



MEDICINAL USES OF *ADANSONIA DIGITATA* L.: AN ENDANGERED TREE SPECIES

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ABSTRACT

Adansonia digitata L. belongs to the Bombacaceae family and is generally known as the African Baobab. It is called “Kalpvriksha” in India and has mythological significance in India and elsewhere. The tree already faces a crisis of survival and is listed as an endangered species in the Red Data Book. It is a massive, deciduous tree up to 25 m in height and may live for hundreds of years. It is considered to be the queen of all carbon storage trees as it absorbs huge quantities of carbon dioxide from the atmosphere. Currently the tree is suffering from drought and desertification and fear has been expressed about its regeneration. It is also reported that baobab seeds have very hard seed coats and germination rate is usually less than 20%. There is lack of awareness by the local population on the need to plant, protect and manage this endangered tree species. Several parts of the tree are reported to have interesting antioxidant and anti-inflammatory properties and are used for healing purposes. For the conservation of such a multipurpose tree species, tissue culture studies are found to be the most lucrative and promising alternative as recently some tissue culture reports are coming up. The conservation strategy under Indian subtropical states will help in studying its medicinal properties for further research. To explore its other pharmacological uses and isolation of bioactive components of this species, cell and suspension culture technology will be the most promising in near future.

Key words: *Adansonia digitata*, Antioxidant, Antipyretic, Analgesic, Antiviral, Antimicrobial, cell and suspension culture technology.

INTRODUCTION

Adansonia digitata is a native deciduous tree of African savannas and belongs to the family Bombacaceae. It is called by several local names in central Africa as ‘bu- hibab’ (fruit with several seeds), Ibozu, Moana, dead rat tree, Tree of life etc¹. The Baobab tree is found in areas of South Africa, Botswana, Namibia, and Mozambique and occurs in semi-arid and sub-humid regions of western Madagascar². The tree can grow up to 25 meters in height, 28 meters in girth and can live for several hundred years. The form of the trunk varies. In young trees, it is conical, in mature trees, it may be cylindrical, bottle shaped or tapering with branching near the base³. It has thick, angular, wide spreading branches and a short, stout trunk which attains 10 – 14m or more girth and often becomes deeply fluted (Fig. 1 A and B). The Baobab tree was named *Adansonia* to commemorate the French surgeon Michel Adanson (1726-1806); the species name *digitata* meaning hand-like, is in reference to the shape of the leaves. The genus comprises of eight species bearing large, nocturnal flowers⁴. *Adansonia* has high water holding capacity and its hollow trunk keeps the water potable for many years and serves as a reservoir during drought⁵. It is also resistant to fire and survives well in dry climate⁶. The leaves are foliate and are simple during the young stage. Flowers are pendulous, showy and white⁷.

Adansonia digitata has numerous medicinal and non medicinal uses^{8,9}. Every part of the tree is reported to be very useful¹⁰. The tree is named as: “**The small pharmacy or chemist tree**” for the reason that all parts like the leaves, bark and fruits, seeds are used as foodstuffs and medicines¹¹. It also has numerous health benefits which can be related to the presence of bioactive compounds (terpenes, saponins, tannins and many more) that are isolated from its various parts like leaves and fruits¹². Studies on morphogenetic potential and ability of *in vitro* cloning of this African genetic

resource of great economic value have been undertaken for its preservation and use in reforestation programs¹³.

In India, this giant baobab (Kalpvriksha) has been located in UP, MP, MS and other states but since it is endangered worldwide, only a few trees have been recorded in these states. It is considered as sacred among Hindus as a mythological wish-fulfilling tree. According to Dr DK Saini, scientist from BSIP (Birbal Sahni Institute of Palaeobotany, Lucknow) “The only way we can understand and save Kalpvriksha is through tissue culture”. Through this technique, scientists would be able to understand the cell structure and genetic material and the impediments, which come in the way of its growth¹⁴. The fruits and seeds are the main source for tissue culture studies (Fig.1C, D and E). The cell and suspension culture technology will help in isolation of bioactive components from different organs of this tree.

Anti oxidant properties

Baobab fruit pulp (Fig. 2) has a particularly high antioxidant capability mainly because of its high natural vitamin C content, which is equivalent to 6 oranges per 100 g. The antioxidant capacity of baobab fruit pulp was investigated using the Photochemiluminescence (PLC) assay¹⁵. The pulp has an average of 8.7% moisture, about 74% carbohydrates, 3% proteins, 9% fibers, 6% ash and only 0.2% fat¹⁶. The content of pectin is approximately 56%¹⁷ that is why the pulp is traditionally used as a base for jam making. Lamien-Meda¹⁸ conducted a study in which the phenolic content of baobab fruit pulp using DPPH, Frap methods was examined. Tests carried out by Adesanya et al¹⁹, showed that the pulp could be used to treat ‘sickle cell anaemia’, as it showed considerable ‘anti-sickling’ activity. It is also reported that some soluble dietary fibers in the pulp have prebiotic effects and stimulate the growth and metabolic activity of beneficial organisms²⁰. Baobab pulp is used internally with buttermilk in cases of diarrhea and dysentery in Indian medicine system.

For external use, the leaves are crushed into a poultice for painful swellings⁷.

