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# PERFORMANCE OF DIFFERENT ACCESSIONS OF *PONGAMIA PINNATA*

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**ABSTRACT**

***Pongamia pinnata* is one of the most promising tree borne oil seed species. Ten better performing accessions mainly based on fruiting were evaluated. Uniform size semi-hardwood cuttings were made and were treated with IBA @ 600 ppm. The cuttings were measured, after 75 days of planting for root length, shoot length, collar diameter, fresh weight and dry weight. The shoot length, collar diameter, fresh weight and dry weight had shown significant difference between the sources. Broad sense heritability was highest for rooting (99.58%) followed by fresh and dry weight. Fresh weight showed high genetic advance. The sources Mundara (Tikamgarh) and Khadauli (Agra) performed better in terms of dry matter production as well as rooting.**

***Key words:*** *Pongamia pinnata,* Performance, Accessions, Cuttings.

## Introduction

*Pongamia pinnata* (L.) Pierre is synonymous to *Millettia pinnata* (L.) Panigrahi, *P. glabra* Vent., *P. mitis* Kurz, *Derris indica* (Lam) Bennett, *Cytisus pinnatus* L. (basionym), *Galedupa indica* Lam. and *G. pinnata* (L.) *Taub* (USDA, 2001). It attains heights of 18 m, the trunk is generally short with thick branches spreading into a dense hemispherical crown of dark green leaves. The bark is thin gray to grayish- brown, and yellow on the inside (GOI, 1983). It is a multipurpose legume tree commonly known as karanja, (Hindi), Indian beech (English) pongam (Tamil), honge (Kannada) and dalkaramcha (Bengali). Karanja is naturally distributed along coasts and river banks in India and Burma. It is one of the promising tree borne oilseeds (TBOs') as identified by National Oilseeds and Vegetable Oils Development Board (NOVOD). Recently, it is becoming one of the excellent tree component of agroforestry due to its multipurpose nature. The species act as leguminous as well as bio-fuel tree. Rameshthangam and Ramasamy, 2007; Punitha and Manoharan, 2006; Elanchezhiyan *et al.,* 1993, many workers have reported its numerous medicinal uses Chopade *et al.,* 2008, and its future prospects as a biodiesel yielding species (Scott *et al.,* 2008 and Sangwan, 2010). Sahoo *et al.* (2010) noted the immediate need to widen the genetic base of *Pongamia pinnata* germplasm for proper characterization, and for extensive plantations of elite varieties to meet the demands for biodiesel.

There are a few studies on genetic variability and rooting performance. But there is no study on rooting performance variation among different accessions.

## Material and Methods

The ten promising accessions based on fruiting; from the on-going plus tree progeny trail of NRCAF, Jhansi is utilized in this experiment (There are 18 plus trees planted in the field on August, 2005 as plus tree progeny trail at NRCAF). There are ten treatments (accessions) with four replications of twenty five cuttings, maintained in a poly house during the month of March. Mata tila, near Jhansi in Lalitpur (U.P) is taken as control (Table 1).

### *Preparation of cuttings*

The leaves and shoot apices were excised and uniform leafless semi-hard wood cuttings (18–22 cm long and 1.0 to 1.5 cm diameter) comprising 3–4 nodes were prepared in the month of March, 2011. The cuttings were dipped in 0.1% aqueous bavistin (fungicide, BASF India Ltd, Bombay) for 5 min. The top (apical) cut ends of the treated cuttings were sealed with paraffin wax to reduce the transpiration loss. All the cuttings were treated with 600 ppm IBA uniformly for 24 hours. Uniformity was maintained for size of cuttings, type of growth hormone its concentration and duration of treatments. IBA has been recommended as the best agent among different auxins (IBA, IAA and NAA) for root induction in cuttings of *P. Pinnata.* However, the concentration advised varies among different studies (Negi and Tiwari, 1984; Palanisamy and Kumar, 1997; Palanisamy *et al.,* 1998; Mishra *et al.,* 2001; Karoshi and Hegde, 2002; Kesari *et al.,* 2009). This may be due to the differences in experimental conditions as well as genotypic variability (Mukta and Sreevalli, 2010).

