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RESEARCH ARTICLE

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Germination and vigor index of different sources of *Pongamia pinnata* (L.) Pierre

H.Y. PATIL, S.M. MUTANAL, M.V. MOKASHI AND S.M. GHATANATTI

ABSTRACT : The study on germination of different sources of *Pongamia pinnata* was carried out in the nursery of the Department of Farm Forestry at Main Agricultural Research Station, University of Agricultural Sciences, Dharwad during the year 2015. The nine Pongamia sources were received from Mahatma Phule Krishi Vidyapeeth (MPKV), Rahuri, Maharashtra for multilocation trial and were evaluated under nursery for vigour and germination percentage. The seeds were measured for its width, bredth, thickness, test weight. Variation in intial parmaters *viz.*, germination per cent, vigour index, roots and shoot length were significantly higher among the Pongamia sources of RAK-7, RAK-10 and RAK-2 as compared to other sources tested.

KEY WORDS : Vigour index, Germination per cent, Sources, Seed characteristics

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INTRODUCTION

Pongamia is an important species with lot of variability, which can exploited for its improvement farming systems in different agroclimatic requirements, evolving the superior seeds. Genetic differences associated with the place of origin have been several times as great as that among individual trees within the population. Hence it becomes necessary to conduct seed source testing prior to a more intensive breeding work (Sniezko and Stewart, 1989).

MEMBERS OF RESEARCH FORUM

Address of the Correspondence : **H.Y. PATIL,** AICRP on Agroforestry and Department of Crop Physiology, University of Agricultural Sciences, DHARWAD (KARNATAKA) INDIA Email: patil_hy@rediffmail.com; patilhy@uasd.in

Address of the Coopted Authors : S.M. MUTANAL, M.V. MOKASHI AND S.M. GHATANATTI, AICRP on Agroforestry and Department of Crop Physiology, University of Agricultural Sciences, DHARWAD (KARNATAKA) INDIA

For a successful promotion of large scale plantations there is a need for carefully planned and well directed seed source research. The most successful tree improvement programme is that where proper seed sources were used. The loss from using the wrong sources can be great and even disastrous (Zobel and Talbert, 1984).

Pongamia pinnata is an important non-edible minor oilseed tree that grows in the semi arid regions. It is a medium sized glabrous tree with a short bole and spreading crown planted for shade and for ornamental purpose. The leaves are a good source of green manure and being leguminous, they enrich the soil with nitrogen. The seeds were compressed ovoid or elliptical, been-like, 10-15cm long, dark brown, which contain around 30-35 per cent of oil identified as a source of biofuel. Extracts from the plant are known for the medicinal properties and their

effects on a wide array of organisms including insect and pests, molluses and nematodes (Raut *et al.*, 2011).

It is predominantly cultivated through seeds and the genetic diversity has been conserved through storage of seeds, the most common conventional and economical method. However, the seeds of *Pongamia pinnata* suffer from germination and storage problems. Seed storability varies greatly among the tree species and is mainly infuenced by the variation in climatic conditions, such as temperature, rainfall and relative humidity, which fluctuate in our country across the year. This makes the storage of seeds difficult for commercial exploitation, cultivation and conservation of plant genetic resources (Kumar *et al.*, 2007). Differences in storage behaviour are often associated with morphological, physiological, anatomincal strucure and biochemical composition of the seeds, which affect the descication and chilling sensitivity of seeds and thereby the longevity in storage.

Genetic differences associated with the place of origin have been several times as great as that among individual trees within the population. Hence, it becomes necessary to conduct seed source testing prior to a more intensive breeding work (Sniezko and Stewart, 1989). Screening of seed source provides great opportunity to the tree breeder to screen and capture natural variation for success of afforestation besides providing information to the raw mateiral for breeding and improved planting stock. Hence, present study was undertaken to know the germination and vigour index of *Pongamia pinnata* seeds suppplied by Mahatma Phule Krishi Vidyapeeth (MPKV), Rahuri, Maharashtra for multilocation trial.

