GENETIC VARIABILITY IN NIGERIAN SCARLET EGGPLANT (*Solanum aethiopicum* L.) FOR SOME MORPHOLOGICAL TRAITS

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ABSTRACT

Scarlet eggplant (*Solanum aethiopicum* L.) is an economically important annual crop commonly grown in Northern and Southern parts of Nigeria. The study was carried out to evaluate the phenotypic variations among six selected *S. aethiopicum* accessions. Seeds of six accessions of *S. aethiopicum* were obtained from National Agency for Conservation of Genetic Resource and Biotechnology (NACGRAB), Ibadan. The seeds were sown in nursery trays and then the seedlings transplanted into 12 litre plastic planting pots. The pots were arranged in a Randomized Complete Block Design (RCBD) with five replicates. Significant variations were observed in plant height, number of leaves per plant, number of branches per plant and petiole length at ($P < 0.05$); the Pearson's linear correlation co-efficient among these parameters indicated that branches of plant is significantly ($P < 0.01$) correlated with length of petiole and number of leaves per plant. The highest plant height at maturity (60.50cm) was found in NHGB/09/128, the value was significantly the same ($P > 0.05$) with NHGB/09/138 but significantly ($P < 0.05$) different from all the other accessions. The variations observed in terms of the morphological parameters of the garden eggs can be attributed to both environmental and genetic factors of the selected accessions. Length of petiole was significantly negatively correlated with both number of branches (-0.65) and number of leaves per plant (-0.51). Similarly, number of branches per plant was highly significantly correlated with number of leaves per plant (-0.79). The genotypic variances were consistently higher than the environmental variances for all the traits; indicating that the genetic influence had a larger role to play in the phenotypic variances. GCV was highest (99.2) for number of branches per plant, this was followed by length of petiole (70.83), the least (16.87) was found in number of days to flowering. The broad sense heritability was high for all the parameters estimated. This is an indication that such characters are heritable and can be selected for improvement of the crop. It is therefore concluded that variation was established among the accessions of *S. aethiopicum*. This variations could serve as base-line information for any programme geared towards improvement of the crop in Nigeria.

Keywords: Accessions, Phenotypic Variation, Correlation, Characterisations

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INTRODUCTION

The term "scarlet eggplant" (*Solanum aethiopicum* L., n = 12) describes the four cultivar groups of *S. aethiopicum* i.e. Gilo, Kumba, Shum in Africa and South America, where they can be utilized as source of fruits (Gilo group) and edible leaves (Shum group), (Sunseri *et al.*, 2010). It is believed to have originated from Africa and have been domesticated from the wild relative *S. anguivi* Lam (Kubie, 2013). The plant belong to the family

Solanaceae and the plant genus *Solanum* with over 1,000 species worldwide. Other common names of *S. aethiopicum* include bitter tomato, Ethiopian eggplant, or nakati. it is also known as Ethiopian nightshade (USDA, 2015). It is a shrub to perennial or annual herb, up to 200 cm tall, often much-branched; root system extending both vertically and laterally; branches and leaves with or without prickles and stellate hairs (PROTA, 2015). Leaves are alternate, simple; stipules absent; petiole up to 11 cm long; blade broadly ovate, (6–)12–30 cm × (4–)7–21 cm, obtuse or cordate at base, acute to obtuse at apex, slightly to deeply lobed at margin, pinnately veined; upper leaves smaller, narrower, less lobed and often sub-opposite (PROTA, 2015).

