International Journal of Agriculture and Environmental Research

ISSN: 2455-6939

Volume:02, Issue:03

STUDIES ON SEEDS GERMINATION AND SEEDLING GROWTH OF *TECOMELLA UNDULATA* AT NURSERY STAGE

Desha Meena*, Anil Singh and Aastha Sharma

*Forest Genetics and Tree Breeding Division, Arid Forest Research Institute, Jodhpur, Rajasthan, India- 342005.

ABSTRACT

Seeds collected from identified Candidate plus trees of *Tecomella undulata* from six districts (Jalore, Pali, Sikar, Churu, Bikaner and Nagaur) of Rajasthan were evaluated for seed size, germination percentage, mean daily germination, peak value, germination value, germination rate, seedling growth and shoot vigour index at nursery stage. Considerable variations were recorded for seed germination among the progenies of identified CPTs which ranged from 27.50 % to 92.0%. Maximum germination percent of 92% was recorded for CPT-35 of Pali districts owing to higher mean daily germination (4.6) and peak value of germination (11.42) with higher germination rate (15.35) and germination value (52.53) whereas with respect to seedling height and shoot vigour index, CPT-4 from Nagaur districts performed better in comparison to other. The results of the present study identified progenies of two CPT's i.e. CPT-35 (Pali) and CPT-4 (Nagaur) as superior which performed better in seed germination and seedling growth attributes at nursery stage. Seed germination for three distinct morphotypes (Yellow, Orange and Red) of *Tecomella undulata* was also recorded and it was observed that seeds collected from yellow colored flower shows higher seed germination.

Keywords: Candidate plus trees, Germination attributes, Seed germination, Shoot Vigour Index

INTRODUCTION

Tecomella undulata (Smith) Seem is an economically important timber species as also evident by its names –Marwar Teak or Rajasthan Teak. It is a very useful and key species for afforestation of the drier tracts due to its drought and fire resistant properties (Shankarnarayan and Nanda, 1963). The species also acts as a windbreak, soil binder and helps in stabilizing

ISSN: 2455-6939

Volume:02, Issue:03

shifting sand dune thus playing an important role in ecology of this region. Over exploitation for timber and fuel, coupled with poor regeneration and sluggish growth has severely depleted the natural population of this valuable tree (Bhau et al., 2007). By selecting superior phenotypes or plus trees from population and subsequent progeny trial of selected plus tree gives a base of genetic improvement programme. Progeny evaluation is one of the selection methods followed in tree improvement programmes, where superior genotypes are selected based on the performance of their respective progenies at an early age by providing similar environmental (growing) conditions to progenies of selected genotypes (Vasav et al., 2011). Individuals selected through this method are known to be superior with respect to their genetic characters. Hence, plus trees are generally graded as elite types based on progeny performance in progeny trials. Thus for a successful promotion of large scale plantations there is a need for carefully planned and well directed seed source research (Zobel and Talbert, 1984). Keeping all this in view, study was conducted at nursery to evaluate the germination and seedling performance of the seeds of Candidate Plus trees (CPTs) of *Tecomella undulata* collected from six districts of Rajasthan.

METHODOLOGY

An extensive field survey was carried out throughout the Rajasthan from geographical range extended from 25° to 28° N latitude and 72° to 75°E longitude and identified thirty six candidate plus trees of *Tecomella undulata* across the six districts Jalore, Pali, Sikar, Churu, Bikaner and Nagaur districts of Rajasthan. Candidate plus trees were identified based on their total height, DBH, bole height, crown area, number of branches, flower color and health of the tree. Care was taken to collect the dry pods directly from the selected trees and maintained the individual tree identity. Fresh ripen pods were collected from the marked trees during the month of April-May and seeds were collected and parameters such as seed length, seed width and 100 seed weight were recorded for each seed source. For germination studies, the experiment was laid out in completely randomized design with five replications of 100 seeds per CPT under nursery conditions. Seeds were artificially propagated by directly sowing the seeds in polythene bags containing the mixture of sand, soil and FYM (1:1:1) arranged in randomized fashion under shaded mother beds of AFRI model nursery. Seeds sown at a depth of 1.5 to 2.0 cm vertically sprout out within four to six days. Manual watering and weeding was done at regular interval. Observations on daily germination were recorded up to 21 days from date of sowing. Seed germination was recorded and quantified as germination percentage; mean daily germination, peak value, germination rate and germination value (Czabator, 1962). After three months, seedling height (in cm) and shoot vigour index (SVI) were also recorded for plant survival percentage. Data collected was analyzed statistically using SPSS 8.0 program.

