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Original Research Article

Estimation of Genetic Parameters in Progenies of *Acacia nilotica* (L.)

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A B S T R A C T

Efficient tree improvement strategies depend upon specific knowledge of genotype composition of population which was visualized by their genetic parameters. The traits with high heritability along with high genetic gain is effective for further improvement programme, since they indicate the heritable additive component of variance. In context to above discussion, acacia nilotica is a multipurpose tree; it provides timber, fuel, food, shade, fodder, honey dye, gum and fences. Present study revealed significant variations between progenies (CPTs) for genotypic and phynotypic coefficient of variance, heritability, genetic gain and genetic advance. Genotypic coefficient of variation ranged between 1.32-20.34. however, height GCV was recorded for shoot/root ratio (20.34%) followed by dry shoot weight (15.34%) while lower GCV were recorded for collar diameter (1.32). highly heritable traits were dry root weight (84.00), internodal length (74.00) and collar diameter (71.00). while low heritability is shown by germination % (64.00). genetic gain ranged from (0.29-27.17) and recorded highest for dry root weight (27.17) followed by dry shoot weight (25.98), shoot/root ratio (19.41) and fresh shoot weight (18.69) while lowest for intermodal length (0.29).

Keywords

GCV, PCV, Heritability, genetic advance, *Acacia nilotica*, Morphological traits

Introduction

Acacia nilotica Linn. Commonly known as (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;). *Acacia nilotica* belongs to family leguminoceae, and is 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. *Acacia nilotica* is a multipurpose tree; it provides timber, fuel, food, shade, fodder, honey, dye, gum and fences (Brenan, 1983). It also impacts on the environment through soil reclamation, soil enrichment, protection against fire and wind. It is widely used in ethno-medicine (Orwa *et al.*, 2009). The crown is flattened or rounded, leaves are 5-15 cm long, Alternate with compound.

Acacia nilotica should not be introduced into humid and sub-humid areas, or into dry areas. *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 (Burley and Wood, 1976).

Acacia nilotica flowers at a relatively young age, around three to fours old in ideal conditions, on current- season growth during

the rainy season. Flowering is prolific, and can occur 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 under condition it June to September and sometimes in December/January, and the ripen fruit 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 treatment of liver and spleen, 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 superior trees. 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 were collected randomly from different parts of the tree and average of 10 pods and 10 seeds measurement were recorded for pod and seed length, respectively. Out of these five, the best one were selected as superior tree and marked with sign with yellow paint. Twenty superior trees were marked and their pods were collected in month of April- June. The latitude and longitude was taken help of GPS for 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).

A total of three hundred healthy pods were collected and from each lot. The average of 10 pods measurement 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.

After taking the observations on pods, seeds were extracted from randomly selected pods in plus tree was kept replication wise for taking observations on seeds. The average of 10 seeds measurements was recorded for seed length, seed width and seed thickness and expressed in mm and 100-seed weight in gram. All pod and seed characters were measured with the help of digital vernier caliper while, 100-seed weight were recorded with the help of electronic weighing balance. To study the genetic divergence in seed source the observations recorded were subjected to statistical analysis.

Results and Discussions

The nature and magnitude of genotypic and phenotypic coefficient heritability and genetic advance studies in a selected parent population is one of the prerequisite in any genetic improvement program and genetic divergence study. Breeder's plants about breeding methodology on the basis of heritability, genetic advances and genetic gain estimates (Bhat and Chauhan, 2003).

The magnitude of the heritability provides blue print about the factors affecting genetic improvement through selection while genetic gain helps in quantification of change produced by selection in the mean genetic level of species. The traits with higher heritability and higher genetic gain should be given emphasis for further improvement program (Divakara and Krishnamurthy, 2009). Therefore heritability, genetic advance and genetic gain estimates (Table 3). And

genetic divergence has been worked out using mean value (Table 2) of traits to estimate the magnitude of association between the characters. In present study, phenotypic coefficient of variation (PCV) is higher than genetic coefficient variation (GCV) in all the cases indicating environmental influence in the expression of characters (Gohil and Pandya, 2008). Genotypic coefficient of variation ranged between 1.32-20.34 (Table 3). However, highest GCV was recorded for shoot/root ratio (20.34) followed by dry shoot weight (15.31%) while minimum was for collar diameter (1.32).

