



Provenance Variation in Seed Germination and Oil Content of *Calophyllum inophyllum* L. Suitable to South Indian Condition

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ABSTRACT

The present investigation was carried out at Forest College and Research Institute, Mettupalayam, Tamilnadu to identify the best half sibs of *Calophyllum inophyllum* across its natural distribution of south India for further collection of seeds for afforestation or breeding purpose. Seeds are sown in nursery to study the variation in germination and initial growth parameters viz., oil content, germination percent, germination value, peak value, mean daily germination of seedlings. Seeds collected from Western Ghats of Karnataka were superior compared to seeds from other parts in all the traits considered for the study. These seed sources can be further screened for tree improvement traits considering their immense value in yielding bio diesel.

Key words:

Germination percent,
Germination value, Peak value,
oil content

INTRODUCTION

Calophyllum inophyllum is in a genus of about 110 species that are pantropical in distribution but most common in tropical Asia. Native from east Africa to Australia. *C. inophyllum* has been widely planted through out the tropics, including many south and central Pacific islands, the Hawaii, and the Caribbean islands. *Calophyllum inophyllum* is a low-branching evergreen tree with a broad, spreading crown of irregular, gnarled branches. It typically attains eight to 20 m in height and 0.5 to 1.0m d.b.h. It is generally described as slow-growing. *Calophyllum inophyllum* is primarily a tree of the seashore, although it occasionally grows at higher elevations and has been successfully planted in inland areas. It grows in areas with annual rainfall ranging from about 1000 to 5000 mm. The tree grows in a wide variety of soils, from nearly pure coastal sands to clay, and is capable of growth on degraded and poorly

drained sites. It can be found right at the edge of the sea, where it may be exposed to high winds, sea spray, and brackish water tables. Descriptions of *C. inophyllum* often emphasize its value as an ornamental because it has attractive leaves, fragrant flowers, and a pleasing form. Indeed, it is probably planted more for ornamental purposes than for other uses. The species is common only planted along streets and in parks in Hawaii and Puerto Rico and in urban areas throughout its native range. The wood is hard, strong, moderately durable, and often highly figured and has a specific gravity of about 0.60 to 0.64. It has been used in general construction and boat building and for flooring, furniture, musical instruments, handicrafts, and a variety of other purposes. The thick, dark green oil extracted from the seeds is used in a number of products, including oil for lighting, medicines, and body and hair grease.

Calophyllum inophyllum grows best in sandy, well drained soils. However it tolerates clays, calcareous, and rocky soils. The tree supports a dense canopy of glossy, elliptical, shiny and tough leaves, fragrant white flowers, and large round nuts. Its size typically ranges between 8 and 20 m (25–65 ft) tall at maturity, sometimes reaching upto 35 m (115 ft). The growth rate of the tree is 1m (3.3ft) in height per year on good sites. Its leaves are heavy and glossy, 10–20 cm (4–8 inch) long and 6–9 cm (2.4–3.6 inch) wide, light green when young and dark green when older. Fruits are spherical drupes and arranged in clusters. The fruit is reported to be pinkish-green at first. However, it turns later to be bright green and when ripe, it turns dark grey- brown and wrinkled. The tree yield is 100–200 fruits/kg. In each fruit, one large brown seed 2– 4 cm (0.8–1.6 in.) India meter is found. The trees yield 3000 –10,000 seeds /tree/season. The seed is surrounded by a shell and a thin layer of pulp of 3–5 mm. *Calophyllum inophyllum* Oil is non-edible and dark green. Traditionally, its oil has been used as a medicine, soap, lamp oil, hair grease and cosmetic in different parts of the world. Recently, *Calophyllum inophyllum* has been proposed as a source of biodiesel.

MATERIAL AND METHODS

The present study was undertaken during the year 2014-15 at Forest College and Research Institute (Mettupalayam), Coimbatore. Location is situated at 11°19'N latitude and 77°56'E longitude and an altitude of 350 m above MSL. The average annual rainfall is 945 mm, most of which is received between June to September. The temperature varies from 15 to 34.9 °C. The extensive survey was undertaken across three different states and one union territory of India. A distance of at least 200 m was maintained between two trees and at least 25 km between two seed sources. The individual tree was identified based on their phenotypic characteristics and the individual tree identity was also maintained.

The germination experiment was laid out in completely randomized design with five replications of 100 seeds each. The seeds were sown in the standard nursery bed and regular

watering was done. Observation on daily germination was recorded up to 45 days from date of sowing. Germination percentage, peak value, mean daily germination, germination rate and germination value were recorded for each seed source. Data collected was analysed statistically using Mstac program.

Estimation of genetic parameters viz., variability, PCV and GCV were computed alongwith heritability and genetic advance.

