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Mesua ferrea: An untapped resource for the future of biodiesel industry

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Abstract

Mesua ferrea is a lesser known biofuel species which is widely used for its medicinal purposes and knowledge regarding its oil content was scanty. Since the majority of the oils used in biodiesel are edible and in higher demand due to the expanding global population, their cost is higher. Finding another natural oil with identical qualities that may be used as a replacement is therefore crucial. It could decrease the price as well as the use of edible oils. Oil extracted from *Mesua ferrea* is one such example. The seeds were collected from in and around Sirsi Division and the studies such as fruit and seed morphometric traits and seed oil content were carried out at College of Forestry, Sirsi. The fruit length and fruit diameter showed higher values in T₁ (60.5 mm and 46.5 mm respectively), seed length and seed diameter were found to be highest in T₁ (33.50 mm and 24.50 mm respectively) and seed thickness in T₈ (16 mm). The oil content obtained was 19.63 percent with orange yellow colour.

Keywords: Hydro-distillation, biofuel, immunomodulatory, pericarp, qualitative, quantitative

Introduction

The family Guttiferae is abundant in secondary metabolites and endowed with a wide range of therapeutic capabilities. With more than 100 species, it has 47 genera. *Cratoxylum*, *Hypericum*, *Garcinia*, *Mesua*, and *Vismia* are well-known genera of this family and are extensively dispersed in tropical Asia, Africa, Brazil, New Caledonia, and Polynesia (Gontijo *et al.*, 2012; Piccinelli *et al.*, 2005) [4, 3]. Asian people have traditionally utilised different species of *Mesua* to cure a wide range of conditions, including asthma, cough, dyspepsia, fever, itching, nausea, and kidney illnesses. Antioxidant, antibacterial, antiviral, anticancer, and immunomodulatory properties are just a few of the pharmacological properties of *Mesua* species that have already been established (Teh *et al.*, 2012; Asif *et al.*, 2016) [5, 2]. Since the majority of the oils used in biodiesel are edible and in higher demand due to the expanding global population, their cost is higher. Finding another natural oil with identical qualities that may be used as a replacement is therefore crucial. It could decrease the price as well as the use of edible oils. *Mesua ferrea* is one such example which belongs to the family Clusiaceae, commonly known as Nagasampige. It is a slow growing medium to large sized tree that can attain a height between 18 and 30 m, with reddish-brown to grey colored bark and trunk up to 2m in diameter. The fruits are ovoid with a conical point, 2.5 to 5 cm long; with a woody pericarp that contains one to four seeds. Hence the present study was conducted with the objective to study the fruit and seed morphometric traits and also to study the oil content of seeds for biodiesel production.

Materials and Methods

The study was carried out at College of Forestry, Sirsi. The seeds of *Mesua ferrea* were collected from trees of girth classes 50-70 cm at 9 locations of Uttara Kannada district belonging to agro-climatic zone 9-10. The species abundance was estimated based on reconnaissance survey.

To study the variation in fruit and seed morphometric traits

The fruits collected were bagged, labelled and transported to the laboratory of College of Forestry, Sirsi where it was subjected to measure both quantitative and qualitative traits. The fruit and seed parameters recorded were fruit shape, fruit colour, fruit length, fruit diameter, seed length, seed diameter and seed thickness. Each location was considered as treatment with 3 replications and the design adopted was RCBD (Table 1).



Plate 1: Collection and processing of *Mesua ferrea* seeds

Table 1: Treatments

Treatment	Site
T ₁	Location 1
T ₂	Location 2
T ₃	Location 3
T ₄	Location 4
T ₅	Location 5
T ₆	Location 6
T ₇	Location 7
T ₈	Location 8
T ₉	Location 9

To study the oil yield

Fresh seed samples from mature fruits were collected from different places. The seeds were immediately packed in polyethylene bags and transferred to experimental laboratory. After processing the seeds were subjected to hydro-distillation.



Plate 2: Hydrodistillation of *Mesua ferrea* seeds

Results and Discussion

Fruit colour varied from brown to dark brown and majority of the fruits showed dark brown colour. The fruit shape varied from ovoid to globuse predominant with globuse shape. There is significant variation in the fruit morphometric traits. Fruit length varied from 46 to 60.50 mm; fruit diameter varied from 41.5 to 50 mm. Seeds showed significant variation in seed length, diameter and thickness. Seed length varied from 21 to 33.5 mm, variation in seed width was 17.5 to 24.5 mm and variation in thickness was found to be between 11.5 and 16 mm. The seed yielded about 19.63 percent oil and colour was orange yellow which was very less compared to the study conducted by Ali *et al.* (2004) [1] which showed that oil content yielded from the seeds was about 63 percent which may be due to variation in seed source and also the method adopted for oil extraction.

Table 2: Variation in fruit parameters of *Mesua ferrea*

Samples	Fruit shape	Fruit colour	Fruit length (mm)	Fruit diameter (mm)
T ₁	Globuse	Dark brown	60.50	46.50
T ₂	Globuse	Dark brown	55.00	44.50
T ₃	Ovoid	Dark brown	46.00	44.00
T ₄	Ovoid	Dark brown	56.50	50.00
T ₅	Globuse	Brown	54.50	46.75
T ₆	Globuse	Dark brown	50.50	45.00
T ₇	Globuse	Brown	57.00	41.50
T ₈	Ovoid	Brown	55.00	44.00
T ₉	Globuse	Brown	52.50	42.00
CD@ 5%			3.40	1.78

Table 3: Variation in seed parameters of *Mesua ferrea*

Samples	Seed length (mm)	Seed diameter (mm)	Seed thickness (mm)
T ₁	33.5	24.50	13.50
T ₂	29	18.00	14.00
T ₃	25.5	17.50	11.50
T ₄	32.5	18.00	13.50
T ₅	30.5	20.00	15.00
T ₆	28.5	18.00	12.50
T ₇	32	21.00	15.50
T ₈	29	19.00	16.00
T ₉	21	18.00	12.50
CD@5%	2.54	1.16	0.81

Table 4: Seed oil yield from *Mesua ferrea*

Species	Oil colour	Oil odour	Oil yield (%)
<i>Mesua ferrea</i>	Orange yellow	Disagreeable	19.63

Conclusion

Significant variations in fruit and seed parameters are existing. The oil yield is lower than popular tree borne oil seeds like Pongamia, Jatropha etc. However, higher oil content of 40-51% was reported by few workers. Hence, further studies are needed to identify the high oil yielding tree source in natural populations. *Mesua ferrea* with its both seed oil content coupled with its wide natural distribution in Western Ghats may serve the needs of both pharmaceutical and biofuel sector.

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