**Cutting of *Pongamia pinnata* accessions from Mundara and Khadauli treated with IBA @ 600 ppm performed better in terms of dry matter production and rooting.**

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**Table 1:** Fruiting based to accessions.

| Accessions | Village | Tehsil | District | State |
|---|---|---|---|---|
| 1 | Mata tila | Lalitpur | Lalitpur | U.P |
| 2 | Police line | Rewari | Rewari | Haryana |
| 3 | Sports stadium | Alwar | Alwar | Rajasthan |
| 4 | Chodi koti | Bassi | Jaipur | Rajasthan |
| 5 | Jari ka har | Haripur | Dholpur | Rajasthan |
| 6 | NDRI | Karnal | Karnal | Haryana |
| 7 | Mundara | newari | Tikamgarh | M.P |
| 8 | Khadauli | Agra | Agra | U.P |
| 9 | Ghughasi | Bangra | Tikamgarh | M.P |
| 10 | Samudan | Gwalior | Gwalior | M.P |

The data were taken after 75 days of planting, the parameters which includes rooting (%), root length (cm), shoot length (cm), collar diameter (cm), fresh weight per plant (g) and dry weight per plant (g).

### *Statistical analysis*

The data obtained were analysed for variance and covariance components using statistical package for agricultural research 2.0 (SPAR-2) software (Ahuja *et al.*, 2008). The phenotypic variation for each trait was partitioned into genotypic and environmental components and estimated using the following formula (Johanson *et al.*, 1955).

$$V_p = MSG/r;\ V_g = (MSG-MSE)/r;\ V_e = MSE$$

Where MSG, MSE and r are the mean squares of accessions, mean squares of error and number of replication, respectively.

To compare the variation among traits, phenotypic (PCV) and genotypic (GCV) coefficients of variation were computed according to the method suggested by Burton (1952):

$$PCV = (\sqrt{Vp}/X) \times 100;\ GCV = (\sqrt{Vg}/X) \times 100$$

where, Vp, Vg and X are the phenotypic variance, genotypic variance and grand mean for each pod and seed-related trait, respectively. Broad sense heritability (h2B) was calculated according to Allard (1999) as the ratio of the genotypic variance (Vg) to the phenotypic variance (Vp). Genetic advance (GA) was estimated in accordance with Johanson *et al.* (1955) as follows:

$$GA = K \cdot h2B \cdot \sqrt{Vp}\ ;\ GA = (GA/X) \times 100$$

where, K is the selection differential (2.06 for selecting 5% of the genotypes); GA is as % of the mean. Phenotypic (rp) and genotypic (rg) correlations were further computed to examine degree and direction relationships among seed and seedling traits following Goulden (1952) as:

$$rp = Covp\ (x1, x2)/[Vp(x1) \cdot Vp(x2)]^{½}$$

$$rg = Covg\ (x1, x2)/[Vg(x1) \cdot Vg(x2)]^{½}$$

where, Covp and Covg are phenotypic and genotypic covariances for any two traits x1 and x2, respectively, and Vp and Vg are the respective phenotypic and genotypic variances for those traits.

## Results and Discussion

The analysis of variance revealed that there was a significant variation found for the traits (rooting, root length, shoot length, collar diameter, fresh weight per plant and dry weight per plant) analysed (Table 2). The highest (28 cm) shoot length were measured for T1, T2 and T8 and lowest (19 cm) was in T3. T7 and T8 measured highest collar diameter (20.43 and 19.65 cm respectively) but it was low in T10 (12.13). Fresh weight/ plant was more in T8 (77 g) and T7 (72 g) and it was less in T3 (32 g) and T2 (33 g). The dry weight/ plant was more in t7 (32 g) and t8 (34 g) and it was less in t3 (16 g) and t2 (17 g).

### *Assessment of genetic variability*

The phenotypic coefficient of variation (PCV) wash higher than genotypic coefficient of variation (GCV) for all the traits studied. (Table 3).

The values of broad sense heritability was highest for rooting (99.58%) which was followed by fresh weight and dry weight (97.10% and 91.98% respectively) and it was lowest in root length (12.42%) followed by shoot length (25.69%). The higher value of heritability was due to additive gene effects under favourable environment. Expressions of genetic variation in growth traits is highest in test environments where tree grow most rapidly (Campbell and Sorensen, 1978).

The calculation of genetic advance as per cent of mean showed highest in fresh weight (66.15%) followed by dry weight (52.77%) and rooting (41.15%) and it was lowest in root length (5.06%) and shoot length (8.17%).

