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Evaluation of growth performance of improved genotypes of Malabar Neem (*Melia dubia*) in low hills of Himachal Pradesh

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Abstract
The present study was conducted to evaluate one year growth performance of 17 improved genotypes released by Division of Genetics and Tree propagation, Forest research Institute, Dehradun under low hill conditions of Himachal Pradesh. On-farm trial of 17 improved genotypes of *Melia dubia* was established under Randomized Block Design (RBD) at experimental farm College of Horticulture and Forestry, Neri, Hamirpur, Himachal Pradesh. One year growth data was recorded and analyzed for height, diameter and genetic parameters. There was significant variation for diameter and height growth as well as genetic parameters among evaluated genotypes. High values for heritability and genetic advance were recorded for diameter and height growth in all genotypes which indicates good scope of early selection for these growth traits. Among the evaluated genotypes 241, 231 and 238 recorded highest values for diameter and height growth best in terms of evaluated traits and these genotypes need further multilocational field trials for further site specific evaluation of growth parameters under varied agro-climatic conditions of low and mid hills of Himachal Pradesh.

Keywords: *Melia dubia*, heritability, genetic advance, genotypes

Introduction
The ever-expanding population requires an enormous amount of wood, which in turn, puts intense pressure on the existing forest wealth of India. This results in a huge gap between demand and supply. Planting fast-growing trees outside the forest in the form of farm-forestry or agroforestry is the only way to meet the goal. In the past two decades, wood-based industries and plantation companies have emphasized on introducing exotic trees like Eucalyptus and Poplar to fulfill the requirement of raw wood. Controversies surrounding the monoculture of exotic trees for soil health and ecological threats to indigenous vegetation are known to everyone. *Melia dubia* is an important indigenous multipurpose fast growing species tree species grown commercially under various afforestation schemes for fodder, timber and industrial woods. It is amenable for pulp and paper industry due to superior pulp yield as well as quality. The current production of raw materials for pulp and paper is 2.76 million tonnes, against the demand of 5.04 million tonnes, a shortfall of 45 percent. The projected demand by 2020 is 13.2 million tonnes, which is still more staggering (Palsynia *et al.*, 2009) [6]. The wood is also used for packing cases, cigar boxes, ceiling planks, building purposes, agricultural implements, pencils, mach boxes, splints and (Parthiban *et al.*, 2009) [7]. In Himachal Pradesh there is no report on introduction and commercial cultivation of *Melia dubia*. So the present study was conducted to evaluate growth performance of 17 improved genotypes of *Melia dubia* procured from Forest Research Institute, Dehardun under low hills conditions (RBD) at experimental farm College of Horticulture and Forestry, Neri, Hamirpur, Himachal Pradesh.

Materials and Methods
The seedlings of 17 improved genotypes released by Division of Genetics and Tree Propagation, Forest Research Institute,

Dehardun were planted at forestry research farm Khaggal, College of Horticulture and Forestry, Neri, district Hamirpur, Himachal Pradesh in August, 2017. The study area has subtropical climate comprising of low hills zone of Himachal Pradesh, lies between 31º41'47.6" N Latitude & 72º28'06.3" E Longitude, having an altitude of 650 m amsl. The study area has medium deep to deep loamy soils. The experiment was laid with seedlings of 17 genotypes of *Melia dubia* with five replications in Randomized Block Design (RBD). Observations on growth parameters of seedlings *viz*., collar diameter and height was recorded after one year of planting in November, 2018. The collar diameter was recorded with the help of digital calliper in millimeter (mm) m and height with the help of measuring tape in centimeters (cm). Statistical Analysis for growth and genetic parameters was performed by JMP-10 software (JMP- 10 software, 2007) [1].

