IJP (2025), Vol. 12, Issue 4 **(Review Article)**

Received on 26 March 2025; received in revised form, 22 April 2025; accepted, 27 April 2025; published 30 April 2025

REVIEW ON PHYTOCHEMICALS AND PHARMACOLOGICAL ACTIVITY OF *BALANITE AEGYPTIACA* (DESERT DATE) FRUIT

B. R. Divya *, Vageesh Revadigar, T. Tamizh Mani, L. Shiju and T. Pavithra

Department of Pharmacognosy, Bharathi college of Pharmacy, Bhrathinagara, Maddur Taluk, Mandya - 571422, Karnataka, India.

Keywords:

Balanite aegyptiaca, Phytochemical constituents, Folk medicine, Phytomedicine

Correspondence to Author:
B. R. Divya

Department of Pharmacognosy, Bharathi college of Pharmacy, Bharathinagar, Maddur Taluk, Mandya - 571422, Karnataka, India.

E-mail: diyabr1996@gmail.com

ABSTRACT: *Balanite aegyptiaca* fruit is also known as Desert date traced under the family *Zygophyllaceae.* Africa, the Middle East, and the Indian subcontinent are all native habitats for this tree. Numerous studies have shown that the phytochemicals and extracts from desert dates have anti-inflammatory, anti-cancer, antidiabetic, antioxidant, wound healing and antibacterial properties. Mesocarp of fruits, seeds, leaves, stem and root bark are the rich sources of saponins. Summarizing the research on various bioactive substances and the advantageous qualities of *B. aegyptiaca* is the aim of this review.

INTRODUCTION: *Balanite aegyptiaca*, also known as "Desert date" which belongs to family *Zygophyllaceae*. It is one of the most prevalent but underappreciated wild plant species found in arid regions of South Asia and Africa.

It is especially prevalent in the Deccan, Madhya Pradesh, Gujarat, and Rajasthan regions of India. In Senegal, this tree is among the most prevalent. Because it can tolerate a wide range of soil types, from sand to heavy clay and climate moisture levels, it can be found in a number of habitat types [1].

Taxonomy [2]:

Botanical Name: *Egyptian balsam.*

QUICK RESPONSE CODE

DOI: 10.13040/IJPSR.0975-8232.IJP.12(4).288-93

Article can be accessed online on: www.ijpjournal.com

DOI link: https://doi.org/10.13040/IJPSR.0975-8232.IJP.12(4).288-93

Synonyms: *Ximenia aegyptiaca* L. (excl. *Balanites roxburghii* Planch), *Agialida senegalensis* van Tiegh., *Agialida barteri* van Tiegh., *Agialida tombuctensis* van Tiegh., *Balanites ziziphoides Milbr. Et Schlechter, Balanites latifolia.*

TABLE 1: TAXONOMICAL CLASSIFICATION OF *BALANITE AEGYPTIACA*

Classification	Name
Kingdom	Plantae
Division	Magnoliophyta
Class	Magnoliopsida
Subkingdom	Tracheobionta
Superdivision	Spermatophyta
Subclass	Rosidae
Order	Sapindales
Family	Zygophyllaceae
Genus	Balanites Delile
Species	*Balanites aegyptiacus (L.) Delile*

Vernacular Names:

Languages: Names

Arabic: Zachun, Zaccone, Heglig (Tree)

Lozi: Mwalabwe

Luganda: Musongole

Amharic: Kudkuda, Jemo, Bedeno

French: Dattier Sauvage, Dattier Du Desert, Myrobalau D' Egypte

Hindi: Engua, Ingudi, Betu, Hingan, Hingn, Hingot, Hongot, Hingota

Bemba: Katikayengele, Mubambwangoma

Bengali: Hin

English: Soap Berry Tree, Simple-Thorned Torchwood, Simple Thorned Torch Tree, Heglig Berries

Mandinka: Sumpo

Nyanja: Nkuyu

Sanskrit: Ingudi

Swahili: Mjunju, Mwambangoma

Tamil: Nanjunda

Tigrigna: Indrur, Mekie

Tongan: Mulyanzovu, Mwalabwe

Trade Name: Desert Date (Dried Fruit, Egyptian Myrobalan).

