J. Biodivers. Conservation 10(2): 198-204
2026

ISSN: 2457-0761 (online)
http://www.aprfjournal.in

Research Article

Quantification of phenolics and flavonoids in relation to the antioxidant activity of *Mesua ferrea* L. flowers

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Article Details: Received: 2026-05-28| Accepted: 2026-06-20| Available online: 2026-06-20

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Abstract: The flowers of *Mesua ferrea* L., commonly known as Nagkesar are quite remarkable, especially when it comes to their medicinal properties. The aim of investigating the antioxidant activity of *M. ferrea* flowers is to evaluate their capacity to scavenge free radicals and reduce oxidative stress. The experimental analysis was carried out by using extracts of n-hexane, ethanol and water, examining their ability to scavenge free radicals at concentrations ranging from 0.125 to 1.0 mg/ml. The findings were pretty interesting; all three extracts showed a clear increase in percentage inhibition as the concentration rose. The ethanolic extract stood out with the strongest antioxidant activity, ranging from 80.83% to 91.69%. The aqueous extract followed closely behind, showing inhibition between 79.13% and 84.30%. Meanwhile, the n-hexane extract had lower activity, with percentages between 68.03% and 79.18%. The peak inhibition of 91.69% was recorded for the ethanolic extract at the highest concentration of 1.0 mg/ml. This pattern ethanolic > aqueous > n-hexane suggests that ethanol, being a polar solvent, is more effective at extracting the phenolic and flavonoid compounds that help in scavenging free radicals. The current investigation highlights the flowers of *M. ferrea* as a promising natural source of antioxidants for developing new therapeutics, nutraceuticals and functional foods.

Keywords: Functional food, Nagkesar, nutraceuticals, oxidative stress, therapeutics

Introduction

Reactive oxygen species (ROS) and free radicals are constantly produced as natural by-products of our cellular metabolism (Juan et al., 2021; Almeida et al., 2022). However, when they build up too much, they can cause oxidative stress, which is linked to a range of chronic and degenerative diseases like cancer, heart issues, diabetes, neurodegenerative disorders and even premature aging (Anwar et al., 2026; de la Lastra et al., 2026). While our bodies do have built-in antioxidant defenses, these often fall short against the overwhelming oxidative stress caused by environmental pollutants, unhealthy diets and lifestyle choices (Chaudhary et al., 2023; Sharifi-Rad et al., 2026). This has sparked a growing interest in finding exogenous antioxidants, especially those derived from natural plant sources, as safer

and more sustainable alternatives to synthetic antioxidants, which can sometimes come with toxic side effects and health risks (Birben et al., 2012; Aseervatham et al., 2013). Among the most abundant and biologically active secondary metabolites in plants are phenolic compounds and flavonoids (Roy et al., 2022; Kuljarusnont et al., 2024). These compounds are well-known for their strong free radical scavenging and antioxidant abilities, thanks to their capacity to donate hydrogen atoms or electrons, chelate metal ions and stabilize reactive radicals (Thakur et al., 2021; Jomova et al., 2025). As a result, many medicinal plants rich in phenolics and flavonoids have been thoroughly researched for their potential to help fight oxidative stress and related health issues.



Figure 1: Flower of *M. ferrea*

Mesua ferrea L., often referred to as Nagkesar or Indian rose chestnut, is a lush evergreen tree that belongs to the Calophyllaceae family and is found throughout South and Southeast Asia (Chahar, 2013; Kuerban et al., 2024). Traditionally, various parts of this plant like its flowers, bark, seeds and leaves have been used in indigenous medicine to treat a variety of issues, including wounds, fever, rheumatism and gastrointestinal problems (Asif et al., 2017; Bundel, 2023). However, even with its rich history in ethnomedicine, the antioxidant properties of *M. ferrea* flowers, especially concerning their phenolic and flavonoid content, haven't been thoroughly investigated in scientific research. The polarity of solvents is key when it comes to effectively extracting bioactive compounds from plant materials, as it significantly affects the solubility and yield of phenolic and flavonoid compounds (Chaithada et al., 2018). Keeping this in mind, present study aimed to analyse the phenolic and flavonoid content in *M.*

ferrea flowers and to carefully assess the antioxidant activity of extracts made with solvents of different polarities like n-hexane (non-polar), ethanol (polar organic) and water (polar) across a range of concentrations from 0.125 to 1.0 mg/ml. The investigation evaluated the free radical scavenging activity of each extract to compare how effective these solvents are at extracting antioxidant compounds, ultimately shedding light on the best extraction methods to tap into the therapeutic benefits of *M. ferrea* flowers as a natural source of antioxidants.



