A REVIEW ON ACACIA NILOTICA LINN. AND ITS ETHNOBOTANY, PHYTOCHEMICAL AND PHARMACOLOGICAL PROFILE

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ABSTRACT
Acacia nilotica (Linn.) Willd. Ex Del., is a medicinal tree, belonging to the Leguminosae family and sub-family Mimosaceae, a moderate sized, spiny, evergreen tree found throughout India, known to be rich in phenolics, consisting of condensed tannin and phlobatannin, gallic acid, (+) catechin, (-) epigallocatechin-7-gallate, and has been used for treatment of viral (colds, bronchitis), bacterial (diarrhoea), amoeboid (dysentery), fungal, bleeding piles and leucoderma diseases. The present review summarizes the information concerning the botany, ethnopharmacology, phytochemistry, biological activity and toxicity of the Acacia nilotica Linn.

Keywords Acacia nilotica (Linn.), medicinal tree, ethnopharmacology, toxicity.

INTRODUCTION
Occurrence, Botanical Description And Ethnopharmacology

Acacia nilotica (Linn.) Willd. ex Del. belonging to the Leguminosae family and sub-family Mimosaceae consists of dried mature stem bark having moderate sized, spiny, evergreen tree found throughout India. Acacia is one of about 135 thorny African Acacia species. Variation is considerable with nine subspecies presently recognized, three occurring in the Indian subcontinent and six throughout Africa [1]. The common name of this tree is Babula tree, Indian gum arabic tree.

Widespread Occurance
The species is naturally widespread in the drier areas of Africa, from Senegal to Egypt and down to South Africa, and in Asia from Arabia eastwards to India, Burma and Sri Lanka. It has also been cultivated elsewhere, including Australia, Cape Verde islands, Indonesia, Iran, Iraq, Nepal, Vietnam, and the West Indies. It is indigenous to the plains of Andhra Pradesh and Maharashtra in...
India. *Acacia nilotica* occurs from sea level to over 2000 m.

**Climate Requirement**

It withstands extremes of temperature (-1 to 50°C), but is frost tender when young. Annual rainfall varies from 250 - 1500 mm. Trees are generally deciduous during the dry season, though riverine species can be almost evergreen [2].

**Physical Characteristics**

It is a moderate-sized, almost evergreen tree with a short trunk, and a spreading crown. The bark is dark brown to almost black, longitudinally fissured or deeply cracked. Leaves are 2-pinnate and the main rachis has glands. Stipular spines are variable. Leaflets are sub sessile and glabrous. Flowers golden-yellow, fragrant, crowded in long-stalked globose heads, forming auxiliary clusters of 2-5 heads. Pods are stalked, 7.5-15.0 cm in length and contracted between the circular seeds [3-5].

**Traditional Uses and Knowledge Acquired During Work**

The stem bark of *Acacia nilotica* Linn. for the treatment of tonsillitis. [6] In traditional practice the plant is used for the treatment of tuberculosis, pneumonia, gonorrhea and small pox. [7] Ethnobotanical study reported the plant to be most frequently used for the treatment of sexually transmitted diseases (STDs) [8]. The antimicrobial activity of the plant extract showed that it is active against *S. aures, E. coli* [7]. The methanolic extract of the plant showed significant inhibition of gram-positive and gram-negative bacteria [8] whereas, the ethanolic extract of the plant displayed activity against gram-positive bacteria only [9]. Apart from its antibacterial activity, the plant possesses antifungal activity, and molluscicidal activity against schistosomiasis transmitting snails *Bulinus truncatus* and *Biomphalaria pfeifferi* and cercarial and miracidial activity against *Schistosoma mansoni* [10, 11]. Also, the methanol extracts of the bark and pods of *Acacia nilotica* and aqueous extracts of pods of *A. nilotica* inhibited HIV-1 Protase replicate activity [12]. *Acacia nilotica* has also been reported to possess antiplasmodial activity *in vitro* against *Plasmodium falciparum* 3D7 (chloroquine sensitive) and Ddz (chloroquine resistant and pyrimethamine sensitive) with an IC50 value of less than 5µg/ml. Bioassay guided fractionation of *Acacia nilotica* revealed that the ethylene extract possessed the highest activity (IC50 =1.5µg/ml) [13]. *Acacia nilotica* extract had an inhibitory effect on carrageen induced paw edema and yeast- induced pyrexia in rats and produced a significant increase in the hot plate reaction time in mice. Flavonoids, polysaccharides and organic acids may be mainly responsible for its 60 pharmacological activities. [14] Also, a steroid 3β-acetoxy-17β-hydroxy-androst-5-ene isolated from aerial parts of *Acacia nilotica* showed dose-dependent anti-inflammatory activity against TPA-induced mouse ear edema [15].

