



**UNIVERSITI PUTRA MALAYSIA**

**MORPHOLOGICAL AND GENETIC DIVERSITY OF  
*JATROPHA CURCAS* L. IN MALAYSIA**

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**MORPHOLOGICAL AND GENETIC DIVERSITY OF  
*JATROPHA CURCAS L.* IN MALAYSIA**

**BY:**

**MAHMOODREZA SHABANIMOFRAD**

**Thesis submitted to the School of Graduate Studies, Universiti Putra Malaysia,  
in Fulfilment of the Requirements for the Degree of Master of Science**

**May 2011**

## DEDICATION

I would like to dedicate my thesis to:

My beloved parents in law for giving me constant encouragement and support

and

My beloved wife,

**Vahideh Bani Ali**

who has been great source of motivation and inspiration



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Abstract of thesis presented to the Senate of Universiti Putra Malaysia in fulfillment of the requirement for the degree of Master of Science

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**May 2011**

**Chairman: Assoc. Prof. Mohd Rafii Bin Yusop, PhD**

**Faculty: Agriculture**

Considering vast semi wild distribution of *J. curcas* species, genetic diversity should be existed in different parts of Peninsular Malaysia. Unfortunately, there is no information on the genetic diversity of this species in this country, while the knowledge of genetic variability of *J. curcas* is completely necessary for introducing its breeding programs. For this purpose, a study of different *J. curcas* accessions in Malaysia is required to identify highly potential elite accessions that are capable of high sustainable yields in different agro-climatic zones.

Fifty nine *J. curcas* accessions were collected from Selangor, Kelantan and Terengganu states were evaluated *in-situ* and *ex-situ* and also by molecular (RAPD) markers. The objectives were to determine the genetic variation and diversity of *J. curcas* accessions in three states of Malaysia, to evaluate the performance of different accessions of *J. curcas*, to assess variability at the molecular level among

the accessions and to identify superior *J. curcas* accessions to develop improved populations

*In-situ* evaluation of 59 *J. curcas* based on Zangemeister's method, Accessions B-05-06, B-02-04, B-05-09, T-01-09, T-01-04, T-01-10, D-01-10, D-01-08 and D-01-06 were distinguished with high oil content, collar diameter, number of fruits per cluster and leaf area. Out of the 59 collected accessions, 48 accessions were survived in nursery and planted in field for evaluation. Results of genetic diversity analysis using 14 morphological characters indicated that the presence of genetic variability among the *J. curcas* accessions. Broad sense heritability of all the traits were high with values exceeded 63%. Molecular analysis using RAPD markers revealed that the majority of accessions from Selangor state were clustered separately from accessions of other states. This indicated that the genetic divergence of the Selangor accessions compared to all accessions from Kelantan and Terengganu.

Two accessions collected from Kelantan and Selangor states, D-01-09 and B-03-02 respectively had relatively higher average total yield, 100-seed weight, oil content and growth characteristics compared to all other accessions. Finally, this study provides important insight in the accessions of *J. curcas* and this finding could be used as background information for breeding and improvement program of this species in Malaysia.

Abstrak tesis yang dikemukakan kepada Senat Universiti Putra Malaysia sebagai memenuhi keperluan untuk ijazah Master Sains

**MORFOLOGI DAN KEPELBAGAIAN GENETIK  
*JATROPHA CURCAS* L. DI MALAYSIA**

Oleh

**MAHMOODREZA SHABANIMOFRAD**

**Mei 2011**

**Pengerusi: Prof. Madya. Mohd Rafii Bin Yusop, PhD**

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Berdasarkan taburan yang luas spesies *J. curcas* separa-liar di merata bahagian di Malaysia, kepelbagaian genetik sepatutnya wujud. Malangnya, tiada maklumat mengenai kepelbagaian genetik spesies ini di negara ini, sedangkan pengetahuan tentang kepelbagaian genetik *J. curcas* amat diperlukan untuk memulakan program pembiakbakaannya. Untuk maksud ini, satu kajian ke atas pelbagai aksesori berbeza di Malaysia diperlukan untuk mengenalpasti aksesori unggul yang berpotensi tinggi yang berupaya memberikan hasil tinggi secara berterusan pada zon iklim yang berbeza.

Lima puluh sembilan aksesori *J. curcas* dikumpulkan dari Negeri Selangor, Kelantan dan Terengganu telah buat penilaian secara *in-situ* dan *ex-situ* dan juga menerusi kaedah penanda RAPD. Objektif kajian ini adalah untuk menentukan variasi genetik dan kepelbagaian aksesori *J. curcas* dari tiga negeri di Malaysia, mengkaji prestasi setiap aksesori *J. curcas*, menilai kepelbagaian pada tahap molekular antara aksesori terpilih bagi menghasilkan populasi yang lebih baik dan mengenalpasti aksesori *J. curcas* yang unggul.