It is represented in Nigeria by about 25 species including those domesticated; with their leaves, fruits, or both eaten as vegetables of used in traditional medicine (Manoko and Van der Weerden, 2004; Bonsu *et al.*, 2008.). They are called Gauta in Hausa, Afufa or Anara in Igbo and Igba in Yoruba. They are highly valued constituents of the Nigerian foods and indigenous medicines that are either eaten raw or cooked, very popular in mixed and rich dishes such as stew and soup (Edem *et al.*, 2009), especially in the Southern and Western parts of Nigeria, although they are highly cultivated in the North (Chinedu *et al.*, 2011). Garden eggs also vary in fruit colour, shape and sizes (Akanitapichat *et al.*, 2010, Chinedu *et al.*, 2011). Egg plants have indigenous medicinal uses which ranges from weight reduction to treatment of several ailments including asthma, skin infections and constipation. Various plant parts are used in decoction for curing ailments such as diabetes, leprosy, gonorrhea, cholera, bronchitis, dysuria, dysentery, asthenia and heamorrhoids (Gill, 1992; Bello *et al.*, 2005). Generally, the genus are morphologically varied, numerically diverse and vastly ecologically distributed.

Despite the numerous importance in the domesticated garden egg, different advantageous traits have not been studied extensively by breeders for the improvement of the crop in Nigeria. Information on the genetic variability and diversity of the crop is scanty and those available are not reliable. The success of any program geared towards improving any crop plant depends on the genetic variability, genetic advance and characters associated with the plant height, number of leaf per plant, number of branches per plant and other morphometric parameters; these information are lacking on this particular crop in Nigeria. Consequently, the need to detect the genetic variability that exist in this plant has been severally stressed by many researchers as this will enhance the success of the plant economic potentials. Genetic variability describes the variation within genetic characteristics (Rao and Hodgkin, 2002). Studies on genetic variability using agro-morphological characteristics in many crop species, even among the family *Solanaceae*, have been reported. Seed conservation has vital role in preservation of genetic variability as it is simple to handle, cost-effective and capable of maintaining genetic stability over long periods of time. Islam and Uddin (2009), successfully characterized sixteen genotypes of local and exotic germplasms of eggplant and suggested that variations was also detected among thirty five diverse genotypes of eggplant while using agro-morphological parameters (Chattopadhyay *et al.*, 2011). Ihtizaz *et al.* (2015), also successfully determined the genetic variability in Pakistani eggplant using different agro-morphological traits.

Morphological parameters were helpful in assessing similarities or differences among *Solanum* accessions (Furini and Wunder, 2004). This work is aimed at evaluating some morphological variations among six genotypes of Nigerian scarlet eggplant (*Solanum aethiopicum* L.)

MATERIALS AND METHODS

The present investigation was carried out at the experimental garden of Department of Biological Sciences, Federal University of Technology, Minna, during the 2015 cropping season. Six accessions of Scarlet eggplant were obtained from National Agencies for Conservation of Genetic Resources and Biotechnology (NACGRAB), Ibadan, Nigeria and also from Biological Garden of Federal University of Technology, Minna. The seeds were sown in nursery trays and latter transplanted twenty one days after seedling emergence. The seedlings were transplanted into 12 litre plastic planting buckets. The buckets were arranged in a Randomized Complete Block Design (RCBD) with five replicates, making 30 plastic buckets altogether. The trait list was selected from The Descriptors for Characterization and Evaluation in Plant Genetic Resources (Ihtizaz *et al.*, 2015). Parameters selected include plant height (cm), number of branches per plant, length of petiole (cm) and number of leaves per plant. These parameters were taken at two week intervals after transplanting until maturity.

Data Analysis

Data collected were pooled for analysis, quantitative data was subjected to descriptive statistics. Analysis of variance (ANOVA) was used to determine the level of significant; Least Significant Difference (LSD) was used to separate the means. All data were considered significant at $P = 0.05$. Pearson's linear correlation was used to determine the relationship among the quantitative data, correlation coefficients were considered significant at $P<0.01$ (highly significant) and $P<0.05$ (significant). For the estimates of genetic parameters, genotypic variation (GV), phenotypic variation (PV), broad sense heritability (h^2), genotypic coefficient of variation (GCV), phenotypic coefficient of variation (PCV) and Genetic Advance (GA), following the method of Falconer and Mackay (1996).

