

## Selection of Candidate Plus Trees (CPTs) in *Grewia tiliifolia* Vahl.

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### ABSTRACT

Investigations were carried out in *Grewia tiliifolia* genetic resources to elicit information on identification of Candidate Plus Trees (CPTs). A total of twenty Candidate Plus Trees of *Grewia tiliifolia* have been selected from the predominant growing areas of Southern India viz., Karnataka, Kerala, Telangana and Tamil Nadu by comparison check tree method. The trees were selected based on comparative superiority of selected trees for growth attributes viz., height, girth at breast height (GBH), and crown width.

**Keywords:** Candidate Plus tree, *Grewia*, Southern India, CPTs, Comparison check tree method

### INTRODUCTION

Indian forests have undergone a tremendous change in the past few decades and are presently under a great threat. The excessive use of forests resources leading to forest degradation, which may become irreversible if not checked in time. The human dependency on forests is complex and diverse (Tewari, 1994). The global forest area is over 4.0 billion hectares. The average per capita of the world forest works out to be 0.6 ha (GFRA, 2010). In south Asian region, three countries viz., Bhutan, Sri Lanka and Nepal have higher percentage of land area under forest than India. India is the seventh largest country in the world (Geographical area 328.73 million ha) with 24.16% Forest / Tree cover (FSI, 2015). With less than 2 per cent of total forest

area in the world, India supports more than 15 per cent of the world's population. The mean annual increment (MAI) of Indian Forest is meager of 0.5 - 0.7 m<sup>3</sup> ha<sup>-1</sup> compared to the global average of 2.1 m<sup>3</sup> ha<sup>-1</sup> (Srivastava, 2005). The annual productivity of India's forests is only 3.18 m<sup>3</sup> ha<sup>-1</sup> yr<sup>-1</sup>, which is too low compared to other developed countries 8.20 m<sup>3</sup> ha<sup>-1</sup> yr<sup>-1</sup> (FSI, 2011). Global annual production of paper has increased more than three fold in the past forty years, amounting to a total production of 487 million tons in 2012-13. The total production of wood pulp in India is 2.5 million tons in 2012-13 (FAO, 2013). Majority of the mills are entering into contracts with local communities in the name of out grower or joint venture schemes for producing wood.

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Due to growing demand for pulp by paper industry and scarcity of cellulosic fibrous raw material in India, there is a need for high cellulosic high pulp yielding plants like *Grewia*, which can grow in wide range of climatic and soil conditions. *Grewia tiliifolia* is one of such alternative species suitable for several uses (Sheikh, 1989). The wood fibres are processed into a pulp and further made into paper (ICRAF, 2007). The wood of *Grewia* is highly durable with excellent finishing colour and smoothness used for veneer, furniture, cabinets, paneling, carving, small timber, plywood and musical instruments (ICRAF, 2007; Lowry & Seebeck, 1997). *Grewia tiliifolia* belong to the Tiliaceae (Malvaceae) family has its trade name as Thadasu and it's locally called as Sadachi and Unnu. (Sasidharan, 2005) Trees with spreading crown, it comes under common in the dry and moist deciduous forest, even on poor and rocky soils, where it is found at elevations up to 900 metres. Despite being a species endowed with an amplitude of utilities and commanding extensive areas, yet it has received little research efforts in genetic improvement. Knowledge on magnitude, nature and type of variation is a pre-requisite for any tree improvement programme (Zobel & Talbert, 1984). The best gains can be made for characteristics that have a wide range of variation and are strongly under genetic control (Zobel, 1971; Lacase, 1978; Zobel & van Buijitenen, 1989).

## MATERIALS AND METHODS

### MATERIALS

*Grewia tiliifolia* is found to be a experimental material and it's consisted of different progenies from Southern India viz., Karnataka, Kerala, Telangana and Tamil Nadu. The experiments were carried out at Forest College and Research Institute, Mettupalayam.

### METHODS

## SELECTION OF CANDIDATE PLUS TREES (CPTs)

In any tree improvement programme, it is normal practice to select Candidate Plus Trees to collect seeds (Zobel & Talbert, 1984). The predominant *Grewia tiliifolia* growing areas of Sothern India were identified and Candidate Plus Trees were selected based on selection tree method by the following morphological features by using the method of Pitcher and Dorn (1966).

