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AN INITIAL INVESTIGATION ON PHYTOCHEMICAL SURVEY OF THE LEAVES OF BALANITES AEGYPTIACA (L.) DELILE.

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ABSTRACT

The desert date, or Balanites Aegyptiaca (L.) Delile, is a member of the Zygophyllaceae family. This tree can be found all over the Middle East and most of Africa. The arid regions of the Indian states of Madhya Pradesh, Gujarat, Rajasthan, and Deccan are ideal habitats for this plant. The tree matures into pale brown fruits that resemble dates and spiky branches that reach a maximum height of 10 meters. Its foliage is complex and greenish yellow. It thrives in conditions with little to no accessible moisture and is very resilient to extreme weather events like sandstorms and heat waves. According to reports, this plant's bark, immature fruits, and leaves possess anthelmintic, antifertility, purgative, and antidysentric effects. Numerous traditional texts, including Ayurveda, attest to the plant's practicality, and its many biologically active phytoconstituents have been identified. Due to a lack of published information on phytochemical investigations, the current study set out to fill that gap by reviewing the physicochemical and phytochemical data collected from Balanites Aegyptiaca (L.) Delile leaves. Ash value, extractive value, and phytochemical screening with various reagents revealed the presence of sugars, proteins, amino acids, glycosides, saponin, tannins, and flavonoids, according to the study. In order to create an appropriate monograph for the plant, it was necessary to collect a number of physicochemical and phytochemical parameters.

Keywords: Balanites Aegyptiaca (L.) Delile, Successive solvent extracts, Physico- chemical analysis, Preliminary phytochemical screening, Foaming index and Fluorescence analysis.

INTRODUCTION

Balanites aegyptiaca, commonly referred to as the Desert Date, is a hardy tree species thriving in arid and semi-arid regions of Africa and the Middle East. Belonging to the Zygophyllaceae family, this plant is well-regarded for its adaptability and the myriad uses of its various parts, including leaves, fruits, seeds, bark, and roots. Traditionally, Balanites aegyptiaca has been utilized for nutritional, medicinal, and economic purposes, making it a vital resource in its native habitats.

Importance of Phytochemical Studies

Phytochemicals are bioactive compounds produced by plants, which play crucial roles in

plant defense mechanisms and have significant therapeutic potential for human health. The leaves of Balanites aegyptiaca, like other plant parts, are believed to contain a rich array of these bioactive compounds. Understanding the phytochemical composition of the leaves is essential for several reasons:

1. **Medicinal Applications:** Identifying bioactive compounds can lead to the development of new drugs and natural health products.
2. **Nutritional Value:** Phytochemicals can enhance the nutritional profile of the plant, contributing to dietary supplements and functional foods.
3. **Biological Activity:** The study of these compounds can uncover new biological activities, such as antimicrobial, antioxidant, and anti-inflammatory properties, expanding the plant's applications.

Objectives of the Investigation

The primary goal of this initial investigation is to conduct a comprehensive phytochemical survey of the leaves of Balanites aegyptiaca. This entails:

1. Identification and Quantification: Determining the presence and levels of key phytochemicals in the leaves.
2. Comparison with Other Plant Parts: Assessing how the phytochemical profile of the leaves compares with other parts of the plant, such as fruits and seeds.
3. Biological Implications: Investigating the potential biological activities associated with the identified compounds, which may explain the traditional uses of the leaves.

The initial investigation into the phytochemical profile of the leaves of Balanites aegyptiaca aims to unlock the potential of this resilient plant further. By systematically identifying and quantifying the bioactive compounds present, the study provides a foundation for future research and development in medicinal, nutritional, and agricultural applications. This work underscores the importance of phytochemical surveys in exploring the full spectrum of benefits that plants like Balanites aegyptiaca offer to human health and well-being.

MATERIALS AND METHODS

In 2011, residents of Nagaur District, Maroth Village, Rajasthan, India, and the surrounding area gathered Balanites Aegyptiaca (L.) Delile leaves from uncultivated fields. Sourced from the "Department of Botany, University of Rajasthan, Jaipur and confirmed by comparing with the help of the herbarium maintained at the same location," the plant was officially named.

