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MORPHOLOGICAL VARIABILITY AMONG NIGERIAN EGGPLANTS (*Solanum* L.) AND THEIR WILD RELATIVES

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Abstract: *Solanum* L., is the largest genus of the family Solanaceae with over 2,000 species. Considering their worldwide distribution, a remarkably high level of morphological diversity has manifested at the species, the cultivar and the generic levels. This coupled with the crossability affinities between *S. melongena* and other distantly related *Solanum* species producing fertile F1 hybrids makes classification much more complicated. This extreme diversity of the species of *Solanum* has been attributed to its great antiquity, as well as its extraordinary rate of speciation. This study explored and determined the levels of both inter and intra genetic relationships as well as variability among vegetable *Solanum* and wild related species collected from Southern Nigeria. Forty nine samples representing 12 different species of vegetable *Solanum* and related species were randomly collected and studied. Data obtained from measurement of thirty seven quantitative and qualitative phenotypic characters were analyzed. Analysis of these traits showed samples occurring in 11 major clusters while 2 samples remained ungrouped at a truncated line of 51%. The correlation coefficient 0.75 for the highest similarity between genotypes and the least 0.34 displayed a good separation from a conserved region of the genome. Principal Component Analysis (PCA) also revealed that fruit characters were important agronomic marker traits with a cumulative total variation of 67.96%. These characters most effectively discriminated among samples and hence are useful in establishing a simple but effective vegetable *Solanum* classification system in Nigeria.

Keywords: *Solanum*, phenotypic, speciation, variability, PCA, crossability

Introduction

Solanum L. is the largest genus of the family Solanaceae with over 2,000 species. Considering their worldwide distribution, a remarkably high level of morphological diversity has manifested at the species, the cultivar and the generic levels (Knapp *et al*., 2004). Several species of the genus are cultivated including three globally important food crops namely tomato (*S. lycopersicum* L.), potato (*S. tuberosum* L.) and eggplant (*S. melongena* L.). Other species are regional significant food crops, such as: Ethiopian eggplant and gilo (*S. aethiopicum* L.). About 200 *Solanum* species are known in Africa, with some 32 indigenous in West Tropical Africa out of which 16 are found widely spread throughout Nigeria (Knapp, 2002). However, the International Solanaceae Genome Project (SOL) listed 24 different *Solanum* species occurring in West Tropical Africa out of which only 13 are found in Nigeria.

Despite the importance of the genus *Solanum*, phylogenetic relationships among the taxa has always been a subject of controversy. The taxonomy of the group has been a challenge due to species' large size, overlapping eco-geographical distribution (Levin *et al.*, 2005), morphological plasticity, similar genomes (Okoli, 1988) and existence of swarms of natural hybrids (Obute *et al*., 2006; Oyelana and Ugborogho, 2008). The inconsistencies and misconceptions generated by these factors have made past attempts at taxonomically resolving the complexities associated with the genus difficult. The extreme diversity of the species belonging to *Solanum* has been attributed to its great antiquity, as well as its extraordinary rate of speciation (Samuels, 1996). *Solanum* is a taxonomical paradox, which exhibits both uniformity and extreme diversity in its morphology at once (Knapp *et al*., 2004). Knapp *et al*. (2004) stated further that this hyper-diversity in one genus is unusual in angiosperms; it makes *Solanum* interesting from an evolutionary standpoint as well as for its usefulness to humans. The ability to characterize morphological diversity is indispensable for effective management, sustainable use of eggplant genetic resources and most importantly in phylogenetic studies. Several researchers have contributed to the characterization of the largest genus *Solanum* of *Solanaceae* family (Furini and Wunder, 2004; Matasyoh *et al.*, 2015; Fawzi and Habeeb, 2016). Fruit colour, size and shape are the most distinctive characters that vary between the cultivated *Solanum* species and their wild types (Kumar *et al*., 2008). Chowdhury (1976), as cited by Martin and Rhodes (1979), had earlier classified eggplant into three main groups based on their fruit shapes: round, oval or egg-shaped (*S. melongena* var. *esculentum* Martin & Rhodes), long slender shaped (*S. melongena* var. *serpentinum* Martin & Rhodes) and dwarf types (*S. melongena* var. *depressum* Martin & Rhodes).

