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Agro-Morphological Characteristics of Sesame (*Sesamum indicum L.*) from the Different States of Nigeria

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Abstract: Sesame (*Sesamum indicum L.*) is an essential oil seed plant widely cultivated in the Central and Northern parts of Nigeria. Morphological characteristics and physical dimensions of fifty-nine accessions from Benue, Kogi, Gombe, Nassarawa, Niger, Kano, Jigawa States, Abuja and Sudan, were studied. Number of days to emergence ranged between 4.6±0.01 and 5.6±0.01 with significant difference (1%). Plant height at four weeks indicated that accessions from Niger State had the lowest value of 11.49±0.13cm, while accessions from Abuja had the highest value of 17.63±0.12cm. Micrometer screw gauge was used to estimate the seed length, width and thickness, while the 1000-seed weight was measured using analytical weighing balance. Sphericity was estimated using standard mathematical procedures. Positive and non-significant correlation exist between seed length, seed thickness (r= 0.40) and plant height (r= 0.40). Positive and significant correlation occurred between seed sphericity (r= 0.90) with 1000-Seed weight (r= 0.73). Negative and non-significant correlation was recorded between seed width (r= -0.58) and days to emergence (r= -0.39). The 1000-seed weight varied between 2.67±0.02mm and 7.49±0.04mm, seed sphericity ranged from 0.98mm to 7.05mm, seed thickness varied between 0.88mm and 2.43mm. Seed width ranged between 1.7mm and 3.4mm and seed length varied between 2.6mm and 3.74mm.

Key words: Agro-Morphological · Sesame (*Sesamum Indicum L*) · Nigeria

INTRODUCTION

The plant called benniseed in Nigeria is an early crop known by mankind [1]. In Asian countries, sesame has been under cultivation for more than 5000 years [2]. It is cultivated in the humid areas as essential oilseed crop [3] on 6.5 million hectares globally, generating over 3 million tons of seeds [4]. Sesame is widely grown in the northern and central parts of Nigeria as a good source of quality oil, rich in carbohydrate, calcium, phosphorus and proteins [5]. As far back as 1950 commercial production of sesame seeds have been reported in America [6] with Nigeria as a major producer contributing meaningfully to the worldwide sesame export market [7]. The seed of sesame has stayed unaffected [8] which showed significant disparity in the magnitude of seeds. Kumor *et al*. [9] found that superior seedling reserve may occur due to larger seeds leading to good seedling vigor, robust stand formation and in the end more stable yield on farmer's field. Physical and engineering properties of plant seeds are crucial in analyzing the manners of the product during agriculture process operations such as sorting. Moreover, works on the physical possessions of sesame have been occasional and such studies were on few varieties which make it difficult for wide application of the outcomes.

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Thus, this study was undertaken to identify variability amongst the Sesame accessions collected from seven states, federal capital territory Abuja in Nigeria and Sudan. This investigation was borne out of the pressing need to maximize the yield of this oil seed crop, to generate a sustained data about the sesame plants in Nigeria and as well as getting a genuine information on the important physical and agro-morphological traits thereby supporting breeding programme for seed development.

MATERIALS AND METHODS

Plant Material: Fifty-nine (59) different sesame accessions, local varieties, breeding lines and experimental lines were collected from Benue, Kogi, Gombe, Nassarawa, Niger, Jigawa, Kano States, Abuja and Sudan. The study area was situated between Latitude 06°4'N and Longitude 08°5'E. The research was conducted in a Randomized Complete Block Design (RCBD) at the school demonstration farm to investigate the morphological attributes.

The land was cleared in June, 2018 planting was done with a depth of 2.5cm [10] and spacing of 60cm was maintained before and after planting. Thinning commenced three weeks after planting to give an inter-row and intra-row spacing of 60cm x 60cm in order to maintain an appropriate plant population density for good growth, yield and development of the sesame plant.

Collection of Data and Analysis: The data were collected from the experimental site and analyzed and the mean of the number of days to the emergence and plant height at 4 weeks after planting (cm) were calculated based on their various states. The seed physical dimensions of the sesame accessions were assessed at the Department of Biology, Microbiology and Biotechnology laboratory of the university. The seeds of the fifty-nine (59) sesame accessions were counted into 1000-seeds per accession and the weight (Grams) were measured using analytical weighing balance [11]. A micrometer screw gauge was used to measure the seed length (SL), seed width (SW) and seed thickness (ST) with a reading accuracy within 0.01mm.

