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Original Research Article

Review on *Adansonia digitata* L. – A Promisable Ethnomedicinal Plant Shikha Sharma^{*1}, V.J. Shukla², C.R.Harisha³, B.R.Patel⁴

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ABSTRACT

"Baobab" a well-known plant botanically known as *Adansonia digitata* L. belongs to the family Bombacaceae. It is an incredible deciduous tree known for its therapeutic and ethnomedicinal values. It is native to Africa, also found in India in Uttar Pradesh, Bihar, Bombay, Gujarat, and Madras. The plant is well documented in *Ayurvedic Nighantus* for its medicinal purpose. The fruit pulp, seeds, leaves, flowers, and bark of the plant are edible and used traditionally as foodstuff and also to treat various ailments such as in digestive disorders, diarrhea, fever, and malaria, etc. Phytochemical investigation revealed the presence of flavonoids, phytosterols, triterpenoids, polyphenols, amino acids, fatty acids, vitamins, and minerals. It has a numerous number of biological activities such as antimicrobial, antiviral, anti-oxidant and anti-inflammatory, etc. This review summarizes the Botanical aspects, Ayurvedic aspects Ethnopharmacology, Phytochemistry and Biological properties of the plant safeguarding it for human health.

KEYWORDS

Adansonia digitata, Review, Baobab

INTRODUCTION

Adansonia digitata, the *baobab*, is the most widespread tree species of the genus *Adansonia*. The scientific name *Adansonia* refers to the French explorer and botanist, *Michel Adanson* (1727–1806), who observed a specimen in 1749 on the island of Sor Senegal.¹ The species name *digitata* (hand-like) was selected in reference to the shape of the leaves.² This is indeed a most remarkably shaped tree with huge, swollen trunk tapers suddenly and sends out several thick, horizontal tranches. The leaves are large and smooth, digitate with five leaflets radiating from a central point. Flowers are very large and hang like balls of pale-green suede before the creamy white petals burst open and fruit is gourd-like has a spongy, acid pulp, containing many blackish, kidney-shaped seeds, surrounded by tough fibers.³

The Baobab is found in savannas of India and Africa. In India, it is found in Gujarat, Utter Pradesh, Bihar, Bombay, and Madras⁴. Adansonia has been used in traditional medicine since ancient times. The plant parts are used to treat various ailments such as tuberculosis, fever, microbial infections, diarrhea, anemia, dysentery, diarrhea etc.⁵ Nowadays, Baobab demand is increasing commercially in the field of medicine and food industry due to its immense number of pharmacological activities. In this review, available data regarding the botanical aspects, Ayurvedic aspects, ethnopharmacology, phytochemistry, and biological activities of different plant parts of baobab are presented.



Fig. 1. Plant (Adansonia digitata) in natural habitat

VERNACULAR NAME AND SYNONYMS

Vernacular names are the names when a single drug is known by multiple names in different places while Synonyms are coined on the basis of various deliberations including morphology, historical background, uses, place of origin, and similarity, etc. It has few synonyms in ancient Ayurvedic texts such as *Panchparnika* (on the basis of leaves arrangement), *Sheetphala* (having Sheeta *veerya*), and *Gandhbahula* (fruits having an aromatic smell), etc. The Vernacular names and Synonyms of *Adansonia digitata* are shown in Table no. 1

| Hindi | Gorakhimli ⁴ |
|----------|--|
| Sanskrit | Sheetphal, Ravanamallika, Panchparnika ⁶ |
| Gujarati | Gorakhamli, Choramli, Rukhdo ⁶ Sumpura ⁵ |
| Telgu | Magimavu ⁶ Simchint ⁷ |
| Tamil | Papparpuli, Aanepuli ⁶ |
| English | Baobab or Monkey Bread tree ⁸ , Dead-rat tree, |
| | Upside-down tree, Cream of tartar tree ⁵ |
| Synonym | Ravanamallika ⁴ ,Sheetphal,Gorakshi,Sarpdandi, |
| | Deergh Dandi, Sudandica, Chitrala, Gandh bahula, |
| | Gopali, Panchparnika. ⁹ |
| | |