FIG. 1: *BALANITE AEGYPTIACA* FRUIT

Ethnobotanical Uses of *Balanites aegyptiaca* Fruits: As reported in one of the ethnobotanic survey, the desert date fruit can treat eight human problems, such as diabetes, high blood pressure, constipation, and cough. The fruit pulp's culinary applications were also documented in the same study. Similar traditional culinary and therapeutic applications of *B. aegyptiaca* fruit have also been documented in other places.

Research studies reveal that fruit pulp is used to treat constipation in Burkina Faso, Algeria, and Senegal, to treat diabetes in Egypt and Sudan, and hypertension in Senegal. The fact that populations in the Sahel and Sahara, especially the Mauritius, use *B. aegyptiaca* fruit pulp similarly for medicinal and culinary purposes shows the plant's nutritional worth as well as its pharmacological and medicinal potential. A bioactive substance found in ethanolic extract of *B. aegyptiaca* roots reported to produces sedative and anxiolytic effects on mice. Notably, saponins were identified as the active chemicals in the majority of these investigations [3].

Morphological Description: *B. aegyptiaca* has prickly branches and is extremely drought-tolerant. A dicotyledonous blooming species, the tolerant evergreen plant is a member of the Zygophyllaceae family. The tree has fruits that resemble dates and has strong, bushy leaves with two roots. Additionally, it is a prickly species with thorns that are 2.5–3.5 cm long. The leaves have two distinct leaflets, each of which is oblong, asymmetrical, 2.5–6 cm long, leathery, bright green and has fine hairs when it is young.

Dark green, complex, and spirally distributed on the shoots, they have two solid coriaceous leaflets; their sizes and forms vary greatly. The bark varies in color, ranging from dark brown to grey and extensively fissured. The trunk is small and frequently branches arise from close to the base. Additionally, reported to be the plant's branches are equipped with robust yellow or green thorns up to 8 cm long, and its flowers are small, bisexual, fragrant, greenish white, in axillary clusters, few or many in number, with cymes or flowers, inconspicuous, hermaphrodite and pollinated by insects.

The fruit is a rather long, slender drupe that is 1.5 to 4 cm in diameter and 2.5 to 7 cm in length. Young fruits are tormentose and green, but they eventually turn yellow and glabrous. Ripe fruits have a brittle outer layer that encloses a brown or brown-green sticky substance, and they are brown

or pale brown when fully ripe. Pulp is edible and has a bitter-sweet flavour. The pyrene (stone) seed is 1.5–3 cm long, light brown, fibrous, very hard, and can be kept in pesticide storage. One tree yields between 100 and 150 kg annually [4].

