Color, Texture Viability and Germinationof seeds of different Provenances of Babul (Acacia nilotica)

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Abstract: -

Twenty-six seed sources of Acacia nilotica scattered over nine states of India were studied to know the pattern and extent of variation in seed morphology and germination. Statistically significant differences were observed among the seed sources for all the characters studied. The Variation in germination percentage was large (34-91.33 %) as compared to other characters studied. Germination per cent is positive and significantly correlated with 100 seed weight and viability and showed negative association with purity and number of seeds in 100 gm. The variation observed in seed morphology and germination characters were non clinal type, except for significant positive relationship between longitudes and germination per cent andsignificant negative association with latitude and 100 seed weight. The seeds fromDalton Ganj Jaipurand Raipurwere found with higher germination and better suited for plantation and tree improvement programme. The study indicated the importance of germination percentage and 100 seed weight as the criterion for selection of seed sources for bulk commercial plantation.

INTRODUCTION

Babul (Acacia nilotica Willd. Ex Del.) is one of the most useful multipurpose trees species introduced in large scale afforestation programs of arid and semi-arid regions of India. It is widely distributed in sub-tropical and tropical Africa from Egypt, Mauritania southwards to southern Africa and in Asia eastwards to India. In India, it occurs extensively on a wide strip under varied ecological conditions. The genus belongs to the family Mimosaceae and is very popular among the farmers of rural areas due to its valuable uses as timber, fire-wood, fodder, bark, tannin, gum, toothbrush, etc. The species is highly versatile and is capable of growing on the degraded and inhospitable sites. It grows quickly and is a good source of fixing nitrogen, thus helping in improving soil fertility.

Due to the wide geographical distribution there is considerable scope of genetic variation in Acacia nilotica. Seeds which are the principal means of propagation contain a lot of variation from one origin to another origin with regards to morphological variation and physiological differences (Mathur et al, 1984) Knowledge of variability within species is a prerequisite for developing effective tree improvement/ breeding strategies (Vakashayaet al., (1992). Variation in seed and seedling traits and dear significant in seeds source studies have been documented in a number of tree species such as Pinus banksiana Lamb. (Yeatman, 1966), Albizia lebbeck (Kumar and Toky, 1993), Prosopis juliflora(1999). Acacia spp. (Bagchi and Dobriyal, 1990) and in Acacia nilotica (Ginwal et al. 1994 & 1998; Shivkumar and Banerjee, 1986). Despite its importance as an agroforestry tree species, the information

on genetic variation in Acacia nilotica is still very limited. Therefore, the present study aims at studying the magnitude of variation and the nature of correlations among the six seed parameters of Acacia nilotica in the natural range of this species. This will help in having an uniform and better plantable stock with lesser seed-bed area and lesser management cost and time for large scale plantation.

SEED SOURCES/PROVENANCES: -

Seeds of Babul (Acacia nilotica) were collected from 40 places in India (Table-4.1). Among the 40 different seed sources, 4 belonged to Maharashtra, 7 to Uttar Pradesh, 16 to Chhattisgarh (Previously Madhya Pradesh), 3 to Gujarat, 2 to Rajasthan, 2 to Bihar, 3 to Tamandu, 2 to Punjab and one to Haryana. The Longitude ^{0}E, Latitude ^{0}N, Altitude (m) and Rainfall of these different seed sources (Provenances) are mentioned in the Table-4.1. It is evident from the Table that the provenances differed in agroclimatic conditions and geographical locations. Longitude varied from 69.40 degree to 85.24-degree East, while latitude varied from 11.00 degree to 30.54-degree North. Range of altitude was 121-596 m and the average rainfall varied from 0-50 to 100-200 cm.

These seeds were studied for their polymorphic characters, such as, 100-seed weight, viability test by Tetrazolium (TTC) solution, germination percentage, seed coat color, seed texture, seed length (L), seed breadth (b), seed thickness (T) and L/B ratio. After polymorphism study these seeds were sown in polybags and the 18-month-old seedlings were transplanted in field. This transplantation was done in a Randomized Block Design using three replications to study their performance, variability, genetic parameters, correlation, path coefficient analysis, and genetic divergence (D^2).

