



An overview of the phytochemical components, pharmacological action, and therapeutic applications of *Balanites aegyptiaca* Del (desert date)

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ABSTRACT

Medicinal plants have been known to display a broad variety of biological activity. They were used to treat a variety of illnesses in herbal remedies. Numerous phytochemical substances that were accountable for the activities' real mechanism were found to be present in them. Among the plants with these unique biological activity is *Balanites aegyptiaca*, often known as *B. aegyptiaca*, saponins, flavonoids, alkaloids, lipids, proteins, carbohydrates, and organic acids are among its constituents. It has been established that rich sources of saponins are the mesocarp of fruits, seeds, leaves, stems, and root bark. Alkaloids, polysterols, phenolic acids, flavonoids, and coumarins are also plentiful in these tissues, used in traditional remedies to treat a wide range of illnesses, including jaundice, worm infection, wounds, stomach pains, malaria, asthma, and fever. Their biological effects are diverse, including antibacterial, antioxidant, anti-diabetic, anti-fibrotic and anti-cancer properties. An outline of the is given in this review for the phytochemical constituents, and pharmacological actions of *B. aegyptiaca* Del.

INTRODUCTION

The Zygophyllaceae family of flowering plants includes the Afrotropical genus *Balanites*. The name *Balanites*, which was first used by Alire Delile in 1813, refers to the fruit and is taken from the Greek word for an acorn¹.

Balanites aegyptiaca

"Desert date" in English is another name for *Balanites aegyptiaca* Del., is a common, but usually disregarded, wild plant species that grows in desert parts of South Asia and Africa. It is a member of the Zygophyllaceae family². A large

portion of Africa and the Middle East are native to this tree. The fruits of the tree are its most valuable component³⁻⁶. It is coarse when green and turns yellowish and dry as it grows⁷. There are four layers to it⁸. The woody shell, known as the endocarp, the fleshy pulp, known as the mesocarp, the inner layer, known as the epicarp. For the seed called kernel different industrial and therapeutic items, all four layers can be used⁹. There is a lot of oil in the seed¹⁰⁻¹². The oil can be transformed into biodiesel^{13, 14} or used as food for humans^{15, 16}. Additionally, the oil has therapeutic uses¹⁰. Several

ethnobotanical investigations have indicated the plant's medicinal benefits to be medicinal, a purification agent for leukoderma, and anthelmintic^{13, 17}. It was also utilized as an effective antidiabetic and antioxidant^{18, 19}, as well as an anticancer, antiviral, and antibacterial^{20, 21}.

Phytochemical constituents of desert date

Plant tissues include galls, roots, stem bark, fruit, seeds, and leaves are used to extract a variety of secondary metabolites generated by *B. aegyptiaca*, such as pregnane glycosides, steroids, alkaloids, and saponins (open-chain steroidal saponins, furostanol, and spirostanol)²².

Polyphenols

The phenolic structural features present in polyphenols are characterized by a single or several aromatic rings, every one of which has one or more groups of hydroxyls. Polyphenols fall into several categories, including phenolic acids, stilbenes, flavonoids, tannins, and lignans. As natural medicinal agents, these chemicals are important in preventing degenerative diseases, as cardiac disease, cancer, and neurological problems^{23, 24}.

Flavonoids

With a bridge made of three-carbons linking

the phenyl groups in their diphenyl propane-flavone structure, flavonoids are frequently cyclized with oxygen. Several *B. aegyptiaca* tissues have been used to identify hyperoside, epicatechin O-glucoside, isorhamnetin, isorhamnetin-3-O-glucoside, isorhamnetin 3,7-diglucoside, and quercitrin, among other compounds²⁵.

Coumarins

The properties of coumarins include neuroprotective, anticoagulant, antimicrobial, anticancer, and anti-inflammatory effects. They consist of rings of α -pyrone and benzene bonded together. Bergapten and marmesin are two coumarins that are isolated from stem bark²⁶.

Alkaloids

Compounds containing basic nitrogen-atoms are known as alkaloids. For a variety of biological functions, when it comes to cancer treatment, they are especially beneficial. Fruit and stem bark contain a variety of alkaloids, including trigonelline and N-cis-feruloyltyramine²⁷.

Phytosterols

Natural bioactive substances derived from plants known as phytosterols have a chemical structure similar to that of cholesterol. Several clinical studies have consistently demonstrated that human levels of low-density lipoprotein had significantly decreased when phytosterols, such as stigmasterol, campesterol, and beta-sitosterol, are consumed. *B. aegyptiaca* produces a wide range of steroids, including as diosgenin, cholesterol, and campesterol²⁸.