Lester and Hassan (1990) also reported the taxonomic confusion between *S. melongena* and its weedy form; *S. incanum.* The high level of morphological plasticity manifested at the generic, species and cultivar levels within the eggplant complex (Furini and Wunder, 2004), and the crossability affinities between *S. melongena* and other distantly related *Solanum* species producing fertile F1 hybrids (Daunay *et al*., 1991) makes classification much more complicated.

Morphological crop descriptors allow a quick and easy discrimination between phenotypes. They are generally highly heritable traits that can be easily recorded through visual observations and are equally expressed in all environments (Naujeer, 2009). Primary characterization has been used in many studies as it involves measuring simple plant characters such as leaf area, fruit shape, size and colour, plant prickliness and hairiness that can be easily recorded through visual observations at different plant growth stages (Ayad *et al*., 1995; Naujeer, 2009).

This study is therefore, aimed at exploring the variation in germplasm of different species of vegetable *Solanum* in Southern Nigeria, with emphasis on the collections, identification and documentation of all voucher specimens in secure repositories as well as determining the level of genetic variability among individuals of different and same species such as inter and intra genetic relationships using data.

Materials and Methods

Sample collections

Sample collections were made during various field trips to places known as primary centres of eggplant diversity and endemism within the Southern part of Nigeria (Longitude 3° 20'E - 8°95'E and Latitude 4°59'N- 9° 00'N) especially in areas known for eggplant diversity. Each sample was labeled accordingly. These were done during the rainy season (between June and October, 2017); a period when eggplant *Solanum* will be flowering and fruiting. The materials collected from each plant include young fresh leaves, mature leaves (for herbarium), fruits and seeds.

Morphological evaluation and identification

A comprehensive morphological study was carried out on at least ten different plants of each species in their natural environment. This was done so that the average value for each character measured could be obtained. The study involved the measurement and recording of both quantitative and qualitative characters on these plants at flowering or fruiting stage when further growth was temporarily suspended. *Solanum* descriptors according to International Plant Genetic Resources Institute (IPGRI), Rome, Italy, now known as Bioversity International standard were used for this study. IPGRI provides internationally accepted definitions for these descriptors and include a complete description of important quantitative and qualitative traits illustrated by figures and measured either in metric or arbitrary scale. The measurement of these descriptors was achieved with the aid of Global Positioning System (GPS) for latitude and longitude of the place of collection, portable weighing balance for measurement of fresh fruit weight, tape rule (measurement of height, length, breadth and width), portable digital clock to record accurately the date and time of the day, a calculator (to get the average value for each quantitative character measured) and a digital camera (to take photographs prior to sample collection).

Identification of the collected plant specimen was achieved by comparing with photographs, drawings and illustrations from existing sample collections as well as through the use of keys in the flora. Authentication of voucher specimen was prepared following Ogundipe and Daramola (1998) was done at Forestry Herbarium Ibadan (FHI) and then deposited at both the University of Lagos Herbarium (LUH) and Forestry Herbarium Ibadan (FHI) for reference purposes.

Data analysis

The Statistical Package for Social Sciences (SPSS) software for Windows Evaluation Version 15.0 (Apache Software Foundation, Chicago, IL) was used to evaluate the values obtained for a particular character on ten different plants of each species, especially quantitative characters. This yielded mean, standard error of the mean (SEM), standard variation and variance for each character. The average (mean) values obtained for quantitative and qualitative morphological characters were analyzed separately to compute pairwise distance (similarity) matrices using Sequential Hierarchical and Nested (SAHN) clustering option of the Numerical Taxonomic System Software (NTSYS) pc version 2.02j software package by Applied Biostatistics Inc. (Rohlf, 1996); then they were combined and analyzed together. The software generated dendrograms, which grouped the test lines using Unweighted Pair Group Method with Mathematic Average (UPGMA) on the basis of genetic similarity and Jaccard's coefficient. Principal Component Analysis (PCA) option of SPSS was also used to analyze the morphological data to determine the relationship between plant traits and accessions. To achieve this, accessions were compared through ordination analysis to generate a bivariate matrix and projected on a three dimensional scale to display the similarity or dissimilarity distance between different accessions in space.

