

Systematic Review of Balanites aegyptiaca (Ingudi): Phytochemistry, Pharmacology, and Therapeutic Potentials

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Balanites aegyptiaca (L.) Delile, commonly known as Ingudi or Desert Date, is a highly valued medicinal tree traditionally used in Ayurveda, Unani, and African folk medicine. Widely distributed in arid and semi-arid regions of Africa, the Middle East, and South Asia, it has been utilized for centuries for its nutritional and therapeutic benefits. Almost all parts of the plant, including fruits, seeds, bark, and roots, are reported to possess medicinal properties. *B. aegyptiaca* contains a wide range of bioactive compounds, including lipids, carbohydrates, proteins, organic acids, alkaloids, saponins, and flavonoids, which are largely responsible for its diverse pharmacological activities. Recent studies have highlighted its antioxidant, antibacterial, antifungal, wound healing, antiulcer, hepatoprotective, antidiabetic, and anticancer effects, attributed to these phytoconstituents. With growing scientific validation, *B. aegyptiaca* holds promise as a source of novel therapeutic agents. The present review aims to provide comprehensive information on its traditional uses, phytochemistry, and pharmacological potential, underscoring its importance as a multipurpose medicinal resource of tropical regions.

Keywords: *Balanites aegyptiaca*, Ingudi, Ayurveda, Phytochemistry, Pharmacological activities

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Introduction

The name *Balanites* is derived from the Greek word *balanos* meaning “acorn,” and *aegyptiaca* refers to its Egyptian origin. *Balanites aegyptiaca* (L.) Delile, commonly known as *Ingudi*, *Hingot*, or Desert Date, belongs to the family Zygophyllaceae.

It is a small, spiny, evergreen xerophytic tree with bifoliate leaves and sharp thorns, distributed across arid and semi-arid regions of Africa, the Middle East, and South Asia.

In India, it occurs in western Rajasthan, peninsular tracts, and extends from southeast Punjab to West Bengal and Sikkim.

The cultural and medicinal importance of *B. aegyptiaca* is deeply rooted in Indian tradition. Ancient scriptures such as the *Vishnu Dharmasutra*, *Sankara Dharmasutra*, and *Mahabharata* record its use as a cleansing and therapeutic plant, while classical poets like Kalidasa in *Raghuvansa* and *Abhigyan Shakuntalam* described its application in daily life and wound care.

Ayurvedic texts, including the *Caraka Samhita* and *Sushruta Samhita*, highlight *Ingudi*'s utility in formulations for skin diseases, wound healing, and other therapeutic indications.

Nearly all parts of the tree—fruits, seeds, bark, roots, and leaves—are utilized as food, fodder, and medicine.

Traditionally, the plant has been used to manage malaria, epilepsy, intestinal worms, syphilis, jaundice, asthma, diarrhoea, dysentery, haemorrhoids, and wounds. *B. aegyptiaca* contains a wide range of bioactive compounds, including lipids, carbohydrates, proteins, organic acids, alkaloids, saponins, and flavonoids, which are primarily responsible for its pharmacological actions.

Modern studies validate its diverse biological activities, such as antioxidant, hepatoprotective, antimicrobial, antidiabetic, anticancer, anti-inflammatory, antiviral, antihelminthic, immunostimulant, contraceptive, and molluscicidal effects.

Its seed oil, rich in unsaturated fatty acids, has both nutritional and therapeutic applications. With such a wide spectrum of actions, *B. aegyptiaca* emerges as an underutilized but highly valuable medicinal resource.

Table 1: Vernacular Names of *Balanites aegyptiaca*

SN	Language	Vernacular Name
1.	Arabic	Elheglyg, Heghelig
2.	Bengali	Hingon
3.	Bombay	Hinganbet
4.	Canarese	Ingalare, Ingalukke, Ingalarade
5.	Cutch	Hinganbet
6.	Deccan	Hingan, Hinganbet
7.	English	Desert date, Soap berry tree, Thorn tree
8.	French	Dattier du desert
9.	Gujarati	Egorea, Hinger
10.	Hindi	Hingan, Hingen, Hingol, Hingot
11.	Kannada	Ingalore, Ingalakayi
12.	Latin	<i>Balanites aegyptiaca</i> Delile
13.	Malayalam	Nanjunta
14.	Marathi	Hingan, Hingane
15.	Rajasthani	Hingoto, Hingomi
16.	Tamil	Nanjundan, Toruvattu
17.	Telugu	Gara, Ingudi, Ringri
18.	Urdu	Hingot
19.	Oriya	Ingudihala

Balanites aegyptiaca (*Ingudi*) is known by several synonyms in classical *Ayurvedic* literature, including *Bhavprakash Nighantu* & *Rajnighantu*. These names reflect its biological traits, therapeutic properties, or characteristic features: In *Bhavprakash Nighantu* (५१०), *Balanites aegyptiaca* is referred to as *Ingudi*, which is known for eliminating *Doshas* and useful in treating skin disorders such as *Kustha*.

