

Morphological Study of *Acacia senegal* (L.) Willd. from Borno and Yobe States, Nigeria

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Abstract— Morphological and Reproductive characters of *Acacia senegal* (L.) Willd. trees were assessed for variation. The morphological characters measured were: Tree Height (TH, m), Bark Thickness (BT, cm), Canopy Cover (CC, m) and Diameter at breast height (DBH, m). Pods and seeds parameters were measured as reproductive characters. These include: Pod length (PL, cm), Pod Width (PW, cm), Seed Diameter (SD, cm), Seed Thickness (ST, cm) and Seed Weight (SW, g). Gum yield (GY, g) was also assessed. The results show that morphological and reproductive characters observed differed significantly ($P \leq 0.05$) among the trees. Performance of trees from Yobe State is significantly higher than those from Borno for all the parameters measured which include; Tree Height (5.64m), Bark Thickness (0.53cm), Canopy Cover (7.01m), Diameter at breast height (8.210cm), Pod width (2.96cm), seed diameter (1.11cm), seed thickness (0.387cm) seed weight (24.10g) and gum yield (216.50g). The variation observed may provide bases for genetic improvement of this important multipurpose leguminous tree.

Index Terms— *Acacia senegal*, Morphology, Characters, Assessments, Borno, Yobe, Nigeria.

1 INTRODUCTION

Gum arabic *Acacia senegal* (L.) Willd. belongs to the genus *Acacia*, and it is a leguminous tree species, belonging to the Family Fabaceae, sub-family Mimosoideae, consisting of more than 300 species that produce gum in commercial quantity [3], [10]. This species with high quality gum production is naturally adapted to the hot, dry and barren region of Africa principally lying between 11° and 14° N latitudes, comprising of Chad, Niger, Nigeria and Sudan. Their distribution extends to Kenya, Zimbabwe and South Africa [4], [9]. In Nigeria, the gum species: *A. senegal*, *A. seyel*, and other dry land *Acacias* (*A. nilotica*, *A. radian* and *A. sieberiana*), grow wildly with other woody plants in the Sudan and Sahel Savannah regions with predominance in the North East region of Nigeria [14], [10]. The evidence from morphological and reproductive variability among *A. senegal*, demonstrate its adaptation and distribution in Africa. This is a probable indicator to its centre of origin and/or diversity as being Africa [14]. In Nigeria, *A. senegal* is found naturally growing predominantly as grooves in Borno and Yobe States of Nigeria. Other States where the trees are available include Adamawa, Bauchi, Gombe, Kano, Kaduna, Kebbi, Jigawa, Katsina, Sokoto, Zamfara [10]. Among the *Acacia* species, *A. senegal* produces the best grade commercial gum exudate. The latter serves as an important source of foreign exchange earnings due to its multifunctional utilization in industries such as pharmaceutical, beverage, confectionery and textile [2]. The pods are used for tannin, dyes and for their medicinal properties. It also serves as an important additive in adhesive

and cosmetic industries; perfume, carbon paper as well as typewriter ribbon. The gum is used by the industries mentioned above as an ingredient in either fixing flavors or foam stabilizer, emulsifier to prevent crystallization of sugars; binder in cough drops, syrups and coating for tablets. In addition, other avenues to be explore are in the area of commercial wood production as in the case of Malaysia [1]. The tree is used in shelter belt afforestation programs for desertification control. *A. senegal* presents considerable variation in the wild grove [7].

The aim of this study was therefore, to assess the morphological and reproductive characters as well as gum production of *Acacia senegal* trees from Borno and Yobe States.

2 MATERIALS AND METHODS

In 2008 - 2009, eighty *Acacia senegal* trees each from Borno and Yobe States were chosen for study by purposeful sampling as described by [13], [6]. A complete randomized block designed was used [8] using four blocks from the each States. Tree Height was measured using Avney level instrument, while Bark Thickness, Pod Length, Pod Width, Seed Diameter, Seed Thickness and Diameter at Breast Height (dbh) were measured by Venier caliper. Measuring tape was employed to assess the Canopy Cover. One hundred seed Weight was measured using metler 0.000g- 25kg sensitive weighing balance. Gum was harvested for a period of six months and was also measured by the aid of sensitive weighing balance. Data obtained were subjected to Analysis of Variance with mean separation using LSD [12].

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5 RESULTS AND DISCUSSIONS

Morphological and reproductive characters of trees assessed are given in Table 1 and 2, respectively. The result revealed significant difference ($P \leq 0.05$) between *A. senegal* from Borno and Yobe States with respect to morphological character (Tree height, bark thickness and canopy cover, gum yield and reproductive character). *A. senegal* trees from Yobe State recorded the highest mean tree height of 5.640m, while that of Borno was 4.776m. Mean Bark thickness of 0.533cm and Canopy cover of 7.010m were obtained from *A. senegal* for Yobe State as against 0.419cm and 5.580m for Borno State respectively. Mean gum production of 216.500g was obtained from Yobe State, while Borno had 171.600g. Among reproductive characters trees from Yobe had the highest pod width (2.960cm), seed diameter (1.018cm) and seed thickness (0.387cm). However, mean pod length of 9.350cm from Borno State was significantly higher than that of Yobe State with 8.841cm mean pod length value.

