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Morphological Characterization of *Melia dubia* Seeds : Implications to Germination

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Abstract

Melia dubia Cav. is an important tree species considering its performance under stressful conditions. However, one of the biggest constraints in establishing *M. dubia* plantation is poor seed germination. This study is an effort to characterize the morphological characters of the fruit and seed which may influence seed germination. About 13 per cent of fruits in a lot were found to be of large size while 45 and 51 per cent was of medium and small size. Number of locules as well as filled locules that results in formation of matured seeds in large fruits was higher than in medium and small fruits. Seeds from large fruits also had longer viability. Strong positive relationship between seed size related morphological characters with seed longevity and therefore, germination indicate that the use of morphological characters is an effective field key for producing quality planting material. This is specially so in case of tree species whose seeds are very difficult to germinate. Results also indicate that, seeds treated with 100 ppm GA resulted in highest rate of 30 per cent germination followed by 17 per cent in 200 and 2000 ppm concentrations, respectively.

Keywords: *Melia dubia*, germination, seed viability, fruit size

Melia dubia is a tree species gaining importance in the recent years. It is becoming popular especially in semi arid regions because of its hardy nature and good growth rates under diverse soil and low moisture conditions. It has reasonably short rotation and the wood is preferred in plywood industry because of its additional anti-termite property. It is also found useful in pulp industry because of its high pulp recovery and fibre strength and desirable Kappa values (Parthiban *et al.,* 2009, Saini *et al.*, 2007, Raghavendra *et al.,* 2009). The thick and lush green canopy of the tree is a good source of fodder especially during summer. All these characters make this species a good candidate for establishing both plantations and also to incorporate it as an agroforestry component. However, one of the major constraint is its poor seed germination (Shearer, 1961, Nair *et al*., 1991). There are many strategies adapted by trees to provide protection to the embryo from mechanical damage, microorganisms and climatic aberrations of fluctuating temperature, light and humidity (Yasseen *et al.,* 1994). However, these adaptive strategies may come in the way of germination. Hence, improvement in seed germination can help in reducing the cost of seedling production and encourage the cultivation of this species. In this study, made an attempt to understand the morphological characters and its relationship to seed germination, because, any phenotypic character is easy and quick to identify at the field level and serve as a useful tool for producing quality planting material. There is no much information available in the regard in *M. dubia*.

Material and Methods

In the present investigation, 500 matured healthy fruits were randomly selected from the seed lot in five replications of 100 each. From these fruits, the morphological characteristics such as, length and width was measured using digital calliper (Mitutoyo, Japan). Fruit length was measured from the base to the tip. Fruit width was measured at the widest point around the middle of the fruit. The individual fruit weight of fresh fruit with pulp was measured using a sensitive balance (Acculab, Sartorius, Japan). Similarly, the seed weight was also measured after extraction from fruits. Based on the above characters, the fruits were grouped into small, medium and large fruits, viability and seed germination were assessed in these three groups of the seed lot.

The fruit pulp was removed after soaking fruits in water overnight and rubbing it on a rough surface.

Number of seeds per fruit was counted by breaking the fruit using a bench wise. Hundred fruits from small, medium and large groups were selected, cut horizontally and number of locules in each fruit was counted. Presence of seed in a locule is treated as filled locule and without seed as empty locule.

TZ test is used for testing seed viability (Bhodthipuks *et al.,* 1996). Seeds were soaked in 0.5 per cent 2, 3, 5-tripheny tetrazolium chloride and incubated in petri dishes under dark at room temperature (25^{0}C) or 24 horus. This test was carried out at 10 days interval in the beginning for one month at 20 and 40, day's interval for another six months. The seed viability percentage was calculated as,

$$\text{Viability (\%)} = \frac{\text{No. of stained seeds}}{\text{Total no of seeds used}} \times 100$$

The seeds were treated with six different concentration of Gibberllic acid (100, 200, 1000, 2000, 3000 and 5000 ppm) for 24 hours and these seeds were sown in root trainers. The experiment was carried out in a poly house where the temperature was maintained between 28-30^{o}C, humidity of 70-80 Per cent and a light intensity of 1000-1100 µmoles $m^{-2}s^{-1}$.