EXPERIMENTAL METHODS

The present experiment was conducted during the year 2015-16 in the Nursery of the Department of Farm Forestry at Main Agricultural Research Station, University of Agricultural Sciences, Dharwad which is located between 15.30^0 N latitude and 75.01^0 E longitude and at an altitude of 678 m above MSL. The zone received an average rainfall of 782.6 mm in 57.2 days during the year. The mean minimum temperature varies from 13.3^0C to 21.9^0C and mean maximum temperature varies from 28.4^0C to 34.7^0C. Relative humidity ranges from 56 per cent to 80 per cent.

The different sources of *Pongamia pinnata* seeds were supplied by the Mahatma Phule Krishi Vidyapeeth (MPKV), Rahuri, Maharashtra for multilocation trial under agroforestry system at Dharwad campus under Northern transitional zone of Karnataka. The zone is known for its maximum number of pulses, cereals and oil seeds grown. In Rahuri, the Pongamia trees were identified based on the growth and yield pattern. The seeds were collected from individual progeny from nine different sources *viz*., RAK-1, RAK-2, RAK-3, RAK-4, RAK-6, RAK-7, RAK-8, RAK-9 and RAK-10.

The seeds received were used for the assessment of germination and seedling characteristics. The seed parameters *viz.*, thickness, length, width and test weight of seeds per 100 seeds were recorded for each source. The experiment was laid out in the Randomized Composite Blcok Design with three replications. The 100 seeds from different sources were sown in polybags of 5" x 8" on 17.07.2015. These polybags were filled with red soil : sand : FYM in the ratio of 2 : 1: 1, respectively. Watering was done to these polybags every day. Observations on daily germination were recorded upto 20 days from date of sowing. Germination percentage, peak value was recorded for each source. The parameters such as seedling hieght, collar diameter, number of leaves, root length and vigour index were assessed. Data collected and analyzed statistically.

$$\text{Germination per cent } Z \frac{\text{Number of seeds germinated}}{\text{Number of seeds sown}} \times 100$$

Vigour index = Germination % x (Shoot length + Root length)

EXPERIMENTAL RESULTS AND ANALYSIS

The results obtained from the present investigation as well as relevant discussion have been summarized under the following heads :

Seed characteristics:

The seeds collected from different sources of Pongamia varied significantly among seed length, width and thickness (Table 1). Seed width varies from 1.80 mm to 2.64 mm and was highest in the RAK-8 (2.64 mm) followed by RAK-4 (2.52 mm) and RAK-7 (2.51 mm). The seed breadth varies from 1.65 mm to 2.32 mm and highest was noticed in the RAK-8 (2.32 mm) followed by RAK-9 (1.80 mm). The thickness varies from 1.08 mm to 1.29 mm. Significantly higher thickness was recorded in RAK-8 (1.29 mm) followed by RAK-1 (1.28 mm) and RAK-7 (1.28 mm) as compared to other seed

sources. The seed test weight was significantly higher in RAK-8 (2.32 g) followed by RAK- 7 (1.78 g). The size and shape of seed variable is depending on structure and form of the ovary and environmental conditions under plant grows. This variation may be due to the fact that these trees were collected from wide range of climatic conditions as will as soil type and altitudes in Rahuri district of Maharashtra. Similar findings were observed in *Jatropha curcas* by Kumar (2003) and in Pongamia by Vasanth Raddy *et al.* (2007).

Germination percentage:

The germination of the seeds can be measured by germination percentage which varies from region to region and from plant to plant. Seed germination was started after 12th day of sowing in all the sources except in RAK-6 and RAK-4. These seed were germinated 18 days after sowing and completed in 20 - 25 days after sowing. Seed germination varies among various provenances from 12.5 per cent to 94.1 per cent. It was significantly higher in RAK-7 (94.1 %) followed by RAK-10 (89.1 %) and RAK-2 (84.0 %) when compared to other seed sources. Minimum germination percent was recorded in RAK-6 (12.5 %) and RAK-9 (25.3 %). The variation in the germination percentage may be due to the size and shape of the seeds and its viability may be attributed to adverse environmental conditions. Both germination rate and vigour index interacted with increase in seed viability and test weight (Police Patil *et al*, 2011).