1. Tree height
2. Diameter at breast height
3. Crown height

## RESULTS

The twenty Candidate Plus Trees selected from the predominant *Grewia tiliifolia* growing areas of Southern India includes Karnataka (2 CPTs), Kerala (2 CPTs), Telangana (2 CPTs) and Tamil Nadu (14 CPTs). From Karnataka, two CPTs were selected which represents Thithimathi (1 CPT) and Megharavatti (1 CPT). From Kerala, two CPTs were selected from different locations viz., Thrissur (1 CPT) and Kalpetta (1 CPT). With respect to Telangana, two CPTs which represents, Ananthagiri hills (1 CPT) and Thiruppathi malaa (1 CPT). In Tamil Nadu, fourteen Candidate Plus Trees were selected from different locations viz., Siruvan (1 CPT), Thalavadi (1 CPT), Pachamalai (1 CPT), Top slip (1 CPT), Kolli hills (2 CPTs), Baraliyaru (1 CPT), Kunjapanai(1 CPT), Thekkampatti(1 CPT), Surulifalls (1 CPT), Sadvayal (1 CPT), Yerkaud (2 CPTs) and Sothuparai dam (1 CPT). The details of locality factors and accession numbers are listed in the Table 1. The details of morphometric traits viz., Height, Girth at breast height (GBH) and Crown Width based on which the twenty Candidate Plus Trees selected are furnished in the Table 2.

**Table 1: Location of selected Candidate Plus trees of *Grewia tiliifolia***

Seed source	District/ State	State	Accession no.	Latitude	Longitude
Yercadu	Salem	Tamil Nadu	TN YR GT 01	10° 99'	76 ° 69'
Yercadu	Salem	Tamil Nadu	TN YR GT 02	10 ° 32'	76 ° 95'
Siruvani	Coimbatore	Tamil Nadu	TN SI GT 03	11 ° 77'	78 ° 20'
Valparai	Coimbatore	Tamil Nadu	TN VA GT 04	11 ° 77'	78 ° 20'
Baraliyaru	Coimbatore	Tamil Nadu	TN BA GT 05	11 ° 25'	76 ° 55'
Kunjapanai	Coimbatore	Tamil Nadu	TN KU GT 06	11 ° 25'	76 ° 55'
Thekkampatti	Coimbatore	Tamil Nadu	TN TK GT 07	09 ° 73'	77 ° 47'
Sadivayal	Coimbatore	Tamil Nadu	TN SV GT 08	11 ° 25'	76 ° 88'
Topslip	Coimbatore	Tamil Nadu	TN TS GT 09	11 ° 24'	78 ° 33'
Kollihills	Namakkal	Tamil Nadu	TN KO GT 10	11 ° 24'	78 ° 33'
Kollihills	Namakkal	Tamil Nadu	TN KO GT 11	11 ° 29'	78 ° 62'
Surilifalls	Theni	Tamil Nadu	TN SF GT 12	10 ° 96'	76 ° 68'
Sothuparai	Theni	Tamil Nadu	TN SP GT 13	10 ° 94'	76 ° 72'
Pachamalai	Trichy	Tamil Nadu	TN PM GT 14	10 ° 47'	76 ° 84'
Kalpetta	Wayanad	Kerala	KL KP GT 15	11 ° 60'	76 ° 09'
Thirissur	Tirissur	Kerala	KL TS GT 16	13 ° 32'	76 ° 26'
Thithimathi	Kodagu	Karnataka	KA TM GT 17	10 ° 48'	75 ° 96'
Magharavatti	Simuga	Karnataka	KA MV GT 18	13 ° 62'	75 ° 15'
Ananthagiri hill	Rangareddy	Telangana	TL AH GT 19	18 ° 19'	82 ° 99'
Tirupathi malaa	Tirupathi	Telangana	TL TM GT 20	13 ° 68'	79 ° 34'

**Table 2: Morphometric traits of selected Candidate Plus Trees of *Grewia tiliifolia***

Progenies	Height (m)	Girth (m)	Crown width (m)	Volume (m <sup>3</sup> )
TN YR GT 01	26.1	0.19	21.3	4.12
TN YR GT 02	23.2	0.12	20.7	2.83
TN SI GT 03	19.5	0.16	20.2	3.18
TN VA GT 04	19.3	0.18	19.5	3.40
TN BA GT 05	24.7	0.19	23.4	4.73
TN KU GT 06	21.4	0.16	18.5	3.34
TN TK GT 07	22.4	0.13	22.0	2.97
TN SV GT 08	20.2	0.10	20.1	2.08
TN TS GT 09	16.9	0.09	17.3	1.48
TN KO GT 10	20.8	0.11	21.3	2.24
TN KO GT 11	23.00	0.17	23.6	4.01
TN SF GT 12	21.50	0.16	19.4	3.38
TN SP GT 13	19.70	0.10	18.3	1.88
TN PM GT 14	21.20	0.18	17.7	3.88
KL KP GT 15	19.5	0.11	16.4	2.06
KL TS GT 16	18.7	0.11	17.5	2.06
KA TM GT 17	17.1	0.10	15.4	1.69
KA MV GT 18	19.3	0.09	20.4	3.41
TL AH GT 19	17.50	0.18	21.0	1.65
TL TM GT 20	21.0	0.14	20.7	3.04