Results and Discussion

A total of 49 samples of different species of vegetable *Solanum* (eggplant) were collected and used for this study. The authenticated voucher specimens (Table 1) showed that the 49 *Solanum* samples collected represent 12 different species and were made up of 3 samples of *Solanum dasyphyllum*, 2 of *S. nigrum*, 6 of *S. macrocarpon*, 5 of *S. torvum*, 1 of *S. erianthum*, 13 of *S. melongena*, 10 of *S. gilo*, 1 of *S. incanum*, 2 of *S. scabrum*, 2 of *S. aethiopicum*, 3 of *S. indicum* subsp. *distichum* var. *distichum* and 1 sample of *S. macranthum*. Sample exploration showed that members of eggplant *Solanum* family studied generally occur as herbs, shrubs or trees, with or without spines, glabrous or pubescent with unbranched or branched, often glandular hairs. Leaves are alternate or paired and frequently unequal in size; simple, petiolate or sessile, without stipules (Fig. 1).

1 represents OG02, 2 represents OG03, etc. See **Table 1** for further clarification.

Table 1: List of samples of *Solanum* species collected and their identification

S/N	Sample I.D No.	Identification
1	OG02	*Solanum dasyphyllum*
2	OG03	*S. nigrum*
3	OG04	*S. dasyphyllum*
4	OG05	*S. nigrum*
5	OG06	*S. macrocarpon* (White fruit)
6	OG07	*S. macrocarpon* (Green fruit)
7	OG08	*S. torvum*
8	OG09	*S. erianthum*
9	OG10	*S. melongena* (Green fruit)
10	OY11	*S. gilo* Raddi (White fruit)
11	OY12	*S. gilo*Raddi (White fruit)
12	OY13	*S. gilo* Raddi (White fruit)
13	OY14	*S. gilo* Raddi (White fruit)
14	OY15	*S. incanum* (Green small fruit)
15	OY16	*S. scabrum*
16	OY17	*S. aethiopicum*
17	OY18	*S. scabrum*
18	OY19	*S. melongena* (White fruit)
19	OY20	*S. aethiopicum*
20	OS21	*S. torvum*
21	OG22	*S. melongena* (Green fruit)
22	LA23	*S. gilo* Raddi (Green egg-shaped fruit)
23	LA24	*S. gilo* Raddi (Green round fruit)
24	LA25	*S. gilo* Raddi (Green round fruit with greenish purple stem)
25	LA26	*S. macrocarpon* (Green fruit)
26	OY27	*S. melongena* (Purple fruit)
27	OY28	*S. macrocarpon* (Brown fruit)
28	OY29	*S. torvum*
29	ED30	*S. melongena* (Purple fruit)
30	ED31	*S. melongena* (Green fruit)
31	ED32	*S. macrocarpon* (Green fruit)
32	ED33	*S. gilo* Raddi (Green fruit)
33	ED34	*S. dasyphyllum*
34	OD35	*S. macrocarpon* (Green fruit)
35	OD36	*S. melongena* (Green fruit)
36	CR37	*S. torvum*
37	CR38	*S. indicum* subsp.*distichum* var. *distichum*
38	CR39	*S. torvum*
39	CR40	*S. melongena* (long&white fruits;thorny)
40	CR41	*S. melongena* (long & purple fruits,no thorns,white flowers)
41	CR42	*S. melongena* (long&purple fruits,thorny,white flowers)
42	CR43	*S.indicum* subsp.*distichum* var. *distichum*
43	CR44	*S.melongena* (Round,purple white striped fruits, no thorns)
44	CR45	*S. gilo* (Green,white striped fruits, & no thorns)
45	CR46	*S. indicum* subsp. *distichum* var. *distichum*
46	CR47	*S. melongena* (Purplish-white fruits with depression at the top & no thorns)
47	CR48	*S. melongena* (Long purple fruits with white patches at the head & no thorns)
48	CR49	*S. gilo* (Pure white fruits & no thorns)
49	CR50	*S. macranthum*

Fig. 1: (i) A simple leaf of *S. melongena* being evaluated (ii) a long sharp thorn/ prickle on the midrib of *S. macranthum* (X ¼)

