International Journal of Engineering Science Invention
ISSN (Online): 2319 – 6734, ISSN (Print): 2319 – 6726
www.ijesi.org Volume 2 Issue 8 ǁ August 2013 ǁ PP.71-79

Morpho-Genetic Vegetative Variabilities of Some Underutilized Legumes.

[1] Agbolade, J.O., [2*]Olakunle, T. P., [3]Aina D.A., [4]Adeyemo, I.A., [5]Aasa-Sadique,A. D., and [5]Taiwo, J.O.

[1]Department of Biological Sciences, Oduduwa University, Ipetumodu, Ile-Ife, Nigeria
[2]Department of Applied Sciences, Osun State Polytechnic, Iree. Nigeria. [1]Department of Biosciences and Biotechnology, Faculty of Basic and Applied Sciences Babcock University, Ilishan- Remo, Ogun State, Nigeria.*
[3]Department of Botany and Microbiology, University of Ibadan, Ibadan, Nigeria.
[4]Department of Basic Studies,Osun State Polytechnic, Iree. Nigeria.
[5]Department of Biology Federal College of Education (Technical), Akoka, Lagos, Nigeria.

ABSTRACT:*Twelve species of twenty-four accessions miscellaneous legumes obtained from Germplasm Unit of the International Institute of Tropical Agriculture (IITA) Ibadan were accessed for their phenotypic,genetic and phylogenetic relatedness.The accessions were planted into plots of 5 ridges of 5m long,spaced 1m apart and replicated three times at Obafemi Awolowo University Teaching and Research Farm.Diversity of the accessions was accessed through vegetative comparative morphology.Differences in the mean values between two accessions were evaluated by descriptive statistics.Principal Component Analysis(PCA) was used to identify discriminatory vegetative morphological traits and similarities among the taxa were accessed through Cluster Analysis(CA).The first three principal component ax axes explained 71% of the total variation for the vegetative character.Rachis length,internode length,stipule length and stipule width were the traits which contributed most of the variations in the legume accessions.Cluster analysis grouped the 24 accessions into 5 clusters based on vegetative morphological descriptors at 0.25 level of similarity.The study revealed intra-specific similarities and inter-specific morphological and genetic diversity among the 24 miscellaneous legume accessions.*

I. INTRODUCTION

Underutilized, orphan, miscellaneous or minor crops are terms used to characterize a range of plant species with under exploited potentials [1, 2]. The crops are known to contribute immensely to food security, income generation and environmental services. Among these under-utilized crops are the minor grain legumes which are found in the marginal regions of the world as niche market crops [2]. Legume is a term applied broadly to all plants of the pea and bean family (*Leguminosae*) which comprises the *Caesalpinaceae*(*Senna* family), *Mimosacea* (l *e*ocust bean) and *Pappillonaceae* [3]. Legume is a simple dry fruit formed from a superior monocarpus pistil in which at maturity, the pericarp dehisces longitudinally along both sutures to liberate the seeds therein; and that the seeds are usually arranged along one of the margins of the fruits [4]. In terms of world economy and plant utility, grain legumes are grouped into two as major and minor species. The major species include the industrial legumes such as soybean and groundnut, which are extremely important in the world economy. Others are common beans (*Pharsalus vulgaris*), chicken pea (*Cicer arietinum.*), mung bean (*Vigna mungo*(L.)Hepper), rice bean (*Vigna angularis*(L.)Thouars), winged bean (*Psophocarpus tetragonolobus*(L.)DC) and pea(*Pisum sativum*)[5].

The minor species exist in a wide range of diversity either as cultivated or wild species across various regions of the world and are usually cultivated by the traditional farmers. In Sub-Sahara African, bambara groundnut (*Vigna subterannea* (*L.*)*Thouars*), Lima bean (*Phaseolus lunatus*), pigeon peas (*Cajanus cajan*(*L.*) DC], African yam bean(*Sphenostylis stenocarpa* (*Harms*) and lablab (*Lablab purpureus var.lignosus*) are the commonly cultivated species of the minor grain legumes. The wild species of the minor grain legumes include Kersting groundnut (*Kerstingiella geocarpa* (*Harms*), and Marama bean (*Tylosema esculentum*)[5].The minor grain legumes have also been referred to as miscellaneous, neglected, underutilized or lesser-known legumes [6; 1; 7; 2]. Miscellaneous legumes are so described because of the unusual characteristics that differentiate them from the common pea. The peculiar characters are reflected in their growth habit, fruiting pattern, seed size and their utilities. These also have special significance in agriculture because of their ability to enrich the soil through symbiotic nitrogen fixation(8). Generally, a plant that meets the following criteria can be considered as being under-utilized.

First, it must have proven food and energy value. Secondly, it must be proven to be cultivated, either by having being widely cultivated in the pasture or by only being cultivated in a limited geographical area. Thirdly, it must be currently cultivated less than other comparable plants [9; 10].