RESULTS AND DISCUSSION

Descriptive statistics of *S. aethiopicum* accessions showed variability in all the quantitative traits evaluated (Table 1 and 2). Consistent variation was obtained in plant height, number of leaves per plant, number of branches per plant, and length of petiole throughout the experiment periods. Similar results on variation in quantitative traits have been reported by Hazra *et al.* (2003); Ihtiza *et al.* (2015). This variation is an indication that the accessions are genetically heterogeneous and might possess superior genes that can be exploited for the improvement of the crop in Nigeria. The range of value of plant height (23.27-60.50 cm) at flowering (i.e. week 8) is within the range of value obtained (48.3-108.2 cm) by Hurtado *et al.* (2012) in eggplant and those obtained by Kubei (2013), i.e. 12.2- 57.5 cm in scarlet eggplant. Thus, these accessions may be said to range from short to moderately tall plant; similar assertion has been made by Boyaci *et al.*, (2015). These similarities might be due to certain genetic factors not influenced by any environmental factor. However the range of values for the number of leaves per plant at flowering (33.33-319) is at variance with that of Kubei (2013). This variation might be due to different soil conditions and even different planting periods.

The results obtained in terms of trait association displayed significant results for some of the quantitative traits (Table 3). Length of petiole was significantly negatively correlated with both number of branches (-0.65) and number of leaves per plant (-0.51). Similarly, number of branches per plant was highly significantly correlated with number of leaves per plant (-0.79). This implies that increase in one parameter will lead to decrease in the other. Although, plant height exhibited positive correlation with all the other traits, the coefficient of correlation was not significant. Ihtizaz *et al.* (2015), had earlier reported positive correlation between plant height and eggplant and some leaf traits. Similar result was also obtained by Kubie (2013) in Scarlet eggplant. The significant correlation between number of leaves per plant and number of branches per plant is in accordance with that of Kubie (2013). However, the negative linear correlation obtained is dissimilar from the work. It should be noted that if negative correlation exists, then selection pressure for either of the traits will lead to positive gains in that trait but negative gain in the other.

Genotypic Variance (GV), Phenotypic Variance (PV), Environmental Variance (EV), Broad Sense Heritability (h^2), Genotypic Coefficient of Variation (GCV), Phenotypic Coefficient of Variation (PCV) and Genetic Advance (GA) for six traits of *S. aethiopicum* accessions are presented in Table 4. The results showed a considerable phenotypic and genotypic variances among the various accessions for all the characters under consideration. The genotypic variances are consistently higher than the environmental variances for all the traits; indicating that the genetic influence had a larger role to play in the phenotypic variances, thus, there is genetic variability to enhance breeding. GCV was highest (99.2) for number of branches per plant, this was followed by length of petiole (70.83), the least (16.87) was found in number of days to flowering. The genotypic variability is dependent upon GCV which was high for plant height, number of leaves per plant (Table 4). The broad sense heritability was high for all the parameters estimated. This is an indication that such characters are heritable and can be selected for improvement of the crop. All traits examined in this study showed a wide range of genetic variability among the evaluated accessions (Vijay and Manohar, 1990). The variations obtained among GCV for all the traits indicated that GA for selection of a trait depend on genetic variability of such trait (Elsadig *et al.*, 2013). High values of GA in some of the traits are indications of fixable (additive) gene traits. Similar conclusion has been drawn by Mostofa *et al.* (2002). The estimates of GV being smaller than PV but higher than their corresponding EV is in line with that of Raffi and Nath (2004) on *Phaseolus vulgaris*.

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Table 1: Variation in Plant height and Number of Branches of the selected *S. aethiopicum* accessions