It is also called *Angarvriksha*, highlighting the use of its wood for preparing coal due to its heat-generating properties. Another synonym, *Tapas-druma*, reflects its traditional use by saints for various purposes.

According to *Rajnighantu* (२१०), the plant is known as *Anilantak*, indicating the seed oil's efficacy in alleviating *Vata* disorders. *Krostuphala* denotes its wide occurrence in the wild and the fact that its fruits are consumed by forest animals. The fruit is also called *Tailaphala* due to its oil-rich nature, while *Putigandha* refers to its disagreeable odor.

The tree is described as *Tiksnakantaka*, owing to its sharp spines, and *Bhallaka*, highlighting that the spines resemble a spear. These classical synonyms not only describe the plant's physical characteristics but also emphasize its diverse therapeutic applications and traditional significance in *Ayurveda*.

[1]

Table 2: Taxonomical Classification of *Balanites aegyptiaca*[2]

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

Table 3: Botanical and Morphological Description

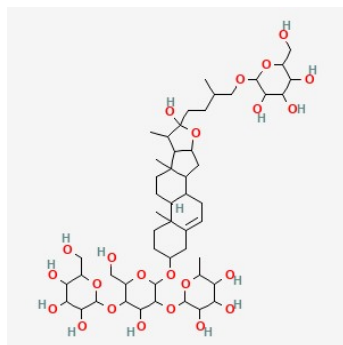
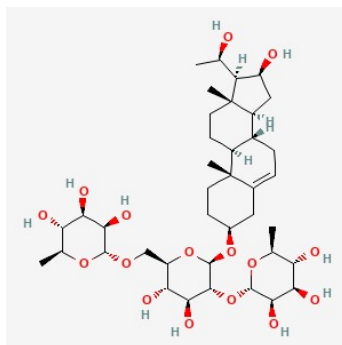
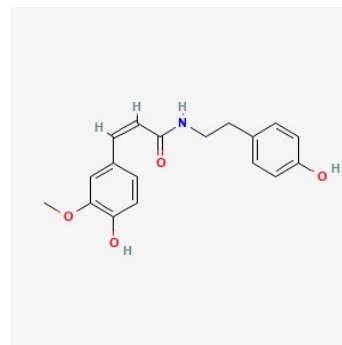
SN	Morphological Character	Description
1.	Family	Zygophyllaceae
2.	Habit	Dicotyledonous, evergreen, thorny tree; highly drought-tolerant
3.	Branches	Prickly with yellow or green thorns (2.5–8 cm long); branches often arise close to the base
4.	Trunk	Short, often branched near the base; bark dark brown to grey, deeply fissured
5.	Leaves	Compound, dark green, spirally arranged on shoots with two coriaceous (leathery) leaflets
6.	Leaflets	Oblong, asymmetrical, 2.5–6 cm long; bright green; fine hairs when young; leathery texture
7.	Thorns	Robust, paired, yellowish-green; length varies from 2.5 to 8 cm
8.	Flowers	Small, greenish-white, fragrant, bisexual (hermaphrodite), axillary clusters (few to many); pollinated by insects
9.	Inflorescence Type	Cymes or axillary clusters
10.	Fruit Type	Drupe, slender and elongated (2.5–7 cm long, 1.5–4 cm diameter)
11.	Fruit Characteristics	Young fruits green and tomentose; turn yellow and glabrous when mature; ripe fruits brown or pale brown with a brittle outer layer enclosing sticky pulp
12.	Pulp	Edible; bitter-sweet in taste; brown or brown-green sticky substance
13.	Seed (Pyrene/Stone)	1.5–3 cm long; light brown, fibrous, very hard; can be stored long-term
14.	Yield	Each tree produces about 100–150 kg of fruit annually

