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***PLANT DIVERSITY IN OIL PALM PLANTATIONS IN FELDA WILAYAH JENGKA,  
MALAYSIA***

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IN FELDA WILAYAH JENGA, MALAYSIA**

**NOR'IZZATI BINTI SHAIPODIN**

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**PLANT DIVERSITY IN OIL PALM PLANTATIONS  
IN FELDA WILAYAH JENGA, MALAYSIA**



By

**NOR'IZZATI BINTI SHAIPODIN**

**Thesis Submitted to the School of Graduate Studies,  
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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

**PLANT DIVERSITY IN OIL PALM PLANTATIONS IN FELDA WILAYAH JENGA, MALAYSIA**

By

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**May 2014**

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The monoculture systems involving the conversions of forest area into the agricultural land have severely restricted the flora and fauna diversity especially in oil palm plantations. However, the plantations were found to accommodate quite a wide range of biodiversity during its long productive life of 25 years. Plants serve as forage resources and habitat for variety of fauna thus, by enhancing plant diversity and abundance could enrich the fauna diversity in this unique ecosystem. Therefore, this study was conducted to investigate the plants associated within the oil palm plantations focused to different types of plantation managements and practices between plantation estate (PE) and smallholdings plantations (SH), and also between the grazed (G) and non-grazed (NG) plantations. Felda Wilayah Jengka which is located at central region of Pahang has been chosen as the study site as it meets the requirements of this study. Thirty 100m<sup>2</sup> plots were established and selected according to a few measurements in each study. One hundred and twenty-four plant (124) species belonging to six divisions; 93 angiosperms (Magnoliophyta), 23 true ferns (Monilophyta), two fern allies (Lycophyta), three mosses (Bryophyta), two liverworts (Hepatophyta) and one gymnosperm (Gnetophyta) were identified throughout this study. A total of 65 (52.4%) species were strictly terrestrial plants, 14 (11.3%) species were strictly epiphytic plants and 45 (36.3%) other species were found as both epiphytic and terrestrial plants. The species richness in smallholding plantation (SH) was found higher than plantation estate (PE) with 93 and 78 species, respectively. However, from the statistical analysis conducted, there was no significant difference on the epiphytic and terrestrial plant diversity between plantation estate and smallholdings plantations. The non-grazed (NG) area has higher number of the plant species with 93 species compared to the grazed (G) area with 72 species. From the statistical analysis conducted, there was statistically significant difference on terrestrial vegetation between the grazed and non-grazed plantation plots but no significant difference on the epiphytic community. Apart from that, 68 plant species are found beneficial as medicinal plants such as *Momordica charantia*, *Selaginella willdenowii* and *Stenochlaena palustris*. Twenty plant species such as *Asystasia gangetica* and *Cyrtococcum oxyphyllum* are found palatable to the livestock whereas other plants served as habitat and forage resources for faunas. Therefore, the plantation managements should conserve these beneficial plants to enhance the plantations biodiversity and

ecosystem while maintains higher and stable oil palm productivity throughout its life cycle.

Keywords: Plant diversity, oil palm, plantation estate, smallholding, grazing practice



Abstrak tesis yang dikemukakan kepada Senat Universiti Putra Malaysia  
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**KEPELBAGAIAN TUMBUHAN DI DALAM LADANG KELAPA SAWIT DI  
FELDA WILAYAH JENKA, MALAYSIA**

