J. Biodivers. Conservation 10(1):109-116 ISSN: 2457-0761 (online)
2026 http://www.aprfjournal.in

Research Article

Antioxidant potential of *Ziziphus mauritiana* Lam.: an approach from culture to cure

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DOI: https://doi.org/10.5281/zenodo.18918384

Article Details: Received: 2026-02-05 | Accepted: 2026-03-04 | Available online: 2026-03-09

Abstract: Species of *Ziziphus* occur naturally in arid and semi-arid regions across the Indian subcontinent and are valued for their multiple uses, including edible fruits, livestock fodder and applications in traditional medicine. Among them, *Ziziphus mauritiana,* famously known as 'Bor' or 'Ber', has been widely used in folk remedies for the management of several ailments. In the present study, the antioxidant potential of *Z. mauritiana* leaves was investigated through a comparative assessment of ethanolic and methanolic extracts using the 2,2-diphenyl-1-picrylhydrazyl (DPPH) radical scavenging assay. Both extracts demonstrated concentration-dependent free radical scavenging activity, with the ethanolic extract exhibiting relatively higher inhibition at higher concentrations. Although the activity was lower than that of the standard (Quercetin), the results indicated the presence of bioactive compounds capable of neutralizing free radicals. This experimental study highlights the

potential of *Z. mauritiana* leaves as a natural source of antioxidants and encourages further phytochemical and pharmacological investigations.

Keywords: DPPH, oxidative stress, traditional medicine, *Ziziphus mauritiana*

Introduction

For a long time, plants have been an integral part of traditional healthcare systems across different cultures (Awoke et al., 2024). For centuries, communities have relied on plant-based remedies to treat a wide range of ailments, drawing knowledge from experience and observations passed down through generations (Tadesse et al., 2025). These ethnomedicinal practices not only reflect the close relationship between people and their natural environment but also show the therapeutic potential of plant resources. In recent years, there has been growing scientific interest in revisiting these traditional claims through modern research approaches (Wang et al., 2025). Studies in pharmacology and phytochemistry are now being conducted to investigate the bioactive compounds present in medicinal plants and to validate their therapeutic properties (Yuan et al., 2016). The previous studies have revealed that the folk and traditional uses of the plant parts can actually help to cure a wide range of diseases, both acute and chronic diseases, many of whose cause is oxidative stress (Chandran and Abrahamse, 2020). Oxidative stress is associated with the development of several diseases (Muscolo et al., 2024) due to the excessive production of reactive oxygen species (ROS) and reactive nitrogen species (RNS). Although low levels of these species are essential for normal physiological functions such as cell signalling, immune response and regulation of blood flow, their overproduction can lead to oxidative damage of biomolecules, including lipids, proteins and DNA (Pizzino et al., 2017). This process may result in lipid peroxidation, disruption of cell membrane integrity and impairment of cellular functions (Obeagu et al., 2024). Due to these harmful effects, there is growing interest in identifying natural antioxidants from medicinal plants.Indian jujube or *Ziziphus mauritiana* (Figure 1) is such a common tree species native to India with a rich genetic diversity of the genus distributed across the arid and semi-arid regions of the country (Awasthi and More, 2009). Historical records indicate that the plant was mentioned in the Yajurveda (Alsayari and Wahab, 2021), signifying its use in traditional healthcare systems. Ethnobotanically, this plant has been surveyed to reveal its uses in treatment of treatment of various ailments like digestive disorders, bronchitis, haemoglobin deficiency, diabetes, skin infections, fever, diarrhoea, liver and urinary problems (Khan et al., 2019). Though its fruits are the most used part, both as an edible and as medicine, the leaves of *Z. mauritiana* are highly nutritious and regenerate rapidly, making them valuable both as a food and fodder. Naaz et al., (2020) reviewed that in several regions, young leaves are consumed as vegetables while the foliage is widely used as livestock feed and as a feed for silkworms. Also, it serves as a host plant for the lac insect (*Kerria lacca*), which feeds on the leaf sap and produces a characteristic orange-red resin known as lac (Naaz et al., 2020). Therefore, *Z. Mauritiana* was investigated in the present study to evaluate the antioxidant potential of its leaf extracts using the DPPH radical scavenging assay.