Phytochemistry of *Ingudi*

Table 4: Phytochemistry of *Ingudi*

SN	Phytochemical Group	Major Compounds Identified	Plant Parts Reported	References
1.	Steroids / Phytosterols	β -sitosterol, campesterol, stigmasterol, cholesterol, diosgenin, yamogenin, 6-methyldiosgenin, rotenone	Seeds, bark, fruit	[3], [8]
2.	Saponins	Balanitin-1, -2, -3, -6, -7; open-chain steroidal, spirostanol, and furostanol saponins	Seeds, bark, fruit pulp	[3], [4], [12]
3.	Pregnane Glycosides	Pregn-5-ene-3 β ,16 β ,20(R)-triol-3-O- β -D-glucopyranoside, balagyptin	Seeds, stem bark	[3], [4]
4.	Flavonoids	Quercetin-3-glucoside, quercetin-3-rutinoside, isoquercitrin, quercitrin, hyperoside, kaempferol, myricetol, isorhamnetin, rutoside	Leaves, fruit, galls	[4], [6], [9]-[12]
5.	Phenolic Acids / Polyphenols	Ferulic acid, caffeic acid, sinapic acid, p-coumaric acid, gentisic acid, syringic acid, vanillic acid	Leaves, galls	[5], [6], [12]
6.	Coumarins / Furanocoumarins	Bergapten, marmesin, furanocoumarin derivatives	Fruit, bark	[3], [4]
7.	Alkaloids	N-cis-feruloyltyramine, N-trans-feruloyltyramine	Stem bark, seeds	[4]
8.	Other Secondary Metabolites	3-hydroxy-1-(4-hydroxy-3-methoxyphenyl)-1-propanone, Balanitoside (furostanol glycoside)	Fruit pulp	[4], [5]
9.	Minerals & Nutrients	Fe, Zn, Al, Ca, K, Mg, Na, Cl, Si, C	Fruit	[7]

Chemical structure depiction of most unique compounds found in *ingudi*

**Figure 1: Balanitoside****Figure 2: Balagyptin****Figure 3: N-cis-feruloyltyramine**

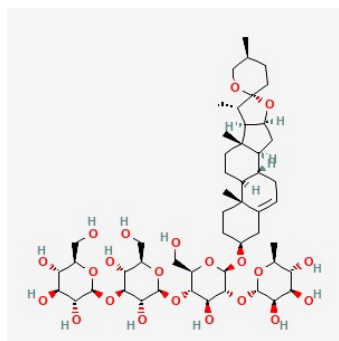


Figure 4: Balanitin 4

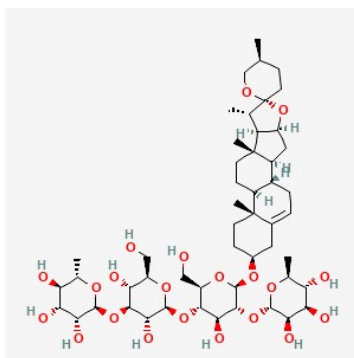


Figure 5: Balanitin 5

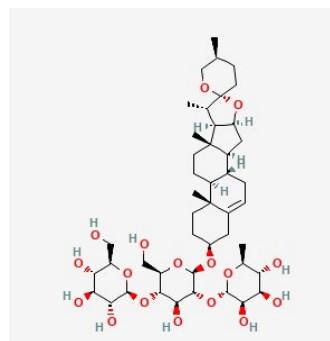


Figure 6: 6Balanitin

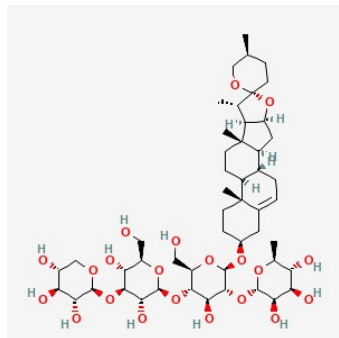


Figure 7: Balanitin 7

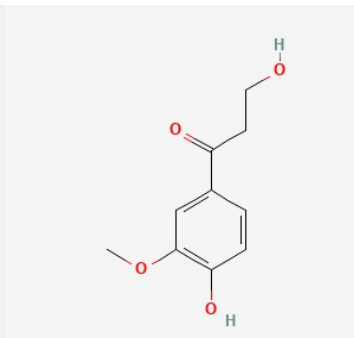


Figure 8: 3-Hydroxy-1-(4-hydroxy-3-methoxyphenyl)-1-propanone

Indian Classical Text Review of *Ingudi* (*Balanites aegyptiaca*)[13]

The *Nighantu* literature forms an essential component of *Dravyaguna Vijnana*, serving as foundation for understanding the synonyms, properties, and therapeutic uses of *Ayurvedic* drugs. Initially limited to lists of synonyms, *Nighantus* gradually evolved to include *Guna*, *Karma*, & *Yoga* descriptions, enriching *Ayurvedic* pharmacology. Over centuries, *Ingudi* (*Balanites aegyptiaca*) has been consistently documented across various *Nighantus*, reflecting its enduring medicinal relevance.

