



Insight on *Acacia nilotica* (L.) Tree through Pharaohs History as a Valuable Medicinal and Holy Plant Species in Egyptian Ecosystem

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Review Article

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Abstract

Acacia nilotica is a popular medicinal plant that grows throughout Africa, the Middle East, and the Indian subcontinent. This is because the plant, from its roots to its leaves, comprises a wide variety of compounds that have been used for ages in traditional medicine. Timber had a religious importance in the civilizations of the ancient Near East and was a major source of materials that had been utilized in buildings in addition to its uses in traditional medicine. In ancient Egypt, the timbers and trees were presented on paintings of the tombs and the archaeological remnants. The current review mainly focuses on the significance of the *Acacia nilotica* tree in the religious and funerary context as well as its distribution, history, uses and benefits in the ancient Egyptian diet, industry, and medical treatments from ancient Egyptian ages up to date. This will be achieved through the available archaeobotanical, textual and iconographical evidence.

Keywords: *Acacia nilotica*; Ancient Egyptians; Biological Activities; Chemical Constituents

Abbreviation

DMBA: 7,12-dimethylbenz(a)anthracene.

Introduction

Egypt's natural flora is represented by a wide variety of trees, plants, and herbals, which reveal valuable insights into many aspects of the ancient Egyptian life, society, and culture. Timber had a religious importance in the civilizations of the ancient Near East and was a major source of materials that had been used in buildings. In ancient Egypt, the timbers and trees were showed on paintings of the tombs and the archaeological remains. The depictions provided some additional information about trees, however the ancient Egyptian names for many present trees are still unknown [1]. Egypt was never a country covered in forests. There have never been many trees, making wood a valuable resource. By the looks of tomb paintings and substantial finds, ancient

Egyptian trees were essentially the same as they are today [2].

Some species like the sacred Shoab-tree, *Mimusops schimperi*, are no more cultivated. There are also trees that are growing up to the present time. A tree which has always been intimately connected with the Egyptian landscape is the Nile-acacia, *Acacia nilotica* [2]. It has yellow flower balls and constricted rosary-like pods, which we may recognize also among the Hieroglyphic signs. This species and another acacia, *A. albida*, with spiked flowers and bumpy fleshy curved pods, are growing along the Nile shores up to the present time and have been one of the main timbers from Predynastic times onwards [2]. Ancient Egyptian trees played a role in doctrine, magic, as well as medicine, were among those sacred trees was *Acacia nilotica* which were local trees and its wood was used in Many purposes, including the manufacture of boats and ship masts.

The study of the ancient Egyptian flora is based mainly on a variety of different Egyptological sources including scenes in tombs, texts, and archaeobotanical remains of plants found in ancient settlements and burials. Egyptian Archaeo-botany or the study of plant remains in ancient contexts has greatly contributed to our knowledge and understanding of the ancient Egyptian, environment, ecology, daily life activities, diet, economy, trade, as well as religion [3]. These remains further provide important information about the various tree species that were planted in ancient Egypt [4]. Although trees are frequently depicted on tomb and temple walls, they are usually drawn in so conventional a manner that only very few can be identified with certainty. The main trees that grew in Egypt in Pharaonic times of which the wood was used in carpentry and joinery were the acacia, the sycamore-fig, and the tamarisk. The wood of other trees, however, was also sometimes used, particularly that of the date- palm, the dum-palm, the sidder, the perseia and the willow.

Acacia first described in 1773 by the Swedish botanist Carl Linnaeus. Acacia is a genus of shrubs and trees belonging to the subfamily Mimosoideae of the family *Fabaceae* or Leguminosae [5]. It is a complex species with nine subspecies, six are native to the African tropics and the others are native to the Indian subcontinent [6]. *Acacia nilotica* (L.) is a species of Acacia native to Africa and the Indian subcontinent [7]. *Acacia nilotica* has different English names: like Tomentose Babool, Black piquant, Black babul, Gum arabic, Egyptian mimosa, Egyptian thorn, Prickly Acacia, Nile acacia, Scented thorn, and Scented-pod acacia; and different Arabic names: as Ummughilan, Usarequrz and kaarad [8]. It is commonly known as babul, kikar or Indian gum Arabic tree, has been recognized worldwide as a multipurpose tree [9].