Preparation of extract

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After collecting the leaves, they were dried in the shade, ground into a coarse powder (40 mesh size), and kept in an airtight container. The crude extracts were obtained by subjecting the dried coarse powder (450 g) to a series of soxhlet extractions using petroleum ether (60-80°), benzene, chloroform, and 95% ethanol. The final step was maceration with distilled water, which was left for 7 days. Prior to each solvent extraction, the powdered material was dried in a hot air oven set at temperatures below 500C. The flash evaporator was used to concentrate the extracts to dryness while maintaining regulated temperature and lowered pressure (50-60°). In preparation for qualitative analysis, all of the extracts were chilled.

Physico- chemical analysis

The inorganic salts that are present in the medicine and bound to it are represented by its ash value. After burning something, the byproduct is known as total ash. When diluted hydrochloric acid does not dissolve any portion of the entire ash, this is known as acid insoluble ash. Preparing sulphated ash by combining sulphuric acid with powdered crude medicine; this ash is typically less fusible than regular ash. When determining whether a medicine is pure, meaning it does not contain any organic contaminants such metallic salts or silica, the total ash is a key indicator. An indicator of the amount of earthy and mineral components bound to plant matter is the total ash value. The standard procedures of the Indian Pharmacopoeia (1996) and the World Health Organization (WHO)/QCMMPM (1992) were followed for the quantitative assessment of ash and extractive values in air dried plant material. We followed the usual protocol outlined in the Indian Pharmacopoeia to determine the foreign organic matter (FOM) and moisture content (w/w) from the drug's weight and the loss on drying process, respectively.

Extractive values

A variety of phyto-constituents can be extracted from crude drugs using certain solvents. The primary application of extractive values is the identification of expired or tampered medications. In addition to helping with the evaluation of crude drugs, extractive value provides insight into the chemical components of these drugs and allows for the estimation of specific components that are soluble in the extraction solvent.

Preliminary phytochemical screening

Hydrogen peroxide, benzoene, chloroform, ethanol, and finally distilled water were used in a sequential order to extract the powdered dried leaves. To identify the presence of different phytoconstituents such as alkaloids, carbohydrates, proteins/amino acids, glycosides, fixed oils & fats, phenolics, tannins, phytosterols, flavonoids, and saponins, the extracts were subjected to a battery of qualitative chemical tests.

Fluorescence characters

Many chemical components found in plants display the significant phenomenon of fluorescence. During the day, several of the components emit visible-light fluorescence.

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Many naturally occurring substances (such as alkaloids like berberine) that do not appear to glow when exposed to daylight instead create fluorescence when exposed to ultraviolet light. An essential metric in pharmacognostical evaluation is the ability to transform non-fluorescent compounds into fluorescent derivatives using various reagents; as a result, this method is frequently used for qualitative assessment of certain crude medications. A large number of organic molecules absorb and then re-emit light within a narrow spectrum. This means that the powder can take on a rainbow of colors when exposed to various chemical reactions in a UV cabinet. As a result, it can be employed for drug identification. Using UV light at 254 and 366 nm, the drug powder's fluorescence properties were investigated using several chemical reagents. One method for identifying plant components that provides a clear picture of their chemical make-up is fluorescence analysis.

RESULTS AND DISCUSSION

Physiochemical analysis

In accordance with the Indian Pharmacopoeia, several physicochemical characteristics, including total ash, acid insoluble ash, water soluble ash, sulphated ash, and loss on drying, were quantitatively determined using air dried powdered leaves. You may find the findings in Table 1.

Table 1: Physico-Chemical parameters of powdered leaves of Balanites Aegyptiaca (L.) Delile

Sr. No.	Parameters	% W/W
1.	Ash values	
	(a) Total ash	12.174
	(b) Acid insoluble ash	0.650
	(c) Water soluble ash	8.508
	(d) Sulphated ash	12.202
2.	Loss on drying	7.564

Foaming Index

Table 2 displays the foaming index of powdered Balanites Aegyptiaca (L.) Delile leaves, which was determined using the given formula.

Foaming index = 1000/a = 1000/2= 500

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As a result, powdered Balanites Aegyptiaca (L.) Delile leaves had a foaming index of 500. It was suggested by this result that there might be a lot of saponin.

