ASSESSMENT OF SOME GENETIC DIVERSITY OF SOME COTTON CULTIVARS IN MINNA NIGER STATE, NIGERIA

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Abstract

Cotton (Gossypium sp.) is an important cash crop of the family Malvaceae which produces lint and seed that serve as food and raw materials for textile and seed crushing industries. Despite, the economic importance of this crop to human livelihood,ts total production remains far below the nationalrequirements for textile and oil mills due to obstacle posed by poor seed quality and germination.Pollen quality and pollination play a fundamental role in fertilization and seed sets. Therefore, study on pollen parameter is essential for understanding fertility of this crop and its improvement. A total of six accessions of cotton(SAMCOT 8, 9, 10, 11, 12, and 13 were evaluated for morphological parameters on the field and their pollen studies were carried out in the laboratory at maturity. The accessions were evaluated for plant height, number of branches, days to bract square and boll formations, pollen viability and size (both intine and exine). The results of the morphological parameters showed significant variations in plant height with SAMCOT 008 having the highest plant (49.75cm) and SAMCOT 010 had the least (26.75cm) at the end of the study period. In terms of earliness to maturity SAMCOT 008 matured earliest, with 37 days and 55 days for bract square and boll formation, while SAMCOT 013 had the least maturity status of 56 days and 77 days for both bract square and Boll formation. Significant variations were recorded in the pollen parameters with highest percentage viability recorded in SAMCOT 009 (94.25%) and the lowest in SAMCOT 008 77.78%. Variation in the pollen size (both intine and exine) among taccessions was recorded, with the lowest intine (20.50µm) and exine (27.00µm) in SAMCOT 011. The highest pollen intine was recorded in both SAMCOT 010 &SAMCOT 012 (25.50µm) and exine (33.00) in SAMCOT 008. The highest pollen size, plant height coupled with least days for bract square and boll formation might indicate the presence of genes for earliness in the accessions which is a good trait for selection and improvement in breeding programs.

Keywords: cotton,accessions,variations,pollination

INTRODUCTION

Background to the study

Cotton (*Gossypium* sp.) is a soft staple fiber belonging to the family *Malvaceae* It is one of the most important and earliest domesticated plants in the world. Among the different domesticated species, *G. arboreum.,G. herbaceum.,G.hirsutum* and *G. barbadense* are the most common. Cotton plant is a native to tropical and subtropical regions around the world, including, Africa, America and India (Wendel and Cronn, 2003; Rahman, *et al.*,2012). The greatest diversity of wild cotton species is found in Mexico, followed by Australia and Africa (Cotton Australia, 2016).

It is an important cash crop in Nigeria which produces lint and seed that serve as food and raw materials for the local textiles and seed crushing industries (Adeniji, 2011). The seeds are about 15% of the value of the crop and are pressed to produce edible oil for human consumption and cotton seed cake for feeding of ruminant animals due to its high protein content. The fiber is pure cellulosic material with unique structure from which paper is made (Adeniji, 2007; Hornyak *et al.*, 2008). Cotton fibers are grown commercially for the seed coat to form a boll of cotton lint.The seed in the "boll", is surrounded by fibers of two types, commercially produced by a process called ginning. At the first ginning, the longer fibers, called staples, are removed and these are twisted together to form yarn for making thread and weaving into high quality textiles. At the second ginning, the shorter fibers, called "Inters", are removed, and these are woven into lower quality textiles (which include the eponymous lint). Commercial species of cotton plant are *G. hirsutum* (>90% of world production), *G. barbadense* (30-45%), *G. arboretum* and *G. herbaceum* (together 2%). Many varieties of cotton have been developed

by selective breeding and hybridization of these species.

Cotton was the fifth most important export source of foreign exchange in Nigeria before now, unfortunately, its total production remains far below the national requirements for consumption and industries. This is as a result of low average yield of the crop on the field below its genetic yield potentials (Ogunlela, 2004).Pollen and pollination have been reported to play a fundamental role in fertilization and consequently seed and fruit sets in spermatophytes (Asma, 2008), Deficiency in pollen production and performance could have direct effects on seed formation, seed viability, seed germinability and fruit production (Raji *et al.*, 2012).Therefore, High pollen quantity and quality profile are central to viable seed formation and propagation in seed plants. However, there are limited studies on the pollen parameter of indigenous cotton species in Nigeria. Therefore, this study was carried out to investigate morphological and some pollen parameters in selected accessions of *Gossypium* sp.

MATERIALS AND METHODS

Study area

The study was carried both on the field (Garden) and laboratory of the Department of Biological Sciences, Federal University of Technology, Minna, Niger State.

Sample Collection

Cotton seed accessions used for the study were collected from institute of Agricultural Research, Ahmadu Bello University Zaria. The accessions were SAMCOT 8, 9, 10, 11, 12, and 13. The samples were packed in a brown envelope and labeled properly as reported by Daudu *et al.*(2015).

Experimental Design and Planting of Seeds

The seeds were sown in twenty-eight (28) plastic buckets of 20 litres each, filled with rich sandy-loamy soil and arranged in Randomized complete Block Design (RCBD).Four plastic buckets were allocated to each accession.