The germination experiment was laid out in complete randomized design (CRD) with four replications. For each treatment, 30 seeds were used. After imposing all the treatments, seeds were sown in root trainers with potting mixture.

Results and Discussion

In the present investigation, the morphological characters of fruit and seed were analyzed to implicate their relevance to seed germination in *M. dubia*. Many studies have shown strong relationship between seed size and germination in tree species (Jakobsson and Eriksson, 2000, Souza and Fagundes, 2014). Significant variation was seen in the fruit size in this species (Table I). It is important to note that only 13 per cent of the fruits were found to be large in size, while 42 and 45 per cent were medium and small in size, respectively (Fig.1). In order to quantify the proportion of biomass allocation between the fruit and seed among

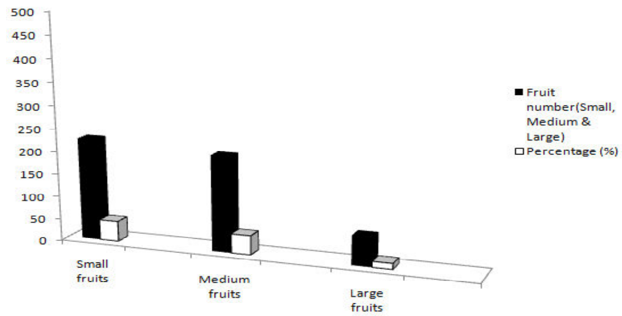

Fig. 1 : Variation in fruit size of *M. dubia*

fruit size, fruit to seed biomass ratios were estimated (Table I). It ranged significantly from 29 in small fruit to 24 and 25 in medium and large fruits, respectively. This indicates the priority of biomass allocation towards producing seeds with higher fitness for germination rather than for developing hard seed coat (Hossain *et al.,* 2005). This was also evident in larger fruits in which seeds size and weight remained more by completely occupying the entire space in a locule and also with more number of filled locules (Table II).

The number of locules increased with size of the fruit (Table II). Total number of locules varied significantly from 2.32 in small fruits to 3.55 in large fruits. Number of filled locules which leads to seed

TABLE I

Description of Morphologial characters of fruit and seed of Melia dubia

Fruit size	Fruit characters			Seed characters			Fruit to seed ratio
	Length (mm)	Width (mm)	Weight (gm)	Length (mm)	Width (mm)	Weight (gm)	
Small	27.50	19.85	9.68	14.25	3.64	0.16	29
Medium	31.75	24.76	12.66	14.36	3.74	0.20	24
Large	36.84	27.89	17.45	14.48	3.86	0.23	25
C.D @ 0.1%	4.30	5.81	2.71	NS	NS	0.05	1.02

formation was also found to be more in large fruits compared to small and medium fruits. Similarly, the number of unfilled locules which leads to incomplete or no seed filling also showed a similar trend. The percentage of filled locules was 86 per cent in large fruits against 66 per cent in small fruits.

TABLE II

Details of the locules and seed formation in Melia dubia *fruit*

Fruit size	No. of locules presentin in a fruit	No. of filled locules in a fruit	No. of unfilled locules in a fruit
Small	2.32	1.55	0.82 (67)
Medium	2.93	2.21	0.72 (75)
Large	3.55	2.97	0.58 (84)
CD @ 5%	0.05	0.07	0.001

Figures in parentheses are percentage of filled locules in a fruit

The seed viability showed significant variation with the seed size (Table III). Seeds from small fruits remained 100 per cent viable upto ten days after harvest but started declining. After one year only 30 per cent of small seeds remained viable. Similar trends but slightly better viability was seen in case of medium sized fruits which showed 40 per cent viability at the end of one year, while about 80 per cent of the seeds remained viable at 180 days and about 60 per cent after one year. This suggests that larger fruits with larger seed size will have higher food reserves which, is very crucial for supplying energy desired at the time of germination (Kumar *et al.,* 2003) as well as to sustain the energy source for longer durations.