FIG. 2: *BALANITE AEGYPTIACA* FRUIT

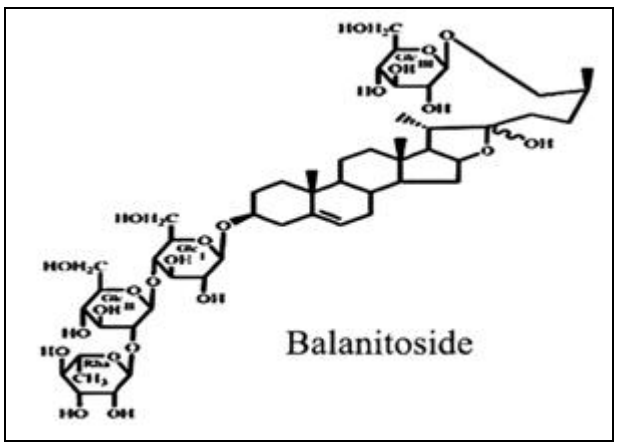
FIG. 3: *BUDBALANITE AEGYPTIACA* FLOWER

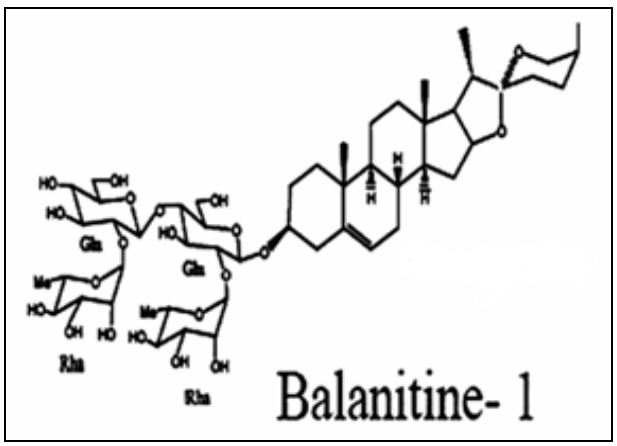
FIG. 4: *BALANITE AEGYPTIACA* LEAVES

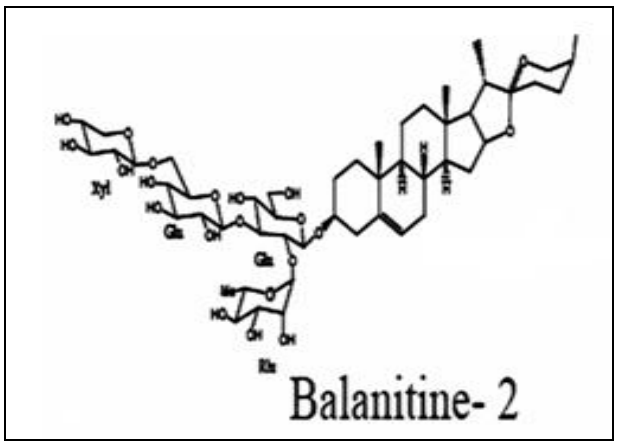
Nutritional Composition and Phytochemicals:

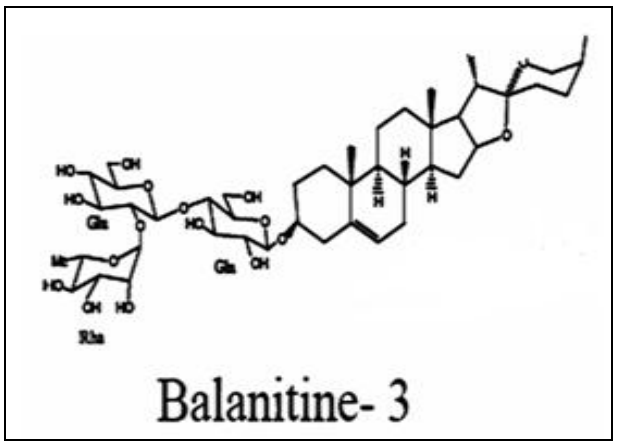
Fruit: The fruit's mesocarp has 1.2–1.5 percent protein, 35–37% sugar, 15% organic acids, and other components such 3-rutinoside and 3-rhamnogalactoside [5], it also contain a mixture of 22R and 22S epimers of 26-(O-β-D-glucopyranosyl)-3-β-[4 – O -(β-D-glucopyranosyl)-2-O - (α-L-rhamnopyranosyl) – β – D –gluco-pyranosyloxy] - 22, 26 – dihydroxyfurost – 5 - ene. However, kernel contains a xylopyranosyl derivative of above saponin present in mesocarp [6]. Six saponins with molecular masses of 1196, 1064, 1210, 1224, 1078, and 1046 Da were discovered from the nine components of the kernel cake of *B. aegyptiaca*, with the compound with mass 1210 Da being the major saponin (about 36%) [7].

6-methyldiosgenin and balanitoside (furostanol ycoside) have been identified in fruits (mesocarp) of *B. aegyptiaca* [8]. The saponins balanitin-1, -2, and -3 undergo hydrolysis [9].









