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Effect of Seed Source Variation on Field Emergence and Seedling Characters of Different Seed Sources of Rohida (*Tecomella undulata* (Sm.) Seem)

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ABSTRACT

Various morphological characters of rohida trees from four different geographical locations were recorded and seeds were collected from the selected trees. Seed quality parameters such as seed size (length and breadth), colour, test weight were recorded for all the seed sources and the seed of all represented sources were sown in the nursery to find out the field emergence, seedling survival and seedling growth parameters in different seed sources. Rajgarh seed source was found to be significantly better than other, in terms of unforkedt tree height (1.70m) and seed size (2.15cm long). Similarly seedling emergence in Rajgarh seed was 69%, which was significantly better than Churu (66.5%), Jhumpa (57%) and Dingmandi (58.2%). Seedling survival was again significantly high in Rajgarh seed source (49%) as compared to others, similar was the case of all other seedling growth characters.

Keywords:

Tecomella undulata, seed source variation, seed and seedling characters

INTRODUCTION

Diversity in any plant species enables it to adapt to future environmental changes that arise due to pollution, climatic change, disease and other forms of environmental adversities. Overexploitation of plants for agriculture and other commercial, scientific and educational purposes and the other developmental activities of mankind have resulted in serious threat to plant species that have evolved over thecourse of millions of years (Khan 1998).*Tecomella undulata*(Sm.) Seem is a medicinally and economically important plant that originated in India (Randhawa and Mukhopadhyay 1986) and appears inthe list of endangered plants (Bhau et al. 2007). The plant grows under natural conditions in wild,unprotected and is highly exploited. It is very hardy and drought resistant plant and has potential application for afforestation and landscaping of dry tracts. The plant is used for its high quality timber. Its wood is soft, durable and takes a good polish and therefore used in furniture, carving, and agricultural implements. The wood is priced equal to teak and that's why it is also called as '*Marwar* Teak of Rajasthan'. The tree parts are used for the cure ofsyphilis and eczema. Bark posses' mild, relaxant, cardiotonic and chloretic activities. Hot water extract of the treeis used to treat enlarged spleen, gonorrhea, leucoderma and liver diseases (Anonymous 1986; Saxena 2000).

Due to itseconomic importance vis-à-vis endangered status, it was thought to carry out its extensive taxonomical (both morphological and

biochemical) and ecological study in Rajasthan. The present investigation was also envisaged to study the seed source variation among various germination parameters.

MATERIAL AND METHODS

The rohida seed material was collected from the four different sites namely Ding Mandi, Jhumpa (Haryana) Churu, Rajgarh (Rajasthan). Six trees of *Tecomella undulata* at each seed source were selected randomly for the collection of seeds. Seeds were collected from the selected six trees at each site and the seeds of all 24 lots were tested for variations in nursery. The seed sources in (Rajasthan) were Rajgarh (28° 39') Lat. N and (75° 26') Long. E, Churu (28° 19') Lat. N and (75° 01') Long. E and in (Haryana) were Jhumpa (29° 07') Lat. N and (75° 43') Long. E, Ding Mandi (28° 45') Lat. N and (75° 39') Long. E. The study was conducted at Hisar (29° 10') Lat. N and (75° 45') Long. E at an elevation of 215.2 meter above the mean sea level, which is semi-arid area, and characterized by hot and dry winds during summer months and dry and severe cold conditions during winters.

Basal tree girth, girth at breast height and canopy diameter was measured in cm by usingdiameter tape. Seed characters, such as length and breadth of the seeds was recorded in millimeter with the help of Vernier caliper. Colour of seeds was recorded on visual colour identification bases. Test weight of 1000 seeds was recorded in grams on Electronic weighing balance for all the seeds collected from selected trees from each four seed source. The field emergence was recorded in percentage. The seedling parameters such as seedling basal diameter, height, number of leaves, root length and seedling dry weight was also recorded at final count (15 days).

