PRINCIPAL COMPONENT ANALYSIS AND CLUSTERING OF EX SITU OIL PALM (*Elaeis guineensis* Jacq.) GERMPLASM

Li-Hammed Morufat Abimbola

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Nilai

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BIODATA OF AUTHOR

Li-Hammed Morufat Abimbola with passport number A0407566, was born on the 22nd August 1988 in the city of Lagos, Nigeria. She is currently residing at PT 5514, Jalan BBN 9/2E, Desa Anggerik, Nilai, Malaysia. She was previously a student of Lagos State University, Ojo (LASU) Lagos, Nigeria (2006-2011) where she obtained Bachelor of Science with Honours in Botany. After her degree, she proceeded after her degree to serve her nation for a year where she tutored as a biology and agricultural science teacher for senior and junior secondary school students for a year. She is at present a Master of Science student of Universiti Sains Islam Malaysia (USIM) (Matric no. 3120239) majoring in Food Biotechnology (plant breeding/genetics options). In her leisure time, she takes to sewing. She can be contacted at murffylee@gmail.com.

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ABSTRAK

Pengetahuan kepelbagaian genetik dan hubungan antara bahan germplasma adalah penting untuk pemilihan bahan pembiakbakaan dan juga untuk memudahkan penggunaannya oleh penyelidik biahbaka. Oleh itu , penyelidikan ini dijalankan untuk meneroka sejauh mana kepelbagaian dan pertalian ciri-ciri dalam germplasma sawit MPOB-Nigeria menggunakan kaedah statistik yang mudah. Corak kebolehubahan untuk mengenal pasti ciri-ciri yang mengisihkan germplasma telah dikaji dengan menggunakan kaedah PCA dan analisis kelompok. Analisis pekali variasi menunjukkan bahawa kepelbagaian luas wujud di antara BTS dan komponennya. Kajian korelasi pula menunjukkan hubungan yang tinggi dan signifikan di antara BTS dan majoriti daripada ciri komponen kecuali ciri asid lemak. Analisis komponen utama berdasarkan semua ciri yang dikaji menunjukkan bahawa lapan PC pertama mempunyai nilai-eigen lebih besar daripada satu dan menyumbang 90.53 % daripada jumlah variasi untuk BTS , ABW , MNW , MF, KF , SF, ODM, OB, KB, OY , TEP , PCS, RL , LL , LW , LN , LA, LAI , BDM , VDM , TDM , e dan f menjadi peranan paling penting pada PC1 yang menyumbang kepada variasi keseluruhan membawa. Analisis kelompok menggunakan kaedah Ward dan SLCA dikumpulkan semua bahan germplasma berdasarkan semua ciri ke dalam lapan kumpulan . Sedikit perbezaan didapati dalam kedua-dua kaedah. Walau bagaimanapun, dari kaedah Ward, Kluster 3 dan 4 mengadungi aksesi dengan ciri hasil yang tinggi, manakala Kluster 2 mengandungi aksesi dengan ciri baik bagi kualiti minyak . Jarak genetik adalah pada aras maksimum dalam Kluster 1 dan Kluster 2 serta juga Kluster 1 dan Kluster 8. Oleh itu, pemilihan ciri bervariasi lebar atau luas boleh digunakan untuk penambahbaikan sawit, manakala penghibridan antara aksesi kelompok yang berbeza dengan kelompok min tinggi bagi ciri terpilih dan jarak maksimum boleh dicapai.

Kata Kunci: Kelapa sawit, germplasma, variasi, korelasi, analisis komponen utama, analisis kelompok.

ABSTRACT

Knowledge of genetic variability and relations among germplasm materials is crucial for selection of promising breeding materials and also to ease their utilization by plant breeders. Hence, this research was undertaken to explore the extent of variability and associations of traits in the MPOB-Nigerian oil palm germplasm using simple statistical tools. Pattern of variability in order to identify the characters which delineate the germplasm materials was as well studied using principal component analysis and cluster analysis. The results of coefficient of variation indicated that wide variability existed for fresh fruit bunch and its components. Estimates from correlation studies showed high and significant relations between FFB and majority of the traits except the fatty acid traits. PCA based on all the traits studied showed that first eight PCs having eigenvalues greater than one accounted for 90.53% of the total variation with FFB, ABW, MNW, MF, KF, SF, ODM, OB, KB, OY, TEP, PCS, RL, LL, LW, LN, LA, LAI, BDM, VDM, TDM, *e* and *f* being the most important characters on PC1 contributing to the overall variation. Cluster analysis using Ward's method and single linkage method grouped all germplasm materials based on all traits into eight groups. Slight variation was found in both methods. However, from Ward's method Cluster 3 and Cluster 4 contained accessions with high yield traits while Cluster 2 contains accessions with good oil quality traits. Genetic distance was maximum in Cluster 1 and Cluster 2 as well as Cluster 1 and Cluster 8. Thus, selections for characters with high wide variations could be used for oil palm improvement while hybridization between accessions of different clusters with high cluster means for desired traits and maximum distance could be achieved.

Keywords: Oil palm, germplasm, variation, correlation, principal component analysis, cluster analysis.

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ABBREVIATIONS

ABW	average bunch weight
ANOVA	analysis of variance
AVROS	Algemene Vereniging van Rubberplanters ter Oostkust van samantra
BNO	bunch number
BDM	bunch dry matter
BI	bunch index
C12:0	lauric acid
C14:0	myristic acid
C16:0	palmitic acid
C16:1	palmitoleic acid
C18:0	stearic acid
C18:1	oleic acid
C18:2	linoleic acid
DIAM	diameter of trunk
e	radiation conversion efficiency
f	fractional interception of radiation
F/B	fruit/bunch
FFB	fresh fruit bunch
FP	frond production
HT	height
IV	iodine value
K/B	kernel/bunch
K/F	kernel/fruit
KY	kernel yield
LA	leaf area
LAI	leaf area index
LL	leaflet length

LN	number of leaflet
LW	leaf width
MARDI	Malaysian agricultural research and development institute
M/F	mesocarp/fruit
MFW	mean fruit weight
MNW	mean nut weight
MPOB	Malaysian palm oil board
NAR	net area ratio
NGA	Nigeria
NIFOR	Nigerian institute for oil palm research
O/B	oil/bunch
O/DM	oil/dry mass
O/WM	oil/wet mass
OY	oil yield
P/B	parthenocarpic fruit/bunch
PCA	principal component analysis
PC(s)	principal component(s)
PCS	petiole cross section
PORIM	palm oil research institute of Malaysia
RL	rachis length
RRS	reciprocal recurrent selection
S/F	shell/fruit
SLCA	single linkage cluster analysis
TEP	total economic product
TDM	total dry mass
UPGMA	unpair weighted group method using arithmetic averages
VDM	vegetative dry mass
WHCA	Ward's hierarchical clustering analysis