Table no. 1. Vernacular name and Synonyms of Adansonia digitata

AYURVEDIC CONCEPT

The plant *Adansonia digitata* is the majestic tree having a huge number of medicinal and nutritional values. Some of the Ayurvedic Nighntus like *Bhavprakash Nighantu, Raj Nighantu, and Nighantu Adarsh*, etc. has well enumerated the plant description and medicinal uses in their texts. *Raspanchak*, Part used, Therapeutic uses and Formulation has been mentioned in Table no. 2.

| Table no. 2. Raspa | nchak, Part used, | Therapeutic uses and | Formulation of | Adansonia digitata |
|--------------------|-------------------|----------------------|----------------|--------------------|
|--------------------|-------------------|----------------------|----------------|--------------------|

| Raspanchak | Rasa: Amla Madhur, |
|------------|--|
| | Guna: Sheeta, |
| | Veerya: Sheeta |
| | Vipak: Amla, Madhur ⁶ |
| | Dosh: Pitta ⁶ |
| Habit | Tree |
| Part used | Bark, Fruit pulp(majja) ⁶ |
| | Fruit pulp: Snehan, Rochak, Hridya, Sheetal, Sanshraman ⁶ |

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| | Leaves: Sangrahi ⁵ |
|-------------|---|
| | Bark: Snehan, Sheetal, Deepan, Grahi, Lepa, Shoth, Dah, Visham jwara ⁶ |
| Ayurvedic | Gorakshchincha avaleha ¹⁰ |
| Preparation | |

DISTRIBUTION

It is not indigenous to India but has been introduced from Africa by Arabian traders. In India, it is found in Utter Pradesh, Gujarat, Bihar, Bombay, and Madras⁴ and also cultivated in some of the places.

BOTANICAL DESCRIPTION

Kingdom - Plantae

- Subkingdom Tracheobionta
- Superdivision Spermatophyta
- Division Magnoliophyta
- Class Magnoliopsida
- Subclass Dilleniidae
- Order Malvales

Family- Bombacaceae

Genus- Adansonia

Species- *digitata*¹¹

It is a curious shaped, medium-sized deciduous tree, native to tropical Africa, up to 21 m in height, and 27 m in girth, with relatively short bole and spreading branches. Bark smooth grayish, often with purplish tinge, or brown;¹² Leaves pubescent beneath when young glabrous digitate deciduous¹³ leaflets three in young plant, five or seven in older plants, 5.0 to 12.5 cm in diameter. Flowers white, 15-18 cm diameter¹² solitary, axillary, pendulous, peduncled. Calyx leathery, cup-shaped, 5-cleft, bibracteolate. Exceeding the sepals, adnate below to the stamens. Stamina tube drical, dividing above into numerous filaments; anthers reniform. Ovary 5-10 celled; style long, divided into as many as branches as there are cells to the ovary, stigmas radiating.¹³ Fruit is capsule long- ovoid, 25-40×8-12 cm,¹⁴gourd like, 20-30cm ×10 cm, woody, grey with soft yellowish felt outside with farinaceous, whitish or yellowish sometimes pink-tinged pulp; seed reniform, shining brown or blackish with thick testa⁸



Fig. 1. (A) Leaves; (B) Flower; (C) Fruits; (D) Seeds of Adansonia digitata

CHEMICAL CONSTITUENTS

Pericarp: The pericarp of the fruits of *Adansonia digitata* L. (Bombacaceae) was found to contain proanthocyanidins as major compounds, viz.: (–)-epicatechin, epicatechin- $(4\beta \rightarrow 8)$ -epicatechin (B2), epicatechin- $(4\beta \rightarrow 6)$ -epicatechin (B5), epicatechin- $(2\beta \rightarrow O \rightarrow 7, 4\beta \rightarrow 8)$ -epicatechin (A2), and epicatechin- $(4\beta \rightarrow 8)$ -epicatechin- $(4\beta \rightarrow 8)$ -epicatechin (C1)^{15.}

Fruit pulp: The presence of organic acids such as citric, tartaric, malic, succinic and ascorbic acid and, pectin, Fe, and Ca in the fruit pulp.²

Seed: Compounds such as campesterol, cholesterol, isofucosterol, β -sitosterol, stigmasterol and tocopherol (α , β , γ , and δ) have been detected in the seed oil. The major hydrocarbons in the seed oil were n-alkanes (57.3%) and squalene (39.5%). Fatty acids present in the seed oil include linoleic and oleic acids in high concentration as well as lesser amounts of palmitic, linolenic, stearic and arachidic acids.² The seed oil contains 4-demethylsterol and tocopherol; squalene being the major constituent.¹⁶