Pharmacological Activity:

Antioxidant Properties: The human body produces too many oxidants as a result of various physical and physiological stressors, which eventually lead to oxidative damage of DNA, proteins, and lipids. This damage is also the cause of a number of disorders, including cancer, aging, and cardiovascular diseases. It has been reported that small fruits and nuts are rich in antioxidant phytochemicals, and eating them is good for the body [10]. *Balanitis* 1 and 2, which isolated from bark extracts and showed antioxidant action *in-vitro* [11]. Polyphenols such as quercetin and kaempferol are the major components responsible for antioxidant activities [12]. Furthermore, it has been shown that phytosterols such as campesterol, stigmasterol, and ß-sitosterol exhibit antioxidant action [13].

Antimicrobial Properties: Plants synthesize several antimicrobial compounds, including phenolics such as simple phenols, phenolic acids, quinones, flavonoids, flavones, flavanols, tannins, coumarins, terpenoids, essential oils and alkaloids [14]. All of these phytochemicals are abundant in desert dates, which also have strong antibacterial properties. African traditional medicine makes extensive use of *B. aegyptiaca* bark to treat wounds and skin conditions. There have been reports on the impact of bark aqueous ethanolic extracts on bacteria isolated from wounds [15]. These extracts inhibited the growth of *Pseudomonas aeruginosa* and *Staphylococcus aureus in-vitro*. The *in-vitro* antifungal activity of saponin-rich extracts of fruit mesocarp was explored against phytopathogenic fungi [16].

Anti-Inflammatory Properties: Desert dates had strong anti-inflammatory properties; for instance, Speroni *et al.* investigated the anti-inflammatory properties. Methanolic and butanolic of Desert dates reported possess two saponins. Balanin-B1 and Balanin-B2, which were separated from the bark of *B. aegyptiaca* have shown significant anti-inflammatory action on Rat paw edema model. Methanol extract, butanol extract, Balanin-B1, and Balanin-B2 have reported to cause inhibition of 32%, 68%, 62%, and 59% of reduction in inflammation respectively. The seed oil of fruit (100 mg/kg) reported to produce significant reduction in lipid peroxidation and nitrogen oxide concentration in rats liver and kidney cells. Additionally, report shows of there was a decrease in cyclooxygenase-2 concentration indicating its anti-inflammatory activity, which is a result of downregulating mRNA and protein production of interleukin-6 and tumor necrosis factor-α [17].

Antidiabetic Activity: Daonil a common drug, pure saponin, which is derived from the mesocarp of the balamite fruit, and aqueous extract have been reported to produce be hypoglycaemic effect on Albino rats. Also reported to decrease the growth of *Escherichia coli* in rats [18]. Numerous studies which have been conducted to demonstrate and comprehend the potential processes underlying the antidiabetic and hypoglycaemic actions of various extracts of *B. aegyptiaca (L.) Del*. In rats with STZ-induced diabetes, the aqueous extract of the mesocarp of *B. aegyptiaca (L.) Del* fruits were found to possess a reducing effect on blood sugar levels [19].

Wound Healing Activity: The wound contraction indicates that *B. aegyptiaca* has strong wound-healing properties. One of the findings showed that *B. aegyptiaca* have strong antioxidant properties by

preventing lipid peroxidation, neutralizing the 2,2-diphenyl-1-picrylhydrazyl (DPPH) radical, and shielding fibroblast cells from oxidative damage and produce wound healing activity [20].

Anticancer Activity: An *in-vitro* study shows that a combination of steroidal saponins isolated from *B. aegyptiaca* kernels, balanitin-6 (28%) and balanitin-7 (72%), showed significant anticancer effects against few human cancer cell lines such as A549 non-small-cell Lung cancer (IC_{50}, 0.3 μM) and U373 Glioblastoma (IC_{50}, 0.5 μM). Studies also showed that the combination of Balanitin 6/7 is more cytotoxic than cytostatic and comparative in action than Etoposide and Oxaliplatin. *In-vitro* anticancer actions are reported to be caused by partial [ATP]i depletion from Mitochondria resulting into significant actin disarray and not raising the intracellular reactive oxygen species. Similar to Vincristine, Bal6/7 reported to extended the survival period of mice containing murine L1210 leukemia grafts *in-vivo* [21, 22].