Figure 2: Collected *M. ferrea* flowers for experimental analysis

Methodology

The present study is based on a conflation of field surveys, experimental analyses and a thorough review of existing literature on *M. ferrea*. The authors gathered relevant peer-reviewed articles, review papers, ethnobotanical surveys and pharmacological studies from scientific databases like Google Scholar, Scopus, PubMed and Web of Science. To find the right publications, some key terms has been used such as '*Mesua ferrea*', 'medicinal uses' and 'potent scavenging bioactive compounds'. The field surveys took place between March - May 2026 and authors have identified the plants following the flora guide by Saxena and Brahmam (1994). Additionally, experimental works were conducted to verify the presence of phytoconstituents and to evaluate the antioxidant activity of *M. ferrea* flowers using the DPPH radical scavenging assay.

Antioxidant DPPH assay

M. ferrea flowers were collected from nearby Mahanadi areas of Cuttack District, Odisha, India (Figures 1 & 2). The flowers were thoroughly washed with distilled water and macerated with different solvents like n-hexane, ethanol and distilled water separately. The DPPH radical scavenging assay was used to evaluate the filtered extract following Dintu et al., (2026) with minor modifications. 1 ml of 0.1 mM DPPH solution prepared in methanol was added to prepared concentrations of aqueous, ethanolic and n-hexane extracts (1.0, 0.5, 0.25 and 0.125 mg/mL) using the respective solvents adjusting the final volume to 2 ml. 1 mL 0.1 mM DPPH in 1 mL methanol was used as control. Sample blanks (without DPPH) were used for background correction of absorbance. Reaction mixtures were exposed to dark incubation at room temperature for 20 minutes and the absorbance was spectrophotometrically taken at 517 nm. Percentage of radical scavenging activity was calculated using the following formula (Table 1; Jena et al., 2025).

% Inhibition= A_0 - A_s /A_0× 100

Where, A_0 is the absorbance of the control and A_s is the absorbance of the sample after blank correction

Results and discussion

The DPPH assay clearly demonstrated a concentration-dependent antioxidant activity in all three extracts of *M. ferrea* flowers (Table 1). Among them, the ethanolic extract stood out with the highest inhibition rates at every concentration tested, ranging from 80.83% to 91.69%. It was followed by the aqueous extract, which showed inhibition levels between 79.13% and 84.30% and then the n-hexane extract, with values from 68.03% to 79.18%. As expected, the inhibition decreased consistently with lower concentrations across all extracts, confirming the typical dose-dependent response seen in plant-derived antioxidants (Figure 3). The ethanolic extract's superior performance is likely due to its effectiveness in extracting polar phenolic and flavonoid compounds, which are key players in radical scavenging activity. This finding aligns with previous studies indicating that polar solvents tend to exhibit higher DPPH scavenging activity in *M. ferrea* compared to non-polar solvents. On the other hand, the n-hexane extract's lower activity can be attributed to its non-polar nature, which favors the extraction of lipophilic compounds rather than phenolics. The moderate activity of the aqueous extract further emphasizes how solvent polarity influences antioxidant recovery. Overall, these results support the idea that the antioxidant potential of *M. ferrea* is closely linked to its rich content of phenolic and flavonoid compounds, reinforcing the effectiveness of ethanol as a solvent for extracting these antioxidant-rich elements from *M. ferrea* flowers.

Table 1: Antioxidant potential of *M. ferrea* flower extracts

Concentration (in mg/ml)	Inhibition (%)		
	n-Hexane	Ethanolic	Aqueous
1.0	79.18	91.69	84.30