Figure 1: Twigs of *Ziziphus mauritiana* with leaves and fruits

Methodology

Leaves of *Ziziphus mauritiana* were collected from nearby Mahanadi areas of Cuttack district, Odisha, India (Figure 1). The species was identified with reference to standard floristic literature (Saxena and Brahmam, 1994). Leaves were thoroughly washed under running water to remove dust, followed by shade drying to eliminate excess moisture (Figure 2). Dried leaves were subjected to maceration using two different solvents, methanol and ethanol. Antioxidant activity of *Z. mauritiana* leaf extracts was evaluated using the 2, 2-diphenyl-1-picrylhydrazyl (DPPH) radical scavenging assay (Baliyan et al., 2022; Kaur et al., 2026) with minor modifications. Various concentrations of extracts were prepared using their respective solvents. 1 mL of 0.1 mM DPPH solution was mixed with the extract samples adjusting the final volume to 3 mL. 1 mL DPPH mixed with 2 mL methanol was used as control. Sample blanks were used for correcting background absorbance. The reaction mixtures were incubated in the dark at room temperature for 20 minutes and the absorbance was taken at 517 nm using a UV-Visible spectrophotometer. The percentage of radical scavenging activity was calculated using the formula:

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

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

Figure 2: Schematic representation of the experimental workflow of the DPPH radical scavenging assay for *Ziziphus mauritiana* (leaves)

Results and discussion

According to traditional and folk medicinal practices, leaves of *Ziziphus mauritiana* have been used in the management of asthma, liver disorders and skin conditions such as scabies (Naaz et al., 2020). Traditionally, its leaves are known for their astringent properties and for being diaphoretic and been prescribed for the treatment of diarrhea and certain thyroid related conditions in children (Naazet al.,

2020; Alsayari and Wahab, 2021). Leaf paste is often applied topically to wounds to promote healing and to relieve burning sensations (Kumar et al., 2024). In folk medicine, freshly collected leaves are sometimes combined with cumin and used as a remedy for urinary tract infections (Kumar et al., 2024). Many of these conditions, including inflammation, infections and tissue damage, are associated with the overproduction of reactive oxygen species (ROS) and oxidative stress (Manful et al., 2025). Plant derived antioxidants are known to neutralize free radicals and help protect cellular components from oxidative damage (Altanam et al., 2025). Therefore, the antioxidant activity of *Z. mauritiana* leaf extracts was evaluated using the 2,2-diphenyl-1-picrylhydrazyl (DPPH) radical scavenging assay and compared with the standard antioxidant, quercetin. Experimental study denoted that, ethanolic and methanolic extracts showed free radical scavenging activity, which generally increased with increasing concentration (Figure 3). The ethanolic extract showed the highest inhibition of 53.43% at 1 mg/mL, followed by 43.81%, 33.46% and 31.49% at concentrations of 0.5, 0.25 and 0.125 mg/mL, respectively. Similarly, the methanolic extract exhibited 41.9% inhibition at 1 mg/mL, which decreased to 36.33%, 35.2% and 27.16% with decreasing concentrations. The ethanolic extract showed slightly higher antioxidant activity than the methanolic extract at higher concentrations, suggesting that ethanol may have extracted more antioxidant compounds from the leaves. However, the activity of both the extracts was much lower compared to the standard quercetin (Figure 4), which showed very high inhibition values ranging from 96.85% to 97.5% even at much lower concentrations. This indicated that while leaves of *Z. mauritiana* possess antioxidant properties, their activity is moderate when compared with a pure antioxidant compound. The observed activity may be due to the presence of natural phytochemicals such as phenolic compounds and flavonoids in the leaves (Ansari et al., 2026).

