
Research Article

Traditional therapeutic relevance and *in vitro* antioxidant potential of leaf extract of *Sterculia foetida* L.

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Abstract: Plants have long been important sources of food, medicine and skin care. Despite the widespread use of synthetic drugs, a significant proportion of the global population still depends on plant-based remedies for primary healthcare. *Sterculia foetida* is a fast-growing tropical tree, renowned for its ethnomedicinal significance and diverse phytochemical composition. Traditional knowledge indicates its use in treating rheumatism, fever, skin diseases, asthma and other ailments. While it is well-known for its edible seeds, its leaves are also utilized in forms such as decoctions and topical preparations. In the present study, we investigated the antioxidant activity of *S. foetida* leaf extracts using the DPPH radical scavenging assay. A concentration-dependent increase in percentage inhibition was observed in the tested methanolic and ethanolic leaf extract. The standard antioxidant, Quercetin, showed inhibition ranging from 96.85% to 97.50% across the tested concentrations. This observed activity may be associated with the presence of phytochemicals such as flavonoids, phenolics, alkaloids, terpenoids and other secondary metabolites found in the species. Our findings highlight the antioxidant potential of *S. foetida* leaves, validating their ethnobotanical uses and supporting further investigation into their pharmacological applications.

Keywords: Antioxidants, ethnomedicinal plants, phytoconstituents, *Sterculia foetida*, traditional healthcare systems

Introduction

The significance of plants dates back to when humans first began searching for food. Over time, plants have also become a vital source of medicine (Niazi and Monib, 2024). In the 21st century, synthetic chemical products have become a common part of our daily lives, being used as nutritional supplements, skincare products, and medicines (Puri et al., 2022). However, the reliance on plant-based resources has not diminished. In fact, around 70-95% of people in developing countries still depend on traditional medicine for their basic healthcare, much of which is derived from plants (Press Information Bureau, 2026). Many of these practices stem from well-established medical traditions such as Traditional Chinese Medicine, Ayurveda and African Traditional Medicine (Latif and Nawaz, 2025). This indicates that the world continues to rely on plant-based remedies today, highlighting the need for further research to identify plants rich in bioactive compounds and explore their medicinal potential. One such plant is *Sterculia foetida* (Figure 1). The name comes from the Roman God Sterquilinus, who was associated with manure and fertilizer.



Figure 1: (a) Leaves and (b) fruits and seeds of *Sterculia foetida*

The genus name *Sterculia* is derived from the Latin word *stercus*, which means 'manure'. The species name *foetida* translates to 'stinking', a reference to the strong odour of its flowers (Farsana et al., 2022). *S. foetida* is a medium-sized deciduous tree characterized by digitate (palmately arranged) leaves with elliptic to elliptic-lanceolate leaflets that have entire margins and pointed tips. Young leaves are sticky, glandular, and emit an unpleasant smell, while mature leaves become smooth and hairless. Flowering occurs from March to July, and fruiting takes place from October to January (Saxena and Brahmam, 1994). The tree produces axillary or subterminal panicles of flowers that often appear in clusters. The flowers are reddish and feature lanceolate, hairy calyx lobes. The gynandrophore is curved and covered with star-shaped hairs. Male flowers typically contain about 15 stamens, while bisexual flowers have five hairy carpels that develop into bright scarlet, boat-shaped follicles with a short beak. The fruits are woody and smooth, and the seeds are dark grey, ellipsoid to oblong, with a small rudimentary yellow aril. Commonly known as the 'Java Olive' and locally called 'Jangli Badam', this tree is valued for its medicinal properties, edible seeds and industrial applications such as oil and timber (Orwa et al., 2009). The seeds (Figure 1) are often roasted and consumed (Saxena and Brahmam, 1994). In traditional practices, a paste made from the seeds mixed with leaf juice is applied to areas affected by ringworm twice daily until healing occurs (Policepatel and Manikrao). The plant has also been widely recognized for its medicinal uses in treating various conditions, including rheumatism, emphysema, asthma, arthritis and fever. It is traditionally used as a laxative and diuretic (Farsana et al., 2022; Dimri et al., 2024). Additionally, the leaves are broadly used as traditional therapeutic and animal fodder (Table 1).

