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A Review on *Acacia arabica (Babool)*: Biological, Morphologicaland Pharmacological Studiesas well as Ethanobotanical, Unani andTraditional Uses

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ABSTRACT

With around 1350 species, Acacia is the second biggest genus in the Leguminosae family. It can be found in tropical and warm temperate regions around the world, with the highest number of species found in the Americas (185 species), Australia (957 species), Asia (89 species) and Africa (144 species). *Acacia arabica* is one of the species that has been successfully used in folk medicine to treat leprosy, tuberculosis,dysentery, cough, smallpox,ophthalmic, skin cancer and toothachein rural populations as an antispasmodic, astringentand aphrodisiac. Herbal medicines have been used for the prevention and treatment of many illnesses since the dawn of time.*Acacia arabica* has been shown to be useful in the treatment of a number of diseases, including diabetes, skin illness, and, most importantly, cancer. In Indian traditional medicine, the fresh plant parts of *Acacia arabica* are considered as astringent, aphrodisiac, demulcent,anthelmintic, antidiarrheal, antibacterialand have good nutritional value. This article provides a brief overview of *Acacia arabica*ethanobotanical and therapeutic uses, as well as a plant description. This is an attempt to collect and document data on many aspects of *Acacia arabica* and its possible applications. More research is needed before *Acacia arabica* pharmacological qualities may be used in therapy.

Keywords: *Acacia arabica*;Babool; *Acacia nilotica*; Antimicrobial; Antibacterial

I. INTRODUCTION:

Acacia is the most important genus in the Leguminosae family, having been identified by Linnaeus in 1773. There are over 1380 Acacia species worldwide, about 2/3rdof them native to Australia and the rest distributed throughout subtropical and tropical climates [1, 2]. Gamble in 1918 documented more than 40 species of this genus in India in his 'Flora of Madras Presidency'.

Acacia species are well known in India as 'Babool' and have been traditionally used in treatment of skin, stomach, genitaland dental problems. The Indian gum Arabic tree is a multipurpose tree that is commonly known as babul, kikar. It can be found in semi-arid and arid regions all over the world. *Acacia arabica* has been shown an efficient effect in the treatment for malaria, as well as toothache and sore throat (aerial portion). The anti-fertility activity of *A. arabica* pods and nuts has been also studied [3-8].

The antiviral activity of methanolic extracts of *A. arabica* pods has been claimed [9, 10]. One group of researchers is currently testing the antiplasmodial activity of *A. militia* ethyl acetate extract against several *Plasmodium falciparum* chloroquine resistant and susceptible strains [11]. This speciesfresh plant parts have been shown to be the most effective against the Hepatitis C virus [12]. It is a versatile tree that has been used to cure a variety of ailments including colds, diarrhoea, bronchitis, dysentery, bleeding piles, biliousnessandleucoderma.

Description:

Acacia arabica

Botanical Name: *Acacia nilotica* (L.) Delile

Common names: Acacia gomifera, acacia à gomme, arabischegummiakazie, acacia de cayenne, babul acacia, babul, black piquant, cassie, casha, egyptian acacia, gommier rouge, goma arabica, gum arabic tree, gum arabic tree, Indian gum-arabic-tree, thorny acacia and thorn-mimosa.

Regional and other name:

- **Ben :** Babul, Babla

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- **Eng :** Babul, Indian Gum Arabic tree, Black Babul
- **Guj :**Babaria,Baval,Kaloabaval
- **Hind :** Kikar, Babul
- **Kan :** Karijali, Gobbli
- **Mal :** Karuvelum, Karivelan
- **Mar :** Babhul,Babhula, Vedibabul
- **Ori :** Baubra, Bambuda
- **Punj :** Sak
- **Tam :** Kaluvelamaram, Karuvael, Karrivelei,Karuvelam;
- **Tel :** Nallatumma, Tuma, Tumma

Synonyms:*Acacianilotica* (Lam.) Willd., *Acacia scorpioides* W. Wight, *Mimosa arabica* Lam., *Mimosa niloticaL*., Mimosa scorpioides L.