Root: 3,7-dihydroxy-flavan-4-one-5-O- β -D-galactopyranosyl (1 \rightarrow 4)- β -D-glucopyranoside and a flavonone 3,3',4'-trihydroxy flavan-4-one-7-O- α -L-rhamnopyranoside were isolated from the roots of A. digitata.¹³

Stem: Quercetin-7-O- β -D-xylopyranoside¹⁰ has been isolated from the stem. On wounding, the bark yields a large quantity of semifluid, white gum like tragacanth, which turns reddish brown on aging.¹²The bark yields a gum which has an acid reaction insoluble in water and which appears to be allied to gum tragacanth.¹⁷ The bark shows the presence of Friedelin, Lupeol, bauerenol, β -sitosterol, and scopoletin. From the bark, Betulic acid is isolated.¹⁰

Leaves: The leaves contain Mucilage which on hydrolysis have Glacturonic Acid and Glucuronic acids with small Quantities of Galactose Rhamnose, Glucose, and Arabinose. It yields β -sitosterol and an alkaloid¹²Tetraxerone, acetates of burenol and lupeol are isolated from the leaves⁷leaves had appreciable levels of flavonoids and phenolic acids, including catechin, epicatechin, rutin, quercitrin, quercetin, kaempferol, and luteolin (flavonoids); gallic, chlorogenic, caffeic, and ellagic acids (phenolic acids).¹⁸ The *Adansonia digitata* shows many medicinal properties and also contains many phytoconstituents; the leaves contain 7–10% mucilage.¹⁹

ETHNOBOTANICAL CLAIMS

Seeds were used in folk medicine to treat diarrhea, and hiccough while their oil extract mainly used to treat skin complaints and for cosmetic applications.²⁰ The seeds and oil are used as food, fuel, cosmetics and medicines in the topical treatment of muscle wounds, dandruff, and other skin ailments.²² The leaves were used to treat a wide variety of conditions including fatigue, as an anti-asthmatic, as a tonic and for insect bites, Guinea worm, and internal pains, diseases of the urinary tract, ophthalmia and otitis. The Leaves are applied locally for a variety of inflammatory conditions, including insect bites and Guinea worm sores. Internally, they are given as an astringent, sudorific, tonic and febrifuge. As a lotion, they are employed in an earache and ophthalmia. An infusion of both the leaves and flower is given in respiratory and digestive disorder⁸. The fresh juice of the leaves mixed with powdered ginger together with the expressed juice of the fresh root of the Salvadora indica is applied with considerable benefits to painful joints, indolent syphilitic ulcer, and chancres. The leaves are used as fomentation and poultices for the rheumatic affection of the limbs and irritable inflammatory ulcers.¹⁵ The roots and bark contain flavonoids and possess hypertensive and antipyretic activity. The dried powdered roots prepared as a mash in sometimes taken as a tonic by malaria patients. The leaf and bark of A. digitata have significant free radical scavenging, cytotoxic, membrane stabilizing, thrombolytic, analgesic, and antidiarrhoeal properties. The plant also exhibited mild antimicrobial potential. The leaf and bark of A. digitata have been reported to be used for inflammation, diarrhea, pain, and other health disorders.²²

In East Africa, the baobab bark, fruit pulp, and seeds were used as an antidote to poisoning by a number of *Strophanthus* species which has been used as an arrow poison. The bark widely used in traditional medicine as a substitute for quinine in case of fever or as a prophylactic.

PHARMACOLOGICAL PROPERTIES

Antimalarial activity

Adeoye A.O. et al. explored the antimalarial activity of the Adansonia digitata stem bark extract. Aqueous and methanolic extracts at the dose of 200 mg/kg b.w. and 400 mg/kg b.w were administered in adult albino mice. The extract significantly reduced the degree of tissue peroxidation, increased the level of reduced glutathione (GSH), catalase and superoxide dismutase activity. Consequently, a reduction in serum C-reactive protein and tumor necrosis factor- α occurred. The study has demonstrated that Adansonia digitata stem bark extract offers protection from malarial infection.²³

Antitumor activity

Fahmy G. Elsaid reported that extracts of seeds and fruit pulp of *Adansonia* could have anti-tumor action through modulation of redox state in sera, EAC cells, ascitic fluid, and liver tissue.