Table.1 Details of morphological observations and other relevant information for 20 Superior trees of *Acacia nilotica* Linn

S. No.	Seed Sources	Altitude (m)	Range of Temp. ºC	Latitude (ºN)	Longitude (ºE)	Rainfall (mm)
S_1	FARRUKHABAD	167	35-45	27º38'N	79 º59'E	896.2
S_2	KANNAUJ	143	30-45	27º05'N	79º91'E	868
S_3	ALLAHABAD	98	32-46	25º45'N	81º84'E	1027
S_4	KANPUR(C.S.A.)	126	25-45	26º49'N	80º30'E	820
S_5	RAWATPUR	126	25-45	26º44'N	80º33'E	820
S_6	BARRA	128	25-45	26º42'N	80º29'E	825
S_7	BAREILLY	268	21-45	28º36'N	79º43'E	1093
S8	SHUATS	98	20-45	25º41'N	81º84'E	1100
S_9	GONDA	111	25-46	27º03'N	81º95'E	1240
S_{10}	BANARAS	76	26-45	25º31'N	82º97'E	998
S_{11}	LUCKNOW	121	24-45	26º84'N	80º94'E	1001
S_{12}	DELHI	215	24-46	28º70'N	77º10'E	693
S_{13}	FATEHPUR	124	25-44	25º85'N	80º89'E	1052
S_{14}	UNNAO	131	24-46	26º53'N	80º48'E	850
S_{15}	MEERUT	226	24-46	28º98'N	77º70'E	933
S_{16}	SITAPUR	141	25-45	27º58'N	80º66'E	1193
S_{17}	PUKHRAYA	130	25-43	26º22'N	79º83'E	1015
S_{18}	HARDOI	147	26-45	27º29'N	79º83'E	1103
S_{19}	FAIZABAD	104	26-45	26º77'N	82º14'E	1143
S_{20}	NURSURY	98	27-44	25º41'N	81º84'E	1027

Table.2 Progeny mean for germination% and seedling traits of 20 Superior tree of *Acacia nilotica*

Character	Height	Collar Diameter	Internodal Length cm	Fresh Shoot Weight	Fresh Root Weight	Dry Shoot Weight	Dry Root Weight	Root Shoot Ratio	Total Biomass
S_1	40.51	1.83	2.19	0.29	0.13	0.19	0.08	2.48	0.42
S_2	40.19	1.83	2.71	0.28	0.15	0.20	0.06	3.11	0.41
S_3	40.36	1.82	2.53	0.30	0.13	0.20	0.06	3.21	0.42
S_4	40.61	1.82	2.52	0.32	0.13	0.21	0.06	3.39	0.45
S_5	41.20	1.83	2.56	0.29	0.13	0.21	0.06	3.49	0.43
S_6	40.41	1.82	2.56	0.30	0.11	0.22	0.07	3.38	0.41
S_7	41.83	1.83	2.56	0.26	0.12	0.16	0.06	2.58	0.39
S_8	41.69	1.80	2.74	0.29	0.13	0.21	0.07	3.08	0.40
S_9	40.31	1.84	2.66	0.26	0.13	0.18	0.07	2.52	0.42
S_{10}	42.32	1.83	2.52	0.27	0.12	0.17	0.07	2.54	0.39
S_{11}	42.07	1.82	2.72	0.29	0.12	0.21	0.07	3.14	0.40
S_{12}	40.44	1.85	2.67	0.29	0.12	0.21	0.07	3.18	0.40
S_{13}	41.46	1.86	2.68	0.29	0.13	0.20	0.08	2.62	0.41
S_{14}	42.68	1.83	2.67	0.28	0.13	0.21	0.07	2.99	0.41
S_{15}	39.48	1.81	2.47	0.25	0.13	0.18	0.06	3.06	0.39
S_{16}	40.86	1.84	2.48	0.25	0.11	0.18	0.08	2.31	0.36
S_{17}	40.36	1.82	2.57	0.29	0.12	0.17	0.07	2.91	0.41
S_{18}	42.73	1.80	2.46	0.25	0.13	0.17	0.08	2.77	0.38
S_{19}	42.01	1.84	2.43	0.27	0.13	0.18	0.07	2.56	0.39
S_{20}	40.34	1.82	2.39	0.29	0.14	0.19	0.07	2.60	0.42
SE	0.75	0.01	0.11	0.02	0.01	0.02	0.00	0.23	0.02
CD5%	1.51	0.03	0.21	0.03	0.02	0.03	0.01	0.47	0.03

