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Research Article

Elemental Analysis of Five Major Elements in Six Month Old Seedlings among Twelve Provenances of *Tecomella undulata* (Smith) Seemann

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ABSTRACT

Tecomella undulata (Smith) Seemann (Rohira, Bignoniaceae) is an agroforestry and ornamental tree of Thar Desert in India. It controls the wind erosion and shifting of sand dunes in arid region and helps to maintain ecological balance by supporting man-cattle-tree interaction. Seeds collected from twelve provenances of Haryana and Rajasthan (India) were sown in polypots at nursery following Randomized Block Design. Roots, stems and leaves from nine randomly selected six months old seedlings of each provenance were taken for analysis of five major elements (N, P, K, Ca, & Mg). Washed and oven dried plant parts were digested using HNO_3 and $HClO_4$. Filtered solution was used to analyse Nitrogen by Micro-Kjeldahl method, Phosphorous by Spectrophotometer and Potassium by using Flame Photometer, while Calcium and Magnesium were estimated by Atomic Absorption Spectrophotometer technique. A significant variation ($P < 0.05$) was observed in elements for most of the provenances for different plant parts. Nitrogen content varied in roots (0.76-1.89%), stems (1.19-1.88%) and leaves (2.27-3.99%). Likewise other elements also varied enormously among different provenances. P & K elements were reported less than 1% in roots, stems & leaves of all the provenances while Mg was found less than 1% in roots & stems but more than 1% in leaves due to the reason that Mg is the constituent of chlorophyll in leaves. The biochemical estimation of elements is important in selection of a superior provenance with better food, fodder & survival capacity in adverse conditions of desert. It is suggested to conserve and multiply the superior provenance of Tecomella undulata since it is listed as one of the endangered species.

Keywords: *Tecomella undulata, Provenances, Elements, Biochemical estimation, Endangered species.*

INTRODUCTION

Tecomella undulata (Smith) Seemann (Vern. Rohira, Rugtrora and Desert Teak) is a monotypic genus of Bignoniaceae family and reputed as a valuable ornamental tree of dry regions (Shankarnarayan & Nanda, 1963). It grows as an important agroforestry tree alongwith *Prosopis cineraria* (Khejri) in Thar Desert of north-western India (Arya et al., 1993).

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It helps to stabilize the shifting sand dunes and controls the wind erosion (Kumawat et al., 2012 & Pandya et al., 2012). Illegal cutting of Rohira for fodder, fuel and timber; poor regeneration capacity and severe attack by insect pests has caused rapid decline in its population and it has been kept in the endangered category list (Bhau et al., 2007). There is a great need of collection and preservation of its germplasm for breeding purposes and to improve its genetic quality for afforestation programme in arid zone (Arya et al., 1997).

Tecomella undulata has a higher rank in list of medicinally important plants and many reports are published to emphasise its use to cure piles, anorexia and worm infestations (Dhir & Sekhawat, 2012), hepatoprotective nature (Khatri et al., 2009), anti-HIV property (Azam, 1999) and anticancer activity (Ravi et al., 2011). Leaves and stem bark of Rohira have chemical compounds that are used to prepare bioherbicide against plant pathogens (Parveen & Sharma, 2014). In identification of natural populations biochemicals can be a reliable source (Hanover, 1974). Variation in different elements (Mg, Ca, K, Na & P) were reported from 294 plant samples of 35 species of grasses, shrubs and trees in arid Rajasthan (Dhir *et al.*, 1984). Chemical composition of N, P, K, Ca, Mg, Na, crude protein and structural carbohydrates of the foliage of one year old plants were analysed in 31 provenances of *Prosopis cineraria* (Arya et al., 1996). Similar studies have also been reported in *Albizia lebbek* (Kumar & Toky, 1995).

Though, biochemical analysis for different elements have been done in a number of plant species by many researchers, yet no systematic study have been reported so far to evaluate the chemical elements in plant parts of Rohira among different provenances. The present study reports the variation in percentage of five major elements (N, P, K, Ca, & Mg) in roots, stems & leaves of six month old seedlings of *Tecomella undulata* among twelve provenances of arid region in India.

MATERIALS AND METHODS

Mature pods of *Tecomella undulata* were hand picked randomly from 10 plus trees for each of the twelve provenances, 4 from Haryana and 8 from Rajasthan ranging from 27º N to 29 º N latitude and 73º E to 76º E longitude of north-western India. Seeds from pods of each provenance were collected, dried at room temperature and stored in air-tight aluminium cans. 600 seeds of each provenance were sown in 3 blocks of 200 sand filled polypots each following Randomized Block Design (RBD). No FYM and chemical fertilizers were added for growth of seedlings in the nursery. After six month of germination, 9 seedlings from 3 blocks of each provenance were selected randomly and uprooted for biochemical estimation. Seedlings were washed with deionized water to remove dust or soil and dried up in the oven at 60 ºC for 72 hours. Roots, stems and leaves of each provenance were milled into powder and passed through a mesh. 1.0 g powder of each part (root, stem, leaf) for each provenance is digested with 5 mL HNO_3 and 2 mL $HClO_4$ and its filtered solution was increased in volume by adding de-ionized water. 3 samples from each solution (provenance) were taken for biochemical analysis of different elements. Nitrogen (N) was estimated by Micro-Kjeldahl method, Phosphorus (P) by Elico Spectrophotometer SL 171, Potassium (K) by Flame Photometer UK 405 while Calcium (Ca) & Magnesium (Mg) were analysed in the samples using a Perkin Elmer Model 306 Atomic Absorption Spectrophotometer. Statistical analysis was done to calculate C.D. at 5% level for each element.

