



## **Balanites (*Balanite aegyptiaca*) Del., Multipurpose Tree a Prospective Review**

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**Abstract:** *Balanites aegyptiaca* (L.) Del., is an evergreen xerophyte with ample beneficial attribute. The plant has major biological active component that contributes in its nutraceutical applications. The seeds of this plant contain 30-60% oil, which is edible and used as cooking oil. Fruits are also edible and contain essential minerals. Beside this, the leaf of this plant is a one of the favorite fodder among goats, so it can play an important role of fodder tree in the desert in severe drought. All parts of the plant gifted various pharmacological activity. For instance, the fruits and roots of this plant contain diosgenin, which can be used in pharmaceutical industry in production of oral contraceptive and steroids. Furthermore, this plant used as treatment of diarrhoea, hemorrhoid, stomach aches, jaundice, yellow fever, syphilis and epilepsy. The fruit is used to treat liver disease and as a Purgative. The plant is containing phenolic compounds including; saponins, flavonoids and alkaloids which contributes in its pharmacological activities including anti-inflammatory, analgesic, antioxidant, anti-tumor, larvicidal, Antinociceptive, Anthelmintic and antidiabetic activity.

**Key point** *Balanites aegyptiaca*, Balantoside diosgenin, nutraceutical, spononin

### **1. Introduction**

*Balanites aegyptiaca* (L.) Del. belongs to the family Balanitaceae. It is a multibranched, evergreen tree native to the Sudano-Sahelian region of Africa, the Middle East and South Asia As described by Hines & Eckman,<sup>[12]</sup>. The plant is known by different vernacular names in different parts of the world. For instance, Arabic names: Heglig (tree), lalob (fruit); trade name: zaccone, zachun, desert date (dried fruit); (Rathore *et al.*,<sup>[22]</sup> in India: Hindi name is Hingot and English name is thorn tree/desert date and in Ethiopia, Amharic name is Bedeno Rathore *et al.*,<sup>[22]</sup> reported that, *B. aegyptiaca* is thorny species, spiny shrub or tree with 10 m in height. Flowers are greenish white fragrant with 5-6 mm in diameter, axillary in few flowers cyme or fascicles. Flowering and fruiting occurs during October (Bhandari,<sup>[2]</sup>. Seeds are pendulous and ex-albuminous The leaves are alternate, two foliate, petioles are 3-6 mm long, leaflets are elliptic and have broadly pointed petioles up to 5 mm long.

According to Abu Al-Futuh,<sup>[1]</sup> *B. aegyptiaca* has a wide range of nutraceutical applications. Fleshy pulp of the fruit is eaten fresh or dried. It contains 64 – 72% carbohydrates, plus crude protein, steroidal saponins, vitamin C, ethanol and other essential minerals for human. Moreover, Mohamed *et al.*,<sup>[17]</sup> pointed out that, the seed kernel is edible product. It contains good quality oil and high protein content. Pervious

finding of Hall and Walker,<sup>[11]</sup>; Tesfay *et al.*,<sup>[24]</sup>; Varshney and Vyas<sup>[25]</sup> indicates that, all parts of the tree have a medicinal uses including fruits, seeds, barks and roots. The most important is steroidal saponins, which yield diosgenin, a source of steroidal drugs, such as corticosteroids, contraceptives and sex hormones as described by Farid *et al.*,<sup>[8]</sup>; Pettit *et al.*,<sup>[121]</sup>.

According to Tesfay *et al.*,<sup>[24]</sup> as a multipurpose tree, *B. aegyptiaca* provide food, medicinal products and fuel-wood valued for subsistence living in arid and semi-arid areas where other options are few.

The potential of *B. aegyptiaca* under management remains unexplored and it is a priority to construct a picture of variation within the natural range and to generate the capacity to raise plants with desirable features as described by Chothani and Vaghasiya,<sup>[5]</sup>. Thus, the present paper point out the overall potential of *B. aegyptiaca* and its nutraceutical application.