ISSN: 2455-6939

Volume:02, Issue:03

RESULTS AND DISCUSSION

Seed germination is one of the important characters that help to calculate seed rate for seedling propagation. A basic knowledge about the nature and extent of seed variation in relation to seed parameters is very useful for the production of quality seedlings. Present study reveals that seeds collected from different sources showed significant variations for seed parameters, germination and seedling traits. The test weight of seeds ranged between 0.6g to 1.04g 100 seeds/gm and color of the seeds were found to be cream to brown in color exhibiting variations from light to dark. Similarly, length of the seeds amongst various seed sources varied from 16.7mm to 22.2 mm and width from 8.3 mm to 9.3 mm respectively (Table 1). Variation in seed morphology characters of *Tecomella undulata* may probably be due to resource availability, which varies over season and therefore, may influence seed size (Murali 1997). The size of seeds is variable due to the presence of the wings also and depending on the structure environmental conditions under which plant is growing. Similarly differences in seed weight between populations could have been a result of differences in the environmental conditions e.g. nutrients, light or water to which the mother plants were subjected during growing season (Gutterman 1992). The variation observed in the seed characters may be attributed to adverse environment and differences in their distribution range which affects the germination of seeds as studied in several tree species like *Azadirachta indica* (Dwivedi, 1993), *Jatropha curcas* (Geetanjali *et al.,* 2003), *Pongamia pinnata (Patil et al., 2011) and Dalbergia sissoo (* Devagiri *et al.,* 1998).

Table 1: Seed characteristics, seed germination and seedlings attributes in candidate plus trees of *Tecomella undulata* from Rajasthan

CPT No	District	Flower color	Length of seeds with wings (mm)	Width of seeds with wings (mm)	Germination Percent	Mean Daily Germination	Peak Value	Germination Rate	Germination Value	Shoot Length Mean	Shoot Vigour Index
CPT-1	Nagaur	Red	19	8.6	40	2.0	2.62	5.15	5.24	32.4	1296
CPT-2	Nagaur	Orange	17.8	8.6	83	4.15	5.6	9.98	23.24	33	2739
CPT-3	Nagaur	Red	19.4	8.9	54	2.7	3.75	7.77	10.12	27.7	1495.8
CPT-4	Nagaur	Orange	17	8.8	86	4.3	8.25	15.21	35.47	38.9	3345
CPT-5	Nagaur	Orange	19.3	8.6	78	3.9	8.87	13.02	34.59	31.7	2472.6
CPT-6	Nagaur	Red	18.3	8.8	64	3.32	6.31	10.04	20.9	37.6	2406.4
CPT-7	Nagaur	Orange	19.2	8.7	62.50	3.1	6.25	9.05	19.37	35.4	2212.5
CPT-8	Nagaur	Red	18.1	8.7	44	2.2	3.6	7.08	8.06	32.5	1446.5
CPT-9	Nagaur	Yellow	18.7	8.6	47	2.35	2.47	6.54	5.8	22.9	1076