0.5	77.81	90.21	83.73
0.25	71.33	88.28	80.65
0.125	68.03	80.83	79.13

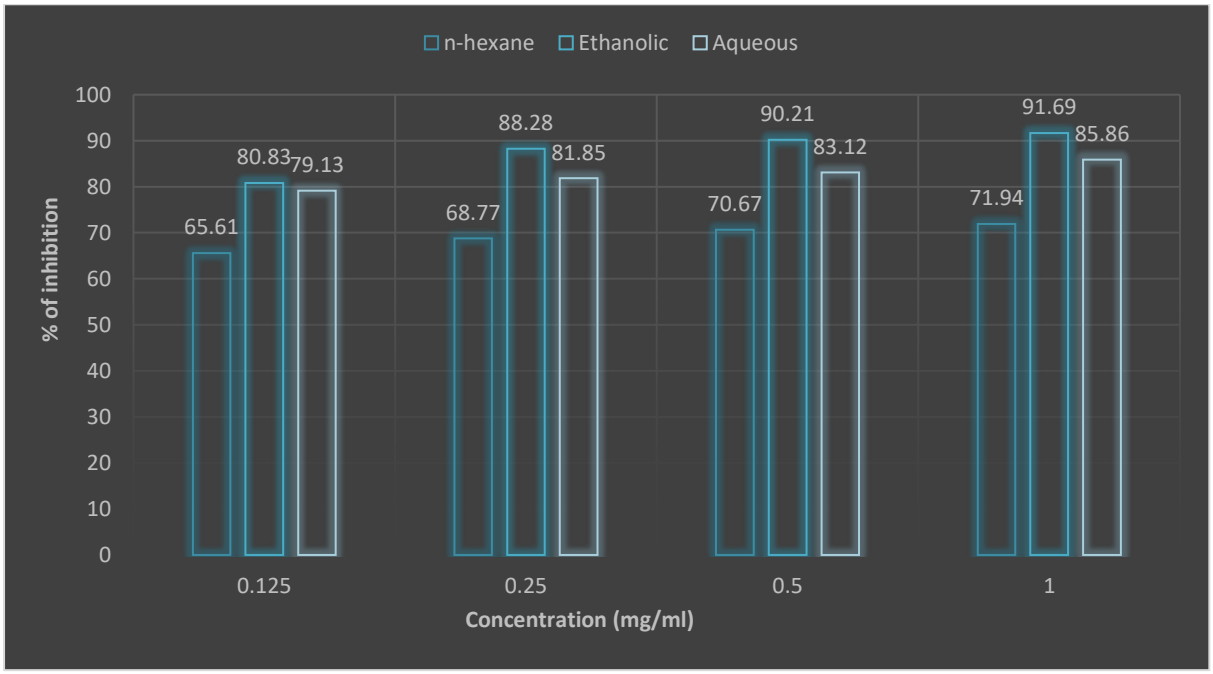


Figure 3: Antioxidant activity of *M. ferrea* flower extracts

Conclusion

The current investigation revealed that extracts from the *M. ferrea* flowers showed impressive antioxidant activity, as demonstrated by the DPPH radical scavenging assay. Out of the three solvent extracts tested, the ethanolic extract stood out with the highest, dose-dependent radical scavenging activity followed by the aqueous extract and the n-hexane extract. This pattern suggests that the antioxidant power of *M. ferrea* flowers is closely tied to the polarity of the solvent used, with ethanol proving to be the most effective at extracting the phenolic and flavonoid compounds that help combat free radicals. These results emphasize ethanol as the go-to solvent for tapping into the antioxidant potential of *M. ferrea* flowers, highlighting the species as a promising natural source of antioxidant agents for future pharmaceutical and nutraceutical uses.

References

Anwar S, Alharbi HOA, Babiker AY and Rahmani AH. (2026). Oxidative stress in health and disease: mechanisms and therapeutic perspectives. International Journal of Molecular Sciences. 27(6): 2681. DOI: 10.3390/ijms27062681.

Aseervatham SB, Sivasudha T, Jeyadevi R and Devanesan AA. (2013). Environmental factors and unhealthy lifestyle influence oxidative stress in humans – an overview. Environmental Science and Pollution Research International. 20(7): 4356-4369.

Asif M, Jafari SF, Iqbal Z, Revadigar V, Oon CE, Majid ASA and Majid AMSA. (2017). Ethnobotanical and phytopharmacological attributes of *Mesua ferrea*: a mini review. Journal of Applied Pharmaceutical Science. 7(4): 242-251.

Birben E, Sahiner UM, Sackesen C, Erzurum S and kalayci O. (2012). Oxidative stress and antioxidant defense. World Allergy Organization Journal. 5(1): 9-19.

Bundel H. (2023). *Mesua ferrea*. medicinally and traditionally important planet. International Journal of Pharmaceutical Research and Applications. 8(5): 786-793.

Chahar K. (2013). *Mesua ferrea* L.: a review of the medical evidence for its phytochemistry and pharmacological actions. African Journal of Pharmacy and Pharmacology. 7(6): 211-219.