### **2. Description of *Balanite aegyptiaca* Botanical Description**

*B. aegyptiaca* belongs to the family Zygophyllaceae which composed of about 25 genera and 240 species and predominant in tropical, subtropical and warm temperate, often in drier areas including in Africa. It is annual or perennial herbs as is assigned to the following botanical classification as described by Chapagain and Wiesman,<sup>[5]</sup>.

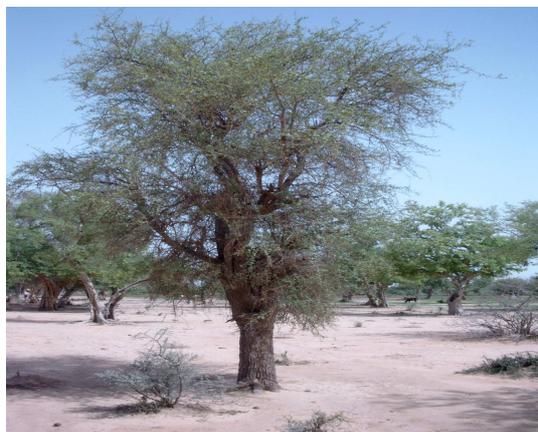


Fig1.1 *B.aegyptiaca*, Ethiopia

Kingdom: Plantae Subkingdom: Tracheobionta  
 Super division: Spermatophyta  
 Division: Magnoliophyta  
 Class: Magnoliopsida  
 Subclass: Rosidae  
 Order: Sapindales  
 Family: Zygophyllaceae  
 Genus: Balanites Delile  
 Species: *Balanites aegyptiaca* (L.) Delile

### 3. Distribution and Ecology

Natural distribution is obscured by cultivation and naturalization. It is believed indigenous to all dry lands south of the Sahara, extending southward to Malawi in the Rift Valley, and to the Arabian Peninsula, introduced into cultivation in Latin America and India. It is the one of the furthestmost neglected common tree, usually found throughout in dried regions of Africa, the Middle East, India and Burma as indicated by Mohd *et al.*,<sup>[18]</sup>; Mitra *et al.*,<sup>[19]</sup>. Boffa,<sup>[3]</sup> pointed out that, the plant is native to

Algeria, Angola, Benin, Burkina Faso, Burundi, Cameroon, Chad, Democratic Republic of Congo, Djibouti, Egypt, Eritrea, Ethiopia, Libyan, Morocco, Myanmar, Nigeria, Saudi Arabia, Somalia, Tanzania, Uganda, Yemen, Republic of, Zambia, Zimbabwe

The plant can survive in various types of soil including deep sands, sandy clay loams, sandy loams or clays but is mainly found on level alluvial sites with deep sandy loam and free access to water as described by Orwa *et al.*,<sup>[20]</sup>. The plant can be growing up to 2000 m altitude with mean annual temperature of 20 to 30°C and mean annual rainfall of 250 to 400 mm<sup>3</sup>. According to Chothani and Vaghasiya,<sup>[6]</sup> after the seedling stage, the plant is intolerant to shade and prefers open woodland or savannah for natural regeneration. It is a lowland species with a full potential to produce reliable yield under unreliable conditions. Orwa *et al.*,<sup>[20]</sup> reported that the plant can withstand high

temperature, high light intensity, high wind velocity and severe drought.

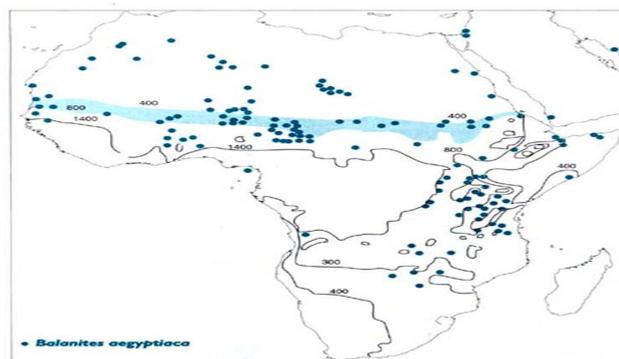


Fig 1.2. Natural distribution of *B.aegyptiaca*  
 Source Boffa,<sup>[3]</sup>.