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Sistem monokultur yang melibatkan pengubahsuaian kawasan hutan kepada tanah pertanian terutamanya ladang kelapa sawit telah menghadkan kepelbagaian flora dan fauna. Walaubagaimanapun, sejumlah besar kepelbagaian biologi dapat ditemui di dalam ladang kelapa sawit sepanjang jangka hayatnya selama 25 tahun. Tumbuh-tumbuhan menyediakan sumber makanan dan habitat untuk pelbagai jenis fauna. Oleh yang demikian, dengan meningkatkan kepelbagaian dan kepadatan tumbuh-tumbuhan akan dapat membantu meningkatkan kepelbagaian fauna di dalam ekosistem ini. Oleh itu, kajian ini dijalankan untuk mengkaji tumbuh-tumbuhan yang terdapat di dalam ladang kelapa sawit melalui pengurusan ladang berbeza iaitu di antara ladang estet (PE) dengan ladang pekebun kecil (SH), dan di antara kawasan ladang yang diragut oleh haiwan ternakan (G) dan yang tidak diragut (NG). Felda Wilayah Jenka telah dipilih sebagai kawasan kajian kerana kawasan ini dapat memenuhi keperluan kajian ini. Tiga puluh plot kajian bersaiz 100m<sup>2</sup> setiap satu telah dibina berdasarkan beberapa ukuran untuk setiap kajian. Seratus dua puluh empat (124) spesies tumbuhan terdiri daripada enam divisi tumbuhan; 93 angiosperm (Magnoliophyta), 23 paku-pakis (Monilophyta), dua kerabat paku-pakis (Lycophyta), tiga lumut jati (Bryophyta), dua lumut hati (Hepatophyta) dan satu gymnosperm (Gnetophyta) telah dikenalpasti dalam kajian ini. Sejumlah 65 (52.4%) spesies adalah tumbuhan di atas tanah, 14 (11.3%) spesies adalah tumbuhan epifitik sementara 45 (36.3%) spesies ditemui tumbuh di atas tanah dan juga sebagai epifitik. Kekayaan spesies di ladang pekebun kecil (PE) adalah lebih tinggi berbanding di ladang estet (PE) dengan masing-masing berjumlah sebanyak 93 dan 78 spesies. Namun begitu, melalui analisis statistik yang dijalankan, didapati tiada perbezaan yang signifikan untuk tumbuhan epifitik dan tumbuhan atas tanah di antara kedua-dua ladang tersebut. Manakala, bilangan spesies di kawasan yang tidak diragut (NG) adalah lebih tinggi dengan 93 spesies berbanding kawasan yang diragut (G) oleh haiwan ternakan dengan 72 spesies. Daripada analisis statistik, didapati terdapat perbezaan yang signifikan di antara kawasan yang diragut dan tidak diragut bagi tumbuhan atas tanah tetapi tidak bagi tumbuhan epifitik. Selain itu, sebanyak 68 spesies tumbuhan didapati berguna sebagai tumbuhan ubatan seperti *Momordica charantia*, *Selaginella willdenowii* dan *Stenochlaena palustris*. Dua puluh (20) spesies tumbuhan

seperti *Asystasia gangetica* dan *Cyrtococcum oxyphyllum* didapati berguna sebagai makanan haiwan ternakan. Manakala, lain-lain tumbuhan berguna sebagai habitat dan sumber makanan untuk pelbagai jenis fauna. Oleh itu, pihak pengurusan ladang haruslah memelihara tumbuhan-tumbuhan yang berguna ini dalam usaha meningkatkan kepelbagaian biologi dan ekosistem di dalam ladang di samping masih tetap mengekalkan produktiviti yang tinggi sepanjang jangka hayat kelapa sawit.

Kata kunci: Kepelbagaian tumbuhan, kelapa sawit, ladang estet, pekebun kecil, amalan ragut oleh haiwan ternakan





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## TABLE OF CONTENTS

	<b>Page</b>
<b>ABSTRACT</b>	ii
<b>ABSTRAK</b>	iv
<b>ACKNOWLEDGEMENT</b>	vi
<b>APPROVAL</b>	vii
<b>DECLARATION</b>	ix
<b>LIST OF TABLES</b>	xii
<b>LIST OF FIGURES</b>	xiii
<b>LIST OF ABBREVIATIONS</b>	xv
<b>CHAPTER</b>	
<b>1. INTRODUCTION</b>	
1.1 Overview of Study	1
1.2 Problem Statements	2
1.3 Objectives of Study	3
<b>2. LITERATURE REVIEW</b>	
2.1 Plants	4
2.2 Oil Palm ( <i>Elaeis guineensis</i> Jacq.)	4
2.2.1 Oil Palm in Malaysia	5
2.2.2 Oil Palm Plantation Management and Practice in Malaysia	6
2.3 Biodiversity in Oil Palm Plantations	9
2.3.1 Plants in Oil Palm Plantations	10
2.3.2 Plant Studies in Malaysian Oil Palm Plantations	12
2.4 Felda Wilayah Jengka	14
2.4.1 History of Felda Wilayah Jengka, Pahang	25
2.4.2 Climate	15
<b>3 MATERIALS AND METHODS</b>	
3.1 Preliminary Survey	18
3.2 Fieldwork Method	19
3.3 Sampling Design	22
3.3.1 Vegetation Parameter	23
3.3.2 Epiphyte Data Collection	24
3.3.3 Terrestrial Vegetation Data Collection	25
3.4 Identification of Plant Specimens	25
3.5 Herbarium Specimens Preparation Method	26
3.5.1 Preserving	26
3.5.2 Pressing	26
3.5.3 Drying	26
3.5.4 Mounting	26
3.5.5 Labelling	27
3.5.6 Filing	27