Results and Discussions

Table 1: ANOVA for height and diameter

Character	Source of variation	DF	Mean Sum of Square	F Ratio	Prob > F
Height	Genotype	16	3.41	55.44	<.0001
	Rep	4	0.08	1.33	0.2701
	Error	64	0.06		
Diameter	Genotype	16	4.42	50.16	<.0001
	Rep	4	0.04	0.46	0.7629
	Error	64	0.09		

Analysis of variance revealed that the variation for one year height (p<0.0001) and diameter (p<0.0001) were significant due to genotypes under study (Table 1). Three genotypes namely 241,231 and 238 performed best both in terms of height as well as diameter growth (Table 2, figure 1 and figure 2).

Table 2: Genotype wise Variance components for height and diameter

Genotypes	Height		Diameter	
20	3.02	DE	2.06	EF
28	3.21	CDE	2.10	EF
32	2.98	DE	2.01	EF
65	2.73	E	1.75	EF
75	2.66	E	1.85	EF
104	2.69	E	1.83	EF
231	4.84	A	3.68	B
232	2.68	E	1.65	EF
235	2.89	E	2.03	EF
238	4.79	A	3.61	B
241	4.99	A	3.62	B
256	2.76	E	1.55	F
261	2.69	E	4.89	A
267	4.08	B	2.92	CD
349	2.85	E	2.29	DE
622	3.50	CD	2.24	E
624	3.73	BC	3.17	BC

*Values not connected by same letter are significantly different.

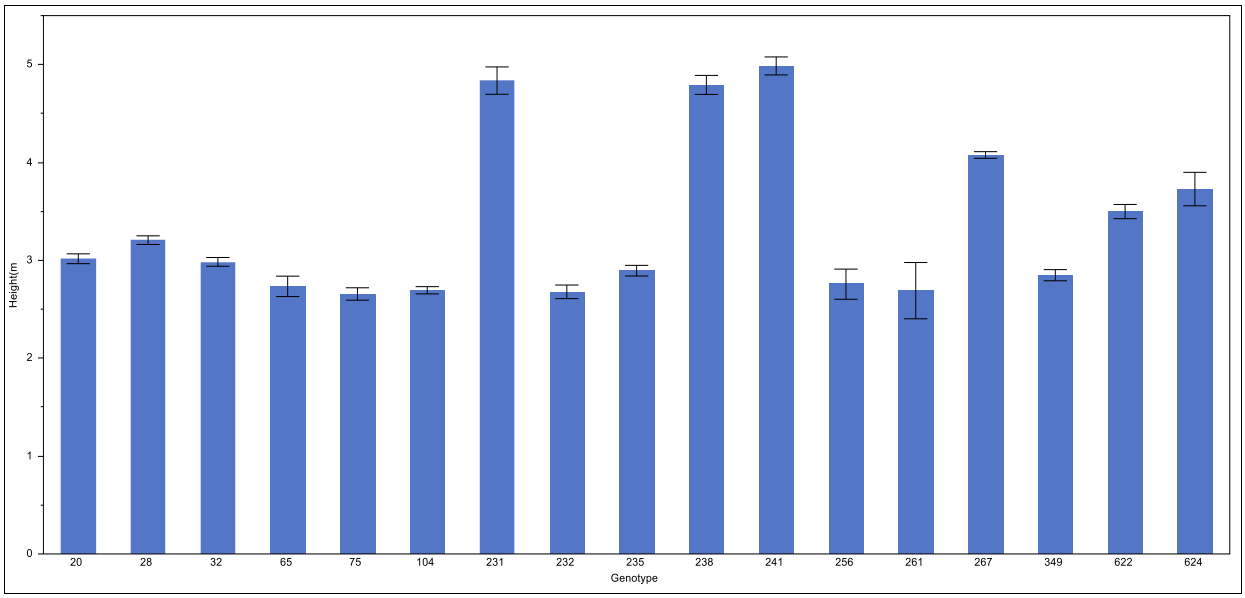

Fig 1: Genotype wise variation in height for three months old *Melia dubia* seedlings

