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A REVIEW OF ETHNOMEDICINE, PHYTOCHEMICAL AND PHARMACOLOGICAL PROPERTIES OF *ACACIA NILOTICA* (BABOOL/KIKKAR)

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ABSTRACT

The medicinal plants used in traditional medicine still plays an important role in emerging and developing countries since; they are inexpensive, effective and have natural origin. *Acacia Arabica/Acacia nilotica* commonly known as babool belongs to the family Fabaceae is widely distributed throughout the tropical and subtropical plains all over India, Sri Lanka, and Sudan, this plant is native to Egypt. Almost all its parts such as root, bark, leaves, flower, gum, pods etc are used in medication. The qualitative phytochemical study of different part of plant extract like leaves and fruits contain tannin; flowers contain stearic acid, kaempferol-3-glucoside, isoquercetin, leucocyanidin; pods contain tannin gumcontain Arabic acid combined with calcium, magnesium and potassium. Moreover, polyphenolic compounds have also been reported in pods and bark Medicinal plants have been used as traditional treatment for numerous human diseases for thousands of years in many parts of the world. In rural areas of developing countries, herbal materials continue to be used as the primary source of medicines *A. Nilotica* showed antihypertensive, antispasmodic, antibacterial, antifungal, antioxidant activity etc. The present review is an attempt to explore and comprehensively highlight the ethnomedicine uses, phytochemical properties and pharmacological uses of *Acacia Arabica* reported till date.

Keywords: ***Acacia nilotica;*** **phytochemical study; tannin; Arabic acid; ethnomedicine uses**

INTRODUCTION

Infectious diseases show an important health problem and represent one of the main causes of morbidity and mortality worldwide, due to the indiscriminate use of antibiotics and incidence of multiple antibiotic resistances in human pathogens, hence it is necessary to search for new agents that are better and without side effect for treating such infectious diseases especially in developing countries [1] therefore approximately 80% of the world population has used herbal products to satisfy their primary health care [2]. Medicinal plants have been used as traditional treatment for numerous human diseases for thousands of years in many parts of the world. Herbs have medicinal property due to presence of different active principles like alkaloids, volatile essential oils, glycosides, resins, oleoresins, steroids, tannins, terpenes and phenols [3]. The plant has been shown to exhibit antibacterial, anti-inflammatory, vasoconstrictor actions, antihypertensive, antispasmodic activities, inhibitory effect against hepatitis virus, cytotoxic activity and antioxidant activity [4].In the last few years there is an exponential growth in the field of herbal medicine because of their natural origin, easy availability, efficacy, safety and less side effects with efficient to cure age-related disorders like memory loss, osteoporosis, immune disorders, etc. for which no modern medicine is available [5].

Botanical description

Acacia nilotica(L.) Del. syn. *Acacia arabica*(Lam.) Willd. (Mimosaceae) is an imperative multipurpose plant [6]. *A.nilotica* occurs naturally and is imperative in traditional rural and agro-pastoral systems [7]. It is a tree 5–20 m high with a dense spheric crown, stems and branches usually dark to black coloured, fissured bark, grey-pinkish slash, exuding a reddish low quality gum. The tree has thin, straight, light, grey spines in axillary pairs, usually in 3 to 12 pairs, 5 to 7.5 cm (3 in) long in young trees, mature trees commonly without thorns. Flowers in globulous heads 1.2–1.5 cm in diameter of a bright golden-yellow color set up either axillary or whorly on peduncles 2–3 cm long located at the end of the branches. Pods are strongly constricted, white-grey, hairy and thick [8]. The species can withstand extremely hot temprature (>50^{o} C) and can also endure floods. The species is sensitive to frost when it is young [9]. Trees can flower and fruit two to three years after germination, but after high rainfall it is more quickly, usually between March and June [10]. The bark has a tinge of orange and/or

green (young tree), but older trees have dark, rough bark and tend to lose their thorns [11].

Distribution

Acacia nilotica (L.) Wild. ex Del. (Mimosaceae), known as prickly acacia in Australia. It is being a multipurpose and nitrogen fixer species is highly preferredby farmers and as a result, it is widely distributed in the field. *Acacia nilotica* is a tropical and subtropical genuswith species abundant throughout Asia, Australia, Africa and America. *Acacia nilotica* occurs naturally and is imperative in traditional rural and agro-pastoral systems. The largest tracts are found in Sind. It is distributed throughout the greater part of India in forest areas, roadsides, farmlands, tank foreshores, 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. Further, MPTs like *Acacia nilotica, Buteamono sperma, Terminalia arjuna, Albizia procera* and *Zizyphus mauritiana* are an integral part of the rural agro forestry practices of the region and have tremendous importance in poverty alleviation and income generation [12].