According to Wikipedia, miscellaneous legumes encompass crops like bambara groundnut (*Vigna subterranean*), green gram (*Vigna radiata* (*L.*) R.Wilczek), jack bean (*Canavalia ensiformis* (*L.*) DC), mung bean (*Vigna mungo*), pigeon pea (*Cajanus cajan*) and rice bean (*Vigna angularis*). Others are African yam bean (*Sphenostylis stenocarpa*), kersting groundnut (*kerstingiella geocarpa*), lablab (*lablab purpureus* (*Var.*) lignosus), mexican yam bean (*Pachyrhizus tuberosus* (*Lam.*), sword bean (*Canavalia gladiata* (*Jacq.*)DC), winged bean (*Psophocarpus tetragonolobus* (*L.*) DC) and other legumes which are generally referred to as pulses.

In many countries, the pulses sometimes serve as the major source of plant protein in human diet, although a significant proportion of the seeds are eaten as relish. When compared with cereal grain, some species of legumes are better sources of quality oil [5; 1]. Legumes are also important major sources of plant protein and fats in tropical countries. They are good sources of essential amino acids and fats. The industrial utilization of miscellaneous legumes depends on the knowledge of their nutritional importance and functional properties.

Scholars like[11;12; 13; 14; 15; 16; 18; 19] have reported on the compositional evaluation, functional properties, amino acids and protein solubility of legume flours. Grain legumes are also known to be useful in furnishing a variety of industrial, agricultural, food and pharmaceutical products. However the industrial importance or usefulness of the minor species of grain legumes are yet to be fully exploited [1; 20] studied the reproductive mechanism and pollen characterization in some accessions of underutilized legumes(*Sphenostylis stenocarpa Hoschst Ex.A.Rich*)and our team has also compared the epidermal features of twelve underutilized legume accessions[2].The aim of the current study is to carry out full morphological characterization on the vegetative characters of the species and accessions with a view to revealing their inter-specific and intra-specific differences and similarities.

II. MATERIALS AND METHODS

2.1 Seed acquisition

Seeds of twenty four accessions of twelve species of miscellaneous legumes were obtained from the Genetic Resources Unit of the International Institute of Tropical Agriculture (IITA), Ibadan, Oyo-State, Nigeria for screening. The species studied are Bambara groundnut (*Vigna subterranean* (*L.*)*Thouars*)(TVSu 1126 and TVSu 1415), Green gram (*Vigna radiata* (*L.*) *R.Wilczek*)(*TVr 145 and TVr 1001*), Jack bean (*Canavalia ensiformis* (*L.*)DC(TCe1 and TCe3), Mung bean (*Vigna mungo* (*L.*) Hepper)(TVm 12 and TVm 13), Pigeon pea (*Cajanus cajan*)(*L.*)DC)(TCc 8127 and TCc8156), Rice bean (*Vigna angularis* (*L.*) Thouars)(TVa 1 and TVa 1173), African yam bean (*Sphenostylis stenocarpa* (*Hochst Ex.A. Rich*) Harms (TSs 137 and TSs 156), *Kersting* groundnut (*kerstingiella geocarpa* (*Harms*), (TKg 6 and TKg 12) lablab (*Lablab purpureus* (*var. lignosus*)(TLn 21 and TLn 29), Mexican yam bean (*Pachyrhizus tuberosus* (*Lam.*)(TPtu 1 and TPtu 5), Sword bean(*Canavalian gladiata* (*Jacq.*)DC)(TCg 1 and TCg 4) and Winged bean (*Psophocarpus tetragonolobus* (*L.*)(DC)(TPt 12 and TPt 18).

2.2 Seed cultivation

Seeds of the twenty-four (24) accessions studied were planted on 5m ridges, spaced 1m apart in the Botanical garden of the University of Agriculture, Abeokuta. Each accession was planted on two rows at 1m intra-row spacing. Initially, two seeds were planted per hill and later thinned to one plant per hill, to give a total of twelve plants per accession per plot. Three replicates of the plot were prepared.

Data were taken on germination rate and the number of seeds that germinated. The plants were sprayed at one week interval with karate at a concentration of 0.5% starting from the period of flower bud initiation to pod maturity. The experimental plots were kept clean throughout the period of the study.

2.3 Morphological studies

Morphological studies were carried out through characterization of the quantitative and qualitative attributes of the vegetative characters of each accession from the time the plants attained 50% flowering. Photographs of the plants were taken at flowering, fruiting and podding stages.

2.3.1 Vegetative Characters

Data were taken on the qualitative vegetative characters of the accessions by scoring the variations in plant habit (determinancy), plant growth habit, terminal leaflet shape, stem texture as well as pattern of pigmentation on stems, branches, petioles and peduncles.

Measurements were taken with the aid of graduated metre rule in centimetres on quantitative vegetative characters such as terminal leaflet length and width, stipule length and width, petiole length and rachis length. Means of ten measurements taken from randomly selected plants were calculated and recorded.

