Studies on seed source variation in *Toona ciliata* M Roem in Himachal Pradesh

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ABSTRACT

The present investigations on seed source studies of *Toona ciliata* M Roem were carried out in the Department of Tree Improvement and Genetic Resources, Dr YS Parmar University of Horticulture and Forestry, Nauni, Solan, Himachal Pradesh during 2010 with the surveying conducted along with species distribution range and ten seed sources were selected from Himachal Pradesh. The studies included parameters viz 100-seed weight, seed colour and seed germination percentage. Seeds were collected from the selected trees during second and third week of June beginning from the seed sources of lower altitudes and moving towards higher altitudes. Seed colour assessment of all the trees within and between seed sources was performed by colour comparison. The weight of 100 seeds was found to differ significantly between different seed sources within the range of 0.18-0.31 g. It was found significantly higher at Nainikhad, Parwanoo, Rajgarh, Palampur, Mandi, Nagni and Jaunaji which were statistically at par. Minimum seed weight was observed at Kandaghat, Renuka and Bilaspur the three being at par with one another. The seed germination percentage varied significantly (0.33 to 27.78) among the various seed sources. Parwanoo, Mandi and Jaunaji seed sources had maximum per cent seed germination and were at par with one another. As against this minimum per cent seed germination was recorded at Rajgarh and Kandaghat the two being at par with each other. Dark brown seeds were most prevalent followed by light brown and brown seeds from all the seed sources. The studies indicated that there existed variability for seed characters in *T ciliata* seed collected from different sources on the basis of 100-seed weight, seed colour and seed germination percentage.

Keywords: Seed source; varioation; seed weight; seed colour; germination; genotype

INTRODUCTION

Toona ciliata M Roem (Meliaceae) is a deciduous or semi-deciduous tree. It is one of the precious timber species in India. The flowers are small and hermaphroditic with the pollen spread primarily by wind. The seeds are light with wings. Propagation by seed is most common. *T ciliata* is mostly distributed in hilly and mountainous areas and its vertical distribution range is extensive (Liu et al 2012). Commonly known as Chinese mahogany the tree grows with straight trunk and produces red wood with beautiful grains (Liang et al 2011). Low natural regeneration and over-exploitation have resulted in the continual decline of *T ciliata* leading to it being classified as an endangered species. It is also listed on China's reference list of cultivated rare species (Wen et al 2012). The seeds of *T ciliata* change in germination percentage and seed moisture content over 360 days of storage at room or low (5-8^{o}C) temperature. Nautiyal and Thapliyal (1993) reported that in India it is found throughout the sub-Himalayan tract and the valleys of the outer Himalayas, plains of Assam, Madhya Pradesh, Tamil Nadu, Karnataka and eastern and western Ghats occurring up to an elevation of 1200 m (rarely 1300 m) in western peninsula Khasi hills and Manipur (Singh 1982). It is a characteristic tree of eastern alluvial secondary semi-evergreen forests in Assam (Champion and Seth 1968). Ecologically tree is restricted to the site where the absolute shade temperature varies from 37.5 to 47.5^{o}C, the absolute mean temperature from -1 to 17.5^{o}C and the annual rainfall ranging from 1100 to 4000 mm.

Success of tree improvement generally depends upon the combination and expression of characters in the new genotypes which holds the key for boosting the productivity and yield of the economic product. In this context regulation of variation through reproductive system forms the basic approach which is dependent upon the information pertaining to reproductive biology as the biological process. Therefore the studies on reproductive biology were conducted.

MATERIAL and METHODS

The investigations were carried out in the department of Tree Improvement and Genetic Resources, Dr YS Parmar University of Horticulture and Forestry, Nauni, Solan, Himachal Pradesh. The area is situated at 30°50'30" to 30°52'0"N latitude and 77°8'30"E longitude in the mid-hills of outer Himalayas with an altitude varying from 950 to 1350 m amsl. The climate here is sub-temperate characterized by mild summers with maximum temperature of 34°C (May to June) and minimum 0°C (January and February). The rainfall is well spread during June to August (monsoon period). Seed study needs to cover an extended vast stretch of species distribution hence ten seed sources of *T ciliata* were selected from different parts of Himachal Pradesh with 5 trees from each source. The survey was conducted along with species distribution range and ten seed sources were selected viz Kandaghat, Renuka, Palampur, Mandi, Bilaspur, Rajgarh, Jaunaji, Parwanoo, Nagni and Nainikhad (Table 1). The characteristics viz 100-seed weight, seed colour (dark brown, brown, light brown) and seed germination percentage were studied.

Seed collection: Seeds were collected from the selected trees during second and third week of June beginning from the seed sources of lower altitudes moving towards higher altitudes. Seeds were processed separately for further seed studies.