Several different varieties of acacia grow in Egypt and the wood was certainly used as far back as the Predynastic period (prior to c. 3200 b.c) [10]. It is mentioned in Egyptian texts as having been obtained from Middle Egypt during the Sixth Dynasty and from Wawat in Lower Nubia. It was used for the construction of boats and war- ships, and Herodotus, who was travelling in Egypt during the fifth century b.c., refers to the use of acacia wood not only for boat building but also for masts. Another Greek writer, the botanist Theophrastus, states that acacia was used for roofing and for the ribs of ships.

In other side, *Acacia nilotica* is an important ornamental and medicinal plant of tropical and sub-tropical regions belongs to family *Fabaceae* of genus Acacia, is a source of many active secondary metabolites which may serve as potential candidates for drug development with greatest possibility of success in near future [11]. It has an inspiring range of medicinal uses with potential antioxidant activity.

This plant contributes a number of groups among which are alkaloids, volatile essential oils, phenols and phenolic glycosides, resins, oleosins, steroids, tannins, and terpenes [12]. Different parts of this plant such as the leaves, roots, seeds, bark, fruits, flowers, gum, and immature pods act as anti-cancer, antimutagenic, spasmogenic, vasoconstrictor, anti-pyretic, anti-asthmatic, cytotoxic, anti-diabetic, and are also engaged for other several activities [13]. The current review mainly focuses on the significance of *Acacia nilotica* tree in the religious and on text as well as its distribution, history, uses and benefits in the ancient Egyptian diet, industry, and medical treatments from ancient Egyptian ages up to date.



Source: Brisbane city council <https://weeds.brisbane.qld.gov.au/weeds/prickly-acacia>.

Figure 1: Graphical representation of *A. nilotica* (flowers- pods- seeds).

Botanical Description

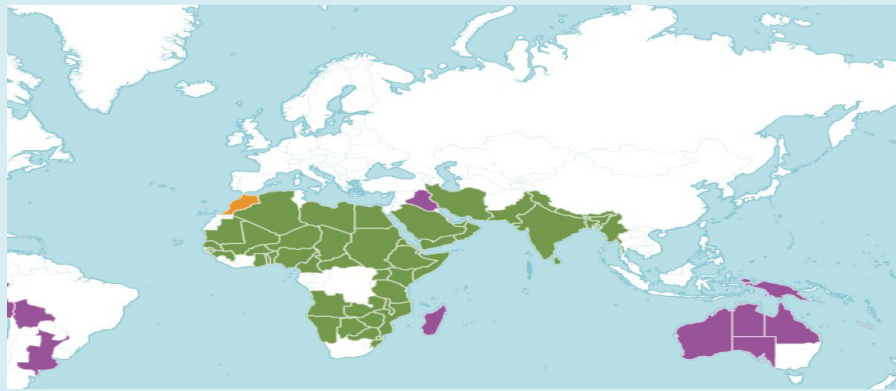
Acacia nilotica (L.) Wild ex. Del. belongs to family *Fabaceae* (subfamily: *Mimosoideae*) of genus *Acacia* comprising an excess of 1350 species [14] is a medium sized tree, 15–18 m tall, with a stem diameter range from 2–3 m and it is nearly symmetrical crown. Bark is fissured, dark brown to blackish in color with profound vertical groove showing inner gray-pinkish slash, exuding a reddish low-quality gum [15]. Young trees possess paired thorns at the nodes of stem which are roughly straight, slightly pointing backwards, 3–12 pairs in number and 5–7; 5 cm in length. The leaves are of compound type with 3–6 pairs of pinnae; 4.5–7 cm long and 10–30 pairs of leaflets [16]. Bright golden-yellow flowers are located at the end of branches in globulous heads, 1.2–1.5 cm in diameter set up either auxiliary or whorly on 2–3 cm long peduncles [17]. Hairy, thick, and strongly constricted pods are white grayish in color [18].