2.3.4 Data Collection

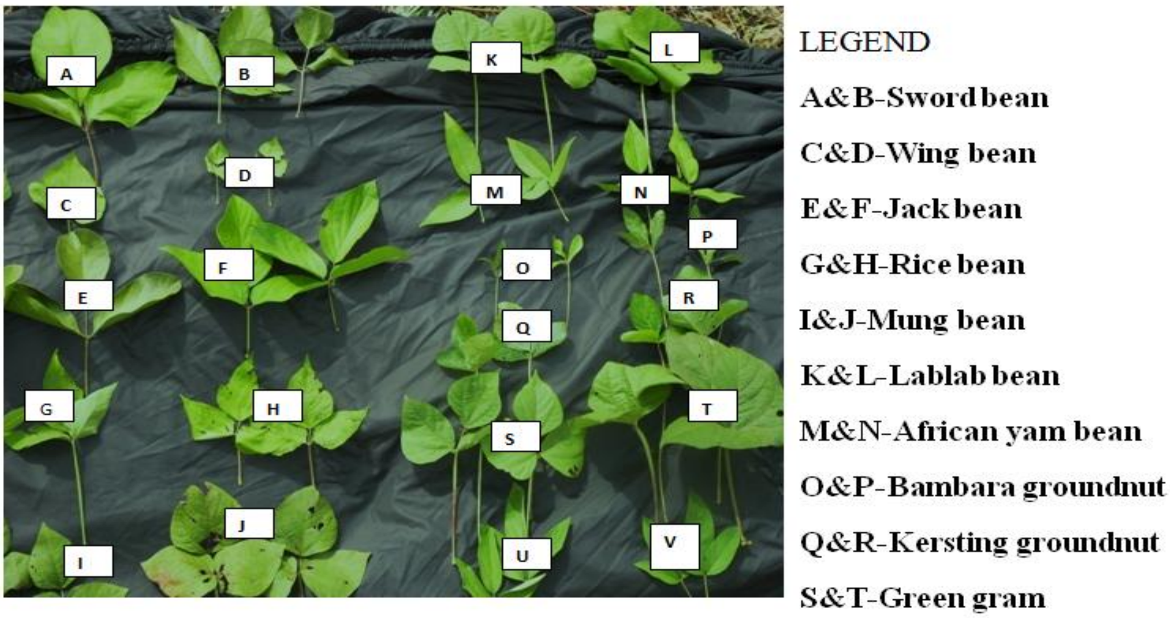
Data for morphological studies were generated from four individual plants within the row of each accession.Seventeen morphological [quantitative and qualitative] characters were scored on each of the miscellaneous legume accessions. Quantitative characters were determined by measurement in centimetres and counting. The qualitative characters which were determined visually were scored by nominal codes. No descriptor had been developed for most miscellaneous legumes yet. Descriptors for cowpea [21; 22] were therefore used as guide to develop the descriptors list for the present morphological characterization. Overall, seventeen characters were considered in this study.

2.3.5 Data Analysis

Duncan multiple range tests were employed to analyze the similarities and differences in the mean values of the quantitative characters. The multivariate statistical methods employed were Principal Component Analysis (PCA) and Cluster Analysis (CA). The principal component analysis produced vector loadings for variables on principal component (PC) axes while cluster analysis produced a cluster grouping in the form of a Dendrogram. Pearson correlation coefficient was employed to identify the dependence of characters on one another.

III. RESULTS AND DISCUSSION

All the species and accessions of the miscellaneous legumes revealed considerable inter and intra specific variations and overlap in most of their vegetative characters. Some of the plants exhibited twining growth habit as obligate stackers,which requires trellises for support while a few others were erect,not leaning on supports.Plate1 shows the leaf patterns of the miscellaneous legumes studied while themean values of ten quantitative vegetative characters studied is presented in Table1.



U&V-Pigeon pea

Plate 1: Leaf patterns of the miscellaneous legumes studied

Table1: Mean Values of Ten Quantitative Vegetative Characters of the Miscellaneous Legumes studied