3.6	Data Analysis	28
3.6.1	Diversity Indices	28
3.6.2	Importance Value Index	29
3.6.3	Statistical Analysis	29
<b>4</b>	<b>RESULTS AND DISCUSSION</b>	
4.1	Plants Associated in Oil Palm Plantations	30
4.1.1	Plant Species Richness and Abundance	30
4.1.2	Plant Habits	35
4.1.3	Plant Life Forms and Origin Status	51
4.1.4	Medicinal Values of Plant Species Found In the Oil Palm Plantations	55
4.2	Plant Diversity Comparison between Two Types of Plantation Managements; Plantation Estate, (PE) vs. Smallholdings, (SH)	56
4.2.1	Plant Species Richness	56
4.2.2	Epiphytic Plants	59
4.2.3	Terrestrial Plants	61
4.3	Plant Diversity Comparison between Grazed (G) and Non-Grazed (NG) Plantations	64
4.3.1	Plant Species Richness	64
4.3.2	Epiphytic Plants	68
4.3.3	Terrestrial plants	70
<b>5</b>	<b>SUMMARY, CONCLUSIONS AND RECOMMENDATIONS FOR FUTURE RESEARCH</b>	
5.2	Summary and Conclusion	74
5.3	Recommendation for Future Studies and Plantation Managements	74
	<b>REFERENCES/BIBLIOGRAPHY</b>	77
	<b>APPENDICES</b>	86
	<b>COLOUR PLATES</b>	126
	<b>BIODATA OF STUDENT</b>	128

<b>Table</b>	<b>LIST OF TABLES</b>	<b>Page</b>
3.1	List and coordinates of sampling plots in this study	19
4.1	Completed lists of plant species found in this study in oil palm plantations in Felda Wilayah Jengka, Pahang according to phylum, class, order, family, species and habits found	47
4.2	Plant life form found in the oil palm plantations in Felda Wilayah Jengka, Pahang according to family, genus and species	53
4.3	Vegetation analysis indices of epiphytic plants in PE and SH plantations	60
4.4	Vegetation analysis indices of terrestrial plants in PE and SH plantations	62
4.5	List of palatable and non-palatable plants found in oil palm plantations in alphabetical order	66
4.6	Vegetation analysis indices of epiphytic plants in NG and G areas	69
4.7	Vegetation analysis indices of terrestrial plants in NG and G areas	71

<b>Figure</b>	<b>LIST OF FIGURES</b>	<b>Page</b>
2.1	Production of top five palm oil producers, averaged from 1961-2010	6
2.2	Location of Felda Wilayah Jengka, Pahang	16
2.3	Map of Felda Wilayah Jengka, Pahang	17
3.1	Sampling localities	21
3.2	Layout of the sampling quadrat	22
3.3	Percentage cover reference guide	24
3.4	Flowchart of preparation process of herbarium specimens	27
4.1	Total number of species found in Felda Wilayah Jengka, Pahang	31
4.2	Number of species and genus according to family in bryophyte	31
4.3	Number of species and genus according to family in Lycophyta and Gnetophyta	32
4.4	Number of species and genus according to family in Monilophyta	32
4.5	Number of species and genus according to family in Liliopsida	33
4.6	Number of species and genus according to family in Magnoliopsida	34
4.7	Number of species found according to plant habits	35
4.8	Number of species found as both epiphytic and terrestrial plants according to plant group	36
4.9	Number of plants species found as both epiphytic and terrestrial according to family in two classes, Liliopsida and Magnoliopsida	36
4.10	Number of plants species found as both epiphytic and terrestrial according to family in bryophyte and monilophyte	38
4.11	Number of strictly epiphytic plant species found in oil palm plantation	39