RESULTS AND DISCUSSION

Variation with significant level ($P < 0.05$) was observed in the percentage of N, P, K, Ca, & Mg in roots, stems and leaves of six month old seedlings of *Tecomella undulata* among most of the provenances (Table 1). In roots, N ranged from 0.76 % (Lachhmangarh) to 1.89 % (Didwana), P from 0.15 % (Jhumpa) to 0.39 % (Nagaur), K from 0.46 % (Bhiwani) to 0.64 % (Didwana), Ca from 1.00 % (Mukam) to

1.59 % (Nagaur) and Mg from 0.33 % (Mukam) to 0.49 % (Nagaur). In stem of seedlings, Jhumpa provenance had the maximum N & P content (1.88 % & 0.55 %) while minimum percentage of Ca & Mg element (0.66 % & 0.25 %) was reported in Mohindergarh provenance. Likewise, in leaves, Jhumpa provenance had maximum percentage of N & K (3.99 % & 0.64 %) but had minimum percentage of Ca & Mg (1.68 % & 1.17 %) while Rajgarh provenance reported minimum K (0.40 %) but maximum percent of Ca & Mg (3.02 % & 1.94 %) respectively. It is interesting to note that P & K were found below 1 % in all the plant parts under study of each provenance. Mg was observed less than 1 % in roots & stems but more than 1 % in leaves of all the provenances. Higher percentage of Mg in leaves is due to the reason that Mg is the constituent of chlorophyll in leaves.

Table 1: Percentage of elements in Roots (R), Stems (S) and Leaves (L) of six month old seedlings of different provenances of *Tecomella undulata*

Sr.No.	Provenance	Plant part	N	P	K	Ca	Mg
01.	Jhumpa	R	1.12	0.15	0.55	1.20	0.36
		S	1.88	0.55	0.84	1.47	0.68
		L	3.99	0.45	0.64	1.68	1.17
02.	Bhiwani	R	1.31	0.16	0.46	1.19	0.37
		S	1.29	0.17	0.74	1.38	0.64
		L	3.56	0.53	0.49	2.32	1.61
03.	Rajgarh	R	0.99	0.27	0.58	1.48	0.44
		S	1.45	0.18	0.44	1.32	0.55
		L	3.39	0.38	0.40	3.02	1.94
04.	Sardarshahr	R	0.92	0.31	0.51	1.20	0.36
		S	1.19	0.30	0.54	1.56	0.64
		L	3.86	0.41	0.49	2.30	1.51
05.	Mohindergarh	R	1.55	0.24	0.48	1.20	0.36
		S	1.51	0.23	0.52	0.66	0.25
		L	3.50	0.58	0.60	2.33	1.67
06.	Rewari	R	1.40	0.29	0.56	1.22	0.44
		S	1.35	0.40	0.48	1.54	1.01
		L	3.86	0.39	0.55	2.24	1.40
07.	Jhunjhunu	R	1.16	0.31	0.48	1.35	0.39
		S	1.63	0.50	0.76	1.39	0.87
		L	2.91	0.42	0.48	2.00	1.22
08.	Bikaner	R	1.19	0.24	0.62	1.10	0.48
		S	1.29	0.42	0.78	1.06	0.68
		L	3.48	0.44	0.45	2.05	1.36
09.	Lachhmangarh	R	0.76	0.33	0.53	1.04	0.35
		S	1.51	0.30	0.82	1.53	0.55
		L	2.33	0.41	0.52	1.94	1.27
10.	Mukam	R	1.14	0.34	0.54	1.00	0.33
		S	1.28	0.30	0.74	1.32	1.02
		L	3.67	0.35	0.43	2.10	1.60
11.	Didwana	R	1.89	0.38	0.64	1.34	0.38
		S	1.42	0.40	0.93	1.46	0.82
		L	2.27	0.38	0.58	2.10	1.32
12.	Nagaur	R	1.81	039	0.53	1.59	0.49
		S	1.63	0.33	0.80	1.36	0.88
		L	2.78	0.46	0.57	2.20	1.34
C.D. at 5% Level		R	0.33	0.12	0.11	0.19	0.18
		S	0.18	0.12	0.10	0.13	0.13
		L	0.21	0.10	0.08	0.13	0.06

CONCLUSION

The variation in chemical components of roots and shoots reflect the genetic differences among provenances. Superiority of some provenances in the early stages of growth may be due to higher N & P content in their roots and shoots. Estimation of nutrients in seedlings is helpful to monitor the metabolism and health of the plants. Present study empowers the researchers as well as farmers to diagnose the deficiency of a particular element in a specific provenance that will also determine its survival in the harsh conditions of arid region. Biomolecules in the leaves enhance the food and fodder value of the tree which is necessary to maintain man-cattle-tree relationship in desert biome. Evaluation of biochemical elements in plant parts of endangered tree species 'Rohira' is pre-requisite to select the superior germplasm and its multiplication through in-situ & ex-situ measures.

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