

Chapter 1

Qualitative phytochemical analysis of *Ziziphus mauritiana* Lam.

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Abstract

A qualitative phytochemical analysis of *Z. mauritiana* is carried out to draw attention to its nutraceutical and pharmaceutical potential. Results revealed that tannin, saponin, flavonoid, reducing sugar, phenolic compounds, and carbonyl compounds are detected in the aqueous extract of leaves; tannin, saponin, phenolic compounds, reducing sugar, and carbonyl compounds are present in fruits; and tannin, saponin, & carbonyl compounds are noted in stems. Further, more pharmacological evaluation is needed.

Keywords: Nutraceutical, pharmaceutical, wild edible fruits

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Introduction

Ziziphus mauritiana, commonly known as Indian jujube or ber, holds a prominent place in traditional medicine and culinary practices across various cultures (Plate 1). This deciduous tree belongs to the Rhamnaceae family (Gupta *et al.*, 2012). This species is thought to have originated in

India and is native to Southern Asia, Eastern Africa, and many islands in the Indian Ocean (Rashwan *et al.*, 2020). It grows vigorously and has a rapidly developing taproot, a necessary adaptation to drought conditions. The plant has adapted to diverse climates and is known for its hardiness and ability to thrive in arid conditions. The species varies widely in height, from a bushy shrub 1.5 to 2.0 m tall to a tree 10 to 12 m tall with a trunk diameter of about 30 cm (Figure 2; Saxena & Brahmam, 1994). The small, round fruits are not only consumed as a nutritious food source but also play a pivotal role in traditional healing practices. Fruits are commonly consumed in households as fresh and is dehydrated for later use. The powder from the fruit is used for baking and to prepare jam and a traditional loaf. The genus *Ziziphus* encompasses several species, with *Z. mauritiana* standing out for its widespread distribution in tropical and subtropical regions, like open woodlands, grasslands, and roadsides (Sameera & Mandakini, 2015). The spread and availability make the species very common in the area. The people often see it everywhere and are well acquainted with its edible fruits, but due to being less ignorant of its medicinal importance, the local people are used to overexploiting it to fulfil their trivial needs like construction and other purposes. Urbanization is also another factor that could be involved in the gradual destruction of this species. Therefore, an attempt has been made to find out the presence of bioactive constituents in the different plant parts of *Z. mauritiana* to highlight its medicinal importance. Thus, this study aims to unravel the phytochemical composition of *Z. mauritiana*, shed light on its potential health benefits, and provide a base for further research in the field of natural medicines.

Methodology

Preparation of aqueous extract

The soxhlet method of extraction was adopted to obtain the plant extracts for phytochemical analysis (Devi *et al.*, 2023). The leaves, fruits, and stem of *Z. mauritiana* were collected from the field nearby the Mahanadi River area along the roadsides of Cuttack district, Odisha (Plate 1), dried at room temperature under shed conditions, and powdered after drying using mechanical devices. The powder was kept in a closed container for extraction (Kumar *et al.*, 2017).

Qualitative analysis of bioactive compounds

Phytochemical analysis was carried out on aqueous extract of *Z. mauritiana* using standard procedure to identify the bioactive compounds present in the plant (Devi *et al.*, 2023).

Test for Tannin

1 ml of filtrate of the plant extract was taken, three drops of 0.1% of lead acetate solution was added to it. The creamy gelatinous precipitate provides the positive result of the presence of tannins.

Test for saponin

1 ml filtrate of the plant extract was mixed with 1 ml of distilled water and shaken it vigorously. The persistent froth formed after shaking provide the evidence of the saponin.

Test for flavonoids

1 ml filtrate of the plant extract was taken and added 2 ml of 2% NaOH solution and 3 drops of dilute HCL. The colour initially turned an intense yellow colour with NaOH solution and later became colourless. This change in colour confirmed the positive result for the presence of flavonoids.

Test for terpenoids

2 ml of the filtrate of plant extract was used and 6 drops of chloroform was added and placed it in the water bath for few minutes. Then, 6 drops of concentrated H_2SO_4 were added. The reddish-brown interface confirmed the positive result for the presence of terpenoids.

Test for phenolic compounds

1 ml of the filtrate of plant extract was taken. Few drops of 5% ferric chloride solution were added. The dark bluish black colour provides the positive result of the test of phenolic compounds.

Test for reducing sugar

1 ml of filtrate of the plant extract was taken and 2 drops of Fehling's solution A followed by Fehling's solution B was added and put it in the water bath for some time. The formation of red orange precipitate confirmed the positive result of the test for reducing sugar.

Test for steroids

1 ml of filtrate of the plant extract was used. 1 ml chloroform and 1 ml of conc. H_2SO_4 was added into it. The presence of upper red and lower yellow with green fluorescence provide the positive result of the test of steroids.

Test for alkaloids

1 ml of filtrate of the plant extract was taken and added 3 to 4 drops of Dragendorff's reagent. The formation of reddish-brown precipitate confirmed the presence of alkaloids.

Test for carbonyl compounds

1 ml filtrate of the plant extract was taken and added 3 to 4 drops of 2,4-DNPH (Dinitrophenylhydrazine) reagent. The formation of yellow crystal confirmed the presence of carbonyl compounds.

Results and discussion

The present findings clearly indicate that the leaves, fruits, and stem of *Z. mauritiana* have several bioactive compounds like tannins, saponins, flavonoids, phenolic compounds, and reducing sugars, which can be responsible for further research studies for the value addition of its existing available information on ethnomedicinal uses. Some literature findings are also being discussed regarding food values, traditional uses, and pharmacopotentials.