ISSN: 2455-6939

Volume:02, Issue:03

CPT-10	Jalore	Orange	19	9.3	83	4.15	9	9.96	37.35	33.8	2805.4
CPT-11	Jalore	Yellow	17.7	8.8	74	3.7	8.12	10.72	30.04	29.2	2160.8
CPT-12	Jalore	Yellow	18.7	8.6	73	3.65	6.27	8.09	22.88	34.4	2511.2
CPT-13	Jalore	Orange	18.6	8.4	74	3.7	7.8	9.9	28.86	30.2	2234.8
CPT-14	Jalore	Red	18.8	9.2	76	3.8	6.2	8.55	23.56	28.8	2188.8
CPT-15	Jalore	Orange	16.7	8.3	80	4.0	5.91	8.17	20.4	23.9	1912
CPT-16	Jalore	Yellow	18.1	8.8	84	2.4	8	9.76	19.2	30.3	2545.2
CPT-17	Bikaner	Orange	18.6	8.7	37	1.85	3.4	4.76	6.38	30.7	1135.9
CPT-18	Bikaner	Orange	18.6	8.7	55	2.75	5.5	7.21	15.12	22	1210.0
CPT-19	Bikaner	Red	18.6	8.7	77	3.6	4.52	7.2	16.2	12.5	962.5
CPT-20	Bikaner	Yellow	19	8.6	30	1.76	1.5	2.79	2.64	19.8	594.0
CPT-21	Bikaner	Orange	18.3	8.6	77	3.7	6.8	10.2	25.16	30.6	214.2
CPT-22	Bikaner	Orange	18	8.6	55	2.65	3.3	6.7	8.74	27.36	1504.0
CPT-23	Bikaner	Orange	19	8.4	45	2.25	3.75	6.34	8.43	18.44	8298.0
CPT-24	Churu	Red	17.6	8.5	77	3.85	8.1	10.09	31.18	30.3	2333.1
CPT-25	Churu	Red	19.8	8.4	37	1.85	2.66	4.11	4.92	13.6	5032.0
CPT-26	Churu	Red	18.8	8.8	53	2.62	4.7	6.42	12.33	25.7	1362.1
CPT-27	Sikar	Orange	18.3	8.7	40	2.0	3.6	5.74	7.2	33.5	1340.0
CPT-28	Sikar	Red	19	9	75	3.75	6.4	14.33	24.0	29.2	2190.0
CPT-29	Sikar	Orange	18.9	8.8	27.50	1.35	2.65	3.02	3.57	18.6	511.5
CPT-30	Sikar	Yellow	22.2	8.8	91.50	4.55	10.5	9.73	47.77	27.7	2534.5
CPT-31	Sikar	Red	19.6	8.7	52.50	2.4	3.18	4.35	9.144	25.4	1333.5
CPT-32	Pali	Orange	18.3	8.4	90	4.5	10.5	14.15	47.25	26.45	2380.5
CPT-33	Pali	Yellow	18.1	8.6	80	4.0	8.55	11.75	34.2	25.66	2052.8
CPT-34	Pali	Red	18.1	8.7	90	4.5	11.25	9.36	50.625	23.11	2079.9
CPT-35	Pali	Yellow	18.3	8.9	92	4.6	11.42	15.35	52.53	29.2	2686.4
CPT-36	Pali	Yellow	18.3	8.8	87.50	4.0	8.12	12.9	32.84	34.6	3027.5
Mean			18.60	8.69	66	3.22	6.095	8.76	21.81	27.97	2156.4
SD			0.90	0.20	19.53	0.95	2.73	3.30	14.31	6.19	1388.5
SEm			0.15	0.034	3.25	0.15	0.45	0.55	2.38	1.033	231.4

ISSN: 2455-6939

Volume:02, Issue:03

With respect to the seed germination greater variation was observed among the progenies of identified CPTs which ranged from 27.50 % (CPT-29 from Sikar) to 92.0% (CPT-35 from Pali). Overall germination percentage of 66 percent was recorded among the identified CPT's of *Tecomella undulata*. Twenty out of thirty six CPTs showed maximum seed germination (more than 70%), whereas nine CPTs recorded very poor seed germination of less than 50%. Maximum germination per cent of 92% was recorded for CPT-35 of Pali districts owing to higher mean daily germination (4.6) and peak value of germination (11.42) with higher germination rate (15.35) and germination value (52.53). This variation could be due to genotype differences as seeds from all the progenies are raised under similar environmental conditions. Sometimes seed dormancy may also influence seed germination, which is controlled by genetic factors. Reports of seed dormancy in this species are scanty, but in other tropical species, seed dormancy that affects seed germination has been documented. Various workers have proved that seeds of a single species when collected from different sources differ in viability, germination and growth (Isik, 1986; Singh *et al*., 2006). Shivanna *et al.*, 2007 recorded variation in seed germination among different seed sources ranging from 69.61% to 89.20%. Similarly, seed source variation has also been recorded in *Acacia nilotica* for seed germination (69.33–80.66%). It shows that seed source and individual trees have more influence on seed germination.