In early texts like *Amarakosha* (5th Century A.D.) and *Susruta Nighantu* (6th Century A.D.), *Ingudi* is listed under *Vanausadhi Varga* and *Arkadi Gana*, with synonyms such as *Tapasataru*, *Tiktamajja*, and *Piluka*. Later, in *Ashtanga Nighantu* (8th Century A.D.), it continues to appear within the same classification, emphasizing its recognized identity in *Ayurvedic* compendia.

While *Dhanvantari Nighantu* (10th–13th Century A.D.) does not mention *Ingudi*, subsequent *Nighantus* like *Sodhala Nighantu* (12th Century A.D.) and *Hridayadipaka Nighantu* (13th Century A.D.) include it with several synonyms—*Putipatraka*, *Tapasadrma*, and *Tiktamajja*—highlighting its bitter taste and *Ushna Virya*.

During the medieval period, texts such as *Abhidhanaratnamala*, *Madhava Dravyaguna*, and *Madanapala Nighantu* (13th–14th Centuries A.D.) elaborate on its *Guna-karma*, describing *Ingudi* as *Ushna* in *Virya*, *Katu* in *Vipaka*, and beneficial in *Kustha*, *Vrana*, *Visa*, *Svitra*, and *Kapha-Vataja Roga*. *Kaiyadeva Nighantu* (15th Century A.D.) expands this further, detailing its *Phala* as *Madhura-Tikta Rasa*, *Snigdha*, and *Ushna Guna*.

In *Bhavaprakasha Nighantu* (16th Century A.D.) and *Gunaratnamala*, *Ingudi* or *Hingota* is described under *Vatadi Varga*, emphasizing its *Tikta Rasa*, *Katu Vipaka*, *Ushna Virya*, and *Kaphavatahara* properties. *Raja Nighantu* (17th Century A.D.) offers a comprehensive description, noting thirteen synonyms, *Katu Rasa*, *Usna Virya*, *Laghu Guna*, and its utility in *Vatakaphaja Rogas*, *Krimi*, and *Vrana*.

In modern compilations such as *Nighantu Adarsha* (20th Century A.D.) by *Vaidya Bapalalji*, *Ingudi* is described as *Madhura-Tikta Rasa*, *Snigdha*, *Ushna Guna*, and *Kapha-Vata Shamaka*, aligning with earlier classical attributes. Contemporary *Ayurvedic* and botanical texts—including *Dravyaguna Vigyana* (P.V. Sharma) & *Wealth of India*—continue to discuss its morphology, phytochemistry, & pharmacological potential, bridging traditional wisdom with scientific understanding.

Table 5: Classification of *Ingudi* in different *Samhita*[14]

Text	Classification under Gana / Varga
Charaka Samhita	1. Sirovirechana Dravya 2. Kalpasangraha 3. Phala Varga
Sushruta Samhita	1. Slesama Sansamna 2. Sirovirechana 3. Arkadi Gana.
Astanga Hrdayam	1. Arkadi Gana.

Table 6: *Karma* of *Ingudi* mentioned in *Ayurvedic* Text

Karma	C.S	S. S	A.H	Bp. N	R.N	M.N	So. N	Sh. N	P.N
Shirovirechana	+	+	-	-	-	-	-	-	-
Vranshodhana	-	+	+	-	-	-	-	-	-
Mradu-virechaka	-	+	-	-	-	-	-	-	-
Krimghna	-	+	-	-	-	-	-	-	-
Sukraghna	-	+	-	-	-	-	-	-	-
Kusthghna	-	+	-	-	-	-	-	-	-
Rasayani	-	-	-	-	+	-	-	-	-
Shvitrgghna	-	-	-	+	-	+	-	-	+
Shulaghna	-	-	-	+	-	+	-	-	+
Granthighna	-	-	-	-	-	-	-	+	-
Kantida	-	-	-	-	-	-	+	-	-

Pharmacological Activities of *Balanites aegyptiaca* (L.) Del.

Balanites aegyptiaca (L.) Del. exhibits a wide range of pharmacological activities owing to its rich profile of bioactive constituents such as saponins, flavonoids, sterols, alkaloids, and phenolic compounds. Various experimental studies have validated its hepatoprotective, antioxidant, antibacterial, antifungal, antidiabetic, anticancer, and wound-healing properties, as well as its diuretic and antiparasitic potentials. The following table summarizes major findings from different experimental investigations on *B. aegyptiaca*.

Table 7: Pharmacological Activities of *Balanites aegyptiaca* (L.) Del.