Seed Coat Color: -

The seed color varied in different provenances. It ranged from dark brown, blackish brown, brown light brown to yellowish brown (Table-4.2). Even in the same State the seed color differed in different provenances. There was no relation of the provenance with the seed coat color, Dark brown seed coat color was found in the provenances Pune, Ludhiana, Palanpur, Parbhani, Allahabad, Mirzapur, MTP-34 (Mettupalayam-34), MTP-29, Pausara-4, Bareli-5, Ranai-3, Mungeli-1 and Tendua-6. Yellowish brown seeds were observed in the provenances Muzaffarpur, Jodhpur, and Pausara-3, Five provenance namely Raipur, Bhuj, Pausara-2, Mungeli-3 and Tendua-8 had light brown seeds.

Texture:-

Seed texture was either rough or smooth, however, it was not associated with any particular provenance.

Viability:-

Viability of seeds was determined by the treatment with TTC (2,3,5-triphenyl tetrazolium chloride) solution. The viability test showed that most of the provenances had 100% viable seeds (**Table-4.2.**). Mostly the seed viability occurred between 98-100%, The lowest seed viability was observed for the provenance Pune (82.0%).

Germination:-

For the study of seed germination, a total of 150 seeds were grown in 3 replications (50 seeds in each) and the seed germination was recorded on 3 day interval for 30 days. Mean germination (%) presented in Table-4.2 ranged from 9.33% in MTP-34 to 90% in Daltonganj provenance. There were 14 provenances that showed seed germination above 50%. These provenances were $P_{8,}$ $P_{13,}$ $P_{16,}$ $P_{19,}$ $P_{22,}$ $P_{26,}$ $P_{28,}$ $P_{30,}$ $P_{31,}$ $P_{32,}$ $P_{33,}$ $P_{37,}$ $P_{38,}$ $P_{39,}$ and $P_{40.}$ (**Table**-4.1,4.2).

Conclusion:-

Collection of seeds from different provenances and their studies enables the scientist to understand the board ecology of the species in wild condition and also to make a classification (**Roche,1965**) Cytogenetical and genetical tests are more important for understanding the relationships. Short-term studies in the provenance trial can give in rapid information, which may be valuable in silviculture, selection and breeding of the species under study as suggested by **Roche (1968)**

There were 40 different provenances that belonged to 9 States namely Maharashtra (4), Uttar Pradesh (7), Madhya Pradesh (16), Gujarat (3), Rajasthan (2), Bihar (2), Tamilnadu (3) Panjab (20 and Haryana (1). Seeds collected from these provenances varied in their color, texture, viability and other characters. Provenance studies have been made by several workers for Acadia nilotica (**Roche 1965, 1968, Shivkumar and Banerjee 1986, Bagchi and Dobriyal 1990, Bagchi 1992, Bagchi and Singh 1994, Ginwal et al. 1995, 1998, Shekhar et al. 2002)** and in other species of Acacia such as Acacia catechu (**Mohapatra et, al. 2001),** and other plant genera such as Pinus brutia (Isik et al. 2000) and albizziaprocera (**Gera et al. 1999).**

In the present study seed germination was found to very between 9.33 to 90 % in different provenances. Out of the 40 provenances, 14 showed more than 50 % germination of the seeds **Ahmad (1964)** also reported germination of Babul seeds ranging from 50 to 90%. Hot water treatment or sulphuricacid treatment are mostly given to the seeds for enhancing the germination (**Karihaloo 1984, Mathur et al. 1984).** In the hot water treatment, the maximum seed germination in A. nilotica was reported to be 89% (**Karihaloo 1984),** 72.17% (**Mathur et al. 1984**) and 91.33% (**Shekhar et. al. 2002**). However, in no case the germination was 100 %. The results of this experiment are similar to those reported by others.