### 4. Morphological Description

According to (Hall and Walker,<sup>[11]</sup>; Orwa *et al.*,<sup>[20]</sup>, *B.aegyptiaca* is spiny branches, highly drought tolerant evergreen plant, a dicotyledonous flowering species, belongs to Zygophyllaceae family. The tree has bushy, tough leaves, and a double root system, and produces date-like fruits. It is also a thorny species which has 2.5-3.5 cm lengthy thorns.

The leaves with two separate leaflets; leaflets obovate, asymmetric, 2.5 to 6 cm long, bright green, leathery, with fine hairs when young leaves compound and spirally arranged on the shoots, dark green with 2 firm coriaceous leaflets; dimensions and shapes varying widely as reported by Chothani and Vaghasiya,<sup>[6]</sup>. Trunk is short and often branching from near the base (Chothani and Vaghasiya,<sup>[6]</sup>) and the bark color vary and it ranged from dark brown to grey deeply fissured. Also Chapagain and Wiesman,<sup>[5]</sup> explained that Branches of this plant is armed with stout yellow or green thorns up to 8 cm long and Flowers are small, bisexual, greenish white, fragrant, in axillary clusters, few or many in number, cymes or fascicles, inconspicuous, hermaphroditic, and pollinated by insects.

Fruit is a rather long, narrow drupe, 2.5 to 7 cm long, 1.5 to 4 cm in diameter. Young fruits are green and tomentose, turning yellow and glabrous when mature while, ripe fruit are brown or pale brown with a brittle coat enclosing a brown or brown-green sticky. Pulp is bitter-sweet and edible. Seed is the pyrene (stone), 1.5 to 3 cm long, light brown, fibrous, and extremely hard and can be stored with insecticides. Approximately one tree produces 100 - 150 kg/ year. According to Chothani and

Vaghasiya<sup>[6]</sup> the plant begins to flower and fruit at 5 to 7 years of age and maximum seed production is when the trees are 15 to 25 years old.

## 5. Phytochemical Constituent

*B. aegyptiaca* contain different biological active compounds which contribute a vital role in its nutraceutical applications. It contains saponin, furanocoumarin, and flavonoid namely quercetin 3-glucoside, quercetin-3-rutinoside; 3-glucoside, 3-rutinoside, 3-7-diglucoside and 3-rhamnogalactoside of isorhamnetinide (furostanol glycoside) and 6 methyldiosgenin, balanitin-3 (spirostanol glycoside), Balanitin-6 and -7 Diosgenyl saponins, two pregnane glycosides namely pregn-5-ene-3 $\beta$ ,16 $\beta$ ,20(R)-triol 3-O-(2,6-di-O- $\alpha$ -l-rhamnopyranosyl)- $\beta$ -d-glucopyranoside (balagyptin), and pregn-5-ene-3 $\beta$ ,16 $\beta$ ,20(R)-triol 3-O- $\beta$ -d-glucopyranoside major sapogenin is yamogenin, two alkaloid namely, N-trans-

feruloyltyramine and N-cis-feruloyltyramine, and three common metabolites, vanillic acid, syringic acid; and 3-hydroxy-1-(4-hydroxy-3-methoxyphenyl)-1-propanone, beta-sitosterol, bergapten, marmes in, and beta-sitosterol glucoside, balanitin-1,-2, and -3 as described by Chothani and Vaghasiya, [6]; Kamel *et al.*, [13]; Farid *et al.*, [8]. The fruit mesocarp contains a large variety of chemicals amongst which are the pregnane glycosides, coumarins, flavonoids, 6-methyldiosgenin and saponins. Koko *et al.*, [15]; Koko *et al.*, [14]; Kamel *et al.*, [13]. Pointed out that the most important biological active component of the plant is steroidal saponins, which yield diosgenin, a source of steroidal drugs, such as corticosteroids, contraceptives and sex hormones.