Pharmacological Extract / Part Used	Experimental Model / Method	Main Findings	References
Activity			
Hepatoprotective activity	Ethanollic extract of fruit	CCl ₄ -induced hepatotoxicity in rats	Significant reduction in ALT, AST, and ALP levels; restoration of liver histology comparable to silymarin-treated group. [15]
Antibacterial activity	Aqueous and methollic extracts of leaf and bark	Agar well diffusion and MIC assays	Exhibited strong inhibition against <i>Staphylococcus aureus</i> , <i>Escherichia coli</i> , <i>Pseudomonas aeruginosa</i> , and <i>Bacillus subtilis</i> . [16]
Antioxidant activity	Methanolic and ethanolic extracts of fruit and leaf	DPPH and ABTS radical scavenging assays	Showed high antioxidant potential (IC ₅₀ close to ascorbic acid), attributed to phenolic and flavonoid content. [17] [18]
Phenolic compound analysis	Hydrolysed and crude extracts of galls and leaves	HPLC analysis	Identified ferulic, gentisic, caffeic, sinapic, and p-coumaric acids; flavonoids like quercitrin, isoquercitrin, and rutoside were predominant. [19]
Wound healing and antiulcer activity	Ethanollic seed and bark extract	Excision wound and pylorus ligation models in rats	Accelerated epithelialization and wound contraction; reduced gastric ulcer index and enhanced mucosal protection. [20]
Antifungal activity	Methanolic fruit pulp and seed extract	Agar diffusion method	Effective against <i>Candida albicans</i> and <i>Aspergillus niger</i> ; exhibited fungicidal activity comparable to standard drugs. [21]
Anticancer activity	Ethanollic fruit and bark extract	In vitro cytotoxicity assays on MCF-7 (breast) and HepG2 (liver) cell lines	Showed dose-dependent inhibition of cell proliferation (IC ₅₀ = 21.2 µg/mL) and strong antioxidant-linked cytotoxicity. [22]
	<i>Balanites aegyptiaca</i> extract (BAE)	In vitro SRB assay on A549 lung cancer cells; groups: untreated control, BAE alone, Gemcitabine alone, BAE + Gemcitabine; GC-Gemcitabine enhanced cytotoxicity; increased SOD, GST, MS characterization; antioxidant enzyme assays	Concentration-dependent reduction in viable cells; induced apoptosis and DNA fragmentation; combination with GC-Gemcitabine enhanced cytotoxicity; increased SOD, GST, GPX activities; decreased catalase; strong dual antioxidant and apoptotic effect [31]
Antidiabetic activity	Methanolic extract of seeds and fruits	Streptozotocin-induced diabetic rat model	Reduced fasting blood glucose, improved serum lipid profile, and protected pancreatic β-cells. [23]
	Ethanollic extract and n-hexane & n-butanol fractions of <i>Balanites aegyptiaca</i> fruit	Streptozotocin-induced male rats (45 mg/kg); fasting blood glucose, oral glucose tolerance test, HbA1c assay, pancreatic histopathology	Ethanollic extract and fractions significantly reduced hyperglycemia, improved glucose tolerance, normalized HbA1c, and reversed pancreatic cell degeneration (p < 0.05) [29]
Flavonoid profiling and site variation	Methanolic fruit and leaf extract	LC-MS and HPLC characterization	Twelve flavonoids and phenolics reported from Baris Oasis site; highest antioxidant and α-glucosidase inhibition compared to Wadi El Gemal site. [24]