Fluorescence analysis

Table 3 displays the results of the fluorescence examination of powdered leaves with different chemical reagents under both natural and artificial light, whereas Table 4 displays the results of the same experiment with dried leaf powder extracts from different solvents.

Table 2: Foaming index of the powdered leaves of Balanites Aegyptiaca (L.) Delile

Sr. No.	Test volumetric flask no. (10ml)	Height of foam (cm.)
1.	1	0.9
2.	2	1.4
3.	3	1.8
4.	4	2.0
5.	5	2.4
6.	6	2.7
7.	7	3.1
8.	8	3.4
9.	9	3.8
10.	10	4.4

Table 3: Fluorescence analysis of powdered leaves of Balanites Aegyptiaca (L.) Delile

Sr. No.	Chemical Treatment	Day light	UV Light	
			254 nm	366 nm
1.	Powder as such	Green	Brown	Greenish brown
2.	Powder + Water	Green	Dark green	Light green

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3.	Powder + 1 N HCl	Light yellow	Light green	Light green
4.	Powder + 5% NaOH	Greenish yellow	Greenish yellow	Greenish yellow
5.	Powder + 1 N NaOH (Alc.)	Green	Yellowish green	Yellowish green
6.	Powder + 50% HNO3	Orange	Yellowish green	Yellowish green
7.	Powder + 50% H2SO4	Blackish brown	Dark brown	Green
8.	Powder +Ammonia	Yellowish green	Yellowish green	Yellowish green
9.	Powder +Acetic acid	Greenish yellow	Greenish yellow	Tan yellow
10.	N Powder + I2 sol .	Red	Red	Reddish brown
11.	Powder + FeCl3	Yellowish Brown	Dark Green	Greenish yellow

Table 4: Fluorescence Analysis of Successive Solvent Extraction of Leaves of Balanites Aegyptiaca (L.) Delile.

Sr. No.	Chemical Treatment	Day light	UV Light	
			254 nm	366 nm
1.	Petroleum ether(60-80) extract	Dark green	Dark green	Greenish black
2.	Benzene extract	Dark green	Black	Black
3.	Chloroform extract	Dark green	Black	Black
4.	Alcoholic extract	Dark green	Dark red	Dark brown
5.	Aqueous extract	Greenish brown	Black	Dark brown

Extractive values

Table 5 displays the results of calculating the extractive values of several extracts taken from the leaves of Balanites Aegyptiaca (L.) Delile. Dark green residues were produced by the petroleum ether, benzene, chloroform, and ethanol extracts, whereas amorphous solids of a greenish brown tint were produced by the water extract. When compared to other medication

extractables, the water-soluble extractive value was significantly higher.

Preliminary phytochemical screening

The method of qualitative phytochemical analysis was used to examine the various extracts derived from the sequential solvent extraction for the presence of various phytoconstituents. Carbohydrates, amino acids, glycosides, tannins, flavonoids, saponin, and fixed oil are all revealed by them.

Table 5: Extractive values of successive solvent extracts of powdered leaves of Balanites Aegyptiaca (L.) Delile

Sr. No.	Solvent extracts	Colour	Consistency	Extractive values (% W/W)
1.	Petroleum ether(60-80) Extract	Dark green	Sticky	1.62%
2.	Benzene Extracts	Dark green	Powder	1.33%
3.	Chloroform Extract	Dark green	Powder	1.05%
4.	Alcohol Extract	Dark green	Sticky	8.79%
5.	Aqueous extract	Greenish brown	Powder	14.75%

CONCLUSION

If the powdered leaves of Balanites Aegyptiaca (L.) Delile can be positively identified and evaluated, as well as distinguished from other, closely related species of the plant, then the results of the current physicochemical investigation and preliminary phytochemical screening will be of great assistance. As a standard monograph for plant identification and evaluation, the additional studies—foaming index and fluorescence analysis—increase its quality control and quality assurance for accurate plant identification in the future. New possibilities for the medicinal use of natural products may emerge as a result of additional study into this species, which might lead to the isolation of molecules with strong therapeutic potential and their subsequent pharmacological activity.

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