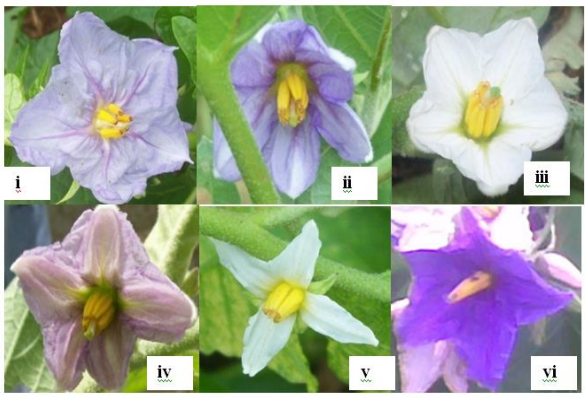


Fig. 2: Variations in flower shape and colour: (i) Semi-stellate purplish-white of *S. macrocarpon*(ii) light purple and rotate of *S. melongena* (iii) white and semi-stellate of *S. melongena* (iv) rotate and purplish of *S. melongena*(v) stellate and white of *S.gilo* (vi) semi-stellate and purple of *S. macranthum*

Inflorescences are cymose, could be branched or unbranched. Flowers are usually perfect (4-) 5-merous, actinomorphic or zygomorphic; calyx campanulate, sometimes accrescent in fruit; corolla rotate, campanulate, or stellate, white, purplish white, pink, orpurple (Fig. 2). Fruits are berry, usually fleshy but occasionally dry, usually green, white, purplish white or purple in colour turning orange or red as they become ripe.

Analyses of morphological data

A total of 37 morphological traits, made up of 26 qualitative (measured by visual observation of the plants according to IPGRI standard) and 11 quantitative characters were measured and compared among the 49 samples studied (Table 2).

All these descriptor states characterized showed high level of morphological diversity among the samples studied. Wide variability for all the quantitative descriptors studied was revealed by the range of variation for the different quantitative descriptors. This led to the observation of a large coefficient of variation (> 30%) for all the quantitative characters studied. Analysis of variances with value 2804.19 showed significant difference ($P < 0.05$) in plant height at flowering/fruiting and stem length at first inflorescence between different accessions**.** Plant growth habit ranged from upright to intermediate types. Stem colour increased from green to green with purple spots and greenish-purple. Leaf blade length was the least diverse among all the traits phenotyped with a low coefficient of variation of 39.85% followed by plant height at flowering (42.37%) and leaf blade width (42.83%). A large coefficient of variation above 50% applied to fruit length, width and weight suggesting that fruit traits were the most diverse quantitative morphological characters observed (Table 3). The five characteristic fruit shapes recorded were flattened, round, ellipsoid, ovate or egg-shaped and obovate or oblong types. Fruits that are round in shape occurred most frequently (40.8%) among the samples characterized. Mean Fresh fruit weight of all the accessions studied ranged from 0.5 g in OY18 to 93.0 g in LA26.

Table 2: List of both qualitative and quantitative characters evaluated in this study

Qualitative character		Quantitative character	
Trait	**Abbreviation**	**Trait**	**Abbreviation**
Plant growth habit	PGH	Plant height at Flowering (cm)	PHF
Plant Size	PS	Stem length at 1st inflorescence (cm)	SLFI
Stem pubescence density	SPD	Internode length (cm)	IL
Stem colour	SC	Leave blade length (cm)	LBL
Type of leaf	TOL	Leave blade width (cm)	LBW
leaf attitude (i.e. orientation)	LA	Petiole length	PL
Leaf shape	LS	Mean fresh fruit weight (g)	MFFW
Foliage density	FD	Fruit length (cm)	FL
Position of widest part of leaf blade	PWPLB	Fruit width(cm)	FW
Leaf colour on the adaxial surface	LCAS	LBL to LBW Ratio	LBL/LBW
Leaf Surface Attitude	LSA	FL to FW Ratio	FL/FW
Leaf Blade Lobing	LBLO		
Leaf Apex Shape	LAS		
Leaf Hairiness type on Abaxial Side	LHTAS		
Anthocyanin Colouration of Leaf Veins	ACLV		
Petiole colour	PC		
Corolla type	CT		
Corolla colour	CC		
Inflorescence type	IT		
Predominant fruit shape	PFS		
Fruits predominant colour at commercial ripeness	FPCCR		
Fruits flesh colour	FFC		
Position of widest part of the fruit	PWF		
Fruit secondary colour at commercial ripeness	FSCCR		
Fruit size uniformity	FSU		
Fruit curvature	FC		

Table 3: Range of variation in quantitative descriptors and coefficient of variations given by the ratio of the standard deviation to the mean