This is further reiterated from the strong correlations that existed between the morphological seed characters such as seed weight and viability with germination (Table V), number of filled locules and its relationship with viability and germination. Significant positive relationships that exists among these seed characters suggests that morphological character of fruit size is a good indicator of seed germination because large fruit size is found to provide desired conditions for the seed germination. Many studies have shown that morphological characters have significant role to play in seed germination (Dabgar *et al.,* 2007).

Based on the above results only large seeds were used for germination studies. Days to initial germination varied from 16 to 25 days among the various GA treatments (Table IV). The time taken for initiation of germination was 16 days in seeds treated with GA at 100 ppm and highest of 25 days was noticed in seeds treated with 1000 ppm. Days for completion of germination varied from 16 to 64 days among the various treatments tried. All pre-sowing treatments significantly influenced the mean daily germination. It varied from 0.142 to 0.045 per cent in seeds treat with 200 and 5000 ppm, respectively. Highly significant variations were noticed in germination per cent among

TABLE III

Per cent seed viability of fully ripe seeds of Melia dubia

Seed Size	Per cent seed viability with time						
	(1 Day)	(10 Days)	(30 Days)	(70 Days)	(150 Days)	(180 Days)	(360 Days)
Small	100 (90)	100 (90)	90 (71.56)	80 (63.44)	70 (56.79)	60 (50.77)	30 (33.21)
Medium	100 (90)	100 (90)	90 (71.56)	90 (71.56)	90 (71.56)	70 (56.79)	40 (39.23)
Large	100 (90)	100 (90)	100 (90)	90 (71.56)	90 (71.56)	80 (63.44)	60 (50.77)
S.Em±	0.58	0.47	0.71	0.79	0.82	0.69	1.57
CD @0.01%	NS	NS	3.75	4.14	4.29	3.61	8.23

Figures in parentheses indicate arcsine transformed values

TABLE IV

Effect of Gibberllic acid on seed germination in Melia dubia

Treatments	Days to initial germination	Days for completion of germination	Mean daily germination	Germination percentage (%)
$T_{1\ 100PPM}$	16	64	0.140	30.00 (33.21)
$T_{2:\ 200PPM}$	18	35	0.142	16.66 (24.12)
$T_{3:\ 1000PPM}$	25	32	0.093	10.00 (18.44)
$T_{4:\ 2000PPM}$	18	35	0.142	16.66 (24.12)
$T_{5:\ 3000PPM}$	19	32	0.125	13.33 (21.39)
$T_{6:\ 5000PPM}$	23	22	0.045	3.33 (10.47)
$T_{7:CONTROL}$	16	16	0.062	3.33 (10.47)
S.Em±	-	-	0.011	5.19
CD @0.01%	-	-	0.046	21.86

Values in parentheses indicate arcsine transformed values

TABLE V

Correlations among major germination determining characters of Melia dubia

Seed characters	No. of filled locules in a fruit	No. of locules present in a fruit	No. of un-filled locules in a fruit	Viability of seeds	Germination	Seed weight
No. of filled locules in a fruit	**1**					
No. of locules present in a fruit	0.896 ***	1				
No. of un-filled locules in a fruit	-0.434 *	-0.09	1			
Viability of seeds	0.763 ***	0.843 ***	0	1		
Germination	0.795 ***	0.889 ***	0.026	0.982 ***	1	
Seed weight	0.382 *	0.561 **	0.265	0.638 ***	0.594 ***	1

NOTE: *, **, *** indicate the significance at 0.05, 0.001 and 0.0001 per cent errors, respectively.

seeds treated with different concentrations of GA. Among the various treatments, seeds treated with 100 ppm GA showed maximum germination of 30 per cent, followed by 16.6 per cent at 200 ppm and 2000 ppm respectively and the least was recorded in 5000 ppm and control treatments, respectively (Table IV). GA is found to improve germination in many tree species (Hossain *et al,* 2005, Musilamani and Dharmalingam, 2002). Maximum germination of 30 per cent further reiterate the fact that germination would be less in medium and small seeds.