Chaithada P, Supapan J, Rodthuk P and Chainarong S. (2018). Total flavonoids, total phenolic content and antioxidant activity from fruits, leaves, twigs and flowers of *Mesua ferrea* L. Walailak Journal of Science and Technology. 15(4): 295-304.

Chaudhary P, Janmeda P, Docea AO, Yeskaliyeva B, Abdull Razis AF, Modu B, Calina D and Sharifi-Rad J. (2023). Oxidative stress, free radicals and antioxidants: potential crosstalk in the pathophysiology of human diseases. Frontiers in Chemistry. 11: 1158198. DOI: 10.3389/fchem.2023.1158198.

De Almeida AJPO, de Oliveira JCPL, da Silva Pontes LV, de Souza Júnior JF, Gonçalves TAF, Dantas SH, de Almeida Feitosa MS, Silva AO and de Medeiros IA. (2022). ROS: basic concepts, sources, cellular signaling, and its implications in aging pathways. Oxidative Medicine and Cellular Longevity. 2022: 1225578. DOI: 10.1155/2022/1225578.

De la Lastra JMP, Andres CMC, Munguira EB, Juan CA and Perez-Lebena E. (2026). Pathophysiology of reactive oxygen species (ROS). Archives of Toxicology. 100(2): 475-513.

Dintu KP, Sharma BP, Singh G, Sahu BK, Sunita K, Jena N and Khanduri A. (2026). Assessment of radical scavenging capacity in *Aegle marmelos* (L.) Correa fruits using DPPH assays. Journal of Biodiversity and Conservation. 10(2): 130-136.

Jena N, Vimala, Singh B, Patra A, Sharma BP, Hossain E and Kumar S. (2025). Methods for ethnobotanical data collection, phytochemistry, antioxidant, anthelmintic and antimicrobial activities for pharmacological evaluation of medicinal plants. Journal of Biodiversity and Conservation. 9(2): 87-107.

Jomova K, Alomar SY, Valko R, Liska J, Nepovimova E, Kuca K and Valko M. (2025). Flavonoids and their role in oxidative stress, inflammation and human diseases. Chemico-Biological Interactions. 413: 111489. DOI: 10.1016/j.cbi.2025.111489.

Juan CA, Lastra JMP, Plou FJ and Perez-Lebena E. (2021). The chemistry of reactive oxygen species (ROS) revisited: outlining their role in biological macromolecules (DNA, lipids and proteins) and induced pathologies. International Journal of Molecular Sciences. 22(9): 4642. DOI: 10.3390/ijms22094642.

Kuerban M, Ma F, Shan L, Wang Y and Zhou G. (2024). Comparative discriminant analysis of *Mesua ferrea* L. and its adulterants. Heliyon. 10(7): e28459. DOI: 10.1016/j.heliyon. 2024.e28459.

Kuljarusnont S, Iwakami S, Iwashina T and Tungmunnithum D. (2024). Flavonoids and other phenolic compounds for physiological roles, plant species delimitation and medical benefits: a promising view. Molecules. 29(22): 5351. DOI: 10.3390/molecules29225351.

Roy A, Khan A, Ahmad I, Alghamdi S, Rajab BS, Babalghith AO, Alshahrani MY, Islam S and Islam MR. (2022). Flavonoids a bioactive compound from medicinal plants and its therapeutic applications. BioMed Research International. 2022: 5445291. DOI: 10.1155/2022/5445291.

Saxena Ho and Brahmam M. (1994). The Flora of Orissa, Volume 1. Regional Research Laboratory, Bhubaneswar and Orissa Forest Development Corporation Limited, Bhubaneswar, Odisha, India.

Sharifi-Rad M, Anil Kumar NVA, Zucca P, Varoni EM, Dini L, Panzarini E, Rajkovic J, Tsouh Fokou PV, Azzini E, Peluso I, Mishra AP, Nigam M, Rayess YE, Beyrouthy ME, Polito L, Iriti M, Martins N, Martorell M, Docea AO, Setzer WN, Calina D, Cho WC and Sharifi-Rad J. (2020). Lifestyle, oxidative stress, and antioxidants: back and forth in the Pathophysiology of Chronic Diseases. Frontiers in Physiology.11: 694. DOI: 10.3389/fphys.2020.00694.

Thakur S, Kaurav H and Chaudhary G. (2021). *Mesua ferrea* Linn. (Nagkesar): a potent antimicrobial plant species. International Journal of Current Pharmaceutical Research. 13(4). DOI: 10.22159/ijcpr.2021v13i4.42734.