In the present study, all the accessions were treated uniformly with 600ppm IBA and therefore the differences in the performance of accessions were

**Table 2:** Performance of ten different accessions of *Pongamia pinnata* in polyhouse.

| Source | Rooting (%) | Root Length (cm) | Shoot length (cm) | Collar Diameter (cm) | Fresh Weight Plant$^{-1}$ (g) | Dry Weight Plant$^{-1}$ (g) |
|---|---|---|---|---|---|---|
| 1 | 93 | 15 | 29 | 13.12 | 39 | 21 |
| 2 | 100 | 18 | 28 | 12.62 | 33 | 17 |
| 3 | 100 | 17 | 19 | 12.23 | 32 | 16 |
| 4 | 95 | 17 | 23 | 15.68 | 60 | 27 |
| 5 | 88 | 18 | 25 | 12.40 | 43 | 20 |
| 6 | 95 | 15 | 22 | 15.55 | 45 | 20 |
| 7 | 90 | 12 | 25 | 20.43 | 72 | 32 |
| 8 | 85 | 18 | 28 | 19.65 | 77 | 34 |
| 9 | 40 | 19 | 22 | 17.78 | 61 | 30 |
| 10 | 88 | 17 | 23 | 12.13 | 39 | 21 |
| CD (P=5%) | 1.942 | 5.268 | 5.572 | 3.045 | 4.840 | 3.219 |
| SEm | 0.653 | 1.773 | 1.875 | 1.025 | 1.629 | 1.083 |

**Table 3:** Genetic estimates of rooting, root length, shoot length, collar diameter, fresh weight and dry weight of *Pongamia pinnata*.

| Genetic estimates | Rooting | Root Length | Shoot length | Collar Diameter | Fresh Weight Plant$^{-1}$ | Dry Weight Plant$^{-1}$ |
|---|---|---|---|---|---|---|
| Genotypic Covariance | 306.09 | 1.34 | 3.65 | 8.72 | 266.55 | 40.41 |
| Phenotypic Covariance | 307.37 | 10.77 | 14.20 | 11.87 | 274.51 | 43.93 |
| Environmental Covariance | 1.28 | 9.43 | 10.55 | 3.15 | 7.96 | 3.52 |
| Phenotypic Coefficient of Variation | 20.05 | 19.65 | 15.36 | 22.93 | 33.09 | 27.89 |
| Genotypic Coefficient of Variation | 20.01 | 6.92 | 7.78 | 19.65 | 32.60 | 26.75 |
| Heritability (%) Broad sense | 99.58 | 12.42 | 25.69 | 73.45 | 97.10 | 91.98 |
| Genetic Advance (%) of mean | 41.15 | 5.06 | 8.17 | 34.39 | 66.15 | 52.77 |

inferred purely as genotypical. The genotypic coefficient of variation and genetic advance as per cent of the mean were found to be high for fresh weight. Higher GCV indicates there is significant improvement could be achieved for this trait through simple selection while higher genetic advance as per cent of mean indicates nature of gene action governing and that suggests population means for fresh weight may be changed considerably by selecting the superior at 5% of the genotypes.

## *पेंगामिया पिन्नाटा* के विभिन्न वृद्धिाकारकों की निष्पादकता

एन. गुरूनाथन, एस.पी. अह्लावत तथा के. राजराजन

### सारांश

*पोंगामिया पिन्नाटा*, वृक्ष से उत्पन्न तेल बीज प्रजातियों में महत्वपूर्ण है। फलन पर आधारित, इसके दस उन्नत वर्धकों की निष्पादकता का मूल्यांकन किया गया। सम-कठोर काष्ठ की एक आकार की कर्तनें बनाई गई जिन्हें आई.बी.ए. @ 600 पीपीएम से उपचारित किया गया। रोपण के 75 दिनों बाद कर्तनों की जड़ीय गहराई, तनों की लम्बाई, कॉलर व्यास, ताजा भार तथा शुष्क भार का मापन किया गया। तने की लम्बाई, कॉलर व्यास, ताजा भार तथा शुष्क भार में मूल स्रोत की तुलना में बहुत अन्तर पाया गया। जड़ों में उच्च आनुवंशिकता (99.58%) पाई गई जिसके बाद ताजा और शुष्कित भार का स्थान रहा। ताजा भार में उच्च आनुवंशिक श्रेष्ठता पाई गई। पदार्थ उत्पादन तथा जड़ीय क्षमता में मुंडरा (टीकमगढ़) तथा खदौली (आगरा) की निष्पादकता उत्तम रही।

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