The variability observed may be due to genetic composition of the trees with each state having distinct features. This is in agreement with the report of [4], [11] who reported differentiation among genotype due to location. The morphological, reproductive and yield differences among the trees could be used to direct further research towards improvement of promising genotypes.

TABLE 2

MEAN REPRODUCTIVE CHARACTERS OF *Acacia senegal* FROM BORNO AND YOBE STATES, NIGERIA

Locations	Reproductive characters				
	GY (g) *	PL (cm) *	PW (cm) *	SD (cm) *	ST(cm) *
Borno	171.600	9.350	2.046	0.936	0.268
Yobe	216.500	8.841	2.960	1.018	0.387
Mean	194.050	9.096	2.903	0.977	0.328
LSD (0.05)	21.504	0.386	0.167	0.051	0.050

KEY: Y = Gum yield, PL = Pod length, PW = Pod weight, ST = Seed thickness, SW = Seed weight, LSD = Least significant difference, * = Significant difference

4 CONCLUSION

The trees of *Acacia senegal* L. (Willd.) from Borno and Yobe States significantly differed in their both morphological and reproductive characters. These variations are important for conservation and further improvement programmes. Further explorations and assessment might yield more important genotypes..

TABLE 1
MEAN MORPHOLOGICAL CHARACTERS OF *ACACIA SENEGAL* FROM BORNO AND YOBE STATES, NIGERIA

Locations	Morphological Characters			
	TH(m)*	BT (cm)*	CC(m)*	DBH (cm)
Borno	4.776	0.419	5.580	8.210
Yobe	5.640	0.533	7.010	8.610
Mean	5.208	0.476	6.230	8.440
LSD (0.05)	0.250	0.035	0.417	0.617

Key: TH = Tree height, BT = Bark thickness, CC = Canopy cover, DBH = Diameter at breast height, LSD = Least significant difference, * = Significant difference.

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REFERENCES

- [1] J. Ahlan, "Millwood Wastes. In: S. J Kenningam (eds.) Information paper, Proceedings of the Twelve Malaysia Forestry Conference Sarawak Forest Department-Kuching, 16(14).17pp, 1997.
- [2] J. M. K. Bell and A. D. Adamson, "The Market for Gum Arabic (Tropical Products Institute, London, 1974).
- [3] I. Ben, "Taxonomic and Ecological Characteristics of Acacia Gum trees. In: C. Ben and Casadei (eds.) Report of the International Symposium on Acacia Gum The Network for Natural Gums and Resins in Africa NGARA Kenya Forestry Research Institute publication, 54pp 2005.
- [4] B. N. Chikami, G. O.Philips and E. Casadei, "Characterization and Specification of Gum Arabic (Technical Cooperation Project, TCP/RAF, 4557pp, 1996).
- [5] C. J. Chiveu., D. G. Otto, M. E. Ogunyi, and F.N, Wachira, " Genetic Variation in Kenyan populations of *Acacia senegal* (L.) Willd revealed by combined RAPD and ISSR markers". *African Journal of Biotechnology*, 7(14), Pp 2333-340, 2008.
- [6] T. P. I. Ellen, "Sampling" (Agricultural Extension Service Publication Texas University, 1998).
- [7] F. N. M. Gachati, "Variation in *Acacia senegal* and its relationship to *A. curcummariginata* and *A. thomasi* in Kenya" M.Sc. Thesis, University of Reading, 1994.
- [8] I. Nasiru, A. M. Gani, S.D. Abdul and K.O.Omokhafa, " Performance

of Difference Seedlings Accessions of *Acacia senegal* (L.) Willd in Bauchi, Nigeria. International Journal of Scientific and Engineering Research. Volume 5, Issue 6, June 2014.

- [9] A. G. Kwanchai and A. A. Gomez, "Statistical procedures for Agricultural Research", 2nd Edition (Jonh wiley and sons, 660 pp, 1984.
- [10] K. O. Omokhafa, O. A., Emuedo, I. Nasiru, "Evaluation of influence of tapping incisions on gum yield of *Acacia senegal* L (Willd.) in Nigeria" *Journal of Sustainable Tropical Agricultural Research*, 23:36-39. 2007.
- [11] Omokhafa K.O. and J.K. Alike, "Clonal variation and correlation of seeds characters in *Hevea brasiliensis* Muel.Arg" *International Journal of Industrial Crops and Products*, 19:175-184, 2004.
- [12] D. F. Polit, "Data Analysis and Statistics for Nursing Research" (Appelon and Lange, Stamford. Conneticut, 1996.
- [13] M. Q. Patton, "Qualitative Evaluation and Research Methods" Second Edition SAGE Publications. Newbury Park, Carlifonia, 1990.
- [14] A. H. W. Weir, "Report of Gum Arabic in Borno province. Nigeria", pp.1-24, 1930.

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