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Research Article

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Provenance Variation in Growth Parameters of *Tecomella undulata* (Smith) Seemann under Field Conditions in Arid India

Satish Kumar*
Department of Botany, CMG Govt. College for Women, Bhodia Khera, Fatehabad, Haryana
*Corresponding Author E-mail: drsatishverma1008@gmail.com
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ABSTRACT

Seeds from twelve provenances of Tecomella undulata (Desert Teak) were collected from north-western India and grown in the nursery. Twelve month old seedlings were transplanted in the arid field of Dhingrala village (Rajasthan). Survival percentage and other growth parameters like root length, shoot length, collar diameter, root dry weight and shoot dry weight of different provenances were observed after 2 and 4 years of transplantation. Survival percentage varied significantly 71% to 95% after 2 years & 60 %to 86 % after 4 years of growth in different provenances. Other growth parameters also differed significantly (P<0.05). Jhunjhunu provenance had maximum shoot length (56cm), root length (154 cm), collar diameter (0.86 cm), shoot dry weight (3.8g) and root dry weight (14g) after two years of growth but after 4 years, Mukam provenance showed superiority over other provenances in shoot length (120cm), collar diameter (2.52 cm), shoot dry weight (5.4g) and root dry weight (24.5g). Minimum values of most of the growth parameters were observed in Bikaner and Sardarshahr provenance after 2 and 4 years of growth respectively. In general, it is observed that CV values were higher for shoot length and collar diameter but lower for shoot and root dry weights. It is interesting to note that root dry weight is 4 to 5 times higher than shoot dry weight as well as root length is 3 folds more than shoot length which signifies the adaptability of the species to the harsh environmental conditions in the desert of India. Provenance study of Tecomella undulata is very useful to select the superior genotype and to conserve this important threatened species.

Key words: *Tecomella undulata, Provenance, Survival percentage, Growth parameters, Threatened species.*

INTRODUCTION

Tecomella undulata (Smith) Seemann (Bignoniaceae family) commonly known as Rohida or Desert Teak, is an evergreen small ornamental tree of Thar desert in India[3]. It helps to stabilize sand dunes and considered as an agroforestly species for arid regions. It is reputed for its timber value and also have a wide range of therapeutic activities[7]. *Tecomella undulata* is a very valuable tree, yet there are limited published work on its provenance variation.

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Kumar[8] reported seedling growth in the incubator and Soni *et al.*[9] observed variation in pod and seed characteristics of *T. undulata*. Arya *et al.*[1] showed variation in pod length and seed weight while Chakravarty and Chand[5] observed provenance variation in different morphological traits like plant height, dbh and collar diameter in 10 years old plants of *T. undulata*. In this species, variability coefficient was maximum in Barmer district when tree height, dbh, basal diameter and canopy diameter were measured from 198 trees from 3 districts of Rajasthan[6]. A significant variation was observed among 21 provenances of *Acacia nilotica* for stem height, branches, leaf and spine growth characters at 6- and 23-month old plants after transplantation[4].

Because of poor regeneration and indiscriminate cutting for timber and fuel, its population has severely declined and now it is in the list of threatened species. There is need of collection of germplasm and study of different provenances of *Tecomella undulata* to improve its quality for reforestation programme[2]. In the present research work, twelve month old seedlings of 12 provenances from nursery were transplanted in the field of Dhingrala village, Distt. Churu (Rajasthan). A significant variation was observed in 2 year and 4 year old plants for survival percentage and different growth parameters.

MATERIAL AND METHODS

Seeds of *Tecomella undulata* were collected randomly from 12 provenances ranging from 27^0N to 29^0N latitude and 73^0E to 76^0E longitude in India. The cleaned, sundried and fumigated 600 seeds from each provenance were sown in nursery by its randomized distribution in 3 blocks. Twelve month old 60 seedlings from each provenance were picked up randomly and were transplanted into a 2.5 acre rectangular field at Dhingrala (Rajasthan) in a randomized block design (RBD) with a uniform spacing of 3x3 meter taking 60 plants from each provenance, splitting up into 3 square blocks (Figure-1). No fertilizer was used in the field during transplantation but watering was done to the plants regularly. After 2 years and 4 years of transplantation, survival percentage was calculated. Total 9 plants (3 from each block) for a provenance were randomly selected, uprooted and washed with water. Shoot length and root length of these plants were measured with the help of thread and scale while collar diameter was calculated with vernier calliper. Uprooted 9 plants per provenance were oven dried and their root and shoot dry weight was measured on electronic balance.

RESULTS AND DISCUSSION

Generally, the survival percentage of all the provenances planted at Dhingrala (Rajasthan) was more than 60 percent after 2 and 4 years of their transplantation (Table 1). On the basis of calculation of 60 plants of each provenance, the maxmium survival percentage was recorded in Jhumpa (95% & 86%) and minimum in Nagaur provenance (71% & 60%) after 2 years and 4 years of growth in field respectively. Rajgarh, Rewari & Bikaner also had significantly high percentage of survival. High mortality was observed in Mohindergarh, Jhunjhunu and Lachhmangarh provenances from 2nd to 4th year of their growth.

Among 12 provenances, the growth parameters in terms of collar diameter, root length, shoot length, root dry weight and shoot dry weight varied significantly. After 2 years of growth, Jhunjhunu provenance had maximum growth while the minimum values of growth parameters were observed in Bikaner provenance (Table 2). But after 4 years of growth, Mukam provenance showed maximum values in shoot length, shoot and root dry weights while Sardarshar had the least values (Table 3). These values signify the hardness and adaptability of the plants of a provenance in a particular habitat.