Hepatoprotective Properties: The study conducted on evaluating the hepatoprotective potential of a methanolic leaf extract against rats' liver injury caused by carbon tetrachloride (CCl4) reported [23]. Administration of the extract (200 and 400 mg/kg per os) markedly reduced the CCl4-induced elevation of serum marker enzymes, such as glutamate pyruvate transaminase, glutamate oxaloacetate transaminase, alkaline phosphatase and bilirubin. Similarly, fruit mesocarp and stem bark aqueous extracts reported to Amelio rate CCl4-induced hepatotoxicity in rats, as measured by liver enzyme activity, blood parameters and histopathology [24].

ACKNOWLEDGEMENT: I would like to express my sincere gratitude to Bharathi education trust, Bharathinagara, Mandya, Karnataka for their invaluable support. I am also thankful to Vageesh Revadigar, Dr. T. Thamizh Mani, Shiju L and Pavithra T for their support.

CONFLICT OF INTEREST: Nil

REFERENCES:

1. Chothani DL and Vaghasiya HU: A review on *Balanites aegyptiaca* Del (desert date): phytochemical constituents, traditional uses, and pharmacological activity. Pharmacognosy Reviews 2011; 5(9): 55.
2. Al-Thobaiti SA and Abu Zeid IM: Medicinal properties of desert date plants (*Balanites aegyptiaca*)-an overview. Global Journal of Pharmacology 2018; 12(1): 01-12.
3. Abdelaziz SM, Lemine FM, Tfeil HO, Filali-Maltouf A and Boukhary AO: Phytochemicals, antioxidant activity and ethnobotanical uses of *Balanites aegyptiaca* (L.) Del. fruits from the arid zone of Mauritania, Northwest Africa. Plants 2020; 9(3): 401.
4. Tesfaye A: Balanites (*Balanite aegyptiaca*) del., multipurpose tree a prospective review. International Journal of Modern Chemistry and Applied Science 2015; 2(3): 189-94.
5. Salwa AM and El Hadidi MN: Flavonoids of *Balanites aegyptiaca* (Balanitaceae) from Egypt. Plant Syst Evol 1988; 160: 153–8.
6. Stærk D, Chapagain BP, Lindin T, Wiesman Z and Jaroszewski JW: Structural analysis of complex saponins of *Balanites aegyptiaca* by 800 MHz 1H NMR spectroscopy. Magnetic Resonance in Chemistry 2006; 44(10): 923-8.
7. Chapagain BP and Wiesman Z: Determination of saponins in the kernel cake of *Balanites aegyptiaca* by HPLC-ESI/MS. Phytochemical Analysis: An International Journal of Plant Chemical and Biochemical Techniques. 2007; 18(4): 354-62.
8. Hosny M, Khalifa T, Calis I, Wright AD and Sticher O: Balanitoside: A furostanol glycoside, and 6-methyldiosgenin from *Balanites aegyptiaca*. Phytochemistry 1992; 31(2): 3565-9.
9. Liu HW and Nakanishi K: The structures of balanitins, potent molluscicides isolated from *Balanites aegyptiaca*. Tetrahedron 1982; 38(1): 513-9.
10. Murthy HN and Bapat VA: Importance of Underutilized Fruits and Nuts. In Bioactive Compounds in Underutilized Fruits and Nuts, Murthy, H., Bapat, V., Eds.; Reference Series in Phytochemistry; Springer: Cham, Switzerland 2020; 7(2): 3–19.
11. Speroni E, Cervellati R, Innocenti G, Costa S, Guerra MC, Dall'Acqua S and Govoni P: Anti-inflammatory, anti-nociceptive and antioxidant activities of *Balanites aegyptiaca* (L.) Delile. Journal of Ethnopharmacology 2005; 98(1-2): 117-25.
12. Rasouli H, Farzaei MH and Khodarahmi R: Polyphenols and their benefits: A review. International Journal of Food Properties 2017; 20(2): 1700-41.
13. Yoshida Y and Niki E: Antioxidant effects of phytosterol and its components. Journal of Nutritional Science and Vitaminology 2003; 49(4): 277-80.
14. Cowan MM: Plant products as antimicrobial agents. Clinical Microbiology Reviews 1999; 12(4): 564-82.
15. Anani K, Adjrah Y, Ameyapoh Y, Karou SD, Agbonon A, de Souza C and Gbeassor M: Effects of hydroethanolic extracts of *Balanites aegyptiaca* (L.) Delile (Balanitaceae) on some resistant pathogens bacteria isolated from wounds. J of Ethnopharmacology 2015; 164(1): 16-21.
16. Chapagain BP, Wiesman Z and Tsror L: *In-vitro* study of the antifungal activity of saponin-rich extracts against prevalent phytopathogenic fungi. Industrial Crops and Products 2007; 26(2): 109-15.
17. Murthy HN, Yadav GG, Dewir YH and Ibrahim A: Phytochemicals and biological activity of desert date (*Balanites aegyptiaca* (L.) Delile). Plants 2020; 10(1): 32.
18. George DH, Ali HK and Abbas OA: Evaluation of the biological activity of *Balanites aegyptiaca* (L.) Del Saponin in the control of type 11 diabetes mellitus on rats and the growth of Escherichia coli. Ahfad Journal 2006; 23(2): 148-9.