Food values

The fruit of *Z. mauritiana* is considered the main nutritious part, which can be consumed as freshly squeezed pulp in the preparation of some food products such as beverages, jams, jelly, pickles, liquor, and compotes (Rashwan *et al.*, 2020). The dried pulp can also be used as an active ingredient in dried food products like dates, cakes, bread, slices of snack, etc. Thus, the fruit can be a promising food ingredient for the development of functional food products for consumer acceptability and health benefits (Dimri *et al.*, 2024).

Ethnomedicinal uses

In traditional medicine, the fruits and other parts are used to treat various diseases such as heartburn, biliousness, astringency, scabies, diuretics, and nausea. During pregnancy, the seeds are taken with buttermilk to stop vomiting and abdominal pain. The seeds are crushed and used to manage sleeping disorders and anxiety. The seeds are blended with oil and employed to treat rheumatic arthritis. The dried root is used to treat diarrhea, which is the leading cause of death, particularly in newborns (Alsayari & Wahab, 2021).

Pharmacological values

Several studies have reported that *Z. mauritiana* fruits or extracts have diverse biological activities. In 2011, Mishra and his team's in vitro studies demonstrated that the oleamide component of the *Ziziphus jujube* seed extract may help patients suffering from Alzheimer's diseases (Mishra *et al.*, 2011). In 2015, Hemmati and his team reported that the fruit extract exhibited antidiabetic activity, reduced fasting blood glucose, triglyceride, and total cholesterol, and increased antioxidant capacity (Hemmati *et al.*, 2015). Jujube fruit has potential antioxidant activity and can be used as a natural antioxidant ingredient in foods and pharmaceuticals (Rashwan *et al.*, 2020).



Plate 1: Different plant parts (a)Leaves, (b) fruits and (c) stem of *Z. mauritiana*

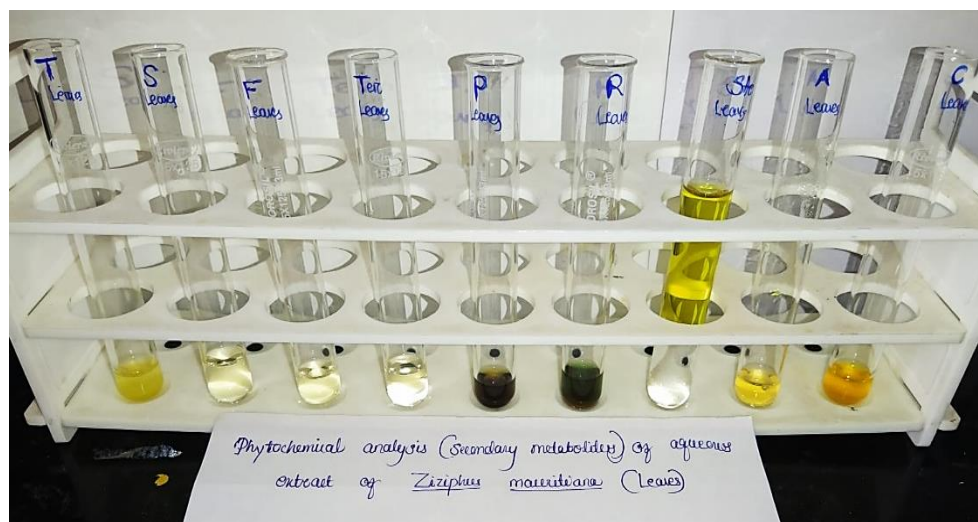


Figure 1: Phytochemical test for secondary metabolites of aqueous extract of leaves of *Z. mauritiana*



Figure 2: Collection of plant parts (leaves, fruits, and stem) of *Z. mauritiana*



Figure 3: Phytochemical test (secondary metabolites) of aqueous extract of fruits of *Z. mauritiana*.



Figure 4: Phytochemical analysis (secondary metabolites) of aqueous extract of *Z. mauritiana*

Table 1: List of phytochemicals present (secondary metabolites) in aqueous extracts of leaves, fruits and stem of *Z. mauritiana*

Phytochemicals	Leaves	Fruits	Stem
Tannin	+	+	+
Saponin	+	+	+
Flavonoids	+	~	~
Terpenoids	~	~	~
Phenolic compounds	+	+	~
Reducing sugars	+	+	~
Steroids	~	~	~
Alkaloids	~	~	~
Carbonyl compounds	+	+	+

Phytochemical analysis

The present investigations on phytochemical analysis of *Z. mauritiana* have revealed the presence of several bioactive compounds such as tannin, saponin, flavonoids, phenolic compounds, reducing sugars, carbonyl compounds, etc. (Figures 1, 3, and 4). From the phytochemical analysis, it was noticed that the fruits and leaves have more phytoconstituents in comparison to the other parts, like the stem, and they could be the best part to analyse the bioactivity for the formulation of novel pharmaceutical products. It was also observed that tannins, saponins, and carbonyl compounds are the common phytochemicals found in all three parts of *Z. mauritiana* (Table 1).

Conclusion

The present study concluded that Indian jujube is not only a nutritious fruit plant but also has medicinal properties due to the presence of several bioactive compounds. In this regard, by associating the gap between traditional practices and modern science, *Z. mauritiana* can hold promising potential in contributing significantly to the development of novel healthcare solutions in the future.

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