Scientific Name	Common Name	Accession No	TLL[cm]	TLW[cm]	SL[cm]	SW[cm]	DSE	PL[cm]	RL[cm]	IL[cm]	NSP	NMB
Canavalia gladiate	Sword bean	Tcg1	14.31^{bcde}	7.27^{j}	2.50^{m}	0.26^{h}	8.10^{d}	20.57^{n}	1.04^{j}	20.32^{l}	7.90^{bcd}	3.20^{abcd}
Canavalia gladiate	Sword bean	Tcg4	14.73^{cde}	7.29^{j}	2.52^{m}	0.23^{g}	8.00^{d}	19.34^{m}	1.08^{j}	16.36^{ij}	7.90^{bcd}	3.20^{abcd}
Pachyrhizus tuberosus	Mexican yam bean	Tptu1	7.90^{abc}	3.21^{b}	0.33^{abc}	$0.16c^{d}$	21.56^{g}	10.20^{b}	0.86^{h}	15.44^{h}	7.80^{bcd}	3.33^{bcd}
Pachyrhizus tuberosus	Mexican yam bean	Tptu5	7.93^{abc}	3.18^{b}	0.33^{abc}	$0.16c^{d}$	22.10^{h}	10.07^{b}	0.86^{h}	15.46^{h}	7.90^{bcd}	3.40^{cd}
Psophocarpus tetragonolobus	Winged bean	Tpt12	7.67^{abc}	4.85^{c}	0.29^{ab}	0.13^{b}	9.10^{e}	13.48^{f}	0.20^{a}	8.88^{b}	8.20^{bcd}	2.20^{a}
Psophocarpus tetragonolobus	Winged bean	Tpt18	7.76^{abc}	4.84^{c}	0.26^{a}	0.16^{c}	9.00^{e}	12.73^{e}	0.22^{a}	9.07^{b}	6.90^{b}	2.30^{ab}
Canavalia ensiformis	Jack bean	TCc1	16.20^{e}	9.44^{k}	1.51^{h}	0.12^{b}	7.40^{c}	15.25^{h}	1.17^{k}	16.6^{ijk}	8.20^{bcd}	4.00^{d}
Canavalia ensiformis	Jack bean	TCc3	15.81^{ef}	9.43^{k}	1.52^{h}	0.17^{c}	7.22^{c}	11.51^{d}	0.93^{i}	16.90^{k}	8.50^{cd}	3.90^{d}
Vigna angularis	Rice bean	TVa1	10.56^{abcde}	5.81^{h}	1.61^{i}	$0.17d^{e}$	6.30^{b}	17.08^{k}	0.48^{d}	13.75^{e}	7.30^{bcd}	3.00^{abcd}
Vigna angularis	Rice bean	TVa1173	10.11^{abcde}	5.62^{g}	1.54^{h}	0.18^{e}	6.20^{b}	17.01^{k}	0.41^{c}	13.50^{e}	7.20^{bc}	2.50^{abc}
Vigna mungo	Mung bean	TVm12	12.49^{abcde}	9.40^{k}	0.87^{d}	0.11^{a}	6.11^{b}	13.50^{f}	0.67^{g}	9.14^{b}	8.70^{de}	3.20^{abcd}
Vigna mungo	Mung bean	TVm13	11.50^{abcde}	9.33^{k}	1.11^{f}	0.11^{a}	6.00^{b}	12.74^{e}	0.67^{g}	9.76^{c}	7.80^{bcd}	3.10^{abcd}
Lablab purpureus	Lablab bean	TLn21	8.96^{abcd}	5.18^{f}	2.28^{k}	0.21^{f}	6.00^{b}	18.20^{l}	0.47^{d}	14.50^{f}	8.30^{bcd}	3.70^{d}
Lablab purpureus	Lablab bean	TLn29	8.98^{abcd}	4.73^{c}	2.39^{l}	$0.17cd^{e}$	6.20^{b}	14.32^{g}	0.47^{d}	15.03^{g}	7.60^{bcd}	$3.40c^{d}$
Sphenostylis stenocarpa	African yam bean	TSs137	13.67^{abcde}	6.11^{i}	0.36^{bc}	0.12^{b}	10.00^{f}	7.35^{a}	0.31^{b}	14.95^{g}	5.20^{a}	3.70^{d}
Sphenostylis stenocarpa	African yam bean	TSs156	24.10^{f}	5.77^{h}	0.35^{bc}	0.13^{b}	9.00^{e}	7.27^{a}	0.32^{b}	16.16^{i}	5.20^{a}	3.70^{d}
Vigna subterranean	Bambara groundnut	TVSu1126	6.63^{a}	2.61^{a}	0.29^{ab}	0.13^{b}	10.00^{f}	7.46^{a}	0.33^{b}	16.56^{jk}	31.40^{h}	31.50^{e}
Vigna subterranean	Bambara groundnut	TVSU1415	7.62^{ab}	2.56^{a}	0.39^{c}	$0.17cd^{e}$	9.20^{e}	11.02^{c}	0.34^{b}	7.22^{a}	31.60^{h}	31.20^{e}
Kerstingiella geocarpa	Kersting groundnut	TKg6	11.55^{abcde}	6.18^{i}	0.96^{e}	$0.17cd^{e}$	6.00^{b}	19.80^{m}	0.32^{b}	7.24^{a}	126.90^{i}	127.10^{f}
Kerstingiella geocarpa	Kersting groundnut	TKg12	12.17^{abcde}	6.17^{i}	0.95^{e}	$0.17cd^{e}$	5.00^{a}	19.98^{m}	0.34^{b}	7.14^{a}	131.70^{j}	131.70^{g}
Vigna radiate	Green gram	TVr45	13.70^{abcde}	6.20^{i}	2.19^{j}	$0.16c^{d}$	5.00^{a}	14.24^{g}	0.55^{e}	9.16^{b}	10.10^{f}	3.70^{d}
Vigna radiate	Green gram	TVr1001	12.57^{abcde}	5.82^{h}	1.24^{g}	$0.17cd^{e}$	6.00^{b}	16.40^{j}	0.62^{f}	9.24^{b}	$9.90e^{f}$	3.60^{d}
Cajanus cajan	Pigeon pea	TCc8127	9.37^{abcde}	4.22^{d}	2.82^{n}	0.11^{a}	8.00^{d}	16.23^{j}	0.33^{b}	12.97^{d}	22.12^{g}	3.70^{d}
Cajanus cajan	Pigeon pea	TCc8156	9.23^{abcd}	3.95^{c}	3.89^{o}	0.11^{a}	6.00^{b}	15.69^{i}	0.33^{b}	12.76^{d}	23.20^{g}	3.30^{bcd}
		Total mean	11.48	11.48	1.35	0.16	8.46	14.22	0.55	12.85	21.15	16.21