In the present study viability of seeds was determined by the treatment with TTC (2’3’5’ – triphenyl tetrazolium chloride) solution. Viability was found to range from 82% to 100%. Few workers in A. nilotica have reported seed viability through TTC test. **Shekhar et al. (2002)**reported a viability range of 66-100 % in the provenances. A Maximum viability of 93 % by using TTC test in A. nilotica was reported by **Gera et al. (1998).**

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Table-4.1 : Geographical location and habitat data of various seed sources under study

Source No.	Name of Seed Source	District	State	Latitude 0N	Longitude 0E	Altitude (m)	Rainfall (cm)
P1	Pune	Pune	Maharashtra	18.32	73.52	600	100-200
P2	Akola	Akola	Maharashtra	20.44	77.00	290	50-100
P3	Ludhiana	Ludhiana	Punjab	30.54	75.51	220	0-50
P4	Brindavan Block	Mathura	Uttar Pradesh	27.30	77.41	150	50-100
P5	Mau	Mau	Uttar Pradesh	25.47	82.58	170	100-200
P6	Junagarh	Junagarh	Gujarat	21.31	70.28	190	50-100
P7	Sholapur	Sholapur	Maharashtra	17.41	75.55	440	50-100
P8	Muzaffarpur	Muzaffarpur	Bihar	26.07	85.24	130	100-200
P9	Raipur	Raipur	Chattishgarh	21.14	81.38	290	100-200
P10	Abohar	Abohar	Punjab	30.09	74.11	135	0-100
P11	Bhuj	Bhuj	Gujarat	23.16	69.40	205	0-50
P12	Palanpur	Palanpur	Maharashtra	24.10	72.26	182	50-100
P13	Daltonganj	Daltonganj	Bihar	24.02	84.04	278	100-200
P14	Parbhani	Parbhani	Maharashtra	19.16	76.47	596	50-100
P15	Gurgaon	Gurgaon	Haryana	28.15	76.44	212	50-100
P16	Jaipur	Jaipur	Rajasthan	26.55	75.49	410	50-100
P17	Jodhpur	Jodhpur	Rajasthan	26.17	73.02	390	0-50
P18	Aligarh	Aligarh	Uttar Pradesh	27.53	78.05	121	50-100
P19	Plain Zone	Allahabad	Uttar Pradesh	25.27	81.51	140	100-200
P20	Vindhyan Zone	Mirzapur	Uttar Pradesh	25.09	82.35	200	100-200
P21	Tarai Zone	Gonda	Uttar Pradesh	27.08	81.56	172	100-200
P22	Barsana Drain	Mathura	Uttar Pradesh	27.20	77.20	150	50-100
P23	MTP-34	Mettupalayam	Tamilnadu	11.00	76.58	176	50-100
P24	MTP-29	Mettupalayam	Tamilnadu	11.00	76.58	176	50-100
P25	MTP-31	Mettupalayam	Tamilnadu	11.00	76.58	176	50-100
P26	Pausara-1	Raipur	Chhattisgarh	21.14	81.38	290	100-200
P27	Pausara-2	Raipur	Chhattisgarh	21.14	81.38	290	100-200
P28	Mungeli-3	Raipur	Chattishgarh	21.14	81.38	290	100-200
P29	Pausara-3	Raipur	Chattishgarh	21.14	81.38	290	100-200
P30	Pausara-4	Raipur	Chattishgarh	21.14	81.38	290	100-200
P31	Pausara-5	Raipur	Chattishgarh	21.14	81.38	290	100-200
P32	Pausara-7	Raipur	Chattishgarh	21.14	81.38	290	100-200
P33	Bareli-5	Raipur	Chattishgarh	21.14	81.38	290	100-200

P34	Ranai-3	Raipur	Chattishgarh	21.14	81.38	290	100-200
P35	Mungeli-2	Raipur	Chattishgarh	21.14	81.38	290	100-200
P36	Mungeli-1	Raipur	Chattishgarh	21.14	81.38	290	100-200
P37	Tendua-4	Raipur	Chattishgarh	21.14	81.38	290	100-200
P38	Tendua-6	Raipur	Chattishgarh	21.14	81.38	290	100-200
P39	Tendua-8	Raipur	Chattishgarh	21.14	81.38	290	100-200
P40	Domaria-1	Raipur	Chattishgarh	21.14	81.38	290	100-200