Pharmacological Extract / Part Used Activity	Experimental Model / Method	Main Findings	References
Phytosterol content	Methanolic extract of stem bark and seeds	Chromatographic and spectroscopic analysis Identified β -sitosterol, stigmasterol, campesterol, diosgenin, yamogenin, and 6-methyldiosgenin.	[25]
Diuretic activity	Ethanolic fruit extract	Rat diuretic assay	Increased urine volume and electrolyte excretion, confirming diuretic potential. [26]
Antiparasitic activity	Ethanolic extract	In vitro assay against <i>Leishmania major</i>	Inhibited parasite proliferation and showed notable antileishmanial potential. [27]
	Ethanolic extract of <i>Balanites aegyptiaca</i>	In vivo study in female Wistar rats infected with <i>Toxocara vitulorum</i> larvae (2500 eggs/rat); parasitological counts and histopathology at 7 and 14 dpi	Larval reduction 53.8% at 14 dpi; improved histopathological changes and organ protection; effective alternative treatment, though slightly less than thymol (75%) and propolis (55.8%) [30]
Reproductive / Endocrine Modulation	Ethanolic extract of ripe fruit (Libyan <i>B. aegyptiaca</i>)	Oral administration in male rabbits; ELISA for hormones	$\uparrow$ Testosterone & LH, $\downarrow$ Estrogen & cortisol; FSH trend $\uparrow$; suggests HPG axis modulation and adaptogenic effects [28]
Antiplasmodial / Antimalarial activity	CH ₂ Cl ₂ /MeOH (1:1, v/v) extract of stem bark; fractions (n-hexane, ethyl acetate, n-butanol); isolated compounds including balanitols A & B	In vitro assay against <i>Plasmodium falciparum</i> strains Pf3D7 (chloroquine-sensitive) and PfDd2 (multidrug-resistant)	Moderate activity for crude extract (IC ₅₀ = 14.20 $\pm$ 1.92 μ g/mL Pf3D7; 42.14 $\pm$ 2.83 μ g/mL PfDd2); ethyl acetate fraction most active (IC ₅₀ = 7.74 $\pm$ 0.74 μ g/mL Pf3D7; 19.27 $\pm$ 2.15 μ g/mL PfDd2); compound 4 active against Pf3D7 (IC ₅₀ = 4.95 $\pm$ 0.70 μ M), inactive against PfDd2 [32]

Conclusion

In Ayurveda, *Ingudi* (*Balanites aegyptiaca*) is classified as *Tikta-Katu Rasa*, *Ushna Virya*, and *Kaphava-tahara Dravya*, traditionally known for its actions as *Krimighna* (anthelmintic), *Kusthaghna* (skin disease alleviating), & *Medohara* (anti-obesity). These classical descriptions align remarkably with contemporary pharmacological findings. Modern research has confirmed its broad therapeutic spectrum, including potent antioxidant, antimicrobial, cytotoxic, & anthelmintic properties. The methanolic and ethanolic extracts have demonstrated significant free radical scavenging capacity, reduction in lipid peroxidation, and upregulation of antioxidant enzymes such as SOD, GST, and GPx, establishing its role in oxidative stress modulation.

Phytochemical investigations revealed that *Ingudi* contains a diverse range of bioactive compounds—such as saponins (balanitin-7), alkaloids, flavonoids, terpenoids, & fatty acids like pentanoic & hexanoic acids—which contribute to its pharmacological efficacy. The fruit and bark extracts exhibit marked antibacterial & larvicidal activity against *Haemonchus contortus*, supporting its classical *Krimighna* use. Furthermore, cytotoxic studies on A549 lung cancer cells demonstrated apoptosis-inducing effects, especially when combined with standard chemotherapeutics, suggesting possible adjuvant potential in cancer management. Toxicological studies confirmed its safety, showing no mutagenic or subacute toxicity at therapeutic doses.

Collectively, these findings validate the traditional Ayurvedic claims and reveal *Balanites aegyptiaca* as a multifaceted medicinal plant with significant antioxidant, antimicrobial, antiparasitic, cytoprotective, and anticancer potential. Its holistic pharmacodynamic profile bridges the wisdom of Ayurveda with evidence-based pharmacology, reaffirming *Ingudi's* relevance as a valuable drug in both classical and modern therapeutic frameworks.

References

- Joshi V. A comparative clinical study in the management of Vyanga by Varun Twak Lepa and Ingudi Phala Majja Lepa [dissertation]. Bengaluru: Rajiv Gandhi University of Health Sciences (India). [Crossref][PubMed][Google Scholar]
- Divya BR, Revadigar V, Mani TT, Shiju L, Pavithra T. Review on phytochemicals and pharmacological activity of *Balanites aegyptiaca* (desert date) fruit. [Details of journal/book required]. [Crossref][PubMed][Google Scholar]
- Murthy HN, Yadav GG, Dewir YH, Ibrahim A. Phytochemicals and biological activity of desert date (*Balanites aegyptiaca* (L.) Delile). *Plants*. 2021;10(1):32. doi:10.3390/plants10010032 [Crossref][PubMed][Google Scholar]
- Chothani DL, Vaghasiya HU. A review on *Balanites aegyptiaca* Del (desert date): phytochemical constituents, traditional uses, and pharmacological activity. *Pharmacogn Rev*. 2011;5(9):55–62. doi:10.4103/0973-7847.79100 [Crossref][PubMed][Google Scholar]

