberapakelainanpadadaundanantarakalangan yang paling rendahbilangandaununtuksetiaptanaman, puratapanjangdaun, sertapuratalebardaun.

CHAPTER 1

INTRODUCTION

1.1 *Etlingera elatior*

Zingiberaceae species are distributed throughout the tropics and subtropicsmainly in Asia regions. The centre of diversity for the Zingiberaceae is the Indo Malayan region (Jaafar et al., 2007*). Etlingera elatior*is classified under the genera of *Etlingera*.Weber (1980) reported that Zingiberaceae species have mucronate petals that correspond to hypsophylls (bracts), consisting of a leaf sheath and a rudimentary 'oberblatt' (leaf petiole + lamina).

Zingiberaceae is a significant component of the herbaceous ground flora of tropical forests. They mostly grow in damp and humid shady places. They are also found from the lowlands, secondary forests, to the highest elevations in primary forests. In terms of light requirement, torch ginger grows best in a semi-shaded area but some species can be fully exposed to the sun.

E. elatior is a herbaceous perennial plant. In Malaysia, this plant is known as kantan whereas kecombrang in Indonesia (Yunus et al, 2012). In addition to that, *E. elatior* has many common names. Jackie et al. (2011) reported that it is also known as 'torch ginger' or 'red ginger lily' and is a perennial plant native to Southeast Asia. Habsah et al. (2005) reported that mature fruits of *E. elatior* are alleged for their antihypertensive activity and also edible but sour.

Of the 50 genera and 1500 species known in the world, at least 20 genera and 300 species are found in Malaysia (Jaafar et al., 2007). Moreover, Wijekoon et al. (2011) reported that the inflorescenes of *E. elatior* are traditionally used for culinary and medicinal purposes in Southeast Asia. The inflorescence possesses a unique flavor and aroma and is used in preparing traditional dishes like Ulam and Asam Laksa in Malaysia (Chan et al., 2007; Wikejoon et al., 2010). Diabetes and hypertension can be reduced by daily consumption of the raw inflorescence. Furthermore, the inflorescence of *E. elatior* is used for ornamental purpose.

Decoction of some part of the plant organs of *E. elatior* may be usedto heal the human body. Habsah et al. (2005) stated that a decoction of the fruits and leaves may be dropped into the ear to treat earache and may be used to clean wounds. In addition to that, the decoction of the flower shoots of *E. elatior* can also be used to reduce body odour for women in confinement.

Mutation techniques can improve crop cultivars, enhancing biodiversity, and increase farmer's income. Gamma ray irradiation on chrysanthemums, dahlia, and other plants, has been able to produce mutant plants of commercial value (Brortjes, 1977).

1.2 Problem statement

E. elatior is propagated through slow growing rhizome, have poor fruit set and low seed production for crop improvement. Rhizomes are susceptible to rhizome rots caused by soil pathogens (Lins and Coelho, 2004). Dwiatmini et al. (2009) stated that among the good qualities possessed by this plant are the ease in cultivation and the presence of wax in the flower (bract) which enables it to withstand rain water and have a long durability of freshness. Among the weaknesses of this plant are its large size and the large and heavy flowers. These weaknesses make it difficult for the species to compete in the market for exports purposedue to the high cost of air transportation. So, in order to have commercial value as an ornamental plant, torch ginger requires improvement on some its characteristics such as inflorescence colour, size, shelf life, odour and time to flowering (Yunus et al., 2012)

Due to these factors, tissue culture technique can be anticipated to promote pathogen free propagation. In addition, in vitro techniques could provide an alternative means of dissemination and a tool for genetic enhancement of *E. elatior* via mutation induction and genetic engineering. Mutant lines of *E. elatior*have been obtained in a previous research in the laboratory. Confirmation of their mutant characteristics was done through analysis using RAPD marker. Evaluation on their morphological performance is essential to further identify their mutant characteristics or variations.

1.3 Objectives

To evaluate the morphological characteristics of mutant lines obtained from an earlier experiment on *in vitro* mutagenesis of *E. elatior*.

1.4 Hyphothesis

The null hypothesis, (Ho): There is no significant difference in the morphological characters between the mutant lines.

The alternative hypothesis, (Ha) : There is significant difference in the morphological characters between the mutant lines.

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