Distribution

A. nilotica is naturally widespread in the drier areas of Africa, from Senegal to Egypt and down to South Africa, and in Asia from Arabia eastward to India, Burma, and Sri Lanka as shown in Figure 2. The largest tracts are found in Sind.

It is distributed throughout the larger part of India in forest areas, roadsides, farmlands, tank shores, agricultural fields, village grazing lands, wastelands, bunds, along the national highways and railway lines. Mostly it occurs as an isolated tree and rarely found in patches to a limited extent in forests [15]. It has been widely planted on farms throughout the plains of the Indian subcontinent. It is a species of Southern Tropical dry deciduous forests and Southern Tropical thorn forests as distinguished by Champion HG, et al. [19].

In Egypt, the plant grows on the banks of canals crossing the Delta and the Nile Valley. It was cultivated in the past, though cultivation has stopped. The relicts of this species are occasionally seen along the canals near the Nile River. *Acacia* groves growing in the Nile region in Egypt were replaced centuries ago by the date palm groves [20–22]. Despite this, the tree was reputed for its value as a source for agricultural tools such as the hoe, plough, etc. With the mechanization of agriculture, the plant was neglected. Moreover, the need of the land occupied by the trees, caused them to be removed [23]. Nowadays, the tree isn't as common as before. It might be considered as endangered, especially due to its geographical scarcity.



Source: Plants of the world online

<https://powo.science.kew.org/taxon/urn:lsid:ipni.org:names:77089275-1#distributions>.

Figure 2: Map shows *Acacia nilotica* distribution that have a widespread range in the drier areas of Africa, native species represented by green color, introduced species represented by purple color, and doubtful species represented by orange.

Ecology

There is some evidence that *A. nilotica* is a weed in its native habitat e.g. South Africa [24], but in other areas it is planted for forestry or reclamation of degraded land [25,26]. The ecological implication of using *A. nilotica* as a browse source while maintaining in appropriate stocking rates is land degradation. It grows well in two types of soils i.e. riverian alluvial soil and black cotton soil. This species grows on saline, alkaline soils, and those with calcareous

soils. *A. nilotica* can be grown in both moist and arid areas because of the fact that it can withstand to extremes of temperatures (>50°C) and moisture stress. Micro propagation and symbiotic relationship with rhizobium and mycorrhizal fungi makes it one of the important species for increasing soil fertility [27,28] and is said to be a possible way for reproducing many plants for conventional breeding, reforestation, and mass propagation. It is frost tender when young and trees of age classes are adversely disturbed by conditions of severe frost. It is fire tender and both seedlings

and saplings are adversely disturbed by fire. The average annual rainfall varies from 250-1500 mm [15].

In the wet season, *A. nilotica* germinates after rain. Some seeds may still germinate up to 15 years after seed drop, even though 95% of seeds die after two years. When seeds are disturbed, such as by fire or going through an animal's digestive system, germination is improved. In open grasslands, seedlings grow more slowly, but close to water, they grow quickly. Trees can flower and fruit two to three years after germination, and more quickly after high rainfall years. Pods form between July and December, and it flowers between March and June. The majority of leaf fall occurs during this arid month of June through November [15].