A total of six seeds of each accession were planted per pot at a depth of 2-3 inches below the soil surface. After two weeks of seed emergence, the less vigorous ones were thinned out and two plants were left per bucket. The plants were monitored for morphological and phenotypic variables at budding, flowering and fruiting stages and using standard procedures as described by Akinyele and Osekita (2006); and Falus *al.*(2014).

Parameters investigated and recorded include plant height: the distance from ground level up to the terminal bud on main axis of the plant in (cm), Number of branches per plant (both monopodial and sympodial branches), stem, leaf, flower colors, stem hairiness, days to bract square formation and days to boll formation. Pollen grain viability test was carried out and the pollen size was measured using ocular graticle as described by Abubakar *et al.* (2015).

Pollen Viability and Size

Mature flowers from each accession were harvested on the field and taken to the laboratory for microscopic analysis of the pollen grain. Pollen grains were picked from the anther of each flower using a pair of forceps and dusted on a glass slide. The pollen grains were then mixed with 1ml of water and two (2) drops of Lecto-phenol blue stain were added. The slide was then mounted on a microscope and viewed at X40 magnification. The deeply stained and rounded pollen were taken as viable and fairly, non-stained and distorted shape pollen as non-viable.

Diameters of 30 randomly selected pollens were measured for both intine and exine using the eye piece graticle and recorded in micrometre (µm) (Abubakar *et al.*, 2015).

Result and Discussion

The result from the analysis of variance showed significant difference at ($P \leq 0.05$) among all the accessions for all the traits examined. The plant height for all the weeks of study showed great variations in the morphological appearance of the crop. SAMCOT 010 had the least plant height of 21.10cm at week 4, and SAMCOT 008 (49.75cm) had the highest. Though there was no significant differences at ($P \geq 0.05$)in the plant height among SAMCOT 009 (31.00cm), SAMCOT 011 (31.25cm), and SAMCOT 013 (35.70cm). The morphological differences in plant height is in agreement with the findings of Mahmood *et al.* (2006) and maharam . (2014). They observed significant differences among cotton cultivars for plant height with most rapid growth occurring before flowering.

From the, result there is an indication that the height does not necessarily translate to many branches as recorded in SAMCOT 008 which has few number (2.00) of branches with the highest plant height of (49.75). Similar to

this result, Basbag and Gencer (2007) reported few number of branches in some varieties of cotton plant. This low values in number of branches per plant might be an advantageous trait for earliness.Baloch *et al.* (2014) reported that low mean value of branches is an indication of earliness in cotton.

Significant differences in number of branches were recorded among all the genotypes. SAMCOT 010 had the highest mean value (5.00) from week four (4) to week (6) and SAMCOT 013 recorded the highest value (6.00) at the end of week 7. This highest value (6.00±1.00) was not significantly different from the values of SAMCOT 9, 10 and 12 (Table.1).The highest value recorded might be an indication of high yield since every branch carries a number of bolls

The formation of bract square is an indication that a cotton plant has attained a maturity age. In terms of earliness to maturity, SAMCOT 008 matured earliest, with 37 days and 55 days for bract square and boll formation, while SAMCOT 013 had the least maturity status of 56 days and 77 days for both bract square and boll formation from the date of crop emergence. This result is in agreement with the reports of Baloch *et al* (2014), Ahmad *et al.*(2012) and Jatoi e *tal.* (2012).

The results of pollen viability and size are presented in Table 2. The results indicated that there was significant variation ($p \geq 0.05$) in the pollen parameters of the cotton accessions. The highest percentage viability was recorded in SAMCOT 011 (93.48%) and the lowest was recorded in Samcot 008 with value of 77.98%. significant variation in the pollen size (both intine and exine) among the accessions was obtained, with the lowest intine (20.50µm) and exine (27.00µm) in SAMCOT 011. The highest pollen intine was recorded in SAMCOT 012 (25.50µm) and exine (33.00) in SAMCOT 008. However, there was no significant different in the values recorded in the intine for SAMCOT 009 (25.50), 10 (25.50) and 12 (25.50), and between the highest exine (33.00) in SAMCOT 008. The variation recorded in the intine and exine of the accessions could be due to aberration in microsporogenesis resulting from high degree of meiotic irregularity. This result is in agreement with the report of Abubakar *et al.* (2015) who recorded variation in the pollen size of *Celosia argentea.*

CONCLUSION

The present study revealed that SAMCOT 008 with least values for bract square formation and days to boll formation posses the genes for earliness and SAMCOT 013 with high number of branches and with the least days of bract square formation might posses the genes for high yield in Minna which is a trait for selection in the breeding programs.

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Table 1: Plant Height (cm) for the Cotton Accessions at 4th,5th,6th and 7th week after sowing.