		PHF	SLFI	IL	PL	LBL	LBW	FL	FW	MFFW	LBL/ LBW	FL/FW
N	Valid	49	49	49	49	49	49	49	49	49	49	49
	Missing	0	0	0	0	0	0	0	0	0	0	0
Mean		124.99	79.17	8.15	3.81	17.63	12.03	3.96	3.20	38.74	1.51	1.23
Std. Error of Mean		7.56	8.20	0.62	0.34	1.00	0.74	0.39	0.24	4.58	0.03	0.07
Std. Deviation		52.95	57.40	4.33	2.35	7.02	5.15	2.70	1.70	32.06	0.24	0.48
Variance		2804.19	3295.04	18.77	5.50	49.34	26.57	7.27	2.880	1027.54	0.06	0.23
Range		310.40	328.00	18.00	7.60	26.60	21.10	11.30	6.80	92.50	.90	2.40
Minimum		43.10	3.20	3.10	0.00	4.90	2.80	0.50	0.50	0.50	1.00	0.50
Maximum		353.50	331.20	21.10	7.60	31.50	23.90	11.80	7.30	93.00	1.90	2.90
Sum		6124.50	3879.40	399.10	186.80	863.70	589.70	194.00	156.80	1898.20	74.20	60.50
Coefficient of Variation (%)		42.37	72.50	53.19	61.51	39.85	42.83	68.11	53.03	82.75	0.16	0.38

PHF= Plant height at Flowering; SLFI= Stem length at 1st Inflorescence; IL= Internode length; PL= Petiole length; LBL=Leaf blade length; LBW= Leaf width length; FL=Fruit length; FW= Fruit width; MFFW= Mean Fresh Fruit weight

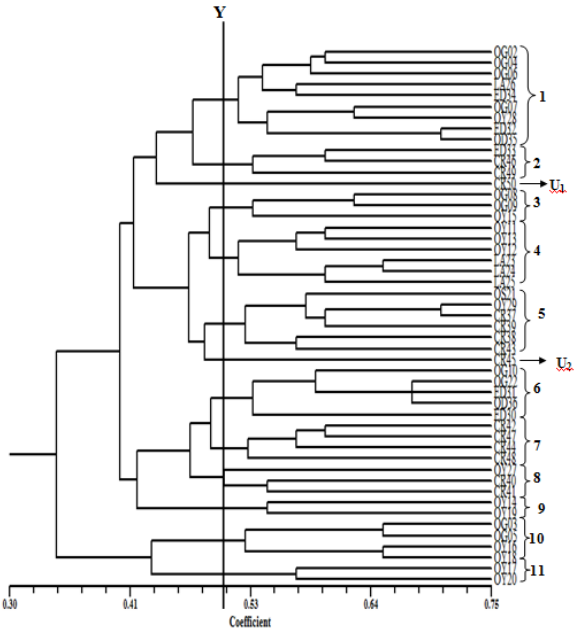
Pair-wise analysis of morphological data

The data obtained for each of qualitative and quantitative characters were analyzed separately and then combined. The average value for each quantitative character measured on each sample was used in calculating total variance explained by Principal Axis. These data were subjected to pair-wise analysis and dendrogram generated showing relationship among the species based on both qualitative and quantitative morphological data. At a truncated line of about 51% (a co-efficient of 0.51), in the dendrogram generated from the combined data, 11 major clusters and 2 ungrouped (samples CR50 and CR45, respectively) were formed (Fig. 3). The grouping pattern as shown in Fig. 3 revealed that Cluster 1 was the largest group with nine samples represented by three of *S. dasyphyllum* and six of *S. macrocarpon* while clusters 9 and 11 have the lowest with two samples each. All samples of *S. dasyphyllum* and *S. macrocarpon* are grouped together in Cluster 1. All *S. nigrum* and *S. scabrum* are grouped together in Cluster 10; Cluster 11 contained exclusively all *S. aethiopicum* samples. Cluster 4 contained exclusively most *S. gilo* samples; Cluster 5 is made up of most samples of *S. torvum* and two samples of *S. indicum*. Remaining accessions of *S. torvum* and *S. indicum* occurred in other clusters. Most of *S. melongena* samples occurred exclusively in Clusters 6, 7 and 8. However, samples CR50 (*S. macranthum*) and CR45 (*S. gilo*) remained ungrouped.