Table 1: Traditional therapeutic uses of *Sterculia foetida* leaves and their modes of preparation (Farsana et al., 2022)

Mode of Preparation	Use(s)	Treatment scope
Decoction	Leaf decoction administered	Management of difficult labour
Leaf paste (ground leaves)	Applied to the affected area	Treatment of eczema and other skin diseases
Pounded leaves (topical application)	Applied externally	Treatment of broken limbs and dislocated joints
Heated oiled leaves (topical application)	Heated leaves are applied to the abdomen of children; used leaves are placed on the chest	Treatment of fever
Fresh leaf juice	Juice is extracted and applied	Insect repellent
Leaf wash / rinse	Used for washing hair	Hair care

General herbal preparation (unspecified)	As traditional remedies	In the treatment of rheumatism, obesity, gonorrhoea, oedema and dropsy
Direct use as fodder	As ruminant feed	Nutritional source (rich in calcium, protein and phosphorus)

Given the broad-spectrum use of *S. foetida* leaves as medicine, hair care and nutritional fodder for livestock, an attempt has been made through this study to evaluate its antioxidant potential to validate its traditional uses.

Methodology

The identification and collection of *Sterculia foetida* leaves were carried out in the nearby areas of the Mahanadi River, Cuttack, Odisha, following the reference standards provided by Saxena and Brahmam (1994). The collected leaf samples were shade-dried for several days to remove excess moisture before undergoing maceration with methanol and ethanol. The resulting extracts were filtered using Whatman no. 1 paper, and the antioxidant activity was evaluated through the 2, 2-diphenyl-1-picrylhydrazyl (DPPH) radical scavenging assay, as described by Baliyan et al., (2022), Kaur et al., (2026), and Kumar et al., (2026) with minor modifications. To conduct the assay, 1 mL of 0.1 mM DPPH solution prepared in methanol was mixed with different concentrations of extracts, which were prepared using their respective solvents. The final volume of the reaction mixture was adjusted to 3 mL, and it was incubated in the dark at room temperature for 20 minutes. A control was prepared using 1 mL 0.1 mM DPPH and 2 mL methanol, while methanol alone served as a blank. Sample blanks were utilized for background absorbance correction. The absorbance readings were recorded at 517 nm spectrophotometrically. The percentage of radical scavenging activity was calculated using the following formula:

$$\% \text{ Inhibition} = \frac{A_0 - A_s}{A_0} \times 100$$

where, A_0 = absorbance of the control and A_s = absorbance of the sample after blank correction.

Results and discussion

Previous studies have identified several bioactive compounds in the leaf extract of *Sterculia foetida*, including 3,7,11,15-tetramethyl-2-hexadecen-1-ol, sucrose, 2,4-dihydroxy-2,5-dimethyl-3(2H)-furan-3-one, 5(2H)-oxazolone-4-(phenylmethyl), 4H-pyran-4-one-2,3-dihydro-3,5-dihydroxy-6-methyl, megastigmatrienone and 2-methoxy-4-vinylphenol. These compounds primarily belong to terpenoid and phenolic classes, along with certain heterocyclic derivatives, which are well-known for their antioxidant and biological activities (Amuthavalli and Ramesh, 2021). Furthermore, phytochemical investigations have documented the presence of several groups of secondary metabolite groups, including flavonoids, fatty acids, alkaloids, phenols, saponins, triterpenoids and steroids in this