4.12	Number of species found according to plant families in Bryophyta and Monilophyta	39
4.13	Number of species found according to plant families in Magnoliophyta	40
4.14	Number of strictly terrestrial plants species found in oil palm plantation	41
4.15	Number of species found strictly as terrestrial plants according to plant family in Magnoliopsida	42
4.16	Number of species found strictly as terrestrial plants according to plant family in Liliopsida	43
4.17	Number of species found strictly as terrestrial plants according to plant family in Monilophyta	44
4.18	Number of species found strictly as terrestrial plants according to plant group	44
4.19	Number of species according to life forms	51
4.20	Number of species with medicinal value according to life forms	55
4.21	Total numbers of species according to family, genus and species and their original area	57
4.22	Number of species found in the plantation estate (PE) and smallholding (SH) according to plant habits	58
4.23	Number of epiphytic plant species found in PE and SH plantations	59
4.24	Number of terrestrial species found in PE and SH plantation area	61
4.25	Total numbers of species according to family, genus and species and their original area	65
4.26	Number of species found in the grazed (G) and non-grazed (NG) plantations according to plant habits	67
4.27	Number of epiphytic species found in G and NG plantations	68
4.28	Number of terrestrial species found in G and NG plantations	70

## LIST OF ABBREVIATIONS

FAO	-	Food and Agriculture Organization
FELDA	-	Federal Land Development Authority
MPOB	-	Malaysia Palm Oil Board
MPOC	-	Malaysia Palm Oil Council
FELCRA	-	Federal Land Consolidation and Rehabilitation Agency
RISDA	-	Rubber Industry Smallholders Development Authority
MMD	-	Malaysia Meteorology Department
FASSB	-	Felda Agricultural Services Sdn Bhd
PPPTR	-	Pusat Penyelidikan Pertanian Tun Abdul Razak
RSPO	-	Roundtable on Sustainable Palm Oil
EFB	-	Empty Fruit Bunch
FFB	-	Fresh Fruit Bunch
CPO	-	Crude Palm Oil
PKO	-	Palm Kernel Oil
R&D	-	Research and Development
GPS	-	Global Positioning System
WCSP	-	World Checklist on Selected Plant Families

# CHAPTER 1

## INTRODUCTION

### 1.1 Overview of Study

Plants play many roles in our ecosystem such as regulating the nutrient and water cycles, habitat for many species of fauna, and most importantly as the main source of food for all living organisms. Presently, oil palm (*Elaeis guineensis* Jacq.) is one of the most rapidly increasing agricultural crops and an important source of vegetable oils worldwide due to increasing number of total global population and a burgeoning demand for food (Green *et al.*, 2005).

Since the year of 1961, palm oil production worldwide has increased from 13 million tonnes to 207 million tonnes with Malaysia and Indonesia as the major contributors with the total yield of 291.6 million tonnes and 214.4 million tonnes, respectively (FAO, 2012). This situation has been driven by further conversion of forest area to oil palm plantation since the 1980s as compared to the years before where the high yields were obtained by increase of yield per area (Murphy, 2009). The oil palm expansion either by design or by chance (Fitzherbert *et al.*, 2008) is considered as the major threats to biodiversity conservation in Southeast Asia especially Malaysia and Indonesia being the major exporters and at the same time biodiversity hotspot (FAO, 2012).

Unfortunately, little research has focused on the impacts of forest conversion to oil palm plantations on biodiversity (Fitzherbert *et al.*, 2008; Foster *et al.*, 2011). Most biodiversity studies in oil palm plantations are focused on the fauna diversity with a wide range of taxa including insects such as ants (Hashim *et al.*, 2010), beetles (Chung *et al.*, 2000) and bees (Liow *et al.*, 2001), mammals (Bernard *et al.*, 2009) and birds diversity (Aratrakorn *et al.*, 2006) but few published studies focusing only on plants diversity in the oil palm plantations (Fitzherbert *et al.*, 2008).