Table-4.2 :Colour, Texture, Viability and Germination of Seeds of Different Provenances of Babul (*Acacia nilotica*)

SeedSource No	Seed Source / Provenance	Seed Coat Colour	Seed Texture	Viability (%) (TTC test)	Germination
P1	Pune (Maharashtra)	Dark Brown	Smooth	82	16.00
P2	Akola (Maharashtra)	Brownish Yellow	Rough	100	46.00
P3	Ludhiana (Punjab)	Dark Brown	Smooth	92	14.67
P4	Brindavan Block (UP)	Brown	Smooth	100	47.33
P5	Mau (UP)	Brown	Smooth	95	46.00
P6	Junagarh (Gujarat)	Blackish Brown	Rough	98	32.67
P7	Sholapur (Maharashtra)	Brown	Rough	100	18.00
P8	Muzaffarpur (Bihar)	Yellowish Brown	Smooth	98	69.33
P9	Raipur (Chattishgarh)	Light Brown	Smooth	100	34.67
P10	Abohar(Punjab)	Brownish Brown	Smooth	99	48.67
P11	Bhuj (Gujarat)	Light Brown	Smooth	99	39.33
P12	Palanpur(Maharashtra)	Dark Brown	Smooth	98	19.33
P13	Daltonganj(Bihar)	Blackish Brown	Smooth	98	90.00
P14	Parbhani(Maharashtra)	Dark Brown	Rough	100	28.00
P15	Gurgaon (Haryana)	Brown	Smooth	99	28.00
P16	Jaipur (Rajasthan)	Brown	Smooth	99	80.66
P17	Jodhpur (Rajasthan)	Yellowish Brown	Rough	100	24.67
P18	Aligarh(UP)	Brown	Rough	98	20.00
P19	Plain Zone(UP)	Dark Brown	Smooth	100	60.00
P20	Vindhyan Zone(UP)	Dark Brown	Smooth	100	39.33
P21	Tarai Zone(UP)	Brownish Yellow	Smooth	100	46.00
P22	Barsana Drain(UP)	Brownish Black	Smooth	100	57.00
P23	MTP-34 (Tamilnadu)	Dark Brown	Rough	100	9.33
P24	MTP-29 (Tamilnadu)	Dark Brown	Smooth	100	26.00
P25	MTP-31 (Tamilnadu)	Brown	Smooth	100	31.33
P26	Pausara-1 (Chattishgarh)	Brown	Rough	97	68.00
P27	Pausara-2 (Chattishgarh)	Light Brown	Smooth	99	34.00
P28	Mungeli-3 (Chattishgarh)	Light Brown	Rough	100	74.00
P29	Pausara-3 (Chattishgarh)	Yellowish Brown	Rough	98	62.22
P30	Pausara-4 (Chattishgarh)	Dark Brown	Rough	100	63.00
P31	Pausara-5 (Chattishgarh)	Brown	Smooth	99	68.00
P32	Pausara-7 (Chattishgarh)	Blackish Brown	Rough	97	75.71
P33	Bareli-5 (Chattishgarh)	Dark Brown	Rough	98	62.00
P34	Ranai-3 (Chattishgarh)	Dark Brown	Rough	100	25.00
P35	Mungeli-2 (Chattishgarh)	Brownish Yellow	Smooth	98	40.00
P36	Mungeli-1 (Chattishgarh)	Dark Brown	Smooth	98	34.44
P37	Tendua-4 (Chattishgarh)	Brown	Smooth	99	63.00
P38	Tendua-6 (Chattishgarh)	Dark Brown	Smooth	98	62.00
P39	Tendua-8 (Chattishgarh)	Light Brown	Smooth	99	51.00
P40	Domaria-1 (Chattishgarh)	Brown	Smooth	100	74.00