100-seed weight: A random sample of 100 seeds per tree was weighed with the help of electronic balance (model: Libror Aeu-210, Shimadzu) as per ISTA 1996 regulations.

Seed colour: Seed colour of all the trees within seed source was observed by displaying all at one platform for comparative colour observation. For this three colour categories were made viz light brown, brown and dark brown.

Seed germination: Seed germination studies were carried out in the laboratory. From each seed source 100 seeds per replication were placed in Petri plates well covered with germination paper at the base. The germination percentage was calculated as given below:

$$\text{Seed germination (\%)} = \frac{\text{Total number of seeds germinated}}{\text{Total number of seed sown}} \times 100$$

RESULTS and DISCUSSION

The weight of 100 seeds was found to differ significantly among different seed sources within the range of 0.18-0.31 g. It was found significantly higher at Nainikhad (0.31), Parwanoo (0.30), Rajgarh (0.29), Palampur (0.29), Mandi (0.28), Nagni (0.26) and Jaunaji (0.26) which were statistically at par. Minimum seed weight was observed at Kandaghat (0.18), Renuka (0.23) and Bilaspur (0.23) the three being at par with one another (Table 2).

The evaluation of seed sources with respect to germination percentage of seeds under laboratory conditions (Table 2) demonstrated that seed germination percentage varied significantly (0.33 to 27.78) among the various seed sources. Parwanoo (27.78%), Mandi (27.63%) and Jaunaji (25.00%) seed sources had maximum seed germination and were at par with one another. As against this minimum per cent seed germination was recorded at Rajgarh (0.33%) and Kandaghat (4.44%) the two being at par with each other.

Nautiyal and Thapliyal (1993) found that germination was 100 per cent in the fresh seeds of *T ciliata* which remained unchanged over the first month of storage. Gupta et al (2012) found that the germination percentage of *A catechu* ranged from 29.07 to 54.47 in laboratory conditions. Chanu and Thapliyal (2016) conducted the seed germination test for *T ciliata* and found that the germination was completed in 20 days and seed germination percentage was found to be maximum at ambient temperature (55%) followed by 25 and 30°C.

Seed colour for different seed sources was compared on individual tree basis and comparative number falling in each of these colour categories (brown, light brown and dark brown) was recorded (Table 2). It was found that dark brown seeds were

Table 1. Seed sources of *Toona ciliata* selected in Himachal Pradesh

Location	Altitude (m)	Latitude	Longitude	Code
Kandaghat	1180	30º59´N	77º07´E	S1
Renuka	1060	30º37´N	77º25´E	S2
Bilaspur	660	31º19´N	76º46´E	S3
Mandi	800	31º44´N	76º56´E	S4
Jaunaji (Solan)	1400	30º54´N	77º06´E	S5
Rajgarh	1760	30º51´N	77º18´E	S6
Parwanoo	540	30º47´N	76º54´E	S7
Palampur	1280	32º07´N	76º31´E	S8
Nagni (Nurpur)	725	32º06´N	76º16´E	S9
Nainikhad	960	32º33´N	78º07´E	S10

Table 2. Performance of seed sources for seed traits

Seed source	100-seed weight (g)	Seed germination (%)	Seed colour depicted in decreasing proportion →	→	→
S1 (Kandaghat)	0.18	4.44 (8.07)	Brown	Light brown	Dark brown
S2 (Renuka)	0.23	13.96 (17.01)	Light brown	Brown	Dark brown
S3 (Bilaspur)	0.23	6.60 (10.34)	Brown	Light brown	Dark brown
S4 (Mandi)	0.28	27.63 (31.48)	Light brown	Brown	-
S5 (Jaunaji)	0.26	25.60 (29.95)	Brown	Dark brown	Light brown
S6 (Rajgarh)	0.29	0.33 (1.35)	Brown	Light brown	Dark brown
S7 (Parwanoo)	0.30	27.78 (31.65)	Brown	Light brown	-
S8 (Palampur)	0.29	15.6 (21.48)	Brown	Light brown	Dark brown
S9 (Nagni)	0.26	12.00 (19.45)	Light brown	Brown	-
S10 (Nainikhad)	0.31	12.11 (18.02)	Dark brown	Brown	Light brown
Mean	0.25	15.10 (19.15)	-	-	-
$CD_{0.05}$	0.05	8.32	-	-	-

Figures in parentheses are arc sine transformed values

most prevalent followed by light brown and brown seeds from all the seed sources.

The studies indicated that there existed variability for seed characters in *T ciliata* seed collected from different sources on the basis of 100-seed weight, seed colour and seed germination percentage.

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