Family: Fabaceae (alt. Leguminosae)

Subfamily: Acacieae also placed in Mimosaceae family

Subordinate taxa:*Acacianilotica* (Niloticadenotes 'of or from the Nile valley)

Morphological description: Perennial tree or shrub, 2.5–10m tall, with a wide range of characteristics. Branchlets purple-brown, briefly or densely pubescent, with lenticels, forming a dense spherical or flat crown with dark to black coloured stems. The bark is rough, thin, fissured with color deep red-brown. In immature trees, spines (thorns) are straight, thin,light-grey in axillary pairs, usually in 5-7.5 cm long, 3-12 pairsand older trees are often devoid of thorns. Pinnae 2–11 pairs, with 7–25 leaflets pairs having length 1.5–7 mm long per pinnae; leaves are bipinnate 30–40 mm long, with 1–2 petiolar glands and additional glands between all or only the highest pinnae.

At the nodes of leafy and leafless branchlets, peduncles form group. Golden yellow flowers in globulus heads 1.2–1.5 cm in diameter. Pods are slightly curved or straight, 5–15 cm long on a pedicel, 0.5–1.2 cm broadmwith constrictions between the seeds resembling a string of pearls, squishy when young, turning black and hard as they mature. Deep blackish-brown seeds with a sub-circular, smooth, compressed areole measuring 6–7 mm length and 4.5–5 mm broad. Seed weights range from 5,000 to 16,000 seeds per kg. *Subsp. militia* has glabrous or nearly glabrous twigs and pods, but *Subsp. kraussiana* has white-grey hairy pods that are constricted. In *subsp. adstringens*, the pods are constricted little or not at all.

Habit: Almost evergreen tree with medium size, crooked or straight, armed tree with dark-blackish-brown, longitudinally fissured and irregularbark.

Stem : Woody withherbaceousupper portion, aerial, branched, erect,solid, dark brown bark, bark also secrets gum.

Fig: 1

Leaves : Cauline and Ramal, alternate, stipulate, stipules modified into half to 2 inches long straight, pinnules 10-20 pairs, pinnae 5-7 pairs, sub sessile or sessile, oblong or ovate, entire, unicostate reticulate.

Fig: 2

Inflorescence: Axillary have cymose head.

Flowers: Flowers are small, grouped together having bright-yellow color and round heads.

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Fig: 3

Fruits: A lomentum, pods are linear-oblong in shape having glaucous-green color, jointed, joints are nearly orbicular, compressed and minutely hairy.

Fig: 4

Seeds: Non-endospermic, oblong, brownish-black, compressed, glabrous, smooth.

Fig: 5

Flowering and Fruiting time: July - December

Significance:

- The bark is used as a strong astringent and a tanning agent.
- The wood is tough and long-lasting, and is commonly used for wheels, fuel and well-curbs.
- The wood is long-lasting and termite-resistant.
- The gum derived from the stem is useful in dysentery and also used in diabetes mellitus.
- It is utilised as railway sleepers and ashigh-quality fuel.
- Calico-printers utilise it and it also makes an excellent tanning substance.
- Tender leaves are used for livestock feed and as a blood purifier.
- Tender leaves are also used to treat gonorrhoeaand diarrhoeawhen combined with pomegranate juice.
- The spines can be used as paper pins and fishing hooks.
- Young twigs are used to clean teeth called "Datoon."
- The fruit act as a powerful astringent.
- The green pods, new shoots and leaves provide excellent feed and are particularly useful during drought seasons[13-37].

Biological and Pharmacological Studies:

Antidiabetic: Wadood*et al.*,found that *Acacia arabica* seeds contained a substances that reduced blood glucose in normoglycemic but not show good result in alloxan-diabetic rabbits, implying that the mechanism of action involves insulin release from pancreatic beta-cells. In mild alloxonized diabetic rabbits fasted for 18 hours, both the bark decoction (20 mg/kg) and the conventional medication talbutamide significantly reduced blood glucose levels. In normal rats, the *A. nilotica* ssp. *Indica* was found to have a hypoglycaemic effect (blood sugar was reduced by 25.05 %), but not in alloxanized diabetic rats (blood sugar lowered by 2.14 %).The legumes' hypoglycemic impact was attributed to their indirect or direct stimulation of β–cells in the Langerhans islets to release more insulin[38-40].

Antimutagenic: Using the *Escherichia coli* WP-2 at a concentration of 5 mg/plate, the methanolic extract of the bark reduced UV-induced mutagenicity. This decrease could be due to an enzymatic mechanism that prevents pyramiding dimmers from forming.[41].