**Phytochemistry**

*Acacia nilotica* Linn. have been reported to contain alkaloids, flavonoids, gum, fatty acids and tannins. It consists principally of arabin a compound of arabic acid with calcium, varying amounts of the magnesium and potassium salts of the same acid being present. It is believed, also, that small amounts of other salts of these bases occur. (Arabic acid can be obtained by precipitating with alcohol from a solution of acacia aci cladulate with hydrochloric acid.) The gum also contains 12 to 17 per cent of moisture and a trace of sugar, and yields 2.7 to 4 per cent of ash, consisting almost entirely of calcium, magnesium and potassium carbonates [16-20]. It contains gallic acid, m-digallic acid,(+)-catechin, chlorogenic acid, galloylated flavan-3,4-diol and robidandiol (7,3',4',5',-tetrahydroxyflavan-3,4-diol) [21]. It also contains 29% oleic, 44.5% linoleic acid) [22]. Seeds of *A. nilotica* contained coronaric acid (cis-9,10-epoxyoctadec-cis-12-einoic [23-25]. The alkaloids found in acacia include dimethyltryptamine (DMT), 5-methoxy dimethyltryptamine (5-MeO-DMT) and N-methyltryptamine (NMT) [26]. Gum contains galactose,l-arbinose,l-rhamnose and 4-aldobiouronic acids,arabinobioses [27]. Bark contains several polyphenols.Bark from Egypt have higher tannin content (27%) than that from India, It has been reported that various parts of the plant are rich in tannins (ellagic acid, gallic acid, tannic acid), stearic acid, vitamin-C (ascorbic acid),...
carotene, crude protein, crude fiber, and selenium.\textsuperscript{[28-34]} Bark consists of octacosanol, betulin, \( \beta \)-amyrin and \( \beta \)-sitosterol.\textsuperscript{[35]} Mainly flavonoids are apigenin-6,8-bis-C-\( \beta \)-D-glucopyranoside (vicenin).\textsuperscript{[36]} (+)-catechin-5,7-digallate, (+)-Catechin-3-,5-digallate, \(+\)-Catechin-4-,5-digallate,\textsuperscript{[37]} melacacidin\textsuperscript{[38]}, rutin (quercetin 3-O-rutinoside)\textsuperscript{[39-41]} 12-dimethylbenz(a)anthracene\textsuperscript{[42]}.

**Bioactivity**

*Acacia nilotica* Linn. has been found to possess significant antimicrobial activity, antioxidant, anti diarrhoeal, anticancer and antimutagenic properties, anthelmintic activity, antiplatelet aggregatory activity and vasoconstrictor.

**Antibacterial Activity**
The methanolic extract of *Acacia nilotica* leaf showed significant activity against *E. coli*, *S. aureus*. The highest antibacterial activity of 20 mm in *B. subtilis* and least activity recorded in *E. coli* measured 14 mm. Bark extract of *Acacia nilotica* Linn. exhibit highest activity against *B. subtilis* and *S. aureus* (15 mm) and lowest in *P. fluorescens*.