Table.3 Progeny variability parameters for germination percent and seedling traits of 20 different superior tree progenies of *Acacia nilotica*

Parameters Traits	Mean	Range	Coefficient of Variability		heritability	Genetic Advanc	Genetic Gain
			Phenotypic (PCV)	Genotypic (GCV)			
Germination %	62.13	52.00-70.00	13.07	10.43	64.00	10.65	17.16
Seedling height	41.09	39.48-42.73	4.36	3.74	73.00	2.71	6.60
Collar diameter	1.83	1.80-1.86	1.58	1.32	71.00	0.06	0.03
Internodal length	2.55	2.19-2.72	9.94	8.56	74.00	0.007	0.29
Fresh shoot weight	0.28	0.25-0.32	12.86	10.80	71.00	0.052	18.69
Fresh root weight	0.13	0.11-0.15	13.48	10.87	65.00	0.022	18.07
Dry shoot weight	0.19	0.16-0.22	18.60	15.31	68.00	0.049	25.98
Dry root weight	0.27	0.06-0.08	15.68	14.38	84.00	0.018	27.17
Shoot/root ratio	2.90	2.31-3.49	22.58	20.34	81.00	0.562	19.41
Seedling biomass	0.41	0.36-0.45	9.29	7.66	68.00	0.017	4.42

Heritability for different character shown significant variation (64.00-84.00). Highly heritable traits are dry root weight (84.00), shoot/root ratio (81.00), internodal length (74.00) and seedling height (73.00), while minimum is germination % (64.00). genetic gain shows highly significant variation (0.29-27.17) and recorded and recorded maximum for dry root weight (27.17) followed by dry shoot weight (25.98%), shoot/root ratio (19.41%) and fresh shoot weight (18.69), while minimum for intermodal length (0.29). the study revealed that considerable gains can be achieved if elite genotypes are selected, multiplied are used in afforestation programme (Murthy and Pavate (1962).

Variation in seedling growth traits of the progenies of trees growing traits of the progenies of trees growing in different localities and different environmental condition have also been reported in different species.

In conclusion, analysis for genetic variability studies of twenty superior trees selected from different location of U.P. that progenies of *Acacia nilotica* exhibited highly significant genotypic and phonotypic coefficient, heritability and genetic advance was found maximum for germination % (10.65) followed by seedling height (2.71), shoot/root ratio (0.56). Most of traits expressed high heritability, moderate to high genetic gain and large variation in populations. This indicates high genetic divergence in seed sources superior trees for morphological and biomass traits from different locality. S_{17} (Pukhraya) and S_8 (Shuats) exhibited maximum superiority to germination % respectively. Maximum heritability value was observed for dry root weight. PCV were higher than the corresponding GCV for all the morphological and biomass traits indicating that characters have interacted with the environment. It was calculated that seedlings biomass was the main contribution for genetic divergence.

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