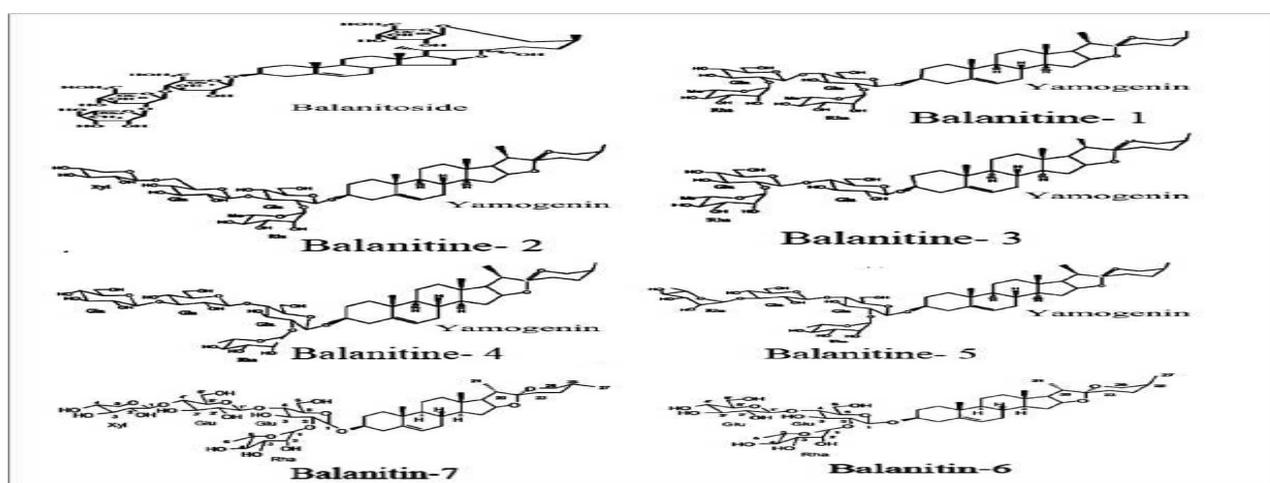


Figure 1.3 Major biological active constituent of *B. aegyptiaca*, source (Chothani and Vaghasiya, [6].

## 6. Nutritional values of *B. aegyptiaca*

Nutritionally, Balanites leaves, flowers and fruit pulp are good sources of protein, K, Fe, Mn, Zn and Cu. Bas mentioned by (Hall and Walker, [11]. Chothani and Vaghasiya [6] clearly explained that, the fleshy pulp of both unripe and ripe fruit is edible and eaten dried or fresh, the fruit is used as sweetmeats in Ghana, alcoholic liquor in Nigeria, a soup ingredient in Sudan. Young leaves and tender shoots are used as a vegetable, which is boiled, pounded, then fried or fat added to prepare it. The flowers are a supplementary food in western part of Africa. As indicated by Hall and Walker, [11].

Chothani and Vaghasiya, [6] reported that, the kernels produce edible oil used for cooking. The oil remains stable when heated and has a high smoking point, and therefore its free fatty acid content is low. Its scent and taste are good. The leaves are eaten raw or cooked, the oily seed is boiled to make it less bitter and eaten mixed with sorghum, and the flowers can be eaten. The fruit can be fermented for alcoholic beverages. The seed contains seed oil used as cooking oil. The seed cake remaining after the oil is extracted is

commonly used as animal fodder.