Treatments	accession	Week 4	Week 5	Week 6	Week 7
Plant Height (cm)	SAMCOT 008	21.60±8.40^{b}	25.25±9.25^{b}	36.35±6.35^{bc}	49.75±3.13^{c}
	SAMCOT 009	22.1±8.10^{b}	28.00±2.00^{b}	31.00±2.10^{b}	35.50±2.05^{b}
	SAMCOT 010	21.10±2.10b	23.40±3.10^{b}	25.65±3.35^{ab}	26.75±1.26^{ab}
	SAMCOT 011	26.50±0.50^{d}	30.15±3.85^{bc}	31.25±4.25^{b}	32.10±1.08^{b}
	SAMCOT 012	24.25±1.25^{c}	42.00±1.50^{c}	42.75±1.25^{c}	43.65±6.20^{c}
	SAMCOT 013	24.90±0.10^{c}	33.00±3.00^{bc}	33.45±3.05^{b}	35.70±0.98^{b}
Number of Branches per plant	SAMCOT 008	2.00±0.01^{b}	2.00±1^{ab}	2.00±1^{a}	2.00±1^{a}
	SAMCOT 009	2.00±1.00^{b}	3.00±1^{b}	4.00±1^{b}	5.00±1^{c}
	SAMCOT 010	4.00±0^{d}	5.00±1	5.00±1^{c}	5.00±1^{bc}
	SAMCOT 011	4.00±0^{d}	2.00±1^{ab}	4.00±1^{b}	4.00±1^{b}
	SAMCOT 012	3.00±1^{c}	3.00±1^{b}	4.00±1^{b}	5.00±1^{bc}
	SAMCOT 013	3.00±0^{c}	4.00±1^{c}	4.00±1^{b}	6.00±1^{c}

Values are Mean ± Standard Error of mean. Values with the same superscript along the column are not significantly different from each other at P ≤ 0.05 according to DMRT.

Table 2: Percentage of pollen viability and non-viability of some cotton cultivars

Accessions	% Pollen viability	% Pollen non-viability	Intine(µm)	Exine(µm)
Sam cot 008	77.78±0.75^{a}	22.22±0.62^{cd}	24.25±2.64^{b}	33.00±1.43^{c}
Sam cot 009	94.25±0.42^{c}	5.75±0.64^{a}	25.25±0.69^{c}	30.50±0.62^{ab}
Sam cot 010	81.22±0.45^{b}	18.78±0.36^{c}	25.50±0.73^{c}	31.50±0.55^{b}
Sam cot 011	93.48±0.96^{c}	6.52±0.74^{a}	20.50±1.17^{a}	27.00±1.11^{a}
Sam cot 012	86.14±0.34^{b}	13.86±1.41^{bc}	25.50±1.17^{c}	31.50±1.19^{b}
Sam cot 013	90.16±1.26^{c}	9.84±0.43^{b}	24.50±0.82^{b}	30.50±0.73^{ab}

Values with the same superscript along the column are not significantly different from each other at $P \leq 0.05$ according to DMRT.

Table 3. Days to bracts square and boll formation

Accessions	Days to bracts square formation	Days to boll formation
SAM COT 8	37	55
SAM COT9	40	59
SAMCOT10	45	64
SAMCOT11	48	67
SAMCOT12	53	71
SAMCOT13	56	77

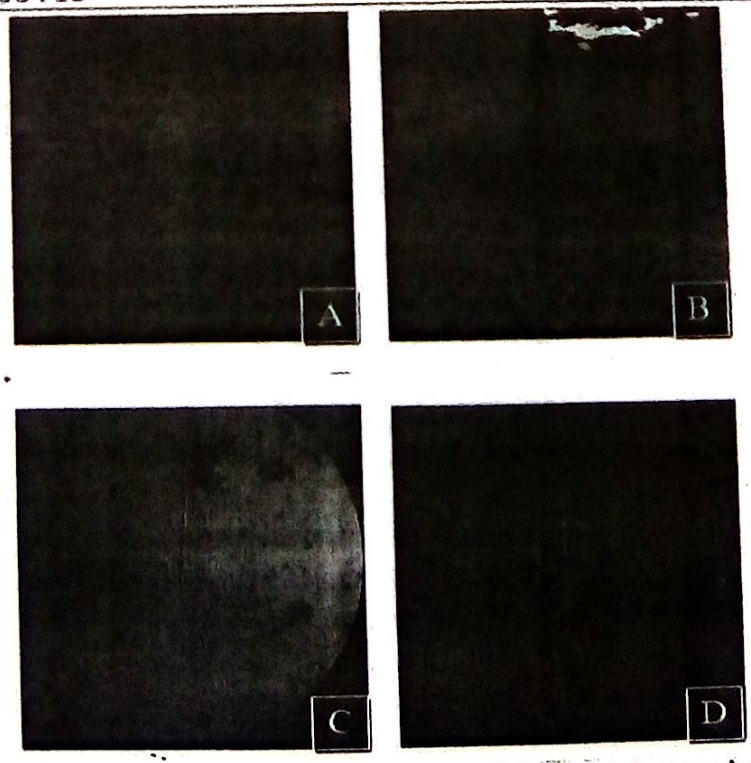

Figure 1: Phenotypic Features of Selected Cotton Accessions

A: bract square formation B: Ball formation
C: Fertile pollen and D: Pollen size