The *Grewia tiliifolia* growing areas of Southern India viz., Karnataka, Kerala, Telangana and Tamil Nadu were surveyed and Candidate Plus Trees were identified based on its superiority in morphometric attributes using Comparison Check Tree Method. The morphological traits viz., tree height, girth at

breast height (GBH), clear bole height and volume were recorded for the selected candidate plus trees (CPTs). The recorded values of morphological traits of various CPTs selected from the different locations is presented in Table 1 and 2. The height of the selected CPT's of *Grewia tiliifolia* had ranged

between 16.9 m (TN TS GT 09) and 26.1m (TN YR GT 01). The Girth at Breast Height exhibited variations from 0.09 m (TN TS GT 09) and 0.19 m (TN BA GT 05) whereas, the crown diameter was ranged between 15.4 m (KA TM GT 17) and 23.6 m (TN KO GT 11). Whereas the volume ranges between 1.48 m<sup>3</sup> (TN TS GT 09) and 4.73 m<sup>3</sup> (TN BA GT 05).

### DISCUSSION

In the current investigation, the selection method adopted was comparison check tree method where the selected Candidate Plus Trees were compared to its nearby test comparison trees. This kind of selection system was reported in many hard wood species with success and failures (Zobel & Talbert, 1984) which thus endorse the selection programme deployed in the current investigation. Accordingly, selections were made from the existing natural populations both within and outside the forest areas of Southern India. A total of twenty Candidate Plus Trees in *Grewia tiliifolia* have been selected from the identified area in Tamil Nadu, Karnataka, Telangana and Kerala. The Candidate Plus Trees were identified based on morphometric traits viz., Tree Height, Girth at Breast Height (GBH) and Crown Width through subjective grading or check tree method. The objective of selection this programme is to obtain significant amounts of genetic gain as quickly and in expensively as possible while at the same time maintaining a broad genetic base to ensure future gains (Zobel & Talbert, 1984). The selection aimed in the current investigation was also attesting the essential needs of tree improvement programme in order to exploit the existing variation among the populations. In *Tecomella undulata*, Desha meena et al. (2015) reported that the selection can also be done based on quantitative traits (height, girth, clear bole and crown area) and qualitative traits (straightness and health). Ombir Singh and Mahant (2013) reported in *Pinus kesiya* that the selection of Candidate Plus Trees was done by check tree system (Zabala, 1983) based on the phenotypical characters of the tree. Selection

of superior genetic resources of *Grewia tiliifolia* towards enhancing the establishment and productivity of forestry plantation is largely governed by the species used and the source of seeds within the species (Hole, 1917). No matter how sophisticated the breeding techniques, seeds were much influenced by their lace of origin (Heydecker, 1972) especially due to environmental variation in latitude, altitude, rainfall, temperature, moisture, soil and the other external factors (Holzer, 1965 and Padmini & Banergee, 1986). The seed parameter variations were reported on many tree species (Shivakumar & Banerjee, 1986; Bagchi & Dobriyal, 1992; Mishra and Banerjee, 1995; Vasudeva et al., 1999) and were dictated by environmental and edaphic factors. This might also be due to altitudinal variation (Barnett & Farmer, 1978) or region of collection (Bonner, 1984). The success of any phenotypic selection depends upon the amount of genetic variability available in the population for important economic characters and their inter relationship (Lone and Tewari, 2008). In the present investigation, a total number of twenty Candidate Plus Trees of *Grewia tiliifolia* were selected from the predominantly growing areas of Southern India viz., Karnataka, Kerala, Telangana and Tamil Nadu based on its superiority in morphometric attributes using Comparison Check Tree Method developed by Pitcher and Dorn (1966). A plethora of scientific evidences are available in deploying selection techniques for various species and stand types (Langer, 1960; Vidakovic, 1965; Morgenstern et al., 1975; Anand et al., 2004; Navhale, 2011; Ombir Singh & Mahanta, 2013; Savitha & Rajesh Sharma, 2015; Vinodkumar & Naik, 2016). This kind of selection system was reported in many hard wood species earlier with success and failures (Zobel & Talbert, 1984) which thus endorse the selection programme deployed in the current investigation.

### CONCLUSION

A total of twenty Candidate Plus Trees were selected from the Southern part of India viz.

Tamil Nadu (14), Karnataka (2), Telengana (2) and Kerala (2) based on its morphometric superiority by using Comparison Check Tree method. The selected Candidate Plus Trees had exhibited variation in height, Girth at Breast Height (GBH), and Crown Width.

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