## 7. Medicinal Application of *B. aegyptiaca*

All the parts of *Balanites aegyptiaca* are traditionally used in several folk medicines across the globe. This plant has got tremendous importance and being used in treatment of several diseases and disorders. According Wilson *et al.*, [26] the fruit used as oral hypoglycemic drug in the Sahara region of Africa. Furthermore, Hall and Walker [11] reported that the fruits are also commonly used as purgative, antiparasitic and schistosomicide. According to Chapagain and Wiesman, [5] reported that, the stem, root and leaf extracts of *B. aegyptiaca* have commonly been used as various traditional folk medicines especially in the treatment of parasites, sore throat, constipation and eye irritation as reported by Gaur *et al.*, [9].

Earlier studies on therapeutic values of *B. aegyptiaca* shown anthelmintic, antivenin, anticancer, antioxidant, mosquito larvicidal Chapagain and Wiesman, [4], anti-inflammatory, antidiabetic Motaal *et al.*, [19], wound healing, hepatoprotective, hypocholesterolemic, diuretic

contraceptive and antiviral activities in various parts of *Balanites* extracts Gaur *et al.*,<sup>[9]</sup>. Aqueous extract of fruits showed spermicidal activity as reported by Speroni *et al.*,<sup>[23]</sup> without local vaginal irritation in human being antidiabetic, treatment of jaundice. Seed is used as expectorant, antibacterial, antifungal, febrifuge, anthelmintic and purgative as indicated by Mitra *et al.*,<sup>[16]</sup>; Chothani and Vaghasiya,<sup>[6]</sup>. Fruit is used in whooping cough, also in leucoderma and other skin diseases. Bark is used as spasmolytic. The seed oil is used to treat tumors and wounds used as laxative, also used in treatment of hemorrhoid, stomach aches, jaundice, yellow fever, syphilis, and epilepsy as explained by Chapagain and Wiesman,<sup>[5]</sup>, the bark of this plant is used in the treatment of syphilis, round worm infections, and as a fish poison .

Furthermore, Speroni *et al.*,<sup>[23]</sup> pointed out that, the plant is used as a purge to remove intestinal parasites with the root, branches, bark, fruit and kernel extracts shown to be lethal to the miracidia and cercariae of *Shistosoma mansoni* and to *Fasciola gigantica* (Koko *et al.*,<sup>[14]</sup>. Extracts of the tree shown abortive and antiseptic properties as indicated by Speroni *et al.*,<sup>[23]</sup>. According to Kamel *et al.*<sup>[13]</sup> roots boiled in soup are used against oedema and stomach pains. Roots are used as an emetic; bark infusion is used to treat heartburn. Wood gum mixed with maize meal porridge is used to treat chest pains as indicated by (Orwa *et al.*,<sup>[20]</sup>.

### 8. Other Uses

The tree is managed through agroforestry. It is used to attract insects for trapping as described by Gour and Kant,<sup>[10]</sup>. The pale to brownish yellow wood is used to make furniture and durable items such as tools, and it is a low- smoke firewood and good charcoal. The smaller trees and branches are used as living or cut fences because they are resilient and thorny. The tree fixes nitrogen. Root cuttings readily form a live fence. The bark yields fibers, the natural gums from the branches are used as glue, and the seeds have been used to make jewelry and beads as explained by Orwa *et al.*,<sup>[20]</sup>. The plant is used as a source of fire, fibre, timber, gum (resin) as described by Gour and Kant,<sup>[10]</sup> ; Orwa *et al.*,<sup>[20]</sup>.

Fire: The wood is good firewood; it produces considerable heat and very little smoke, making it particularly suitable for indoor use, it produces high-quality charcoal, and it has been suggested that the nutshell is suitable for industrial activated charcoal.

Fibre: A strong fibre is obtained from the bark (Orwa *et al.*,<sup>[20]</sup>. Timber: The wood is pale yellow or yellowish-brown. Heartwood and sapwood are not clearly differentiated. The wood is hard, durable, worked easily and made into yokes, wooden spoons, pestles, mortars, handles, stools and combs.