LEGEND:DSE- Days from sowing to emergence,**TLL-**Terminal leaflet length, **TLW-** Terminal leaflet width, **SL-** Stipule length, **SW-** stipule width, **PL-** petiole length, **RL-** Rachis length, **IL-** Internode length, **NSP-** Number of stem per plant, **NMB-** Number of main branches.

3.1.1.1 Principal Component Analysis (PCA)

The Eigen values, variance proportion of five principal component (PC) axes and the Eigen vectors of ten vegetative morphological characters are presented in Table 2. Though ten PC axes were identified by PCA, only four [4] had Eigen values greater or equal to 0.1. The percentage variance reduced progressively from PC1 to PC10; the percentages of the total variance within the first four PC-axes were 29.21, 26.18, 15.73 and 13.05; respectively. The Eigen values for each of the first two PC-axes were greater than 2.5 and the two explained 55.39% of the total variation. In Table 2, vegetative morphological traits with Eigen vectors greater than or equal to 0.2 were significant in their contribution to loading each PC- axis. Five characters including rachis length, Internode length, number of stem per plant, number of main branches and days to seed emergence loaded PC1. Terminal leaflet width, terminal leaflet length, petiole length, stipule length and stipule width accounted for the variations in PC2 and PC3. Two of the five characters in PC1 re-featured in PC2. Three out of the five featured vegetative characters in PC1 made positive contribution to total variation in the 24 legume accessions.

Table 2: Eigen values, Variance Proportion of Five PC-Axes and Eigen vectors of Ten Vegetative Morphological Characters

	Principal Component Axes				
	PC1	PC2	PC3	PC4	PC5
Eigenvalues	2.9207	2.6179	1.5726	1.3051	0.6532
% variance per Pc-axes	0.2921	0.2618	0.1573	0.1305	0.0653
% cumulative variance across Pc-axes	0.2921	0.5539	0.7111	0.8416	0.9069
Morphological traits			Eigenvectors		
Terminal leaflet width	0.1330	**0.3996**	**-0.4757**	0.1458	**-0.4032**
Terminal leaflet length	0.1781	**0.2484**	**-0.4892**	**0.2984**	**0.5130**
Petiole length	-0.1809	**0.5083**	**0.2861**	-0.1028	-0.1821
Rachis length	**0.3807**	**0.2699**	0.0962	**0.3708**	**-0.4121**
Internode length	**0.4611**	0.0734	0.1786	0.1573	**0.5010**
Number of stem per plant	**-0.5078**	0.1302	0.0437	**0.3227**	0.1548
Number of main branches	**-0.4976**	0.1157	0.0313	**0.3918**	0.1427
Stipule length	0.0942	**0.4023**	**0.2058**	**-0.4846**	**0.2389**
Stipule width	0.0759	**0.3045**	**0.5191**	**0.2485**	0.0718
Days to seed emergence	**0.2003**	**-0.3962**	**0.3108**	**0.4033**	-0.1164

NB: Eigenvectors ≥ 0.2 are in bold.

3.1.1.2 Cluster Analysis

The two dimensional spatial configuration of 24 accessions of the miscellaneous legumes according to their vegetative characters is presented in Figure 1. The configuration explained about 55% of the total variation among the species and accessions. The two accessions coded 19 and 20 (TKg6 and TKg 12) appeared to distant themselves from all other accessions and fell loosely at the left plane. Similar observation was made for accessions coded 1, 2 (TCg1 and TCg4); 7, 8 (TCel and TCe3) and 3, 4 (TPtu1 and TPtu5), though all appeared at the right plane with the other accessions.

A high degree of genetic relatedness was depicted among accessions coded 21, 22, 9, 10, 11, 12, 14 (TVr 145, TVr 1001, TVa1, TVa 1173, TVm12, TVm 13 and TLn 29 respectively). Six specific cluster groups were visible among the 24 miscellaneous species and accessions as shown in Figure 1.

Although, the rachis and the internode lengths were observed in PC1 to reveal vast distinctiveness among the 24 miscellaneous legumes accessions, nevertheless, other traits were equally of good discriminatory value in depicting diversity and similarity among the accessions and such definitely would have been responsible for the minor but specific clustering observed. A striking revelation observed in the configuration was that species and accessions sharing the same generic nomenclature clustered together. This could be seen in cluster 1, 11 and more repeatedly in cluster 111.