Saponins

Bioorganic substances known as saponins have steroidal or triterpenoid skeletons and are glycosylated in varying degrees by sugar moieties bonded at various points. Additional classifications of steroidal saponins include furostanol, spirostanol, and open-chain steroidal saponins²⁹.

Pharmacological Action

Currently, extracts from *B. aegyptiaca* and the compounds that make them up have shown a variety of biological activities, such as:

Anti-microbial Action

B. aegyptiaca produces phenolics, simple phenols, and phenolic acids³⁰, among other antibacterial compounds. These compounds function by a number of different methods, including as enzyme inhibition, depletion of substrate, membrane disruption, and integration into DNA or cell walls. Desert dates are rich in all of these compounds and have potent antibacterial qualities³¹.

Hepatoprotective Action

The extensive range of free radical scavenging components found in bioactive compounds, mostly sourced from dietary sources, such as polyphenols, alkaloids, and phytosterols in desert dates are thought to be responsible for their hepatoprotective impacts. Desert dates' exceptional antioxidant content, which has strengthened the antioxidant defense system of cells, may be the cause of their hepatoprotective qualities³².

Antitumor Action

Two of the plant-based bioactive compounds that are crucial in reducing the risk of cancer are saponins and phytosterols. Numerous steroidal saponins that were isolated from various *B. aegyptiaca* tissues have been shown to possess anticancer qualities. For instance, a combination of balanitin-6 and balanitin-7 separated from kernels has been demonstrated to impede the growth of human tumor cell lines in vitro³³. This suppression has been related to reduce oxidative stress, increased apoptosis, cell growth, and inflammatory marker expression³⁴.

Anti-inflammatory Action

Desert dates demonstrated strong anti-inflammatory qualities; examined the in vivo anti-inflammatory characteristics of

methanol and butanol extracts as well as two saponins, balanin-B1 and balanin-B2, extracted from the bark of *B. aegyptiaca* in rats whose edema was caused by carrageenin. Both extracts considerably lessened the edema in the rat paw³⁵. According to reports, *B. aegyptiaca* has strong anti-inflammatory properties.

Anti-Diabetic Action

Numerous studies have demonstrated the anti-plasmodial, antinematode, and anti-molluscicidal qualities of *B. aegyptiaca* extracts^{36,37}. Also, shown how methanolic fruit extracts affected *Trichinella spiralis*'s enteral and parenteral phases (pig worm)³⁸. Additionally, assessed the antiplasmodial activity of a crude seed extract against *Plasmodium falciparum*³⁹.

Anthelmintic Action

In mature earthworms, a decrease in dosage-dependent of spontaneous movement was noted in the water-based extract of *B. aegyptiaca* root bark. furthermore, has vermifugal action⁴⁰. According to reports, comparing *B. aegyptiaca* to albendazole, there is a notable anthelmintic effect on the adult *Fasciola gigantica* worm⁴¹. In comparison to the anthelmintic medication albendazole, fruit extract methanolic of *B. aegyptiaca* is found to show anthelmintic effect against various phases of *Trichinella spiralis* in rats⁴².

Actions that promote wound-healing

Based on the wound contraction, *B. aegyptiaca* is said to have strong wound-healing properties. The findings further demonstrated plants' potent antioxidant activity via preventing lipid peroxidation, neutralizing the DPPH (2,2-diphenyl-1-picrylhydrazyl) radical,

as well as protecting fibroblast cells from reactive damage⁴³.

Diuretic Action

Tested on Wistar albino rats, the *B. aegyptiaca* leaves extract in methanol and ethanolic revealed a diuretic action. The standard treatment was frusemide. The results show that, in contrast to the control, the methanol and ethanol extracts significant rise the amount excreted in urine and electrolyte⁴⁴.

Antiviral Action

AIDS and leukaemia have reportedly been treated with *B. aegyptiaca* of bark aqueous extraction. The demonstrated outstanding outcomes for the treatment of HIV patients. After one month, patients with leukaemia who received the same treatment showed a healthy increase in platelets and a normal blood differential measurement⁴⁵.

CONCLUSIONS

"Desert date" has long been used traditionally to treat a variety of illnesses. Due to the presence of poly phenol, flavonoid, coumarins, alkaloids, Phytosterols and saponins with great medicinal value—in different portions of the plant, it is also very significant economically. *B. aegyptiaca* has demonstrated through experimentation that it possesses anti-inflammatory, anthelmintic, wound-healing, antiviral, antioxidant, antibacterial, and anticancer properties. In order to determine whether *B. aegyptiaca* has the ability to treat and cure disease, more research must be done.

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