Estimation of oil content

For estimating oil, the seeds were depulped and the kernels were dried at 50°C for 16 hrs and allowed to cool in adessicators. Five grams of seeds were pulverized to a fine powder in a porcelain mortar. Ground samples were placed in a filter paper and fastened in such a way to prevent escape of the meal and then carefully transferred to an extraction thimble. The thimble was then placed in a Soxhlet extractor to which sufficient quantity of solvent petroleum ether (40 - 60°C) was added and heated until eleven siphoning were completed. The oil content was recorded by evaporating the petroleum ether at 60°C. The entire extraction process was carried out in Soxhlet extractor according to AOAC (1970). The percentage of oil content was then calculated by using following formula.

$$\text{Oil per cent} = \frac{\text{Oil weight (g)}}{\text{Sample weight (g)}} \times 100$$

RESULTS AND DISCUSSION

Variation in seed germination

Significant differences were observed for seed germination and its attributes viz., germination percent, germination value, peak value, mean daily germination among the evaluated provenances of *Calophyllum inophyllum*. One of the provenances, FCRICI 14 (78.00%) registered significantly higher value for germination percent as compared to other provenances. Provenances viz., FCRICI 14 (5.11) and FCRICI 2 (4.71) recorded significantly higher germination values as compared to FCRICI 27 (2.24). Peak value varied from 1.68 (FCRICI 24) to 3.06 (FCRICI 14). The mean daily germination ranged from 1.33 (FCRICI 27) to 1.79 (FCRICI 14).

The oil content ranged from 35.7 (FCRICI 26) to 64.6 (FCRICI 14). Similarly, FCRICI 14 (64.6) also recorded significantly higher germination value as compared to other provenances. Among the thirty provenances, FCRICI 14 performed better for germination and its attributes, followed by FCRICI 2. The progenies and provenances in various tree species like *Santalum album* (Bagchi and Sindhu 1991), *Dalbergia sissoo* (Rawat and Nautiyal, 2007) and *Meliadubia* (Kumar et al. 2013) which thus lend support to the current findings in *Calophyllum inophyllum* genetic resources. Similar results of superiority of provenances in *Azardiracta indica* (Jain and Dhar 2008) and in *Acacia catechu* (Gera and Gera 2006) were also lend support to the current investigation.

Genetic variability

Genetic variability in tree species is a gift to mankind, as it forms the basis for selection and further improvement of species. The results clearly indicated that for a majority of traits there is much scope for selection for improvement in *Calophyllum inophyllum*. Variation among progenies are commonly used as an estimate of total genetic variation and to calculate the degree of genetic control for a particular trait (Meena et al. 2013). Character with high GCV have more improvement potential than those with moderate and low (Olayiwola and Soremi 2014). Estimates of PCV were higher than GCV for all germination traits and oil content. In the current study, maximum phenotypic coefficient of variability was registered by germination value (26.40), followed by peak value (21.11) and oil percent (18.71). Genotypic coefficient variability ranged from 5.37 to 15.25. Maximum GCV was observed for germination value (15.25), followed by peak value (10.87) and oil percent (9.38). Mean daily germination (5.379) was recorded as minimum GCV (Table 3). The value of GCV was also high for germination value and peak value. The higher PCV than corresponding GCV for all traits implies that the variability observed were not solely under genotypic influence but with some levels of environmental influence justifying the need to explore more genetic parameters to ascertain the traits to be considered. The variability parameter

estimates in the study are in close approximation with the findings of genetic parameters in *Azadirachta indica* (Dhillon et al. 2003), *Acacia nilotica* (Ginwal and Mandal 2004), *Melia dubia* (Kumar et al., 2013) and also in progenies of *Dalbergiasissoo* (Dogra et al. 2005) which lend support to the findings of current investigation.

In the present study, heritability was low for germination value (0.333), peak value (0.265) and oil percent (0.251). Character with high genetic advance would response favourably to selection as it implies preponderance of additive gene effect. Minimum genetic advance was estimated for germination percent (-1.183 %) and maximum for germination value (18.15 %) followed by peak value (11.53 %) and oil percent (9.69 %). Similarly higher and lower heritability values for different growth attributes were earlier reported in *Eucalyptus* (Dogra and Luna 2006) and in *Casuarina* (Rao et al. 2001) which lend support to the current findings.

CONCLUSION

A total thirty candidate plus trees have been selected in three states of southern region of India by subjective grading and comparison tree selection method. Result of the present study revealed that the two provenances viz., FCRICI-14 (Honnavaara) and FCRICI-2 (Nagapattinam) proved superior in terms of germination and oil content and they are suggested to use and multiplication in large quantity for plantation programme.

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