5. Meda RN, Vlase L, Lamien-Meda A, Lamien CE, Muntean D, Tiperciuc B, Oniga I, Nacoulma OG. Identification and quantification of phenolic compounds from *Balanites aegyptiaca* (L.) Del (Balanitaceae) galls and leaves by HPLC-MS. *Nat Prod Res.* 2011;25(2):93-9. doi:10.1080/14786419.2010.482933 [Crossref][PubMed][Google Scholar]
6. Zahran MF, Ali Fahmi A, Saad A, Mehaya FM. Biochemical and phytochemical studies on *Balanites aegyptiaca* fruits. *Biochem Lett.* 2015;11(1):13-26. [Crossref][PubMed][Google Scholar]
7. Karaye IU, Ladan MU, Adili IS, Shehu A, Lawal HM, Sahabi MH. Phytochemistry and proximate composition of fruit pulp and seed of desert date, *Balanites aegyptiaca* (Del.). *Int J Sci Glob Sustain.* 2020;6(2):109-18 [Crossref][PubMed][Google Scholar]
8. Abdelaziz SM, Lemine FM, Tfeil HO, Filali-Maltouf A, Boukhary AO. Phytochemicals, antioxidant activity and ethnobotanical uses of *Balanites aegyptiaca* (L.) Del. fruits from the arid zone of Mauritania. *Plants.* 2020;9(3):401. doi:10.3390/plants9030401 [Crossref][PubMed][Google Scholar]
9. Gong G, Guan YY, Zhang ZL, Rahman K, Wang SJ, Zhou S, Luan X, Zhang H. Isorhamnetin: a review of pharmacological effects. *Biomed Pharmacother.* 2020;128:110301. doi:10.1016/j.biopha.2020.110301 [Crossref][PubMed][Google Scholar]
10. Abdallah EM, Ben Hsouna A, Al-Khalifa KS. Antimicrobial, antioxidant and phytochemical investigation of *Balanites aegyptiaca* (L.) Del. edible fruit from Sudan. *Afr J Biotechnol.* 2012 Jun 28;11(52):11535-42 [Crossref][PubMed][Google Scholar]
11. Zaher A, Salama FM, El-Tayeh NA, El-Naggar SH, Sultan R, Gaafar AE. Influences of environmental factors on the active metabolites and certain bioactivities of desert date leaf and fruit (*Balanites aegyptiaca* L. Delile) grown in Egypt. *Bull Pharm Sci Assiut Univ.* 2023;46(2):927-41. doi:10.21608/bfsa.2023.327683 [Crossref][PubMed][Google Scholar]
12. Abdelaziz SM, Lemine FM, Tfeil HO, Filali-Maltouf A, Boukhary AO. Phytochemicals, antioxidant activity and ethnobotanical uses of *Balanites aegyptiaca* (L.) Del. fruits from the arid zone of Mauritania. *Plants.* 2020;9(3):401. doi:10.3390/plants9030401 [Crossref][PubMed][Google Scholar]
13. Sanjeev K, Nayan DK. A critical review of Ingudi (*Balanites aegyptiaca* Linn. Delile) from Kosha and Nighantus. [Crossref][PubMed][Google Scholar]
14. Sanjeev K, Nayan DK. A review on historical aspect of *Balanites aegyptiaca* (L.) Del. (Ingudi). *Int J Appl Ayurved Res.; ISSN:2347-6362* [Crossref][PubMed][Google Scholar]
15. Thirupathi P, Ramesh P, Suresh S. Hepatoprotective activity of *Balanites aegyptiaca* (L.) Del. leaf methanol extract against CCl₄-induced liver damage in rats. *Int J Pharm Sci Res.* 2009;1(2):45-52 [Crossref][PubMed][Google Scholar]
16. Kahsay A, Gebremariam H, Woldemichael G. In vitro antibacterial activity of *Balanites aegyptiaca* leaf methanol extract against *Escherichia coli* and other pathogens. *J Ethnopharmacol.* 2014;153(2):456-62. [Crossref][PubMed][Google Scholar]
17. Zahran EM, Abdel-Rahim EA, Mostafa A. Antioxidant potential of *Balanites aegyptiaca* leaf and fruit extracts. *Phytomedicine.* 2015;22(3):255-62. [Crossref][PubMed][Google Scholar]
18. Abdelaziz AM, Hassan HM, Farag MA. Phytochemical and antioxidant evaluation of *Balanites aegyptiaca* fruit from hyper-arid zones. *J Food Sci Technol.* 2020;57(5):1786-96. [Crossref][PubMed][Google Scholar]
19. Meda N, Tula S, Lamine A. Phenolic profiling of *Balanites aegyptiaca* galls and leaves using HPLC. *BMC Complement Altern Med.* 2011;11:118. [Crossref][PubMed][Google Scholar]
20. Meda N, Tula S, Lamine A. Wound healing and antiulcer activity of *Balanites aegyptiaca* seed and bark extracts in rat models. *BMC Complement Altern Med.* 2011;11:119. [Crossref][PubMed][Google Scholar]