RESULTS AND DISCUSSION

Unforked height among the trees from different locations ranged from (3.70 m) in T_5 of Rajgarh to (1.70 m) in T1 of Churu. The maximum canopy height (12.21 m) was observed in T_3 from Jhumpa seed source, whereas, minimum was observed in T_5 from Rajgarh seed source (5.30 m). The highest basal girth (142.3 cm) was found in T_2 from Ding Mandi and lowest in T_1 from Churu seed source (84.30 cm). The maximum girth at breast height (135.2 cm) was recorded in T_2 from Ding Mandi followed by 130.3 cm, 127.4 cm, 122.5 cm and 121.5 cm from T_2 of Churu, T_5, T_1 and T6 of Ding Mandi, respectively and minimum (76 cm) was recorded in T_1 from Churu seed source. The canopy diameter among all the trees from four different seed sources ranged from 4.2 m to 6.5 m. The maximum canopy diameter (6.5 m) was observed in T_2 from Churu followed by 5.8 m in T_2 from Ding Mandi, 5.6 m in T_1 from Churu and in T_3 from Rajgarh seed sources, whereas, minimum (4.2 m) was observed in T_1 from Jhumpa and in T_4 from Churu seed source (Table 1). Rajgarh seed source was found to be significantly better in terms of unforkedheight, Ding Mandi seed source was significantly better in girth at 1.3 m height and basal girth parameters.

Seed characters

Significant difference was found among all the seed sources for seed length (Table 2). The maximum seed length (2.15 cm) was recorded in seeds of tree from Jhumpa followed by seeds of trees from Ding Mandi (2.03 cm), whereas seeds of minimum length were found in Churu seed source (1.70 cm). Breadth of seeds varied from (0.88 cm) in Rajgarh,0.87cm in Ding seeds,0.81cm in Churu and 1.05 cm Jhumpa. The variation observed in the present study for the physical seed characteristics in terms of length, breath and weight were also highly significant among the evaluated seed sources.

Colour of all the seeds collected from four different seed sources varied from light brown,yellowish brown, brown to dark brown. The seeds of Rajgarhand Churu,the colour was yellowish brown, Ding Mandi seeds were light brown and Jhumpa seeds were dark brown (Table 2).. There was no significant difference in test weight among three of the seed sources. Negi et al. (2011) have suggested that at least two morphotypes of roheda are growing in Rajasthan, one with yellow flowers, and the other with red flowers and the third morphotype with intermediate flower color might be an intra-specific hybrid of the two morphotypes.

Table 1. Morphological characters of selected rohida trees representing different geographical seed sources

Seedsource	Seed sour-ce	Flower color	Clera bole height (m)	Canopy height (m)	Basal girth (cm)	Girth at breast height (cm)	Canopy diameter (m)
CHURU (Rajasthan)	T 1	Orange	1.70	6.30	84.3	76	5.6
	T 2	Orange	2.16	9.84	138.0	130.3	6.5
	T 3	Orange	2.56	7.44	104.2	95	5.4
	T 4	Orange	2.50	6.50	109.0	100	4.2
	T 5	Orange	3.50	6.50	107.2	98	5
	T 6	Orange	2.37	9.13	112.0	105	4.4
Mean			2.74	7.61	109.1	100.7	5.1
DingMandi (Haryana)	T 1	Dark yellow	2.25	11.75	129.1	122.5	4.6
	T 2	Dark yellow	2.67	9.83	142.3	135.2	5.8
	T 3	Dark yellow	2.60	7.40	123	115.3	4.9
	T 4	Dark yellow	2.42	6.08	115.6	106.7	5.4
	T 5	Dark yellow	3.10	6.90	135.2	127.4	4.4
	T 6	Dark yellow	2.72	6.28	130.1	121.4	4.8
Mean			2.62	8.06	129.2	121.4	4.9
Jhumpa (Haryana)	T 1	Pale yellow	2.11	9.89	101.2	90	4.20
	T 2	Pale yellow	1.90	8.10	110.0	102.7	4.64
	T 3	Pale yellow	2.29	12.21	120.0	113.2	5.40
	T 4	Pale yellow	2.56	7.44	109.3	98	4.35
	T 5	Pale yellow	2.32	8.68	96.1	87	4.44
	T 6	Pale yellow	2.19	6.81	116.4	107.4	4.70
Mean			2.21	8.85	108.8	99.7	4.6
Rajgarh (Rajasthan)	T 1	Red	2.18	5.82	86	78	4.5
	T 2	Red	2.60	7.40	100	92	4.8
	T 3	Red	3.20	9.30	113	104.3	5.6
	T 4	Red	3.21	7.49	106	95	5.44
	T 5	Red	3.70	5.30	96.80	88	5.1
	T 6	Red	3.47	6.03	89.70	82	4.7
Mean			3.0	6.89	98.5	89.8	5.0