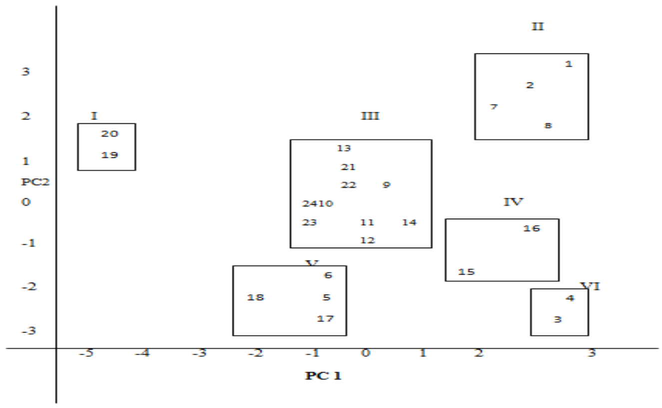


Fig 1: Two dimensional spatial configurations of the twelve species of twenty- four accessions of the miscellaneous legumes according to their vegetative characters.

Table 2 shows the cluster history of the 24 accessions of miscellaneous legumes based on their vegetative characters. The analysis produced 23 morphotypes or clusters. Accessions TVa1&TVa1173 were the most similar phenotypes based on the ten vegetative morphological characteristics employed to discriminate among the 24 accessions as both had the least distance (indicative of highest similarity) of 0.0178 (Table 2). TSs 156 significantly differentiated itself and tied with other accessions at a higher distance of 0.2818. The diversity of the 24 accessions spanned a distance between 0.0178 and 3.2758 (Table 2).

Table 2: Cluster history of the 24 accessions of Miscellaneous Legumes studied based on their Vegetative Characters

Morph types	Paired accessions or clusters		Rate	Distance
23	TVa1	TVa1173	2	0178
22	TPtu1	TPtu5	2	0223
21	TPt12	TPt18	2	0369
20	TVm12	TVm13	2	0407
19	Tcc8127	TCc8156	2	0579
18	CL23	TLn21	3	0636
17	TVr145	TVr1001	2	0684
16	CL18	TLn29	4	0888
15	TCe1	TCe3	2	0916
14	TCg1	TCg4	2	1003
13	CL20	CL17	4	1008
12	CL14	CL15	4	1239
11	CL16	CL13	8	1371
10	CL12	CL11	12	1414
9	TKg6	TKg12	2	1631
8	CL10	CL21	14	1637
7	CL8	TSs137	15	1829
6	TVsu1126	TVsu1415	2	2436
5	CL7	TSs156	16	2818
4	CL5	CL22	18	3208
3	CL4	CL19	20	3479
2	CL3	CL6	22	7253
1	CL2	CL9	24	2758

Figure 2 shows the Dendrogram obtained from cluster analysis for quantitative vegetative characters by single linkage cluster technique on the 24 accessions of miscellaneous legumes. The clustering technique was based on similarity for some morphological traits among the 24 accessions. At 0.0 similarity level, the 24 accessions were virtually similar. However, at about 25% similarity level, about nine clusters were identified. At this level (25%) for instance TCg1and TCg4 were clustered together, TPtu1 and TPtu5 stood alone, all the TVs were together, so also the TKgs. Expectedly, only five clusters could be identified at about 75% similarity level. All the *Vigna* species (TVa1 and TVa1173; TVm 12 and TVm13; TVr145 and TVr1001) appeared to cluster together at nearly the same similarity level with the exception of *Vigna subterranean*(TVsu 1126 and TVsu 1415). *Lablab purpureus*(TLn 21 and TLn29) appeared clustered with the *Vigna species* at nearly the same similarity level.