Major chemical constituents

Acacia species contains secondary metabolites including amines and alkaloids, cyanogenic glycosides, cyclitols, fatty acids and seed oils, fluoroacetate, gums, nonprotein amino acids, terpenes (including essential oils, diterpenes, phytosterol and triterpenegenins and saponins), hydrolyzable tannins, flavonoids and condensed tannins [13]. The plant is richer source of cystine, methionine, threonine, lysine, tryptophan, Potassium, phosphorus, magnesium, iron and manganese [14]. **Seeds:** It contain high percentage of phenolic constituents consisting of m-digallic acid, gallic acid, protocatechuic and ellagic acids, leucocyanidin. The mature seed also contains crude protein, crude fibre, crude fat, carbohydrates, potassium, phosphorus, magnesium, iron and manganese occurred in high concentrations and it is richer source of cystine, methionine, threonine, lysine and tryptophan. Fruit also contains mucilage and saponins [15]. **Pods:** It contains gallic acid and condensed tannins. **Leaf:** It contain apigenin, 6-8-bis-D-glucoside, rutin, 8% digestive protein (12.4% crude protein)**Bark:** It contains tannin (12-20%), terpenoids, saponins and glycosides, Phlobetannin, gallic acid, protocatechuic acid pyrocatechol, (+) – catechin, (-) epigallocatechin-5,7-digallate [16]. **Root:** It contains octaconsanol, betulin, B-amyrin and B-sitosterol. **Gum:** It is composed of galactoaraban which gives on

hydrolysis L-arabinose, D-galactose, L-rhamnose, D-glucuronic acid and 4-O-methyl- D-glucuronic acid. Among the acacia species, *A. nilotica* Subsp. *indica* is widely distributed in tropical and subtropical countries belonging to family Mimosoideae. In other studies it has been reported that *Acacia* species contains secondary metabolites e.g. amines and alkaloids, cyanogenic glycosides, cyclitols, fatty acids and seed oils, fluoroacetate, gums, non-proteinamino acids, terpenes (essential oils, diterpenes, phytosterol and triterpenegenins and saponins), hydrolysable tannins, flavonoids and condensed tannins [17].

Phytochemical and pharmacological properties

Acacia nilotica is an important multipurpose tree that has been used extensively for the treatment of various diseases, e.g. colds, bronchitis, diarrhoea, dysentery, biliousness and bleeding piles [18]. *A. nilotica*is an imperative multipurpose plant that has been used broadly for the treatment of various diseases and serves as a source of polyphenols [19]. *A. nilotica*has anti-plasmodial, molluscicidal, anti-fungal, anti-microbial activity, inhibitory activity against HCV and HIV-I [20]. Leucorrhoea is extensively treated by this plant [21]. Gum is used as astringent, emollient, liver tonic, antipyretic and anti-asthmatic [22]. It is used for stomach upset and pain, the bark is chewed to protect against scurvy, an infusion is taken for dysentery and diarrhea. In Nigeria it is one of the standard drugs for treating diarrhea. In all plants and mammals other than guinea pigs and primates-glucuronic acid is a precursor of ascorbic acid, also known as vitamin C. *A. nilotica* may be due to hydroxyl groups existing in the phenolic compounds that can scavenge the free radicals. It has an inspiring range of medicinal uses with potential antioxidant activity [23].

Ethnopharmacological studies

Several research workers have reported different biological activities of *Acacia arabica* in various *in vitro* and *in vivo* testmodels. These have been highlighted in detail in following headings**.**

Antidiabetic activity (Hypoglycemic effect): In a study by Karau, 2013 [24] the antidiabetic potential of aqueous leaf extracts of *Acacia nilotica* was evaluated in alloxan induced diabetic mice. The results showed that the aqueous leaf extracts of *A. nilotica* showed antidiabetic activity, suggesting that the mechanism of action involved release of insulin from pancreatic beta-cells.

Antiviral activity: Mohamed *et al*., [25] showed in their study that methanolic extract

of *Acacia nilotica* has antiviral activity against animal viruses named Fowl pox viruses and Newcastle diseases.

Antioxidant activity: A study by Agrawal in 2010 [26] explored methanolic extract of plant have anti-oxidant activity which was found to be 9.88 µg/ml.

Antibacterial activity: Sharma *et al*., [27] evaluated antibacterial activity of *A. Arabica* bark extracts in different solvents against *S.aureus, P. aeruginosa* and *E. coli* and observed maximum activity with acetone followed by methanolic extracts.

Antifungal activity: Tissouras *et al*., [28] performed biological tests also showed a strong antifungal activity against *Aspergillus niger* and *Candida albicans* strains. The minimum inhibitory concentrations were recorded in the range $0.079 \leq MIC \leq 0.158$ mg/ml respectively for the two oils of the species *raddiana* and *arabica*. Biological tests with two raw acacia oils showed strong antifungal activity *A. niger* and *C. albicans* with MICs of 0.079 and 0.088 mg/ml.

Antimicrobial activity: Solomon *et al*., [29] examined antimicrobial activity (in vitro) of ethanolic extract of *Acacia nilotica* against the bacteria Campylo bacteria coli which was isolated from goats. The results showed highest zone of inhibition at concentration of 70mg/ml.

CONCLUSION

Acacia nilotica has been in use since ancient times to treat wide range of diseases in traditional system medicine. Experimental studies have proven its antidiabetic, anti-hypertensive, antispasmodic, antibacterial, antifungal activity, antiplaque, antioxidant, antiplasmodic, antiviral activity, catalytic and galactagogue. The scientific studies have proven the claims of traditional system of medicine. Further more detail clinical researches are needed to explore its medicinal value in order to establish it as a standard drug.

Acacia nilotica is a potentially interesting species for therefore stations programs. However, it is important to select subspecies to be targeted. Indeed, the interpretation of data relative to *Acacia nilotica* raises problems if we do not clarify the subspecies about which we speak. Nowadays, the contribution of rural communities in forest resources management begins to appear as an inevitable element in the forest resources management strategies. Conservation and management of natural *Acacia nilotica* populations is essential in environment stabilization and fighting against drought.

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