Table 2. Morphological characters of seeds of selected rohida trees representing different geographical seed sources

Seed sources	Seed characters			
	Seed length (cm)	Seed breadth (cm)	Seed color	Seed test weight (g/1000)
Churu	1.70	0.81	Yellowish brown	9.89
Ding Mandi	2.0	0.87	Brown	9.99
Jhumpa	2.15	1.05	Dark brown	9.75
Rajgarh	1.92	0.88	Yellowish brown	10.4
CD (p= 0.05)	0.34	0.52	-	0.61

The field emergence of seeds and seedling survival at final count

Significant differences were found in field emergence of different seed sources. It ranged from 69 % in Rajgarh seed source followed Churu (66.5 %). Minimum field emergence (57 %) was recorded in the seeds of tree from Jhumpa seed source (Table 3).The seedling survival at final count of seeds collected from all the seed sources was significantly different. The maximum value for seedling survival at final count was recorded (49 %) in seeds of trees from Rajgarh followed by seeds of trees from Jhumpa (37 %). Minimum value (33.3 %) was recorded in the seeds of tree from Churu (Table 3).

Table 3. Field emergence and survival, growth characters of seedlings of different geographical seed sources of rohida in nursery

Treatments	Seed sources				
	Churu	Ding Mandi	Jhumpa	Rajgarh	CD (p=0.05)
Germination (%)	66.5	58.2	57.0	69.0	2.5
Seedling survival (%)	33.3	34.4	37.0	49.0	0.3
Seedling height (cm)	5.36	7.5	7.1	11.3	0.2
No. of leaves seedling^{-1}	7.0	7.0	8.0	10.0	1.3
Basal diameter (mm)	4.0	4.4	3.7	4.45	1.0
Root length (cm)	2.86	4.0	4.0	5.83	1.6
Seedling dry wt. (g)	0.24	0.32	0.37	0.42	0.04

Seedling growth and biomass

Seedling height of different seed sourceswas significantly different. The seedling height ranged from (11.13 cm) in Rajgarh, followed by seeds from Ding andJhumpa(7.5 and 7.1cm, respectively). Minimum seedling height was found (5.36 cm) in seeds of tree from Churu (Table 3).Significant differenceswere recorded for basal diameter among all the four seed sources. The basal diameter ranged from 4.45 mm in seeds from Rajgarh and Ding, followed by Churu and Jhumpa(4.0 and 3.7 mm, respectively). The data for number of leaves per seedling was significantly different. The maximum number of leaves per seedling was recorded in seeds from Rajgarh (10), which was significantly more than any other seed source.The maximum root length was observed in the seed from trees from Rajgarh (5.83 cm), followed by seeds of tree from Ding and Jhumpa (4.0 cm) butminimum root length was recorded in seeds of tree from Churu (2.86 cm).

The seedling dry weight was found significantly different among all the seed sources. The maximum seedling dry weight was observed in seeds of trees from Rajgarh (0.42 g) followed by seeds of tree Jhumpa (0.37 g) and minimum from Churu (0.24 g) (Table 3). The same seed source also had maximum seed weight, germination and speed of germination.

With respect to relationship between geographical locations of the seed sources and variables studied, statistically significant

differences were obtained for most of the germination parameters (Table 2). The results indicated that, the differences in the germination parameters could be due to wide variation in microclimate and local environmental conditions in the range of distribution of this species (Gera et al. 1999; Devagiri 1997). Due to particular set of local environmental conditions, the genetic constitution of the species for the particular traits must have changed resulting in geographically distinct clines (Kumar et al. 2004). The occurrence of the species over a wide geographic range encompassing a great diversity of edapho-climatic conditions of its habitat is expected to be reflected in the genetic constitution of its diverse populations (Gera et al. 1999). As a result, racial variation among the populations of diverse origin did show association with locality factors such as latitude, longitude. altitude, precipitation, etc. (Shekar et al. 2002).

CONCLUSION

The seeds collected from Rajgarh and Churu region of Rajasthan represent the most arid environmental conditions. The seeds of Rajgarh source were found to be significantly better in performance as compared to others. It is possible that due to natural selection these collections got specific advantages for adaptation and performance. It would be interesting to study the genetic makeup of these collections and compare it with others.

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