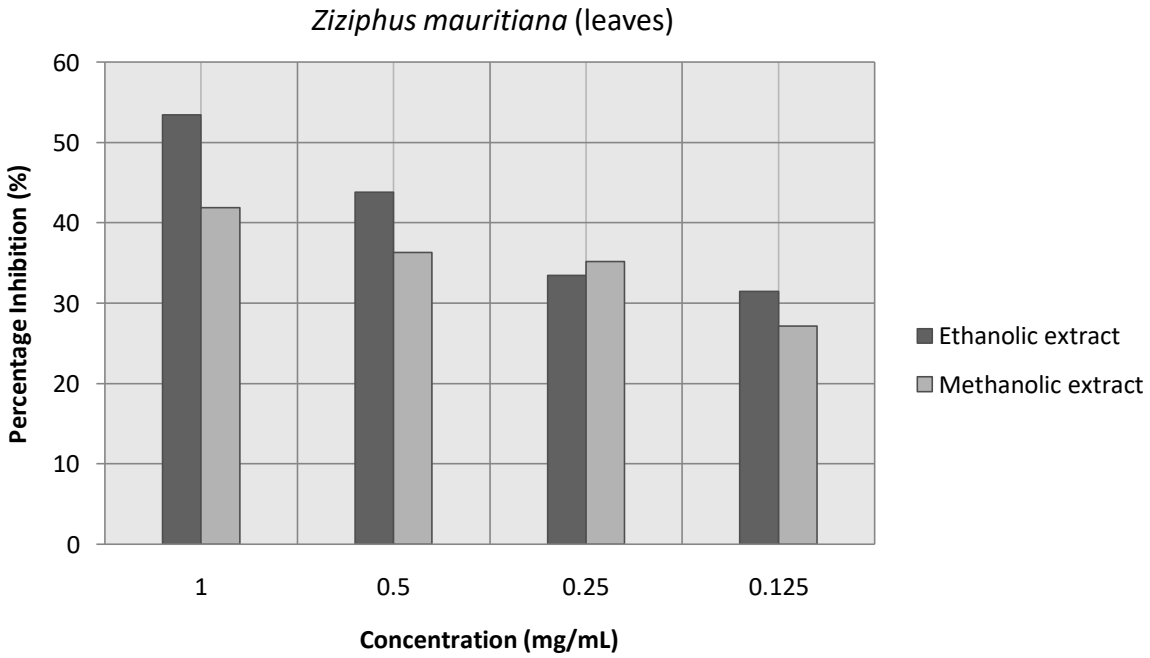

Figure 3: Percentage inhibition against concentration showing DPPH free radical scavenging activity of methanolic and ethanolic extracts of *Ziziphus mauritiana* (leaves)

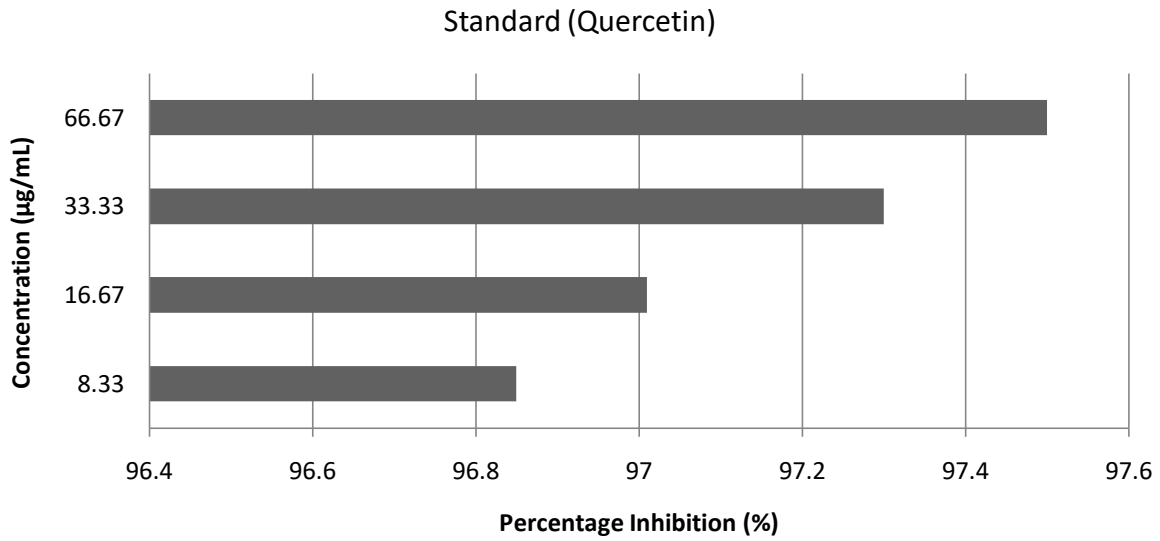

Figure 4: Percentage inhibition against concentration showing DPPH free radical scavenging activity of standard (Quercetin)

Research gaps

This study presented a comparative evaluation of the antioxidant activity of *Ziziphus mauritiana* leaf extracts, providing scientific insight into the possible mechanisms associated with its traditional therapeutic uses. However, further studies involving phytochemical profiling, isolation of bioactive compounds and *in vivo* antioxidant investigations are required to better understand the mechanisms responsible for the observed activity and to explore its true potential as a natural source of antioxidants.

Conclusion

Species of *Ziziphus* are commonly found growing in the wild, particularly in arid and semi-arid regions and some have been domesticated due to their significant economic and ecological value. In addition to their practical uses as edibles, fodder, fuel wood and furniture, different parts of *Ziziphus* species have long been employed in traditional medicine for treating various ailments. Present study evaluated the antioxidant activity of *Ziziphus mauritiana* leaf extracts was using the DPPH radical scavenging assay. Both ethanolic and methanolic extracts demonstrated noticeable free radical scavenging activity, with the ethanolic extract showing comparatively higher inhibition at higher concentrations. Although the activity was lower than that of the standard, the results indicated the presence of antioxidant compounds in the leaves, suggesting that *Z. mauritiana* may serve as a potential natural source of antioxidants, supporting its traditional medicinal relevance.

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