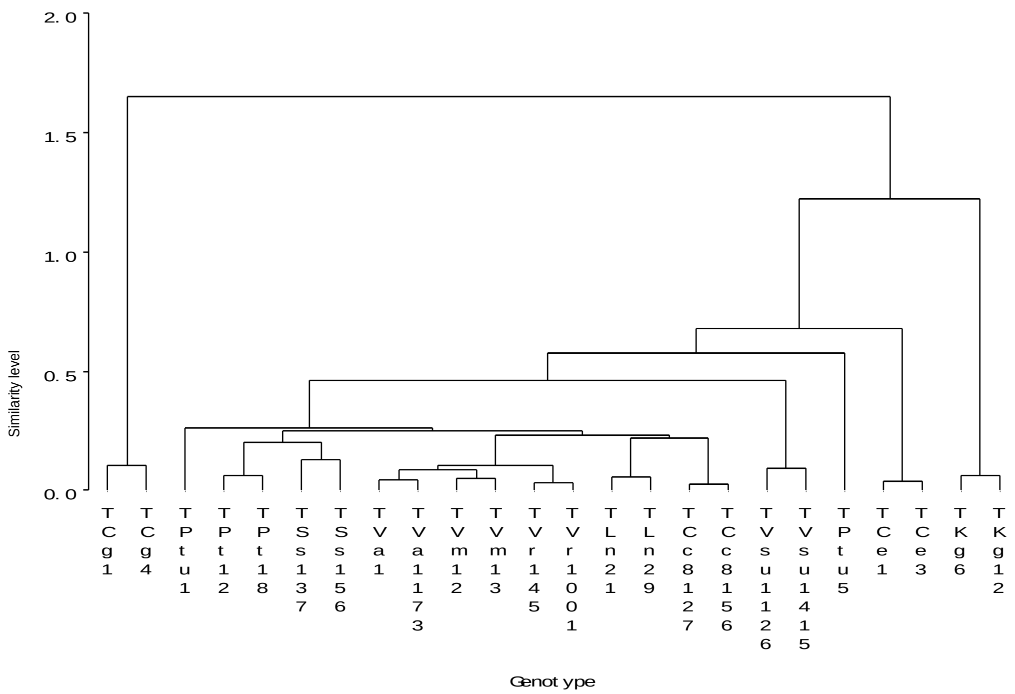


Fig.2: Dendrogram showing the grouping of the 24 accessions of miscellaneous legumes

Based on the quantitative vegetative characters.

3.1.1.3 Vegetative Characters Correlation Studies

The phenotypic correlation coefficients among ten vegetative characters of the miscellaneous legumes are presented in Table 3. Positive and significant ($p \leq 0.05$) association was observed between rachis length and terminal leaflet width ($r = 0.511$), stipule length ($r = 0.400$) and internode length ($r = 0.546$; $p \leq 0.01$). Petiole length, also positively and significantly ($p \leq 0.01$) correlated with stipule length ($r = 0.598$); stipule width ($r = 0.545$) and number of main branches with number of stem per plant ($r = 0.992$). However, significant but negative correlation ($p \leq 0.05$) between day to seed emergence and terminal leaflet width ($r = -0.467$), stipule length ($r = -0.449$); and number of stem per plant with internode length ($r = -0.488$). There was no negative correlation at ($p \leq 0.01$) level among the vegetative characters.

Table 3: Correlation Data on Vegetative Quantitative Characters of the Miscellaneous Legumes studied.

Characters	TLL	TLW	SL	SW	DSE	PL	RL	IL	NSP	NMB
TLL	1	.604**	.052	.058	-.267	-.030	.317	.288	-.065	-.040
TLW		1	.144	.034	-.467*	.268	.511*	.065	-.063	-.047
SL			1	.247	-.449*	.598**	.203	.248	-.099	-.188
SW				1	-.016	.545**	.406*	.330	.023	.060
DSE					1	-.495*	.250	.310	-.214	-.192
PL						1	.179	-.151	.389	.345
RL							1	.546**	-.303	-.284
IL								1	-.488*	-.473*
NSP									1	.992**
NMB										1

**. Correlation is significant at the 0.01 level (2 – tailed).

*. Correlation is significant at the 0.05 level (2 – tailed)

Note:
TLL - Terminal leaflet length
TLW - Terminal leaflet width
SL - Stipule length
SW - Stipule width
DSE - Days from sowing to emergence
PL - Petiole length
RL - Rachis length
IL - Internode length
NSP - Number of stem per plant

3.2DISCUSSION

The miscellaneous legume species and accessions studied revealed considerable similarities and differences in habit and vegetative morphological traits.

Variabilities revealed in their morphological traits were expressed in their pigmentation on stem,branch,petiole,leaflet size(that is,terminal leaflet length and width),stem texture and leaf shape.The species and accessions also varied in the petiole length,rachis length,stipule length,stipule width and the internode's length. However, two accessions of each of the species had very close values [recorded in each case] for both quantitative and qualitative characters, which were indicative of relatively more intra-specific relatedness. This corroborated the findings of 23; 20 and 1.

Principal Component Analysis (PCA) is a very important multivariate statistical technique for species classification [23,1]. Phenotypic characters with significant contribution to detecting variation among the 12 species of 24 accessions of the miscellaneous legumes were stipule length, petiole length, number of stem per plant and number of main branches. That the Principal Component Analysis (PCA) agrees with cluster analysis lends credence to the variabilities among the miscellaneous legumes species and accessions that justifies their classification.

This result clearly presents vegetative variability studies on the twenty four accessions of twelve species of miscellaneous legumes. Variations and similarities observed in the qualitative characters depicted different and common genetic basis for the phenotypic expressions. The wide range of differences among species for the quantitative characters as shown by high coefficient of variation in their mean values is indicative of wide genetic variability among the taxa. Values recorded in this study are representative of the genetic variants and overlaps among and within the species of the taxa, and may serve as future reference for other studies in this field.

REFERENCES

[1]. Aremu, M.O, Olaofe, O. and Akintayo, T.E. [2006]: A comparative Study on the Chemical and Amino Acid Composition of Some Nigerian Under-utilized Legume Flours. Pakistan Journal of Nutrition. 5[1]: 34-38

[2]. Agbolade,J.O.,Adegbite, A.E.,Olawuyi,O.J., Aina D.A.,PopoolaJ.O.,and Aremu B.R.,[2011] Comparative Study on the Epidermal Features of Under-Utilized Legume Accessions.Scholarly Journal of Agricultural Science.Vol.1[3]pp133-139.

