UNIVERSITI PUTRA MALAYSIA

THE VARIATION OF HOMOGENTISATE GERENYLGERANYL TRANSFERASE (HGGT) PROMOTER SEQUENCE IN DIFFERENT Elaeis guineensis GENOTYPES

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FP 2013 18

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BY

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A project report submitted to Faculty of Agriculture, Universiti Putra Malaysia, in fulfillment of the requirement of PRT 4999 (Final Year Project) for the award of the degree of Bachelor of Agriculture Science

Faculty of Agriculture

Universiti Putra Malaysia

2012/2013

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CERTIFICATION

This project entitled 'The Variation of Homogentisate Geranylgeranyl Transferase (HGGT) Promoter Sequence In Different *Elaeis guineensis* Genotypes' is prepared by Khairul Anwar Bin Ismail and submitted to the Faculty of Agriculture in fulfillment of the requirement of the PRT 4999 (Final Year Project) for the award of degree of Bachelor of Agriculture Science**.**

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ACKNOWLEDGEMENT

First of all, pray to ALLAH S.W.T because I could successfully complete my final year project in a period of time. I would like to thank my supervisor Associate Professor Datin Dr. Siti Nor Akmar Binti Abdullah for her guidance, advice and comments. Her willingness to encourage me contributed tremendously to my project.

Other than that, I would to thank the staffs of Agrobiotechnology Laboratory for being kind and helpful to assist me doing my project. Also thanks to Madam Mas Muniroh Binti Mohd Nadzir, which assist me on my laboratory works.

Also, I am grateful to the Head Department of Agriculture Technology, Faculty of Agriculture for providing me the laboratory facilities in carrying out the final year student project.

Last but not least, an honorable mention to my beloved parents Ismail Bin Mahmood and Jamiah Bte Madon, family and friends for their understanding and support while I am doing the project. Thank you.

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ABSTRACT

Vitamin E can be divided into two important forms which are tocotreinols and tocopherols. *Elaeis guineensis* revealed high content of tocotreinols compared to tocopherols. Homogentisate gernylgeranyl transferase (HGGT) is involved in the biosynthesis of tocotrienols. It has an important role as it catalyzes the first committed step in tocotrienol synthesis. The vitamin E content of the Tanzanian population in the *Elaeis guineensis* germplasm collection at MPOB shows a high degree of variability (ranging from 300 – 3200 ppm). Some of the palms have high vitamin E content while others have very low vitamin E lower than the commercial palms which contains around 700 ppm of vitamin E. The aim of the study was to detect sequence variation in the forms of single nucleotide polymorphism (SNP) by comparing individuals from the Tanzanian population that exhibited low and high vitamin E content. The project involves analyzing the promoter sequence and detecting for variation that falls within important promoter motifs. Through out the study, there 91 SNPs were detected between HGGT promoter sequence of Tanzanian plams with low and high vitamin E content. The 91 detected SNPs, there were only 9 SNPs that fall within important promoter motif.

ABSTRAK

Vitamin E boleh dibahagikan kepada dua bentuk penting iaitu tocotreinols dan tocopherols. Elaeis guneensis menpunyai kandungan tocotreinols yang tinggi berbanding tocopherols. Homogentisate gernylgeranyl transferase (HGGT) merupakan enzim yang terlibat dalam proses biosintesis tocotrienol dan memainkan peranan yang penting kerana ia merupakan pemangkin langkah pertama yang komited dalam sintesis tocotrienol . Populasi Tanzania dalam koleksi germplasma Elaeis guneensis di Station Penyelidikan Perbadanan Kelapa Sawit Malaysia (MPOB) Kluang merupakan populasi yang mempunyai kadar vitamin E yang tinggi iaitu antara 300-3200 ppm. Beberapa germplasma telah dikenalpasti mempunyai kandungan vitamin E yang tinggi, manakala yang lain mempunyai vitamin E yang sangat rendah dan sesetengahnya mempunyai kadar vitamin E yang lebih rendah daripada kelapa sawit komersial yang mengandungi sekitar 700 ppm vitamin E. Tujuan kajian ini adalah untuk mengesan variasi jujukan dalam bentuk polymorphism nukleotida tunggal (SNP) dengan membandingkan individu daripada populasi Tanzania yang mempunyai kandungan vitamin E rendah dan tinggi . Projek ini melibatkan prosess pengenalpastian urutan penganjur dan mengesan perubahan yang berada dalam motif penganjur yang penting. Melalui hasil kajian, terdapat 91 SNPs telah dikesan antara jujukan pengawalatur HGGT sawit Tanzania vitamin E tinggi dan vitamin E rendah . Diantara 91 SNPs yang dikesan, terdapat hanya 9 SNPs yang berada di dalam motif pengawalatur yang penting.

CHAPTER 1

INTRODUCTION

Vitamin E was discovered mainly due to the major interest in its ability to act as antioxidant and potential to prevent atherosclerosis and cancer (Schnieder, 2005). Vitamin E consists of 2 major molecules which are tocopherols and tocotrienols. In the biosynthesis of vitamin E, tocopherols and tocotrienols are synthesized through two important converging pathways that fused the side chain building block and head group together (Schnieder, 2005). Homogentisate geranylgeranyl transferase (HGGT) is the enzyme that plays important role as the first committed step of the tocotrienol biosynthesis in monocotyledon plant such as the oil palm. Compared to other vegetable oil, palm oil is the richest source of tocotrienols where the concentration in crude palm oil (CPO) and residual oil from palm press fiber (PFO) is at 600-1000ppm and 2000-4000ppm, respectively (Ng *et al.,* 2004). The market value of vitamin E product all around the world is large and steadily increase. For example in 1995, the sale of vitamin E containing product achieved one billion USD. This shows that palm oil has the high potential to be a good resource of vitamin E and at the same time it can increase the market value of palm oil. To meet the market demand of the vitamin E product, the productivity of oil palm which have high vitamin content need to be increased. However, the oil palm that have been commercialized for more than 4 decades in Malaysia have limited gene pools and also low vitamin content compared to other populations such as the Tanzanian population. Therefore, the improvement of vitamin E content of Malaysian commercial oil palm needs to be started through scientific research. There are more than 26 populations of *Elaeis guineensis* with high genetic divergence and each of the populations has different content of vitamin E (Bramley *et al.,* 2000). Tanzanian populations is one of the *Elaeis guineensis* population that

has a high diversity of vitamin E content. So, through discovering the variation of homogentisate geranylgeranyl transferase (HGGT) promoter sequence of *Elaeis guineensis* of the Tanzania population may help to identify the single nucleotide polymorphism (SNPs) which control the production of tocotrienols in oil palm. HGGT is a key regulatory enzyme that catalyzes the first commited step for tocotrienols biosynthesis.

The objectives of the project were

1. To detect variation of promoter sequence of HGGT in palms with high and low vitamin E content from Tanzanian population.
2. To select for SNPs affecting important promoter motifs.

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