Shoot and root length:

The shoot lengh was significantly higher in RAK-10 (35.0 cm) followed by the RAK-7 (29.5 cm) and RAK-1 (28.0 cm) and the lowest was observed in RAK-8 (16.0 cm). The root length was higher in RAK-2 (25.0 cm) and RAK-10 (23.0 cm) and the lowest root length was observed in RAK-9 (12.0 cm) and RAK-3 (12.1 cm). The phenotypic and genotypic co-efficient of variation was also close to each other for all traits and test weight exhibited higher phenotypic and genotypic co-efficient variation than other traits (Divakara *et al.*, 2010). Collar dimater of the seedling was recorded which ranged between 0.10 cm to 0.17 cm where maximum collar diamter was recorded in the RAK-6 (0.17 cm). Number of leaves were also significantly higher among RAK-8 (15.4) and RAK-6 (12.3).

Table 1 : Germination percentage and vigour index of different source of *Pongamia pinnata*

Sr. No.	Sources	Germination percentage (%)	Shoot length (cm)	Root length (cm)	Collar diameter (cm)	Number of leaves	Vigour index
1.	RAK-1	53.75	28.00	17.00	0.13	7.00	2418.8
2.	RAK-2	84.00	27.00	25.00	0.15	10.30	4368.0
3.	RAK-3	38.67	19.80	12.10	0.10	5.00	1233.5
4.	RAK-4	31.33	26.00	22.00	0.14	7.10	1024.0
5.	RAK-5	12.50	25.00	18.00	0.15	6.00	537.5
6.	RAK-6	94.12	29.50	18.50	0.17	12.30	4517.6
7.	RAK-7	29.27	16.00	15.00	0.12	4.71	907.3
8.	RAK-8	25.33	25.70	12.00	0.16	15.40	955.1
9.	RAK-9	89.17	35.00	23.00	0.15	10.50	5171.7

Table 2 : Seed characteristics of *Pongamia pinnata* sources

Sr. No.	Sources	Seed breadth (mm)	Seed width (mm)	Seed thickness (cm)	Seed test weight (g / 100 seeds)
1.	RAK-1	1.67	1.93	1.28	1.29
2.	RAK-2	1.79	2.12	1.16	1.32
3.	RAK-3	1.59	2.26	1.14	1.44
4.	RAK-4	1.72	2.52	1.26	1.49
5.	RAK-5	1.68	1.80	1.19	1.68
6.	RAK-6	1.57	2.51	1.28	1.78
7.	RAK-7	2.32	2.64	1.29	2.32
8.	RAK-8	1.80	2.36	1.10	1.24
9.	RAK-9	1.65	2.02	1.08	1.10

Vigour index:

The vigour index was calculated by multipying the germination percentage with root plus shoot length as described by Abdul Baki and Anderson (1973). The vigour index was higher in RAK-10 (5171.7) followed by RAK-7 (4517.6) and RAK-2 (4368.0) as compared other sources tested. This variation is mainly attributed to genetic and environmental factors which affect the seedling growth. This is supported by the study done by Geetanjali *et al.* (2003) in *Jatropha curcas* and George *et al.* (2003) in *Madhuca latifolia*. The seed sources with higher seed weight are endowered with higher biomass and seedling vigour index with test weight, germination and seedling traits may prove to be important selection criteria for breeding and improvement of this species.

Hence, seed source screening provides a great opportunity to the tree breeder to screen and capture natural variation for success of afforestation, besides providing information on the raw material for breeding and evolving improved planting stock within a seed source.

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