**Anthelmintic Activity**

*In vitro* anthelmintic activity of crude methanolic extract (CME) of the plants was determined against *Haemonchus contortus* by the adult motility assay, the egg hatch test and the larval development assay. *In vivo* anthelmintic activity was evaluated in sheep naturally infected with gastrointestinal nematodes by administering increasing doses of crude powder (CP) and CME (1.0–3.0 g/kg). The plants exhibited dose- and time-dependent anthelmintic effects by causing mortality of worms, and inhibiting egg hatching and larval development\textsuperscript{[45]}.  

**Anticancer And Antimutagenic Properties**
The chemotherapeutic activity of aqueous extracts of *Acacia nilotica* (Linn.) gum, flower and leaf is due to 7, 12–dimethylbenz(a) anthracene (DMBA) and croton oil induces skin papillomagenesis in male Swiss albino mice. Thus a significant reduction in the tumor burden, tumor incidence, and cumulative number of papillomas was noted, with a marked increase in the latency period as compared to the animals treated with single topical application of DMBA alone and croton oil. Available online on www.ijprd.com

Significant reduction in micronuclei number and chromosomal aberrations in the form of chromatid breaks, chromosome breaks, centric rings, dicentrics, acentric fragments and exchange was also apparent\textsuperscript{[42,46]}.

**Antidiarrhoeal Activity**

Methanol extracts of *Acacia nilotica* showed highest inhibition and the activities were reported at the concentration of 50 g/ml Chloroform extracts of *Acacia nilotica*, were found active at the concentration of 100 gm/ml. Aqueous and petroleum ether extracts of *Acacia nilotica* inhibited the pathogen at the concentration of 500 gm/ml\textsuperscript{[47]}.

**Antioxidant Activity**
The extracts of *Acacia nilotica* pod exhibited strong and effective *in vitro* and *in vivo* antioxidant potential by scavenging free radical. Presence of polyphenols is hold responsible for their overall antioxidant potential. It can also prevent strand break formation in supercoiled plasmid DNA and protein oxidation\textsuperscript{[48-50]}.

**Antihypertensive And Antispasmodic**

A methanol extract of *Acacia nilotica* Linn. pods caused a dose-dependent (3-30 mg/kg) fall in arterial blood pressure. Treatment of animals with atropine abolished the vasodilator response of acetylcholine (ACh), whereas the antihypertensive effect of the plant extract remained unaltered. Phentolamine (an alpha-adrenergic blocker) abolished the vasoconstrictor effect nor epinephrine (NE), whereas pretreatment of the animal did not modify the NE response. These results indicate that the antihypertensive effect of plant extract is independent of muscarinic receptor stimulation or adrenoceptor blockade. In the in vitro studies, *Acacia nilotica* produced a dose-dependent (0.3-3 mg/ml) inhibitory effect on force and rate of spontaneous contractions in guinea-pig paired atria. Similarly, it inhibited the spontaneous contraction of rabbit jejunum in a concentration-dependent (1-3. mg/ml) manner. *Acacia nilotica* also inhibited K(+)−induced contractions in rabbit jejunum at a similar concentration range, which suggests that the antispasmodic action of *Acacia*
nilotica is mediated through calcium channel blockade, and this may also be responsible for the blood pressure lowering effect of Acacia nilotica observed in the in vivo studies [51,52,53].

**Anti Inflammatory Activity**

3-beta-Acetoxy-17beta-hydroxy-androst-5-ene was isolated from aerial parts of Acacia nilotica (L.) Willd (Mimosaceae). The structure of this compound was established by spectral analysis and single crystal X-ray diffraction analysis. The steroid showed dose-dependent anti-inflammatory activity against TPA-induced mouse ear edema [54].

**Immunosuppressive effect**

Acacia nilotica Delile (Mimosaceae) stem bark showed immunosuppressive effect in vivo [55].

**CONCLUSION**

Acacia nilotica Linn. is an important source of many therapeutically and pharmacologically active constituents. The plant has been widely studied for its pharmacological activities and finds its position as a versatile plant having a wide spectrum of medicinal activities.

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