The Acacia Tree among Ancient Egyptians

Acacia nilotica has great importance on two levels the religious and worldly levels, on the religious level it is considered one of the sacred trees, it was associated with Osiris, so the texts mentioned that when Osiris died, and he was placed in a coffin that was made of acacia wood, and that the tree grew around his body to hide it as in Figure 3a [29]. It was also mentioned in the Pyramid Texts that the acacia tree was a sacred tree to God Hur, the tree was also associated with a number of goddesses, such as Izeh, Nephthys, and Sekhmet, who were known as acacia goddesses, it was also mentioned in some religious books such as the Pyramid Texts and the texts of the coffins, and the Book of Dead. The acacia tree had a structure that played an important role in religion, especially in burial rituals [30]. Some women's groups used acacia tree in offering sacrifices and performing funeral dances [31]. The acacia tree played an important role in protection, as it was mentioned in paragraph 436 of the

Pyramid Texts that the acacia tree was a sacred tree for the god Hur and that he took it shelter from lions [32].

The acacia tree has been used in many industries, such as the manufacture of statues, paintings (Figure 4), chairs, and coffins. The acacia tree was used to make a large number of statues, as a painted wooden statue made of acacia wood dating back to the Fourth Dynasty was found depicting a person and his wife as in Figure 3b [33]. A statue of "Merit" made of acacia wood and was found in his tomb at Saqqara, which back to the Fifth Dynasty [34]. Wood of *Acacia nilotica* is used in the manufacture of coffins due to its hardness and resistance for fungi, it has been used throughout the ancient Egyptian periods and was widely used in the family Sixth to Twelfth Dynasty [35].

The bark of the *Acacia nilotica* tree was also used for tanning, and it was found in the town of Al-Jabalain in Upper Egypt on a leather tanned with the juice of the horns of the acacia tree, which contains tannins, at a rate of about 30%, which is used in tanning, it was back to Pre-dynastic era, preserved in the Turin Museum [36]. The ancient Egyptians also knew how to color tanned leather in different colors, the most common of which was red, yellow, and green color [37]. The acacia tree was an important source to obtain the yellow and blue colors, it also used some mordants to fix color or dye, such as alum, vinegar, urine, as well as the infusion of some plants [38]. The acacia tree was also an important source of gum, and a statue depicting the god Osiris was found, it was back to the late era and acacia glue also was used in statues to fix the colors [39]. Its gum was used in the textile industry and leather adhesives, as well as in medicine [40].

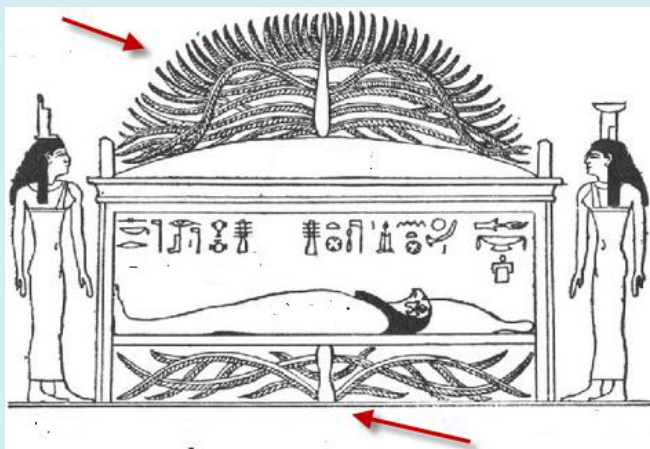


Figure 3: A picture showing uses of acacia tree among ancient Egyptian.

Figure 3a: Osiris tomb made of acacia in the Temple of Dendera.

Figure 3b: Statue of acacia wood depicting a person and his wife.



Figure 4: *Acacia nilotica* paintings on tombs wall.

The Use of *Acacia nilotica* Tree Products in Ancient Egyptian Medicine

Acacia nilotica tree products were used in different purposes. Modern medicine has proven that the acacia tree is generally a medicinal tree that has antimicrobial properties and perhaps the ancient Egyptian realized this and made it a container to store mummified entrails [41]. Acacia was mentioned in the Ebers Papyrus for killing a belly worms, expel pus from the abdomen, and treatment of hemorrhoids and anal diseases, As also stated in the Edwin Smith Papyrus, if you examine a person who complains about his anus while standing or sitting, and he is in a lot of pain from contractions: Treatment includes a very protective ointment made from acacia leaves. Seeds and leaves of acacia also were used in treatment of women's diseases, as Ebers's papyrus says that "To cause a woman to stop being pregnant, be it one, two or three years: part of acacia, colocynth, dates, finely ground in a hin of honey, fibers are moistened therewith, introduced into her vagina.