Since, *Tecomella undulata* shows three distinct morphotypes (Yellow, Orange and Red) based on flower colors therefore seed germination was also recorded with respect to flower color. Variation in seed germination with respect to flower color of the tress ranged from 73.22% (yellow flowered tree seeds) to 61.62 % (red flowered tree seeds). Orange colored flowers shown seed germination of 64.86%. During the survey it was noticed that orange and yellow color flower plants are in majority in most of the sites whereas red flower plants are poor in frequency. With this overall performance of seeds of the CPT's collected from six districts of Rajasthan was also compared and it was observed that seeds from Pali districts performed better with a germination of 88% followed by Jalore (77.71) and Nagaur districts (62.06). Whereas, minimum germination per cent was recorded for Bikaner district (54%) of Rajasthan (Figure 1).

ISSN: 2455-6939

Volume:02, Issue:03

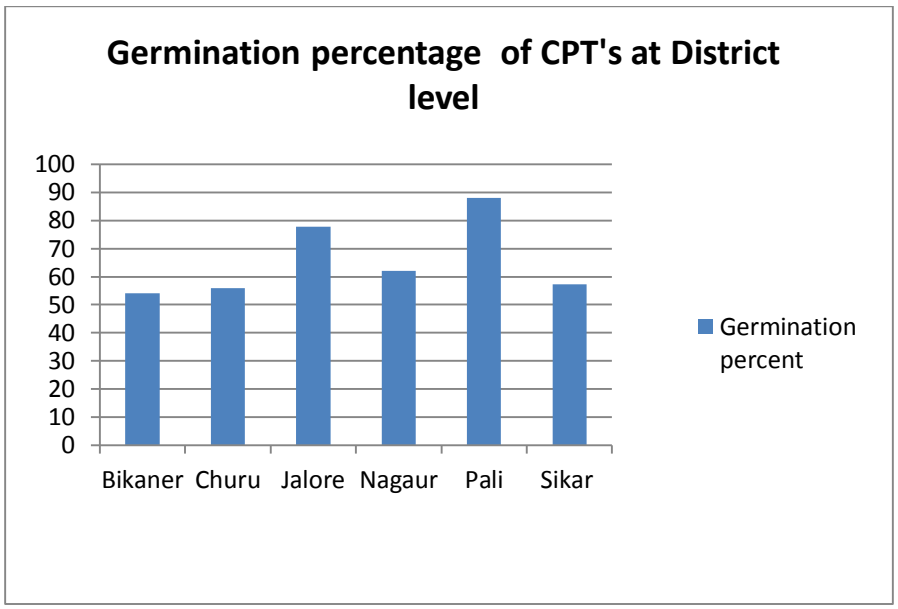

Figure 1: District wise germination percentage of the identified CPTS

Further to study the seedling parameters at nursery stage, three month old seedlings of *Tecomella undulata* were measured for shoot height and shoot vigour index for each of the progenies. Results were greatly varied among the progenies from 12.5cm (CPT-19 from Bikaner) to 39.8 cm (CPT-4 from Nagaur). Sixteen CPTs showed higher seedling height of more than 30 cm. Shoot vigour indices varied significantly among genotypes which ranged from 511.5 (CPT-29 from Sikar) to 3345 (CPT-4 from Nagaur). With respect to seedling height and shoot vigour index, CPT-4 from Nagaur districts performed better in comparison to other. This variation is mainly attributed to genetic and environmental factors which affect the seedlings growth. Similar trend has also been documented among seed sources for vigour indices in many tropical species like *Pongamia pinnata* (Patil, et al., 2011) ; *Jatropha curcas* (Geetanjali *et al.,* 2003) ; *Madhuca latifola* (George *et al.*, 2003) ; *Acacia nilotica* (Chillar *et al.,* 2002) and *Prosopis julifera* (Chopra and Hooda, 2001). Summing up, the results of the present study identified progenies of two CPT's i.e CPT-35 (Pali) and CPT-4 (Nagaur) as superior which performed better in seed germination and seedling growth attributes compared to others. These variation in seed and seedling traits among and within sources suggest that selection among sources might result in rapid genetic gain for the traits (Dhillon and Khajuria 1995).