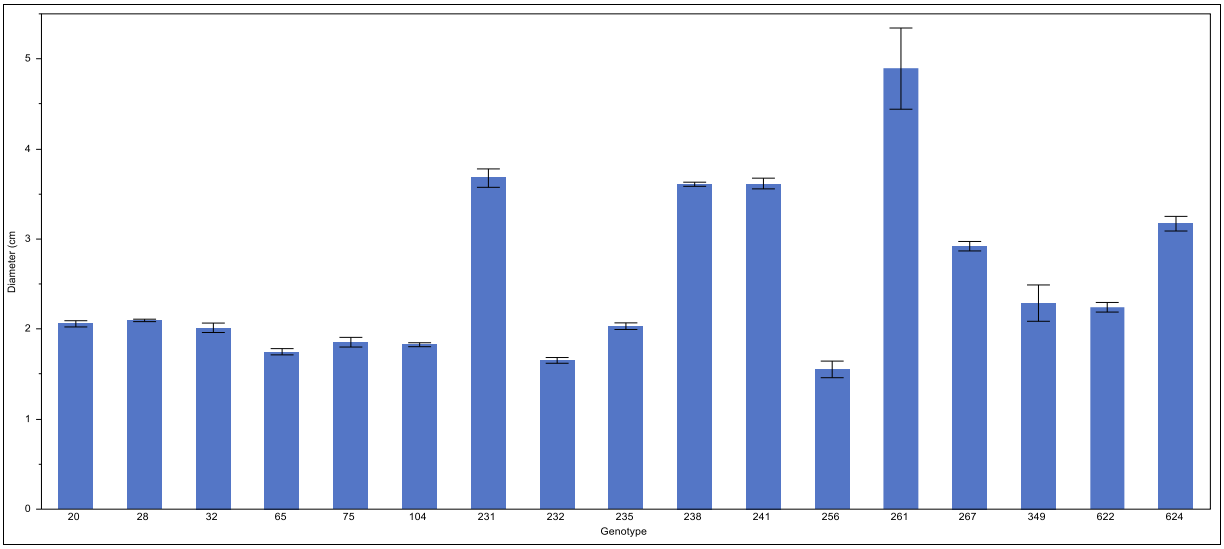

Fig 2: Genotype wise variation in diameter for three months old *Melia dubia* seedlings

Table 3: Variance components for height and diameter

Component	Height (cm)	Diameter
Vg	0.67	0.77
Ve	0.06	0.08
Vp	0.73	0.85
GCV	24.36	26.10
ECV	7.38	8.52
PCV	25.45	27.45
h^2	0.92	0.90
GG	1.61	1.72
GA	48.02	67.60

The variance component analysis showed that the genetic variance was higher as compared to environmental variance for both the characters which is reflected in heritability (h^2) and genetic advance (GA) values where both the character showed higher heritability value (0.92) for height and (0.90) for diameter as well genetic advance value (48.02) for height and (67.60) for diameter (Table 3). These results are in agreement with the findings of other researchers on *Melia dubia* (Sharma *et al*., 2018, Kumar *et al.*, 2017) [9, 5] The variation in productivity has also been reported in tree species by Kumar *et al*., (2010) [4] in *Eucalyptus tereticornis*, Prasad *et al*., (2001) [8] in *Lucaena leucocephala* and by Jayraman and Rajan (1991) in *Eucalyptus auriculiformis* [2]. Plethora of workers reported the existence of significant differences and superiority of few seed sources, open pollinated families and provenances in tree species like Lagerstroemia spp. (Jamaludheen *et al*., 1995) [3] in different age gradations which lend support to the current findings genotypes of *Melia dubia*. Assessment of genetic variability is a key to progress in tree improvement programme (Zobel, 1981) [10] and is a useful tool in determining the strategies for tree improvement and breeding of any species.

Conclusions

Significant variation among all genotypes was found for height as well diameter growth. The high value of heritability (h^2) and genetic advance (GA) for both height and diameter growth in evaluated genotypes suggest that early selection can be made for these traits in *Melia dubia*. Genotypes 241,231 and 238 performed outstanding in terms of height, diameter and variance components among all in present study however these genotypes need further site specific testing by raising multilocational field trials for evaluation of growth parameters under different agro-climatic conditions of low and mid hills of Himachal Pradesh.

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