Chemical Composition of Different Parts of *Acacia nilotica*

Leaves: Phytochemical screening of ethanolic extracts revealed that the leaves of *Acacia nilotica* contain tannins, alkaloids, sterols; and there are no glycosides, saponins, resins or flavonoids substances were detected [42]. Ethyl gallate was isolated from the ethanol leaves extract of *A. nilotica* through se-quential extraction procedure completed by TLC and HPLC analysis [43]. The qualitative and quantitative GC/MS and HPLC analyses showed presence of γ - Sitosterol from leaves extract [44]. Mrityunjoy D, et al. [45] indicated the presence of alkaloids, saponins, cardiac glycosides, tannins, and flavonoids in leaves.

Root: A screening study of the ethanolic extracts of the roots of *Acacia nilotica* indicated the presence of sterols and

tannins; and the aqueous extract contains tannins, saponins, flavonoids, terpenes, sterols, phenols, alkaloids and anthraquinones; and Lukman, et al. indicate the presence of saponins, flavonoids, terpenes, tannins, phenols, alkaloids, and anthraquinones [42,46].

Pods: Sabah EE, et al. [47] used a different solvent to indicate the presence of alkaloids, flavonoid, saponins, tannin, cardiac glycoside, sterol, and carbohydrate. They used ethanol, water, and petroleum ether extracts. water and ethanol showed positive results of alkaloids, flavonoids, tannins, saponins and carbohydrate; and sterol was indicated by ethanol and petroleum ether extracts; and no saponins or carbohydrate were indicated by using of petroleum ether. In addition, Oladosu P, et al. [36] indicated the presence of alkaloids, saponins, tannins, and carbohydrate by using an aqueous methanol extract. Anti-uveal melanoma activity-guided fractionation of the methanol pods extract resulted in the isolation of 1-O-galloyl- β -D-glucose, 1,6-di-O-galloyl- β -D-glucose, digallic acid, and galocatechin-5-O-gallate [48].

Bark: Phytochemical analysis of ethanol and petroleum ether extract of the stem bark of *Acacia nilotica* exposed that the plant comprises terpenoids, tannins, alkaloids, saponins, and glycosides [49,50]. The carbohydrates and anthraquinone were detected in ethanol extract by Deshpande N [50]; while the results described by Okoro, et al. [42] revealed that, the ethanolic extracts of *Acacia nilotica* possess sterolsm and tannins; no alkaloids, saponins or glycosides.

Biological Activity of *Acacia nilotica*

Antimicrobial Activity: According to Unani traditional medicine, *A. nilotica* fruit is used to treat venereal diseases, diarrhea, dysentery, leprosy, colds, bronchitis, pneumonia, ophthalmia, and sore throats. The decoction of the bark is largely utilized as an astringent douche in sozak (gonorrhoea), waram al-mathana (cystitis), waram-al-mahbil (vaginitis), sayalan al-rahim (leucorrhoea) [51]. A study was investigated

the *in vitro* antibacterial activity of *Acacia nilotica* methanolic fruits extract against clinical isolates performed by cup-plate agar diffusion method against five gram-negative bacteria (*E. coli*, *S. flexneri*, *Salmonella typhi*, *Pseudomonas aeruginosa*, and *Klebsiella pneumonia*) and 2 gram-positive bacteria i.e., (*Listeria monocytogenes* and *Bacillus cereus*) [52].