Daripada 59 aksesori yang telah dikumpulkan, 48 aksesori yang hidup di tapak semaian ditanam di ladang untuk penilaian. Keputusan daripada analisa kepelbagaian genetik menggunakan 14 ciri morfologi menunjukkan terdapat variasi yang tinggi di antara aksesori *J. curcas* yang dikaji. Secara keseluruhannya, keterwarisan luas adalah tinggi untuk semua ciri dan nilainya melebihi 63%. Analisa molekul menggunakan penanda RAPD, menunjukkan kebanyakan aksesori daripada Selangor dikelompokkan secara berasingan daripada aksesori dari negeri yang lain. Ini menunjukkan terdapat kepelbagaian genetik aksesori dari Selangor berbanding aksesori dari Kelantan dan Terengganu.

Dua aksesori *J. curcas*. daripada negeri Kelantan dan Selangor, D-01-09 dan B-03-02 masing-masing secara relatifnya menghasilkan purata hasil keseluruhan, berat 100 biji benih, kandungan minyak dan ciri pertumbuhan yang tinggi berbanding dengan aksesori lain. Akhirnya, kajian ini menyediakan pemahaman yang penting terhadap aksesori *J. curcas* tersebut dan hasil penemuan ini boleh digunakan sebagai informasi asas untuk program pembiakbakaan dan kemajuan spesies ini di Malaysia.

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I would like to praise God for His infinite blessings.



I certify that a Thesis Examination Committee has met on 06 May 2011 to conduct the final examination of Mahmoodreza shabanimofrad on his thesis entitled “Morphological and molecular diversity of *Jatropha curcas* in Malaysia” in accordance with the Universities and University Colleges Act 1971 and the Constitution of the Universiti Putra Malaysia [P.U.(A) 106] 15 March 1998. The Committee recommends that the student be awarded the Master of Science.

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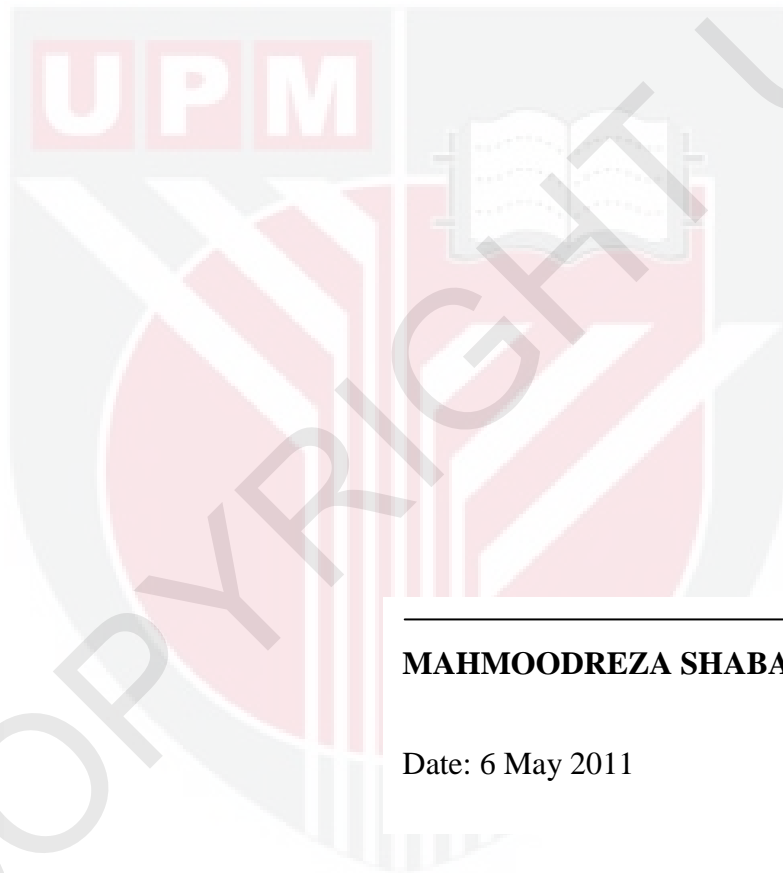
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## DECLARATION

I declare that the thesis on my original work except for quotations and citations which have been duly acknowledged. I also declare that it has not been previously, and is not concurrently, submitted for any other degree at Universiti Putra Malaysia or other institutions.



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**MAHMOODREZA SHABANIMOFRAD**

Date: 6 May 2011

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