Antiproteolytic: Ten types of legume seeds were tested for their ability to inhibit total tryptic (by hydrolysis of benzoyl arginine p-nitroanilide), proteolytic (caseinolytic)and chymotryptic (by hydrolysis of acetyl tyrosine ethyl ester) activities

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on human and bovine pancreatic proteases. Acacia seed extracts had a stronger inhibitory effect on human chymotrypsin and trypsin, as well as the total proteolytic activity of the bovine system.[42].

Antifertility: The flowers' aqueous extract has 11.5 % abortifacient effect in rats. It was also tested for teratological problems in pregnant rats in failure situations (when pregnancy was not avoided). External morphological and skeletal abnormalities were present in the foetuses [43]. A preliminary screening demonstrated semen coagulant activity in a stem bark extract at a concentration of 2%[44].

Antimicrobial: The antibacterial activity of *C. reflexa* methanol extracts has been suggested. Plant extracts of *C.reflexa* grown on two distinct sources (*Zizyphusjujube*and*Acacia arabica*) were made with organic and aqueous solvents such as acetone, benzene,ethanoland methanol. The antibacterial activity of plants from various sources was assessed using the agar well diffusion technique against gram positive bacteria (*Staphylococcus epidermidis*and*Staphylococcus aureus*), gram negative bacteria (*Pseudomonas aeruginosa* and *Escherichia coli*)and fungus (*Aspergillus niger*).

The antibacterial action was measured by the diameter of the zone of inhibition. The methanol and ethanol and extracts of *C. reflexa* (arabica and jujuba) were shown to have a strong inhibitory impact on most gram negative and gram positive bacteria in this investigation. *C. reflexa* (arabica) aqueous extract had no antibacterial action, while *C. reflexa* (jujuba) had only a minor effect. As a result, *C. reflexa* growing on *Zizyphus jujuba* could be regarded as a natural antibacterial source[50].

Antimicrobial screening was carried out in a study and *A. nilotica*and*A. catechu* were found to have the maximum activity against three bacterial (*Staphylococcus aureus*, *Escherichia coli*and*Salmonella typhi*) and two fungal strains (*Aspergillus Niger* and *Candida albicans*). Secondary metabolites including as flavanoids, alkaloids, saponins and tannins were discovered in various plant parts (pods and bark) of both species. The antibacterial action in plants is not caused by tannins, but by another substance, according to this study, because activity was observed following heat treatment. In tea, tannins are assumed to have the bactericidal agent[50, 51, 52].

Antibacterial: The antibacterial activity of *Acacia nilotica* extracts was tested using the agar diffusion method against *Staphylococcus aureus*, *Streptococcus viridans*, *Escherichia coli*, *Shigella sonnei*and*Bacillus subtilis*. The plant extract was antibacterial against all of the microbes tested. *Candida albicans* was the most resistant to the plant extract, whereas *B. subtilis* was the most sensitive. The least inhibitory concentration of the plants stem bark extract varied from 35 to 50 mg/ml, while the minimum bactericidal concentration was 35 to 60 mg/ml. Antimicrobial agents could be produced by *A. nilotica*[53].

The aqueous extractantibacterial activity, different solvent extracts and isolated constituents were evaluated by the method of cup diffusion against methanol, aqueousand ethanol extracts of *Acacia nilotica*, Family-Fabaceaeleaves showed efficient antibacterial activity against three phytopathogenic *Xanthomonas pathovars* associated with angular leaf spot of cotton, common blight of bean and bacterial spot of tomato respectively and 14 human pathogenic bacteria. When compared to synthetic antibiotics like K-cycline and Bact 805 for phytopathogenic bacteria and Streptomycin and Gentamicin for human pathogenic bacteria, this active fraction fractioned from methanol extract showed highly significant antibacterial activity in *in vitro*study(MIC 5, 6, and 7 g/ml for *Xanthomonas pathovars* and 6-12 g/ml for human pathogenic bacteria)[54].

By using the agar diffusion method, the alcoholic extract of leaf, gumand fruit activity revealed during *in vitro* antibacterial activity against *Staphylococcus aureus* (Zone of inhibition 10-19 mm), but no activity against *Bacillus subtilis*, *E. coli*, *Salmonella typhimurium*, *Proteus vulgaris*and*Pseudomonas aeruginosa*. The activity of the aqueous and hexane extracts was completely absent [55]. Using the disc method, the barks are air dried and powered water and alcoholic extracts showed substantial *in vitro* antibacterial activity against *Streptococcus pyogenes*, *Escherichia coli*, *Staphylococcus aureus*, *Salmonella typhimurium*, Klebsiella sp. *Pseudomonas aeruginosa* and *Pseudomonas aeruginosa*was shown to be resistant to both extracts, and both extracts were found to be significantly suppressive to gram positive bacteria as compared to gram negative bacteria.Againstthe pet. ether extracts the entire microorganism showed resistance[56].