Gum or resin: A greenish-yellow to orange-red resin is produced from the stems. It is sucked and chewed when fresh. It is used as glue for sticking feathers onto arrow shafts and spearheads and in the repair of handle cracks and arrows.

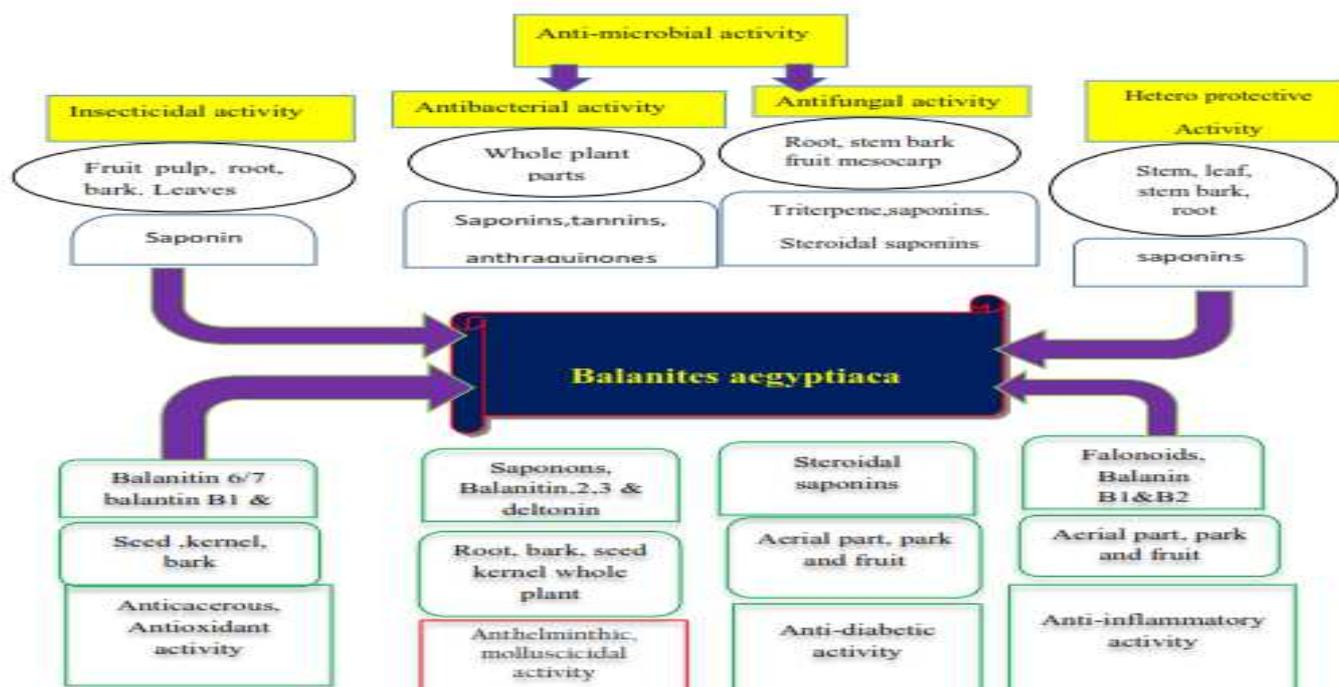


Fig 1.4 summary on phytochemical constituents of Desert Date with their therapeutic activities

## 8. Conclusion

*B.aegyptiaca* is a multipurpose plant with high economic potential for the people of desert. The plant has tremendously biological active component which contribute in its neuractical application, all parts of the plant used as food with promising effects antimicrobial, hepatoprotective, anti-proliferative and antioxidant activities antidiabetic activity ,antiviral activity wound healing activity, Hypocholesterolemic activity, and diuretic activity Plantation of this species should be promoted in arid regions as shelterbelts and in saline soil for reclamation of soil, it will be helpful in conservation of biodiversity.

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