Three (3) seeds from each accession were used for linear dimensional measurements and the mean of data obtained from each accession were recorded. The seed sphericity, Φ (The spherical extent of the seed) was determined by the relation, sphericity, Φ = Length × Thickness/ Length square. Thus, $\Phi = LT/L^2$.

Statistical Analysis: Data collected were subjected for analysis using Microsoft Excel office 2007 to determine the effect of the sesame accessions, highest and lowest means of the treatment from different states and those from outside the country. Two-dimensional scatter plot was performed using Microsoft Excel office 2007. This was used to classify the sesame accessions, with respect to their varying days to emergence, the plant height of treatments, seed lengths, widths, thickness, 1000-seeds weight and sphericity. Their correlation was determined using the CORREL function and test for significance at 5% probability level was calculated using the correlation value between the plant height and the number of days to emergence.

RESULTS AND DISCUSSION

There was a high significant difference among the sesame accessions on the number of days of seedling sprouting. The results shown in Figure 1 indicated that sesame accessions from Niger State breeding lines had the least total mean of 4.6±0.11 in terms of seedling emergence, while the accessions from Sudan breeding lines had the highest mean of 5.6±0.14 emergences.

There was also a high difference between accessions on height of plant at four weeks after germination. The total mean of the plant height at four weeks after sprouting indicated that accessions from Niger State had the lowest mean value of 11.49±0.13cm while, the accessions from Abuja had the highest mean value of 17.63±0.12cm and the total mean value of other accessions varied significantly. The values recorded for the height of sesame were less compared to the value 54cm-84cm obtained by Batiseba *et al.* [12] by assessing the genetic diversity in wheat using agro-morphological traits and association between them.

The total mean values of the seed physical dimensions are shown in figure 1 below. Therefore, seeds of the fifty-nine genotypes from various states varied significantly in all the physical dimensions. The mean of 1000-Seed weight of the genotypes varied between 2.67±0.02mm and 7.49±0.04mm with Kogi having the least and Jigawa had the highest value. The findings are in agreement with the result obtained on the combined effect of nitrogen and micronutrient for yield and yield contributing characterization of sesame (*Sesamum indicum*) by Shirazy *et al*. [13]. Seed sphericity ranged from 0.98mm to 7.05mm with Kano showing the heaviest value and Jigawa the lowest. Seed thickness varied between 0.88mm and 2.43mm with Nassarawa being the highest and Gombe indicated the lightest value.

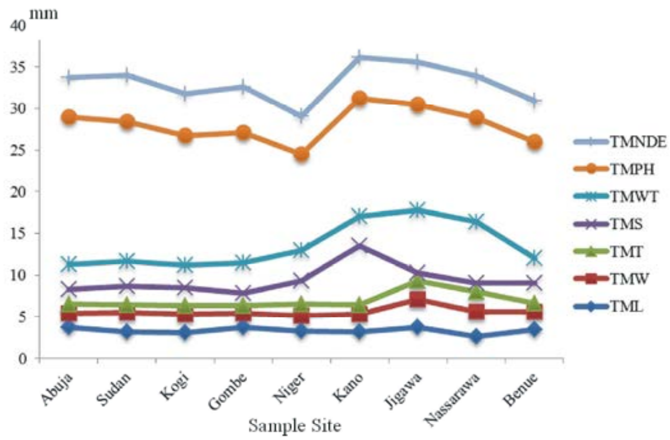

Fig. 1: Comparison of days of emergence, plant height and seed physical dimension among sesame from different states.

Table 1: Correlation table among all the agro-morphological characteristics of the sesame accessions.

	TML	TMW	TMT	TMS	TMWT	TMPH	TMNDE
TML	0						
TMW	-0.58	0					
TMT	0.40	0.01	0				
TMS	0.08	0.41	0.90	0			
TMWT	0.73	-0.25	0.13	-0.01	0		
TMPH	0.40	0.10	0.11	0.14	0.37	0	
TMNDE	-0.35	0.47	-0.39	-0.22	0.04	-0.22	0

TML= Total Mean of seed Length.
TMW= Total Mean of seed Width.
TMT= Total Mean of seed Thickness.
TMS= Total Mean of seed Sphericity.
TMWT= Total Mean of 1000-seed Weight.
TMPH= Total Mean of Plant Height.
TMNDE= Total Mean of Number of Days of Emergence

The seed width ranged between 1.7mm and 3.4mm with Jigawa recording the greatest value and Abuja had the least value. Seed length varied between 2.6mm and 3.74mm with Abuja and Gombe having the highest value and Nassarawa had the least.