Large variation in fruit size in seen in *M. dubia*. Large seeds has more number of locules and larger seed size. The large size seeds also showed higher viability. A strong positive relationship seen between number of locules, filled locules and seed viability with germination. Treating seeds with 100 ppm gibberlic acid was found effective in enhancing the seed germination. Therefore, fruit size which is a simple morphological character can be used as an indicator that help in increasing seed germination and obtaining higher number of seedlings.

REFERENCES

BHODTHIPUKS, J., PUKITTAYACAMEE, P., SAELIM, S., WANG, B. S. P. AND YU, S. L., 1996, Rapid viability testing of tropical tree seed. *Training course Proceedings No. 4, ASEAN Forest Tree Seed Centre Project,* Kuak-Lek, Saraburi, Thailand.

DABGAR, V. M., MANJUNATHA, G. O., PRADEEP KUMAR, H., AND PATIL, S. K., 2007, Seed source variation for seed traits in *Jatropha curcas*. ISOR, National Seminar, p. 374 - 376.

HOSSAIN, M. A., AREFIN, M. K., KHAN, B. M. AND RAHMAN, M. A., 2005, Effects of Seed treatments on germination and seedling growth attributes of Horitaki *(Terminalia chebula* Retz.) in the nursery. *Res. J. Agric. Bio. Sci.,* **1** (2) : 135-141.

JAKOBSSON, A. AND ERIKSSON, O., 2000, A comparative study of seed number, seed size, seedling size and recruitment in grassland plants. OIKOS, **88** (3) : 494 - 502.

KUMAR, D., MISHRA, D. K. AND SINGH, B., 2003, Effect of temperature, media and light on germination of Neem (*Azadirachta indica* A. Juss.) seeds. *Indian For.,* **133** (12) : 1636 - 1642.

MUSILAMANI, P. AND DHARMALINGAM, C., 2002, Enhancement of germination and seedling growth in Silver oak (*Grevillea robusta*) seeds. *Indian J. For.,* **25** (1) : 30 - 33.

NAIR, K. K. N., CHACKO, K. C., MENON, A. R. R., BHATT, K. V. GEORGE MATHEW, MOHAMMED ALI, M. I AND PANDALAI, R. C., 1991, Studies on selected indigenous species for future plantation programmes in Kerala. KFRI research report No.231. Kerala Forest Research Institute, Peechi, p. 110.

PARTHIBAN, K. T., BHARATHI, A. K., SEENIVASAN, R., KAMALA, K. AND RAO, M. G., 2009, Integrating *Melia dubia* in agroforestry farms as alternate pulpwood species *Asia-Pacific Agroforestry Newsletter,* No. 34.

RAGHAVENDRA, T. R., PRITI, V., SWATHI, H. K., RAMESHA, B. T., RAVIKANTH, G., GANESHAIAH, K. N., SRIKRISHNA, A AND UMA, S. R., 2009, Prospecting for alternate sources of shikimic acid, a precursor of Tami flu, a bird-flu drug. Scientific correspondence. *Curr. Sci.,* **96** (6) : 771 - 772.

SAINI, V., KINGER, H. K., MIDDHA, A. AND RATHORE, G. S., 2007, Study of anti-bacterial and anti-fungal activity of *Melia dubia* leaves. *Inter. J. Pt. Sci.,* **2** (1) : 239 - 240.

SHEARER, R. C., 1961, A method of overcoming seed dormancy in subalpine larch. *J. For.,* **59**: 513-514.

SOUZA, M. L. AND FAGUNDES, M., 2014. Seed size as key factor in germination and seedling development of *Copaifera langsdorffii* (Fabaceae). *American J. Plant. Sci.*, **5** : 2566 - 2573.

Yasseen, M. Y., Barringer, S. A., Splittstoesser, W. E. and Costza, S., 1994, The role of seed coat in seed viability. *Bot. Rev.* **60** (4) : 426 - 439. doi:10.1007/BF02857926.

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