Adansonia seeds and fruit pulp extract at the dose of 300 mg/kg b. wt. (i.p.) in Adult female BALB/C mice were able to restore and modulate the tumor markers levels such as α -l-fucosidase and arginase activity in the sera of EAC bearing mice. Also, *Adansonia* attenuates the *p*53 and *Bcl*-2 gene expression as pro-apoptotic and anti-apoptic genes leading to management of tumor growth.²⁴

Antiasthmatic, Antiviral, and Anti-inflammatory activity

The powdered leaves or an extract, when administered orally to guinea pigs prevented asthmatic crisis induced by histamine aerosols. Aqueous and alcohlic extract of the leaves produced low toxicity in mice and slight hypotensive effect in Dogs when administered.¹² The flower extract exhibit antifungal activity, inflammatory and antipyretic activity in mice.¹⁶

Hudson James et.al reported the anti-inflammatory and antiviral activity of leaves fruit and seeds of *Adansonia digitata*. The extracts of leaves, seeds, and fruit were compared quantitatively for antiviral MIC100 (minimal inhibitory concentration) values against influenza virus, herpes simplex virus and respiratory syncytial virus and for their effects on cytokine secretion (IL-6 and IL-8) in human epithelial cell cultures. The leaf extracts had the most potent antiviral properties, especially the DMSO extracts and influenza virus was the most susceptible virus. Pulp and seed extracts were less active but significant. Leaf extracts, were also active as cytokine modulators, some being pro-inflammatory and others being anti-inflammatory²⁵.

Hepatoprotective activity

Abeer Hanafyr et. al investigated the hepatoprotective effect of *Adansonia digitata* extract in Wistar rats at dose 200mg/kg was given orally once daily for one week. The study shows the significant protective effect of the extract against acetaminophen-induced hepatotoxicity showed that extract exerts the protection through amelioration of lipid peroxidation by its scavenging activity of free radicals and enhancement of the antioxidant defense system.²⁶

Testicular Toxicity

Oyewopo A. Oyetunjiet. al evaluated the ameliorative effect of the aqueous leaf extract of *Adansonia digitata* in carbon tetrachloride (CCl4) – induced testicular toxicity in Wistar rats. At dose 500 ml/kg (p.o) for two weeks, the ameliorative effects of *Adansonia* were observed on reproductive hormonal parameters, the activity of an antioxidant enzyme and cytoarchitecture of the testis. Carbon tetrachloride treatment significantly (P<0.05) reduced levels of testosterone, follicle stimulating hormone, luteinizing hormone and superoxide dismutase levels with distortions in the cytoarchitecture of the testes in treated animals. These effects were ameliorated with AeAD treatment.²⁷

CONCLUSION

Adansonia digitata is a medicinal herb which is used extensively in Indian system of Medicines. In the present review, we have made an attempt to assemble all information on about the plant such as botanical, phytochemical and pharmacological, etc. Ayurvedic survey of the plant revealed that it has been used in Ayurveda since Nighantu periods in various ailments such as inflammation, digestive disorders, and fever, etc. Adansonia fruit pericarp, leaves, and root bark contain flavonoid derivatives which may be responsible for its astringent action whereas its seeds are a rich source of oil (fatty acids). Leaves contain different carbohydrates while Fe, and Ca are present in the fruit pulp which may be responsible for its nutritional value. Fruit pulp contains organic acids such as citric, tartaric, malic, succinic and ascorbic acid which makes the fruit acidic in nature. The fruit pulp is also rich source of pectin which is used as a gelling agent, thickening agent, and stabilizer in food that's why increasing its demand in the food industry. The ethnobotanical review reveals that it is used in fever as prophylactic whereas studies have also shown that bark extracts also possess anti-malarial activity. The leaf extracts have also shown potent antiviral properties. Apart from that, it has a numerous number of pharmacological activities reported such as anti-oxidant, anti-inflammatory, hepatoprotective and cytotoxic activities, etc. However, there is a need to conduct the clinical trial of the plant scientifically to validate the results of in-vivo and in-vitro studies. Alternatively, the further exploration of the plant should be required pharmacognostically, phytochemically and pharmacologically for better utilization for the wellbeing of humans.

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