species (Alam et al., 2022). Given the reported bioactive constituents, the antioxidant activity of the leaf extracts was evaluated using the DPPH radical scavenging assay. Both methanolic and ethanolic extracts demonstrated a clear concentration-dependent increase in percentage inhibition (Figure 2a). At the lowest tested concentration (0.125 mg/mL), the ethanolic extract showed higher scavenging activity (52.24%) compared to the methanolic extract (36.95%). At concentrations of 0.25, 0.5 and 1 mg/mL, the methanolic extract showed inhibition rates of 62.26%, 88.24% and 94.54%, while the ethanolic extract demonstrated inhibition rates of 67.37%, 83.35% and 93.47%, respectively. Consistently high radical scavenging activity was obtained with the standard, Quercetin, across all the tested concentrations, with inhibition ranging from 96.85% at 8.33 μ g/mL to 97.50% at 66.67 μ g/mL (Figure 2b). Although the plant extracts exhibited slightly lower inhibition than the standard, the high percentage inhibition observed at higher concentrations indicates a strong antioxidant potential of the leaf extracts. This antioxidant activity may be attributed to the presence of phenolic and other bioactive compounds reported in the literature (Farsana et al., 2022).

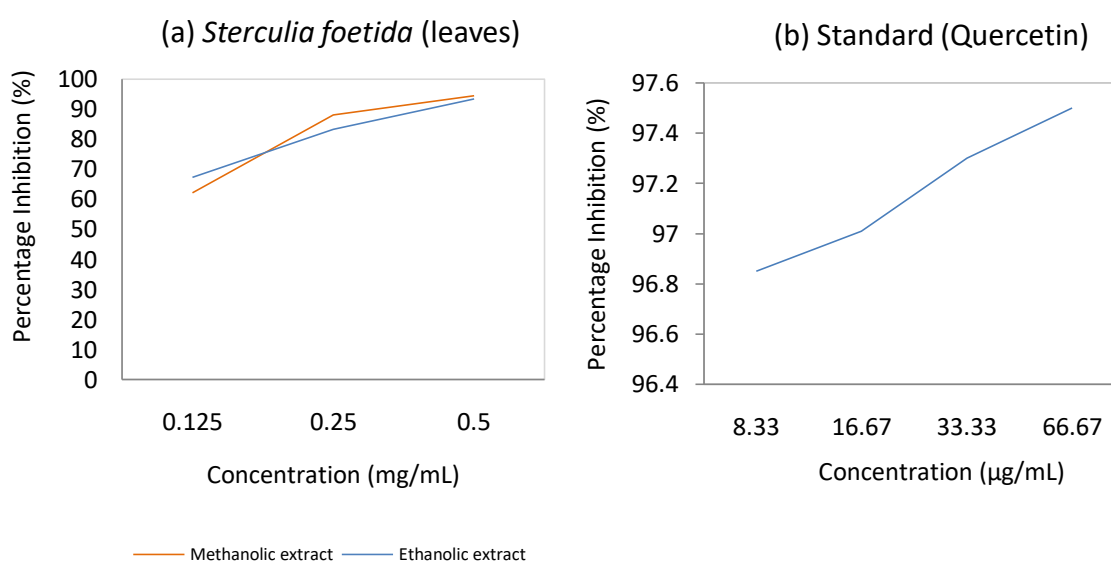


Figure 2: Percentage inhibition against concentrations showing DPPH free radical scavenging activity of (a) methanolic and ethanolic leaf extracts of *Sterculia foetida* and (b) quercetin standard

Research gaps and future aspects

This study presents a preliminary evaluation of the leaf extracts from *Sterculia foetida*. While most research has focused on its seeds, there is limited information on its leaves, including their isolation, characterization and the mechanisms of action of their active compounds. Therefore, future studies should aim to identify and quantify the bioactive constituents using advanced analytical techniques and assess their biological activities through detailed *in vitro* and *in vivo* studies. Such investigations could help validate traditional uses of *S. foetida* and explore its potential applications in the pharmaceutical, cosmetic and nutraceutical fields.

Conclusion

Plants such as *Sterculia foetida* have historically served as important sources of food, medicine and bioactive compounds. Nowadays, their ethnomedicinal uses are still preserved in folk medicine and practices. The present study was conducted to study the antioxidant activity of its leaf extracts using the DPPH radical scavenging assay. Both methanolic and ethanolic extracts demonstrated a percentage inhibition of 94.54% and 93.47%, respectively, at a concentration of 1 mg/mL. The standard range for inhibition range was between 96.85 - 97.50% for the tested concentrations in micrograms. Although slightly lower than the standard, the high inhibition observed indicates strong antioxidant potential of the leaf extracts, likely linked to the presence of phenolics and other phytochemicals reported in the species. These findings support the medicinal importance of *S. foetida* and highlight its potential as a natural source of antioxidant compounds, which can be further, explored in future research.

