

Genetic Divergence in Pod and Seed Traits of *Acacia nilotica* (L.)

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Abstract

The aim of the study was to determine seed sources variation in *Acacia nilotica*. Seed collected from twenty locations of Uttar Pradesh were subjected to variation analysis. A significant seed source variation was observed in seedling height, collar diameter, inter nodal length, seed germination and biomass data (fresh shoot weight, fresh root weight, dry shoot weight, dry root weight, shoot/root ratio, total biomass of seedling). The seed source of S₁₇ Pukhraya (U.P.) Twenty superior trees of *A. nilotica* were selected 20 different locations in Uttar Pradesh for the study of genetic divergence in pod and seed characters. The eight principal components (PCs) explained large portion (105.88%) of the total variation. The study revealed that the cluster IV comprised highest number of ten superior tree.

Keywords: Seeds, Genetic divergence, Cluster analysis, *Acacia nilotica*

INTRODUCTION

Acacia nilotica Linn. (Babul or Desi babul), is a medium sized, thorny, nearly evergreen tree that can reach up to 20-25 m height but may remain a shrub in poor growing conditions (Ecocrop, 2012; Orwa et al., 2009; Fagg et al., 2005). Belongs to family leguminosae. *Acacia nilotica* originated from Africa and the India subcontinent it is now commonly found or cultivated with in almost all tropical and subtropical areas of Africa, Asia, Australia (Brenan, 1983). *Acacia nilotica* is a multipurpose tree; it provides timber, fuel, food, shade, fodder, honey, dye, gum and fences. It also impacts on the environment through soil reclamation, soil enrichment, protection against fire and wind, and as a haven for biodiversity and ornament. It is widely used in ethno-medicine (Orwa et al., 2009; Cook et al., 2005; Fagg et al., 2005). The crown may be flattened or rounded. The leaves are 5-15 cm long.

Alternate and compound with 7 to 36 pairs of elliptical, 1.5-7 mm long 0.5-2 mm broad, grey-green hairy leafless. Their pods have a characteristic “neck lece” shape with constriction between the seeds.

The pioneer characteristics of *Acacia nilotica*, often on over grazed lands, result in an invasive propensity and the formation of thorny thickets (**Beniwal, R.S. 2011**), and it has become a major weed in Australia and java, indonesia (**Chauhan,K.C. and Kanwar, M.S. 2003**).

Acacia nilotica should not be introduced into humid and sub-humid areas, or into dry areas where there are adequate supplies of grazing and fuelwood. *Acacia nilotica* is a pioneer species that is relatively fast growing on arid sites. It is an important riverine tree in india, sudan and Senegal, where it is planted for timber described native range habitat types for several subspecies, tomentosa, adstringes and nilotica.

Acacia nilotica flowers at a relatively young age, around three to four old in ideal conditions, on current- season growth during the rainy season. Flowering is prolific, and can occur a number of times during the year, depending on the availability of soil moisture. Peak flowering appears to occur from October-December and peak fruiting around April-June. Fruiting peaks in January for subspecies, Indian flowers from June to September and sometimes in December/January, and the ripen from April to june. Seeds are dispersed by mammalian herbivorous. The gum or bark is used for cancers and / or tumors (or ear, eye or testicles) and Induration of liver and spleen, and excess flesh. Bark, gum, leaves and pods used medicinally.

Materials and Methods

The present study was conducted at college of Forestry, SHUATS Allahabad to estimate the genetic divergence in pod and seed characters of *Acacia nilotica* collected from different locations of Uttar Pradesh. Trees growing at one location were considered to be one population. Twenty different locations with 5 random trees from each location were selected as seed source. Superior tree and four comparison trees almost of similar size free from an insect-pest and diseases representing each stand were selected and morphological

observations were recorded both for comparison and superior trees. For taking observations on pod and seed character, 10pods /tree was collected randomly from different parts of the tree and average of 10 pods and 10 seeds measurement was recorded for pod and seed length, respectively. Out of these five, the best one was selected as superior Tree and marked + sign with yellow paint. Twenty superior Trees were marked and their pods were collected in month of January -May. The latitude and longitude with the help of GPS and other individual CPTs selected from 20 different locations. The pods were cleaned and stored in muslin relevant information of each selected Superior Tree are presented (Table 1).

More than 300 mature pods were collected from different parts of the crown of bags at ambient conditions. All lots were dried under similar temperature and humidity to reach constant weight. A total of three hundred healthy pods were counted and taken from each lot to make three replications containing 100 pods per replication. Ten pods were taken randomly from each replication for taking observations on pod. The average of 10 pods measurements was recorded for pod length, pod width and pod thickness and expressed in mm. Pod damage was calculated by counting the damaged pods containing in each replication and expressed in percentage.