The accumulation of humus and plant debris on the oil palm trunks has modified the microclimatic conditions around it to make it more hospitable and provides an important habitat for fauna especially the arthropods as well served as the base for other epiphytic plants to establish and grow on it (Piggott, 1996; Turner and Foster, 2006). Besides that, the existence of terrestrial vegetation may increase the diversity of fauna such as insects, birds and others that depend on this vegetation as their home and food resources (Hassan, 2001; Najera and Simonetti, 2010). In addition, the understory vegetation also could serve as indicators of several parameters for oil palm growth such as nutrients and water availability and also help to limit soil erosion (Germer, 2003).

However, both epiphytic and understory species may change as the plantation ages (Piggott, 1980; Turner *et al.*, 2011) and different types of

plantation management also could have significant impact on species diversity (Fitzherbert *et al.*, 2008). Therefore, maintaining these species in this ecosystem can be treated as part of plantation management practices to enhance biological diversity from the producer up to the top consumer. Moreover, the species that are found to be in abundance in the oil palm plantations might be important as they may play special roles in preventing other species loss and maintaining the ecosystem services within oil palm plantations, even if they may have only a little or totally out of the conservation interest (Zhang *et al.*, 2007; Turner *et al.*, 2011).

The present study aimed at providing essential quantitative data on plant diversity with special reference to plantation management and practices in oil palm plantations in general and in Felda Wilayah Jengka in specific. This focused to contribute new findings and may be perceived as an effort towards the conservation of plant diversity which has significant impacts to the overall biological diversity in oil palm plantations.

## **1.2 Problem Statements**

Land conversion from forested area into oil palm plantations in Malaysia and Indonesia has been globally argued as the cause of biodiversity declining and species extinction. Not only oil palm creates a monoculture practice that is unfavourable towards sustainable agriculture, other plant species abundance was also hypothesized to be similar among plantations. However, it is unfair to directly quantify that establishment of the oil palm plantations is the main cause of biodiversity depression in this region as reliable data on land use changes and biodiversity especially associated flora compositions in the plantations is still lacking (Foster *et al.*, 2011; Fitzherbert *et al.*, 2008; Turner *et al.*, 2008).

Adaptation of good management practices with special attention on plant diversity in this landscape would allow sustainable yield production as well as its biological diversity. However, only a small number of researches have been carried out to study the impact of different management systems on biodiversity within plantations (Donald, 2004). This may be due to big commercial plantation are more concern on the weed management at the canopy base although there may be important usage of vegetation in the plantation as feed for livestock and having medicinal values. Most of the big commercial plantations are not interested in integrated farming because they prefer to focus on one source of income from the oil palm production and prefer not to increase their production cost in cattle or goat farming.

Therefore the chosen study site, Felda Wilayah Jengka is found to have different types of plantation management and agronomic practices since it was established in the 1960's. Currently, it has undergone the second cycle of oil palm replanting starting in the year 2000 until last four years. It covers an area of 70,000 ha that includes plantations and settlement areas which have not been fully accessed for biodiversity studies. Thus, the results from this study could be used as references or guidelines for further biodiversity

studies in oil palm plantations especially in Malaysia and perhaps provide more positive insights for integrated farming.

This study was conducted with a hypothesis that different types of plantation management and practice will lead to different plant diversity found in the plantations. This study aims at to provide accurate understanding of plant diversity and their relationship with the plantation managements and practices within the oil palm plantations. Such information would be useful for the plantation management in making decision on the utilization of available plant species as medicinal plants, forage resources and other values besides enhancing the oil palm productivity and biodiversity in this landscape. In addition, this study also aims to narrow the gap of knowledge in plant species richness and abundance as an effort towards conservation of overall biological diversity in this unique man made ecosystem.

### **1.3 Objectives of Study**

The main objectives of this study are:

1. To identify plant species found at oil palm plantations in Felda Wilayah Jengka, Pahang.
2. To differentiate and elucidate plant diversity among plantations with different managements and agronomic practices.

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