References

- Alam N, Banu N, Alam NU, Ruman U, Khan Z, Ibn Aziz MA, Barua N, Chy FJ, Jahan A, Juthy TS and Nassan MA. (2022). Deciphering the pharmacological potentials of methanol extract of *Sterculia foetida* seeds using experimental and computational approaches. Evidence-Based Complementary and Alternative Medicine. 2022(1): 3403086. doi: 10.1155/2022/3403086
- Amuthavalli A and Ramesh T. (2021). Phytochemical, fluorescence and GC-MS analysis of methanolic extract of *Sterculia foetida* L. seeds. International Journal of Environment, Agriculture and Biotechnology. 6(1): 46-53.
- Baliyan S, Mukherjee R, Priyadarshini A, Vibhuti A, Gupta A, Pandey RP and Chang CM. (2022). Determination of antioxidants by DPPH radical scavenging activity and quantitative phytochemical analysis of *Ficus religiosa*. Molecules. 27(4): 1326. doi: 10.3390/molecules27041326
- Dimri R, Alam SKS, Dehar PD and Kumar S. (2024). Medico Bio-wealth of India, Volume 8. Ambika Prasad Research Foundation, Odisha, India.
- Farsana S, Sandra S, Ansil PN and Soumya S. (2022). Pharmacological Importance of *Sterculia foetida*. In: Singh PS (Ed.). Traditional Medicinal Plants, Volume 6. AkiNik Publications, Delhi, India.
- Kaur R, Basole S, Khanduri A, Sharma BP, Agrahari D, Jethy S and Dharasurkar AN. (2026). Antioxidant potential of flowers of *Moringa oleifera* Lam.: a solvent based comparative study. Journal of Biodiversity and Conservation. 10(1): 94-100.
- Kumar S, Sharma BP, Sahu BK, Sabu VU, Majhi S, Tambe SS and Jethy S. (2026). Antioxidant potential of *Ziziphus mauritiana* Lam.: an approach from culture to cure. Journal of Biodiversity and Conservation. 10(1): 109-116.
- Latif R and Nawaz T. (2025). Medicinal plants and human health: a comprehensive review of bioactive compounds, therapeutic effects and applications. Phytochemistry Reviews. 1-44. doi: 10.1007/s11101-025-10194-7

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- Niazi P and Monib AW. (2024). The role of plants in traditional and modern medicine. *Journal of Pharmacognosy and Phytochemistry*. 13(2): 643-647.
- Orwa C, Mutua A, Kindt R, Jamnadass R and Anthony S. (2009). *Agroforestry database, a tree reference and selection guide, Version 4.0*. World Agroforestry Centre, Kenya.
- Policepatel SS and Manikrao VG. (2013). Ethnomedicinal plants used in the treatment of skin diseases in Hyderabad Karnataka region, Karnataka, India. *Asian Pacific Journal of Tropical Biomedicine*. 3(11): 882-886.
- Press Information Bureau. (2026). World wildlife day 2026 concept note. Theme: medicinal and aromatic plants: conserving health, heritage and livelihood. Government of India. <https://www.pib.gov.in/PressReleaseDetailm.aspx?PRID=2234951®=3&lang=2>
- Puri V, Nagpal M, Singh I, Singh M, Dhingra GA, Huanbutta K, Dheer D, Sharma A and Sangnim T. (2022). A comprehensive review on nutraceuticals: therapy support and formulation challenges. *Nutrients*. 14(21): 4637. doi: 10.3390/nu14214637
- Saxena HO and Brahmam M. (1994). *The Flora of Orissa, Volume I*. Regional Research Laboratory, Bhubaneswar and Orissa Forest Development Corporation Limited, Bhubaneswar, Odisha, India.