ISSN: 2455-6939

Volume:02, Issue:03

REFERENCES

Bhandari M M (1990). Flora of Indian desert. MPS Repros Jodhpur, India. pp. 42

Bhau B.S. Negi M.S. Jindal S.K.Singh Mand Lakshmikumaran M. (2007). Assessing genetic diversity of *Tecomella undulata* (Sm.) Seem – an endangered tree species using amplified fragment length polymorphisms based molecular markers. *Curr. Sci.* **93**(1): 69-71

Burley J. and Von Carlowitz P. 1983. Multipurpose Tree Germplasm. ICRAF, Kenya : 298.

Chillar S. Hooda M.S. and Chopra D. 2002. Seed source variation in Acacia nilotica (L.) wild. Indian J. of Forest, 25(2): 150-153.

Champian H. G. and Seth S. K. 1968. *The Revised Survey of the Forest Types of India*, Manager of Publication, Delhi: 404.

Chopra D. and M. S. Hooda. 2002. Variability in mineral content of *Prosopis juliflora* seeds collected from different places. Indian J. Anim. Nutr. 19(2):162-165.

Czabator F.J. 1962. Germination value: An index combining speed and completeness of pine seed germination. For. Sci. 8:386–396.

Devagiri G. M. Dhiman R .C. Thapiyal R. C. and Nautiyal S. 1998. Seed source variation in pod and seed traits of *Dalbergia sissoo.* Ann. For., 6: 148 -155.

Dhillon G.P.S. and Khajuria H.N. 1995 Variation in seed Characters of *Acacia nilitica* (L). J. Tropical. Forestry. **2**: 17-19.

Divekara B. N. Alur A. S. and Tripati S. 2010. *Int. J. Plant Prod.* 4(2), 129–141.

Dwivedi A. P. 1993. National level of Neem Seed source trials at Jodhpur. Syst. Ecol. Contrib. 5(7):20-34

Gutterman Y. 1992. Maternal effects on seed during development. In: Fenner, M. (ed.) *Seeds*. The Ecology of Regeneration in Plant Communities. Wallingford CAB International, pp. 27-59.

Geethanjali K. Balasubramanian A. and Paramathma M. 2003. Seed technological studies in *Jatropha Curcus*. *Nation. Workshop Jatropha Other Perennial Oil Seed Species*, 5th to 8th Aug.2003, Bharathiya Agro-Industries Federation of India (BAIF), Pune: 31-33.

ISSN: 2455-6939

Volume:02, Issue:03

George Jenne M. Dasthgiri Prathiban K. and Judesudhagar 2003.Variability studies in seed and seedling attributes in Mahauva(*Madhuca latifolia*). Indian For., 129 (4): 509-516.

Isik K. 1986. Altitudinal variation in *Pinus brutia* Ten: seed and seedling characteristics. Silvae Genetica. **35**: 59-67

Kumar S. Radhamani J. Singh A. K. and Varaprasad K. S. 2007.*Curr. Sci*., 93, 910–911.

Murali K.S. 1997 .Patterns of seed size, germination and seed viability of tropical tree species in southern India. Biotropica. **29**: 271-279.

Police Patil V. M. H. Shivanna P. Surendra G. O. Manjunath A. Krishna and G. V. Dasar. *2011.* Variability studies for seed and seedling traits in *Pongamia pinnata* (L.)Pierre. *Karnataka J. Agric. Sci., **24** (2) : (201-203)* .

Shivanna H. Balachandra H. C. and Suresh, N. L. 2007.*Karnataka J. Agric. Sci.*, 20(2), 438–439
Singh R.P. (1992). On factors affecting clonal propagation of *Anogeissus rotundifolia, Prosopis cineraria* and *Tecomella undulata*. Ph.D Thesis University of Jodhpur India

Shankarnarayan K.A. and Nanda P. C. (1963). Cytotaxonomy of *Tecomella undulata* Seem. Ann Arid Zone 1: 174-75

Vasav V. P. Narkhede S. S. Rane A. D. Gunaga R. P. Rewale A. P and Bhave S. G. 2011. Evaluation of Progenies of Candidate Plus Trees Of *Pongamia Pinnata* (L.) Pierre. For Seed Germination and Seedling Vigour. Current Science, **100** (4).

Wright, J. W.1976. *Introduction to Forest Genetics*, Academic Press, New York :463.

Zobel B. and Talbert J. J. 1984. Applied Forest Tree Improvement. John Wiley and Sons, New York: 75 -116.