Principal component analysis of morphological data

The clustering pattern of accessions obtained in the dendrogram was further investigated through Principal Component Analysis (PCA) by comparing accessions through ordination analysis and projected on three dimensional matrix plots to show the relationship among the 49 eggplant accessions studied. The projected bivariate matrix plot on a three dimensional scale displayed the similarity or dissimilarity distance between different accessions in space (Fig. 4). Two major clusters (X and Y) are formed this time around. The larger been X with forty four samples distantly followed by Y with three samples. Again, samples OG09 and CR50 (numbered 8 and 49, respectively) separated out and remained ungrouped. Sample CR50 has been observed earlier to be ungrouped in the dendrogram.

The ability to characterize morphological diversity is indispensable for effective management, crop improvement, conservation and sustainable use of eggplant genetic resources in breeding programmes. In many crops, simple and useful systems of classification have been developed that rely on only a few simply inherited and easily observable traits (Riley *et al*., 1996). This would allow curators to focus on characterizing a greater portion of their collections for these key traits. According to Kumar *et al*. (2008), one way to promote use is to develop a simple classification system based on key morphological characters such as fruit shape and colour that will uncover the pattern of variation in eggplant landraces.



Legend: Y represents truncated line at a Co-efficient of Similarity of 0.51 (about 51%); Eleven Clusters and 2 Ungrouped (U_1 and U_2) samples were equally distinguishable at that Similarity Coefficient

Fig. 3: Dendrogram of the combined morphological data at a similarity coefficient of 0.51 (about 51 %.)

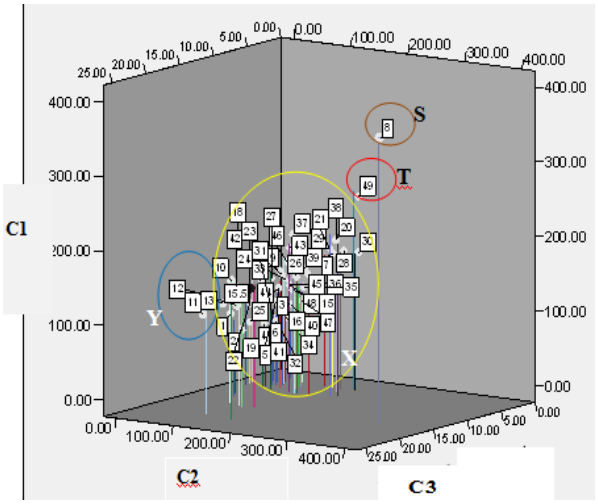


Fig. 4: Projection of the 49 *Solanum* accessions morphologically characterized on a Three Dimensional Bases:

Legend: Illustration of the Dis (similarity) distance among them in space and hence their clustering into distinct groups of similar accessions using the three major Components C1, C2 and C3; X and Y are the 2 major clusters formed while S and T are the ungrouped samples

The grouping together (Fig. 3) of *S. gilo* and *S. melongena* in Cluster 9 clearly indicates closeness between *S. melongena* and *S. gilo*. *S. macrocarpon* and *S. dasyphyllum* were grouped with each other in Cluster 1, an indication that they are only distantly related to cultivated type (*S. melongena*) and are more closely related to each other. This is in contrast to the findings of Naujeer (2009), who observed *S. macrocarpon* accessions occurring in the same cluster with *S. melongena* indicating their close genetic affinities and phenotypic relationship. *S. indicum* is grouped with *S. gilo* in Cluster 2 and also clustered with *S. torvum* in Cluster 5. This is an indication of relatedness of *S. gilo* with *S. indicum* and *S. torvum* whereas *S. indicum* and *S. torvum* are distantly related. The occurrence of all accessions belonging to *S. nigrum* and *S. scabrum* in Cluster 10 shows a very close relatedness between them. One accession of *S. torvum* also occurs in the same cluster with *S.erianthum* and *S. incanum* (Cluster 3), indicating closeness among them.