Seed length showed positive correlation with thickness, 1000-Seed weight, sphericity and plant height but insignificant ($p>0.01$). Furthermore, seed width recorded negative but not significant correlation with number of days to emergence. Seed length had positive and non-significant correlation with seed thickness ($r= 0.40$) and plant height ($r= 0.40$). Seed sphericity showed positive and significant correlation ($r= 0.90$) with 1000-Seed weight ($r= 0.73$). Negative and non-significant correlation was recorded between seed width ($r= -0.58$) and number of days to emergence ($r= -0.39$).

The variation observed in days to seedling germination and plant height (cm) was largely due to varietal differences among the sesame accessions studied. Similar variation in the height of sesame plant was recorded by Shirazy *et al.* [14] by growing sesame (*Sesamum indicum L.*) with combined nitrogen and micronutrients.

The results shown in Figure 1 indicated that the mean of the sesame accessions based on number of days to emergence ranged between 4.6±0.01 and 5.6±0.01 with significant difference (1%). Niger State breeding lines have the least mean in terms of seedling emergence, while the accessions from Sudan breeding lines have the highest mean and other accessions also varied and their significant difference was recorded. This result is in agreement with Weiss [15] who also reported variation in growth characteristics in sesame accessions and linked it to variation in seed size as accessions with large seed sizes normally have large cotyledons at seedling germination and tend to grow faster because they use less stored materials to emerge.

In designing grain handling machinery and determination of aperture size, physical seed dimensions parameters like thickness, length and width are important and enhances the size perforations selection for optimum performance of the cleaner as small or huge holes may either result in lesser or unclean efficiency of the machine [16].

The range of values obtained for sesame seed length ranged from 2.6mm to 3.74mm with Abuja and Gombe showing the highest value and Nassarawa had the least; for the seed width, it ranged between 1.7mm and 3.4mm with Jigawa indicating the highest value and Abuja had the lowest value and the seed thickness varied between 0.88mm and 2.43mm with Nassarawa being the highest and Gombe had the lightest value. The array of data obtained for these parameters falls within the values for millet [17] cumin seeds [18] and the native variety of sesame seeds [19].

The degree of sphericity ranged from 0.98mm to 7.05mm with Kano having the heaviest value and Jigawa the lowest which is more than the values obtained by Adebowale *et al.* [16], Tunde-Akintunde and Akintunde [19] and Tunde-Akintunde and Akintunde [20] for sesame. The 1000-seeds weight varied between 2.67mm and 7.49mm with Kogi showing the smallest and Jigawa had the biggest value. The differences detected may be linked to variations in the genotypic contextual of seeds of sesame investigated.

Positive-significant correlations occurring between seed sphericity and 1000-Seed weight showed that enhancement in one of these characteristics in sesame will definitely affect others and thus leads to rise in seed weight and shape. Furthermore, seed length, seed thickness and plant height showed positive and non-significant correlation and these will also lead to an increase in seed size. In this work, seed sphericity and 1000-Seed weight, seed length, seed thickness and plant height were loaded positive signs and exhibited high correlations. This result is in agreement with Biabani and Pakniyat [21] on sesame who further suggested that traits with positive loading and high correlation might be influenced with the sesame genes. Also, the range of values for seed length (2.6-3.7mm), seed width (1.7-3.4mm) and seed thickness (0.88-2.43mm) recorded in this work were in line with the values (3.02-3.07mm), (1.84-1.94mm), (0.72-0.77mm) found in white sesame seeds by Hosain [22] and less than values (6-10mm, 4-7mm, 3-5mm) obtained in Cowpea seeds by Henshaw [23] respectively.

This study showed that sesame had a broad morphological base that should be considered when planning conservation strategies or when sesame variability is used in breeding programs.

CONCLUSION

The results of this study has shown extensive agro-morphological characteristics among sesame accessions which can be exploited by crop breeders towards the improvement of the crop. Selection based on number of days to emergence, plant height, seed sphericity, thickness, width, length and 1000-seed weight may be very effective for appropriate sesame genotype screening for large seed size. A suitable approach on this crop will go a long way in solving most of the nutritionally related ailments suffered by people in developing countries like Nigeria.

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