Result & Discussion

Genetic diversity in plant species is a gift to mankind as it forms the basis for selection and further improvement. Genetic diversity analysis is an efficient method that facilitate the identification of superior germplasm, acceralates the collection, conservation, improvement of germplasm for breeding programmes and tree improvement. Information regarding genetic similarity measures can be used for selection of superior quality planting material for improvement or for use in tree hybridization program (Pavithra *et. al.*, 2010).

Persual of table 2 revealed that germination% (67.09), seedling height (41.87), fresh shoot weight(0.29), internodal length (2.73), dry shoot weight(0.20) and shoot/root weight(3.11) Recorded maximum mean value for cluster II whereas, maximum mean value of collar diameter (1.85), dry root weight (0.08) and seedling biomass (0.41) was observed in cluster V, V, IV, respectively, minimum mean value for germination% (58.09), seedling height (39.48), collar diameter (1.81), internodal length (2.47), fresh shoot weight(0.25), fresh root

weight(0.11), dry shoot weight(0.17), seedling biomass(0.39) for cluster III, VIII, II, V, whereas, minimum number of dry root weight (0.06) and shoot/root weight(2.12) was observed cluster I and VIII. The study revealed that the maximum mean value was recorded in cluster II 5 traits whereas, minimum mean value was observed in cluster VIII 6 traits. Cluster II comprising six superior trees is delineated from cluster II based on significantly high means for majority of pod and seed traits (table 5). Superior trees cluster IV can be directly selected and utilized for with in group hybridization for maximizing biomass of seedling. Difference between means of different cluster was significantly different. Wide diversity exists between the cluster: crosses between these clusters may result in substantial segregates and further selection for overall improvement of species.

Table1: Details of morphological observations and other relevant information for 20 Superior trees of *Acacia nilotica*

S. No.	Seed Sources	Altitude (m)	Range of Temp. °C	Latitude (°N)	Longitude (°E)	Rainfall (mm)
S ₁	FARRUKHABAD	167	35-45 °c	27°38'N	79 °59'E	896.2
S ₂	KANNAUJ	143	30-45 °c	27°05'N	79°91'E	868 mm
S ₃	ALLAHABAD	98 m	32-46 °c	25°45'N	81°84'E	1027 mm
S ₄	KANPUR(C.S.A.)	126 m	25-45 °c	26°49'N	80°30'E	820 mm
S ₅	RAWATPUR	126 m	25-45 °c	26°44'N	80°33'E	820 mm
S ₆	BARRA	128 m	25-45 °c	26°42'N	80°29'E	825 mm
S ₇	BAREILLY	268 m	21-45 °c	28°36'N	79°43'E	1093 mm
S ₈	SHUATS	98 m	20-45 °c	25°41'N	81°84'E	1100 mm
S ₉	GONDA	111 m	25-46 °c	27°03'N	81°95'E	1240 mm
S ₁₀	BANARAS	76 m	26-45 °c	25°31'N	82°97'E	998 mm
S ₁₁	LUCKNOW	121 m	24-45 °c	26°84'N	80°94'E	1001 mm
S ₁₂	DELHI	215 m	24-46 °c	28°70'N	77°10'E	693 mm
S ₁₃	FATEHPUR	124 m	25-44°c	25°85'N	80°89'E	1052 mm
S ₁₄	UNNAO	131 m	24-46 °c	26°53'N	80°48'E	850 mm

S ₁₅	MEERUT	226 m	24-46 °c	28°98'N	77°70'E	933 mm
S ₁₆	SITAPUR	141 m	25-45 °c	27°58'N	80°66'E	1193 mm
S ₁₇	PUKHRAYA	130 m	25-43 °c	26°22'N	79°83'E	1015 mm
S ₁₈	HARDOI	147 m	26-45 °c	27°29'N	79°83'E	1103 mm
S ₁₉	FAIZABAD	104 m	26-45 °c	26°77'N	82°14'E	1143 mm
S ₂₀	NURSURY	98 m	27-44 °c	25°41'N	81°84'E	1027 mm

Table 2: Mean value for various traits in different cluster refer twenty superior tree progeny of *Acacia nilotica*

Cluster	Germination %	Seedling height	Collar diameter	Internodal length	Fresh shoot weight	Fresh root weight	Dry shoot weight	Dry root weight	Seedling biomass
I	60.16	40.73	1.82	2.51	0.29	0.12	0.19	0.06	0.41
II	67.09	41.87	1.81	2.73	0.29	0.12	0.20	0.07	0.40
III	58.06	41.54	1.83	2.53	0.26	0.12	0.17	0.07	0.39
IV	67.07	40.35	1.82	2.48	0.28	0.13	0.18	0.07	0.41
V	64.26	41.16	1.85	2.57	0.26	0.11	0.18	0.08	0.38
VI	61.05	42.70	1.81	2.56	0.26	0.12	0.19	0.07	0.39
VII	63.91	40.44	1.85	2.66	0.29	0.12	0.21	0.07	0.40
VIII	64.33	39.48	1.81	2.47	0.25	0.13	0.18	0.06	0.39

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