Anti-inflammatory Activity: Traditionally, *A. nilotica* is used in numerous inflammatory conditions like bronchitis, pharyngitis, vaginitis, and conjunctivitis as it possesses (anti-inflammatory) property. The decoction of the bark is locally useful in cystitis, and vaginitis [53]. The juice of bark mixed with breast milk is dropped into the eye in conjunctivitis [53,54]. The ointment of the young leaf around the eyes is beneficial in *Ashob-ichashm harr* (Acute conjunctivitis) [55]. It is used in ophthalmia, tender leaf fried in ghee and wrapped around the eyes in chronic ophthalmia and subconjunctival haemorrhage [54]. The bruised leaves are useful to sore eyes in children [55]. The tender leaves growing tops rubbed into a paste with sugar and water and given two times a day are useful in cough [52]. The bark is also utilized in asthma and bronchitis [55].

Anticancer Activity: Cancer is a multifactorial disease and a major worldwide health problem. According to earlier research, plants and their components can modulate cellular proliferation, tumor suppressor genes, apoptosis, and other processes to exhibit inhibitory effects on the growth of malignant cells, etc. It contains flavonoids and various other components that play an important function in the inhibition of cancer development. The experiment was made to assess the anticancer activity of aqueous extracts of gum, flower, and leaves of *A. nilotica* in 7,12-dimethylbenz(a)anthracene (DMBA) induced skin papillomagenesis in Swiss albino mice. The results showed a significant reduction in the values of tumour burden, tumour incidence [56].

Antioxidant Activity: One of the primary factors in the development of many diseases is reactive oxygen species, also known as free radicals. Free radicals are neutralized by antioxidants, frequently before they reach their target cells. There have been reports of antioxidant activity in medicinal plants. An important investigation was conducted to assess the *in vitro* antioxidant activity of eight distinct crude extracts from *A. nilotica* pods. The outcomes clearly showed that *A. nilotica* green pods are a significant natural antioxidant source [57]. Other results indicate that umbelliferone a coumarin derivative studied *in vitro* and exhibited a higher antioxidant activity [17].

Antimalarial Potential: A study was performed to investigate the anti-plasmodium activity of aqueous and methanolic root extract of *Acacia nilotica* in *Plasmodium Berghei* infected mice. The results revealed significant activity against chloroquine-sensitive strains [58]. Ethyl acetate extract of its root exhibited the highest activity against *P. falciparum*. Another *in vitro* study evaluates the antimalarial activities of leaves, pods and bark extracts of *A.*

nilotica. The results revealed that it had an antimalarial effect as all extracts inhibited the development of mature schizont indicating schizonticide activity against *P. falciparum* [59].

Analgesic and Antipyretic Activity: *A. nilotica* has traditionally been found to be a strong analgesic when used to treat ocular discomfort. The young leaves are cooked in ghee and wrapped over the eyes in cases of chronic ophthalmia and subconjunctival hemorrhage [60]. Modern study has also shown that it possesses analgesic and antipyretic properties. One study investigated the antipyretic and analgesic properties of an aqueous root extract of *A. nilotica* in Wistar albino rat models. The extract was tested for antipyretic and analgesic efficacy in comparison to acetaminophen. At 200 and 400 mg/kg body weight, the extract reduces rats' rectal temperature significantly in a dose-dependent manner. Significant analgesic activity was also noted, compared to acetaminophen [61-64].

Conclusion

Acacia nilotica is an important ornamental and therapeutic trees in tropical and subtropical areas. It was an attractive plant to the ancient Egyptians because of its wood and chemical components. It was used to build boats and warships, according to Herodotus, who was traveling in Egypt in the fifth century B.C. It is also a source of numerous active secondary metabolites, which might give viable candidates for therapeutic development with the best chance of success in the near future. *Acacia nilotica* has been used in traditional medicine for thousands of years to cure a variety of ailments. Antibacterial, antifungal, antioxidant, antidiabetic, antihypertensive, antispasmodic, antiviral, anti plasmodial analgesic, antipyretic, and galactagogue properties have been shown in experimental research. Several scientific research supported the theories of the old medical system.

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