[3]. Anyanwu, A.C. [1981]: A Textbook of Agriculture. 1st Edition.African Educational Publisher [Nig].Pp 103-104

[4]. Brenan, J.P. [1963]: Geographical Relationship of Leguminoseae. Proc. Fifth Plenary Meeting of A.E.T.F.A.T., New York.Pp 102-105.

[5]. Aykroyd, W.R. and Doughty, J.C. [1969]: Legumes in Human Nutrition. Nutritional Studies No.19, Food and Agricultural Organization, Rome.

[6]. Omitogun, O.G, Okeola, O.G, Fasidi, I.O, Obisesan, I.O. and Machuka, J. [2001]: A Galactose-specific Lectin from Sphenostylis stenocarpa is Insecticidal against Cowpea Genetic Engineering. African Crop Science Proceedings, 5: 111-116.

[7]. Adeboye, O.C. [2008]: Reducing the Oligosaccharide and Anti-nutritional Factor Contents of Two Under-utilized Grain Legumes of Southwest Nigeria. ActaHorticulturae, International Society for Horticultural Science.

[8]. Daramola,D.S.,Ogunnowo,A.A.,Aina, D.A.,Olawuyi, O.J.,Agbolade, J.O. and Nwadike[2011].Maize[Zea mays L.]Growth and Nitrogen Responses to Organic Manure and its Mineral-Nitrogen Fortification.Scholarly Journal of Agricultural Science Vol.1[4],pp.47-54.

[9]. King, H.G. [1963]:Pasture for the South'. 4th Edition. The Inter Estate Printers and Publishers, Inc. Dancville, III Pp. 1-12

[10]. National Academy of Sciences of the United State of America [NAS][1979b]: Tropical Legumes: Resources for the Future.National Academy of Science, Washington, D.C. 30:301-302

[11]. Ige, M.M., Ogunsua, A.O. and Oke, O.L. [1984]: Functional Properties of the Proteins of some Nigeria Oil Seeds, Castor oil seeds and Three Varieties of Melon Seeds.J. Agric. Food Chem.

[12]. Aletor, V.A. and Aladetimi, O.O. [1989]: Compositional Evaluation of Some Cowpea Varieties and Some Under-utilized Edible Legumes in Nigeria. Nahrung, 33: 999-1007.
[13]. Oshodi, A.A. and Ekperigin, M.M. [1989]: Functional Properties of Pigeon Pea [Cajanus Cajan]Flour. Food Chem. 34: 1-5.
[14]. Fagbemi, T. N. and Oshodi, A.A. [1991]: Chemical Composition and Functional Properties of Full Fat Fluted Pumpkin Seed Flour. Nig. Food J., 9: 26-32
[15]. Olaofe, O, Umar, Y.O. and Adediran, G.O. [1993]: The effect of Nematicides on the Nutritive Value and Functional Properties of Cowpea Seeds. Food Chem. 46: 337-342
[16]. Adeyeye, E.I, Oshodi, A.A and Ipinmoroti, K.O. [1999]: Fatty Acid Composition of Six Varieties of Dehulled African Yam Bean Flour. Int. J. Food Science Nutr. 50: 357-365.
[17]. Onwuliri, V.A. and Obu, J.A. [2002]: Lipids and other Constituents of Vigna unguiculata and Phaseolus vulgaris grown in Northern Nigeria. Food Chem., 78: 1-7.
[18]. AdebowaleS.A. and Lawal, O.G.[2004]: Comparative Study of the Functional Properties of Bambara Groundnut, Jack Bean and Mucuna Bean Flours. Food Res. Int.:27: 355-365.
[19]. Popoola, J.O.,Adegbite A.E.,ObembeO.O.,andAgbolade J.O.[2011]Reproductive Mechanisms and Polen Characterization in some Accessions of an Underutilized. Legume[Shenostylis stenocarpa Hochst Ex.A.Rich]harms.International Journal of Biodiversity and Conservation.Vol.3[6].pp 185-192.
[20]. Adewale, D.B. [2010]: Genetic Diversity, Stability and Reproductive Biology of African Yam Bean, Sphenostylis stenocarpa[Hochst. Ex A. Rich] Harms Ph.D Thesis Submitted to the Department of Plant Breeding and Seed Technology, University of Agriculture, Abeokuta.
[21]. IPGRI [1983]: Descriptors for Cowpea. International Plant Genetic Resource Institute, Rome. Italy.
[22]. IPGRI [International Plant Genetic Resources Institute][2001]: Neglected and Under-utilized Crop Species. www.bioversityinternational.org
[23]. Ariyo, O. J. [1993]: Genetic Diversity in West Africa Okra [Abelmoschuscaillei] – Multivariate analysis of Morphological and Agronomic Characters. Genetic Resources and Crop Evolution, 40;25-32.