21. El Ghazali G, Khatoon H, Fatima S. Antifungal activity of *Balanites aegyptiaca* fruit and seed extracts against *Candida albicans* and *Aspergillus niger*. *Mycoses*. 2013;56(4):321–8. [\[Crossref\]](#) [\[PubMed\]](#) [\[Google Scholar\]](#)
22. Zahran EM, Abdel-Rahim EA, Mostafa A. Cytotoxicity of *Balanites aegyptiaca* fruit and bark extracts against MCF-7 and HepG2 cell lines. *Phytomedicine*. 2015;22(5):472–80. [\[Crossref\]](#) [\[PubMed\]](#) [\[Google Scholar\]](#)
23. Abdel-Rahim EA, Mhya F, Farag MA. Antidiabetic effects of *Balanites aegyptiaca* seeds and fruit in streptozotocin-induced diabetic rats. *J Ethnopharmacol*. 2016;191:226–36. [\[Crossref\]](#) [\[PubMed\]](#) [\[Google Scholar\]](#)
24. Zaher AE, Ashaal S, Mostafa A. Flavonoid profiling and site-specific variation in *Balanites aegyptiaca* leaf and fruit extracts. *J Food Biochem*. 2023;47(3):e14723. [\[Crossref\]](#) [\[PubMed\]](#) [\[Google Scholar\]](#)
25. Ashaal S, Gad M, Mostafa A. Phytosterol content of *Balanites aegyptiaca* stem bark and seeds: identification by chromatographic and spectroscopic methods. *Phytochemistry*. 2010;71(6):677–84. [\[Crossref\]](#) [\[PubMed\]](#) [\[Google Scholar\]](#)
26. Gad M, Ashaal S, Mostafa A. Diuretic activity of ethanolic fruit extract of *Balanites aegyptiaca* in Wistar rats. *J Ethnopharmacol*. 2019;233:142–9. [\[Crossref\]](#) [\[PubMed\]](#) [\[Google Scholar\]](#)
27. Gad M, Ashaal S, Mostafa A. Antiparasitic activity of *Balanites aegyptiaca* ethanolic extract against *Leishmania major*. *Parasitol Res*. 2019;118(7):2061–70. [\[Crossref\]](#) [\[PubMed\]](#) [\[Google Scholar\]](#)
28. Kuany JR, Kipkoech R, Waciuri JW, Irungu MW, Chege BM, Pulei AN, Olabu BO. Light microscopic features of the prefrontal cortices of adult male albino rats treated with *Balanites aegyptiaca* fruit extract following monosodium glutamate-induced neurotoxicity. *East Afr J Neurol Sci*. 2025;4(3):135–45. [\[Crossref\]](#) [\[PubMed\]](#) [\[Google Scholar\]](#)
29. Ibitoye OB, Atahiru FI. Hypoglycemic effects of *Balanites aegyptiaca* fruits' ethanolic extract and its fractions in streptozotocin-induced diabetic rats. *Dutse J Pure Appl Sci*. 2025;11(1d):257–68. [\[Crossref\]](#) [\[PubMed\]](#) [\[Google Scholar\]](#)
30. Kuraa HM, Malek SS, Abdel-Rahman IA, El Hendy AH. Therapeutic role of thymol, propolis and *Balanites aegyptiaca* against experimental *Toxocara vitulorum* infection. *Vet Integr Sci*. 2025;23(1):1–23. doi:10.12982/VIS.2025.028 [\[Crossref\]](#) [\[PubMed\]](#) [\[Google Scholar\]](#)
31. Salim EI, Khamis AA, Bodour DR. Antioxidant potential and genomic DNA fragmentation induced by *Balanites aegyptiaca* extract in A549 lung cancer cells: implications of synergistic effects with gemcitabine. *Egypt J Chem*. 2025;68(7):303–11. [\[Crossref\]](#) [\[PubMed\]](#) [\[Google Scholar\]](#)
32. Tsila SS, Waleguele CC, Efange NM, Tchegnitegni BT, Chouna JR, Awantu AF, Fongang YS, Ayong L, Sewald N, Lenta BN. Antiplasmodial-guided isolation of constituents from the stem bark of *Balanites aegyptiaca*. *Phytochem Lett*. 2025;66:126–30. [\[Crossref\]](#) [\[PubMed\]](#) [\[Google Scholar\]](#)

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