Accession Numbers	Plant Height			Number of Branches/Plant		
	Week 4	Week 6	Week 8	Week 4	Week 6	Week 8
NG/AO/06/12/193	5.73±0.43^{a}	13.03±1.86^{a}	23.27±2.54^{a}	1.33±1.33^{a}	1.33±1.33^{a}	1.33±1.33
NHGB/09/100	11.80±0.23^{c}	45.00±1.73^{d}	48.00±1.15^{c}	2.33±0.33^{ab}	3.67±0.58^{a}	4.33±0.58
NHGB/09/128	16.97±4.07^{d}	47.00±1.15^{d}	60.50±3.18^{d}	1.33±1.33^{a}	4.67±0.00^{b}	6.00±0.58
NHGB/09/132	16.67±2.03^{d}	36.43±2.83^{c}	38.90±3.09^{b}	8.67±0.33^{c}	20.00±1.53^{d}	26.00±2.08
NHGB/09/138	21.20±0.00^{e}	43.00±0.58^{d}	60.00±1.15^{d}	1.33±1.33^{a}	1.67±1.67^{a}	2.33±2.33
MN/S/02/2015	8.63±0.71^{b}	28.00±2.65^{b}	37.50±0.29^{b}	6.00±0.00^{bc}	1 15.00±2.89^{c}	18.67±3.48

Values are Means ± S.E, Values with the same superscript on the same column shows no significant different at P>0.05 tested by LSD

Table 2: Mean Variation in the Number of Leaves and Length of Petiole of the selected *S. aethiopicum* accessions

Accession Numbers	Number of Leaves/Plant			Length of Petiole (cm)		
	Week 4	Week 6	Week 8	Week 4	Week 6	Week 8
NG/AO/06/12/193	20.00±2.89^{a}	29.33±2.60^{a}	33.33±2.73^{a}	4.00±0.58^{d}	5.33±0.67^{d}	7.20±0.[illegible]
NHGB/09/100	96.33±25.39^{c}	120.67±10.81^{c}	148.67±24.78^{d}	2.50±0.83^{bc}	3.80±1.27^{bc}	4.00±1.[illegible]
NHGB/09/128	42.00±9.81^{b}	55.00±10.53^{b}	81.00±6.35^{c}	3.00±1.15^{cd}	4.60±1.53^{cd}	5.23±1.[illegible]
NHGB/09/132	116.67±8.33^{d}	221.33±21.40^{d}	319.67±95.53^{e}	2.20±0.06^{ab}	2.57±0.58^{a}	2.93±0.[illegible]
NHGB/09/138	37.33±12.33^{ab}	60.67±19.67^{b}	69.00±21.67^{b}	3.50±1.17^{cd}	5.60±1.87^{d}	6.00±2.[illegible]
MN/S/02/2015	37.00±4.62^{ab}	62.67±16.74^{b}	142.67±18.7^{d}	1.10±0.37^{a}	3.20±1.07^{ab}	3.50±1.[illegible]

Values are Means ± S.E, Values with the same superscript on the same column shows no significant different at P>0.05 tested by LSD

Table 3: Pearson's Linear Correlation coefficient of some parameters of the selected *S. aethiopicum* accessions

	Plant height (cm)	Length of Petiole (cm)	Number of Branches	Number Leaves/Plant
Plant height (cm)	1			
Length of Petiole (cm)	0.05	1		
Number of Branches	0.22	-0.65*	1	
Number of Leaves/Plant	0.15	-0.51*	0.79**	1

**Correlation is significant at the 0.01 level (2 tailed); *Correlation is significant at the 0.05 level (2 tailed)

Table 4 Genetic parameter estimates of the selected *S. aethiopicum* accessions

Morphological Parameters	Means	Genotypic Variance	Phenotypic Variance	Environmental Variance	Broad sense heritability (h²) %	Genotypic Coefficient of Variation	Phenotypic Co-efficient of Variation	Genetic Advance
Plant Height (cm)	44.70	203.10	217.50	14.40	93	31.89	33.00	63.47
Number of Branches/plant	9.78	93.93	119.82	25.89	78	99.12	111.95	180.79
Length of Petiole (cm)	4.81	2.34	3.25	0.91	72	31.77	37.47	55.48
Number of Leaves	132.33	8786.84	13568.57	4781.72	65	70.83	88.02	117.43
Number of days to bud	22.44	18.70	20.70	2	90	19.27	20.27	37.72
Number of days to floweri	28.67	23.40	26.40	3	89	16.87	17.92	32.73

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