Antipyretic properties

A semi-fluid gum, obtained from baobab bark, is used to treat sores⁶. It also contains an alkaloid 'Adansonin' which has been used for the treatment of fever especially that is caused by malaria²². This bark is used in Europe as a febrifuge (antipyretic). In the Gold Coast (Ghana), the bark is used instead of quinine for curing fever²³ and also as a decoction if taken with 30 g/l of water and is boiled down to two thirds⁷. In Congo Brazzaville, a bark decoction is used to bathe rickety children and in Tanzania, it is used as a mouthwash for toothache²⁴. Furthermore, a new flavanone glycoside was reported in the root bark¹². Not only this, an infusion of roots is used in Zimbabwe to bathe babies to promote smooth skin²⁴.

Analgesic and Antiviral Properties

Analgesic and antipyretic activities were also mentioned by Anani and co-workers²⁵, probably due to the presence of sterols, saponins and triterpenes in the fruit pulp. *Adansonia digitata* root bark and leaf methanol extracts have shown high antiviral activity against Herpes simplex, Sindbis and Polio²⁶, together with viricidal (direct inactivation of virus particles)

and also intracellular antiviral activity, which could indicate the presence of multiple antiviral compounds, or a single compound with multiple actions²⁷. Leaves are applied locally for a variety of inflammatory conditions, insect bites and guinea worm sores²³.

Antimicrobial Activity

The leaf infusions are used in the treatment of diarrhea, fever, inflammation, kidney diseases, blood clearing and asthma⁹. The leaves are also a good source of proteins. The extracts from fruits, seeds and leaves are antimicrobial against: *Bacillus subtilis*, *Escherichia coli*, *Mycobacterium leprae*, and antifungal against *Penicillium crustosum*, *Candida albicans* etc.²⁸. The stem and root barks of baobab also contain bioactive constituents which are responsible for antimicrobial activity of the crude aqueous and ethanolic extracts. *Vitex doniana* is used by traditional healers alone or in a combination with stem bark of *Adansonia digitata* to treat diarrhea, leprosy and dysentery²⁹. Extracts of baobab roots eliminate the motility in *Trypanosoma congolense* within 60 minutes and drastically reduce motility in *T. brucei* and *T. congolense* which are unicellular parasites transmitted by the bites of tsetse fly and are the causative agents of sleeping sickness in humans and related diseases in animals³⁰.

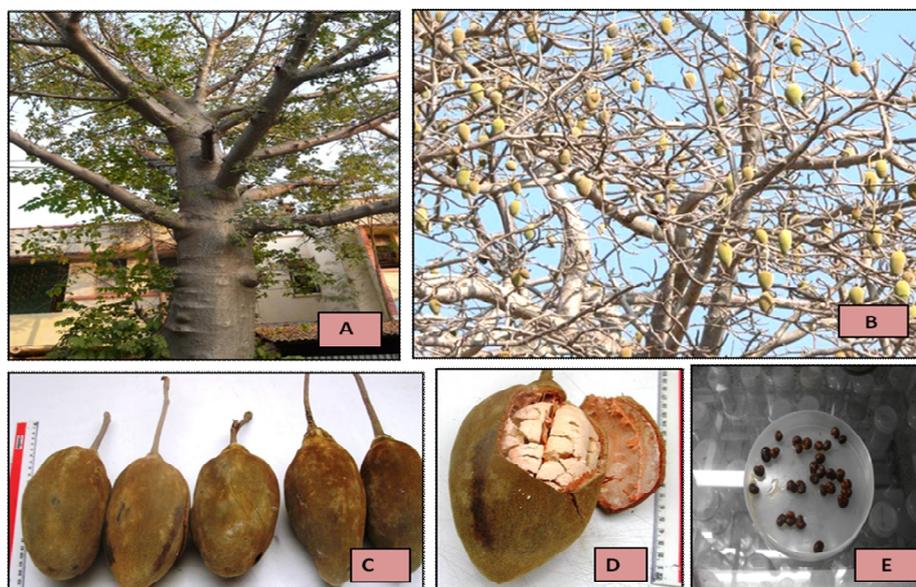


Fig. 1: *Adansonia digitata* trees from M.P and fruits collected from these trees for research studies.

A: More than 50 year old *Adansonia digitata* tree located in Tulsi Nagar area of Bhopal city.

B: More than 100 year old *Adansonia digitata* bearing fruits which give it the name Dead rat tree, located in Mandav Dist. Dhar region (M.P).

C: Fruits of *Adansonia digitata* about 20-25 cm in length collected from Dhar region (M.P).

D: Breaking of fruit shows the fruit pulp with seeds inside.

E: Seeds of *Adansonia digitata* after separation from its pulp.

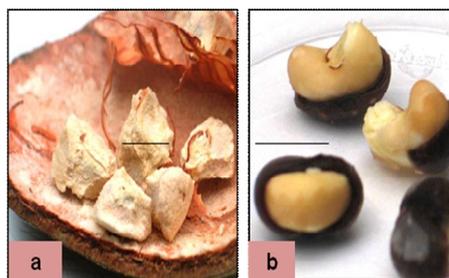


Fig. 2: Enlarged view of the broken fruit of *Adansonia digitata*

a: White powdery fruit pulp.

b: Seeds separated from pulp and seed coat removed by mechanical breaking to show white embryo which is being used extensively for tissue culture studies.

CONCLUSION

Looking into the pharmacological uses and importance of this endangered, medicinally important African tree species and its extremely low presence in the Indian sub continent, its conservation is recently being initiated using tissue culture approaches. For this, cell and suspension culture along with micropropagation studies are being carried out by us to identify and isolate the bioactive compounds in near future. We have located more than 5 trees in Bhopal (M.P.) and more than 100 trees in Mandav, Dhar (M.P.) when work was initiated on this tree species. Healthy fruits have also been abundantly obtained from these MP locations. Hence, for its future conservation tissue culture studies have been initiated.

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