It could be observed that *S. gilo* is the only species that showed close relatedness with cultivated *S. melongena* in this study. All others are only distantly related (if at all) with it. All accessions except one of *S. melongena* studied are characterized by wide diversity in stem, leaf, flower and fruit characters, but their overall close morphology allows them to be grouped together in distinct clusters (Clusters 6, 7 and 8) (Fig. 3). The observation also shows that they all belong to the same species irrespective of the geographic location of collection. This observation is in agreement with the report of Furini and Wunder (2004). The same could equally be said of most accessions of *S. gilo* occurring exclusively in Cluster 4. The observed *S. macranthum* not grouped with any of the other accessions is a clear indication of its non-relatedness or it's distantly relatedness with all others. The reason for one accession of *S. gilo* (CR45) not grouped with either other *S. gilo* accessions or any other accession is not yet known. It may even be a different species that was wrongly identified as *S. gilo*.

The results obtained in this study revealed wide morphological diversity among the 49 accessions for all the thirty seven quantitative and qualitative morphological descriptors analyzed. This result showed the diversity among different groups and within the same species. The high level of polymorphism observed in the present study when both qualitative and quantitative data were combined, is an indication of a wide and diverse genetic base. The correlation coefficient 0.75 for the highest similarity between genotypes and the least 0.34 displayed a good separation from a conserved region of the genome. These results are in agreement with those earlier obtained by other workers (Furini and Wunder, 2004; Singh *et al*., 2006; Kumar *et al*., 2013). However, the results differ from those workers who studied variation among the cultivated and weedy taxa of *S. melongena* by allozymes (Isshiki *et al*., 1994) and RAPD (Hassan and Lester, 1990; Karihaloo and Gottlieb, 1995). These authors observed little genetic variability among the genotypes studied and suggested the existence of a very small gene pool from which the cultivated forms arose. This observation of low genetic diversity was also noticed by Fawzi and Habeeb (2016) while working on three *Solanum* species. Fawzi and Habeeb (2016) attributed this to occurrence of natural hybridization that is probably more widespread in the section studied.

Interestingly, collections originating from various parts of the study area did not form well-defined distinct groups and were interspersed with each other. This clustering together of accessions from different areas of collection as observed in this study implies no association between morphological variation and the geographic origin of accessions. This supports the findings of Singh *et al*. (2006), who equally observed no association between RAPD pattern and the geographic origin of accessions. According to Furini and Wunder (2004), diverse geographic origin of two accessions may not necessarily reflect in genetically diverse plant materials although these parameters are central in genetic diversity studies. Matasyoh *et al.* (2015) equally observed this and attributed it to overlapping of *Solanum* genetic data at some times. Frary *et al*. (2003) had explained this observation by the fact that the phenotypes for certain traits (leaf and fruit characters) are controlled by a limited number of genes with major effects on phenotypic traits and their quantitative trait loci are conserved during domestication and plant evolution.

PCA multivariate analysis reveals that fruit traits, both qualitative (shape, size and colour) and quantitative (length, width and mean fresh weight having coefficient of variation 68.11, 53.03 and 82.75%, respectively) with a cumulative total variation of 67.96% most effectively discriminated between *S. melongena* and their related species. These traits can be used as important marker traits in the classification of *S. melongena* and other *Solanum* accessions found in Nigeria into specific cultivar groups. This finding corroborates the work of Kumar *et al*. (2008), who stated that fruit colour, size and shape are the most distinctive characters that vary between the cultivated *Solanum* species and their wild types. Sample CR50 (*S. macranthum*) which is a tree in nature and labelled 49 (Fig. 4) occur separately without clustering with any other samples. This had earlier been observed (Fig. 3) thus confirming it's distantly relatedness to *S. melongena* and other *Solanum* samples. This was found to be a new species, which hitherto, was not included among the reported *Solanum* species found in Nigeria.

However, morphological diversity observed in all the accessions is not restricted to fruit characters only. Other vegetative and flower traits such as leaf blade lobing, flower colour, leaf blade length, leaf blade width, plant height, stem length and internode length are equally identified as useful marker traits that also distinguished between eggplant accessions, their related species and wild types. Portis *et al*. (2006) who worked on Italian pepper landraces suggests that independent selections pressures across a number of crop

generations to a restricted gene pool can result in genetic divergence within a particular landrace. This could also explain the phenotypic variation manifested in plant characters such as fruit traits among individuals within the different accessions studied. Mace *et al*. (1999) reported a high degree of morphological plasticity in *S. melongena* and their related species which may have further contributed in the differentiation process and accumulation of variation in eggplant landraces and traditional varieties.

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