It is observed that root length was around 3 times higher than shoot length in most of the provenances, while root dry weight was observed 5 to 6 folds more than shoot dry weight. Stastitical analysis showed that among most of the provenances after 2 and 4 years of growth, the differences were significant ($P < 0.05$) for growth parameters. For 2 years old

plants, CV values for shoot and root lengths were much higher (>20%) while the root and shoot dry weights showed lesser values (<20%). In 4 years old plants, CV values were observed higher for shoot length and collar diameter but lower for shoot and root dry weights. The dry weight of the plants seems to be important for the survival percentage of the seedlings.

RANDOMIZED BLOCK DESIGN

12	10	8	6	
1	9	3	4	Block -I
11	5	7	2	
4	8	6	10	
12	5	7	3	Block-II
1	2	9	11	
8	6	2	12	
9	1	4	7	Block -III
11	3	5	10	

Fig. 1: Layout plan of the seedlings transplantation in the field at Dhingrala (Rajasthan) Distance 3 x 3 m

No. of plants of each provenance = 60

1. Jhumpa 2. Bhiwani 3. Rajgarh 4. Sardarshahr 5. Mohindergarh
6. Rewari 7. Jhunjhunu 8. Bikaner 9. Lachhmangarh 10. Mukam
11. Didwana 12. Nagaur

Table 1. Survival percentage of diferent provenances of *T. undulata* after 2 years and 4 years of growth in the field at Dhingrala (Rajasthan)

Provenance	**2 years old plants**		**4 years old plants**	
	***No. of plants survived**	**Percentage survival**	***No. of plants survived**	**Percentage survival**
Jhumpa	57	95	52	86
Bhiwani	48	80	41	68
Rajgarh	54	90	51	85
Sardarshahr	46	76	44	73
Mohindergarh	50	83	40	66
Rewari	53	88	50	83
Jhunjhunu	49	81	39	65
Bikaner	53	88	50	83
Lachhmangarh	52	86	43	71
Mukam	49	81	44	73
Didwana	53	88	49	81
Nagaur	43	71	36	60
C.D.		**5.4**		**6.8**

* Calculation on the basis of 60 plants of each provenance

Table 2.Variation in growth parameters of 2-year old plants of *T. undulata* in the field at Dhingrala (Rajasthan) n=9

Provenances	Shoot length (cm)	Root length (cm)	Collar diameter (cm)	Shoot dry wt. (g)	Root dry wt. (g)
Jhumpa	49	137	0.78	2.5	12.9
Bhiwani	45	138	0.63	2.7	12.5
Rajgarh	49	148	0.78	2.6	12.7
Sardarshahr	38	109	0.68	2.1	10.4
Mohindergarh	50	140	0.64	3.1	12.2
Rewari	48	138	0.75	3.6	13.2
Jhunjhunu	56	154	0.86	3.8	14.2
Bikaner	36	103	0.59	1.9	10.1
Lachhmangarh	37	112	0.78	3.1	10.8
Mukam	39	104	0.64	2.8	10.9
Didwana	46	140	0.83	3.5	13.0
Nagaur	37	92	0.76	3.1	10.8
F value	**2.2**	**2.8**	**1.00**	**7.99**	**8.82**
C.D.	**12.3**	**34.6**	**0.24**	**0.57**	**1.26**
P <0.05					

Table 3.Variation in growth parameters of 4-year old plants of *T. undulata* in the field at Dhingrala (Rajasthan) n=9

Provenances	Shoot length (cm)	Root length (cm)	Collar diameter (cm)	Shoot dry wt. (g)	Root dry wt. (g)
Jhumpa	84	174	1.95	4.8	20.7
Bhiwani	77	170	1.51	4.6	18.1
Rajgarh	71	122	1.42	4.3	22.7
Sardarshahr	53	124	1.42	4.5	19.8
Mohindergarh	68	162	1.49	4.3	19.4
Rewari	103	210	2.10	5.3	22.7
Jhunjhunu	81	151	1.75	4.5	20.7
Bikaner	65	129	1.52	4.4	18.2
Lachhmangarh	84	154	1.75	4.8	19.7
Mukam	120	197	2.52	5.4	24.5
Didwana	90	158	1.86	4.7	19.6
Nagaur	66	151	1.87	4.7	20.1
F value	**4.53**	**4.72**	**7.27**	**2.73**	**3.48**
C.D.	**23.95**	**34.88**	**0.34**	**0.60**	**2.89**
P <0.05					

CONCLUSION

The variation in different growth parameters of *Tecomella undulata* recorded in present study is very helpful for the selection of superior provenance for arid conditions. The variations observed among the provenances continued upto 4th year in the field will provide a scope to screen the most suitable seed sources for a particular soil type and environment. Variation in the survival percentage among provenances attributed to genetic adaptations of its populations to the particular climatic conditions. The length of the roots in T. *undulata* is 3 to 4 fold higher than shoot length showed the adaptability of the species to survive in the harsh environmental conditions of the desert, particularly when the plants are at young stage (2 to 4 years). As the *Tecomella undulata* is a threatened species of the Thar desert, so there is a great need to select the superior genotype with fast growth & straight bole to develop its orchards and to preserve its

variations through *ex-situ* and *in-situ* measures.

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