19. Mansour HA: Amelioration of impaired renal function associated with diabetes by *Balanites aegyptiaca* fruits in streptozotocin induced diabetic rats. Journal of the Medical Research Institute 2000; 21(2): 115-25.
20. Annan K and Dickson R: Evaluation of wound healing actions of *Hoslundia opposita* vahl, *Anthocleista nobilis* G. Don. and *Balanites aegyptiaca* L. Journal of Science and Technology (Ghana) 2008; 28(2): 26-35.
21. Gnoula C, Mégalizzi V, De Nève N, Sauvage S, Ribaucour F, Guissou P, Duez P, Dubois J, Ingrassia L, Lefranc F and Kiss R: Balanitin-6 and-7: diosgenyl saponins isolated from *Balanites aegyptiaca* Del. display significant anti-tumor activity *in-vitro* and *in-vivo*. International Journal of Oncology 2008; 32(1): 5-15.
22. Pettit GR, Doubek DL, Herald DL, Numata A, Takahasi C, Fujiki R and Miyamoto T: Isolation and structure of cytostatic steroidal saponins from the African medicinal plant *Balanites aegyptica*. Journal of Natural Products 1991; 54(6): 1491-502.
23. Thirupathi K, Krishna DR, Ravi Kumar B, Apparao AVN and Krishna Mohan: G. Hepatoprotective effect of leaves of *Balanites roxburghii* against carbon tetrachloride-induced hepatic damage in rats. Curr Trends Biotechnol Pharm 2009; 3(2): 219–224.
24. Mariam S, Onyenibe NS and Oyelola OB: Aqueous extract of *Balanites aegyptiaca* Del Fruit mesocarp protects against CCl4 Induced liver damage in rats. Br J Pharm Res Int 2013; 3(2): 917–928.

How to cite this article:
Divya BR, Revadigar V, Mani TT, Shiju L and Pavithra T: Review on phytochemicals and pharmacological activity of *Balanite aegyptiaca* (desert date) fruit. Int J Pharmacognosy 2025; 12(4): 288-93. doi link: http://dx.doi.org/10.13040/IJPSR.0975-8232.IJP.12(4).288-93.