Antifungal: In comparison to controls, the polyphenol complex of the bark at a concentration of 50% showed the greatest growth inhibition (56%) against *Fusarium oxysporum*. *In vitro* experiments, the extract at 10 and 25 % dilutions demonstrated 24 % and 37 % inhibition, respectively. After 10 hours of treatment, the floral extract showed a 65 % suppression of alternarissolani conidial germination [57]. The plant pathogenic fungi *Fusarium oxisporum* (69 %) and *Sarocladiumoryzae* (37 %) [58] were both suppressed by the water extract of leaves, whereas *Rhizoctonia solani* was inhibited by the ethanolic extract (51.13 %)[59].

Helminthosporiumoryzae spore germination was increased by the pollen suspension, generating paddyleaf blight [60]. The deproteinised young leaves extract of the plant was found to be less inhibitory to the spore germination of plant fungi such as *Alternaria brassicicola*, Pestalotiasp.,*Helminthosporiumapattaranae*, *Penicilumpurpurogenum*, *Trichothesium*, *Asperaginosniger*, Neurospora, Fusarium, Trichoderma and Rhizopus species when compared to the extract of pods, flowers and old leaves.All fungi were completely inhibited by the flower and bark extract[61].

*Alternaria tenuis*have the phenolic or tannins substancewhich is obtained from the leaf and bark decoctionwhichinhibits the polygalacturonaseenzyme[62]. At a concentration of 10 gm/lit, the acetone extract of the bark inhibited *Pyriculariaoryzae* and *Coletotrichumfalcatum* conidial germination and to a lesser amount at a dosage of 1 gm/lit. It was poisonous at a concentration of 0.1 gm/lit[63].

Antidiarrhoeal: Five medicinal plants (*Acanthospermunhispidum*, *Acacia nilotica*, *Gmelina arborea*, *Vitex doniana* and *Parkia biglobosa*) used in treatment of diarrhoeain Kaduna State, Nigeria, were investigated. Perfused isolated rabbit jejunum and castor oil-induced diarrhoea in mice were employed in this investigation. In the isolated rabbit jejunum, the aqueous methanol extracts (0.5, 1.0, 2.0, and 3.0 mg/ml) caused a dose-dependent response, however this was not consistent in all of the plants. At low dosages (0.5, 1.0 mg/ml), *Gmelina arborea* and *Vitex doniana* displayed concentration-dependent relaxation, but no significant relaxation at higher levels (2.0, 3.0 mg/ml). Biphasic effects were seen in other extracts. At 3.0 mg/ml, *Acacia nilotica*, for example, elicited initial relaxation followed by contraction.*Parkiabiglobosa*and*Acacia nilotica* extracts (100, 200 mg/kg) provided 100 % protection against castor oil-induced diarrhoea, while *Vitex doniana* had a dose-dependent effect[64].

Antiviral:*In vitro* antiviral activity was found in a crude extract of the plants leaves against the *Turnip mosaic* virus. On the hosts *Chenopodium amaranticolor* (93.77 %) and *C. album*, the number of lesions decreased (80.2 %). Lesions were similarly reduced when the extract was applied to the host leaves. The potato virus was suppressed by the bark extract[65, 66].

Nematicidal: The*A. Senegal* aqueous leaf extracts had nematicidal action against *Meloidogyne incogenita*, inhibiting its hatching.[67].

Antioxidant:A fraction, AN-2, was recovered from a methanol extract fractionation and identified as a coumarin derivative, umbelliferone, using spectroscopic techniques such as NMR and mass spectroscopy. *In vitro* antioxidative activities were investigated and performed, including DPPH, deoxyribose (site and non-site specific), chelating power, reducing power and lipid peroxidation assays. The antioxidative impact of umbelliferone was shown to be dosage dependent up to 100g/ml, after which it plateaued with no further rise in activity. This is the first time that umbelliferone from *A. Nilotica* has been isolated and studied for its antioxidant properties [68].

The two extraction methods were compared in terms of their ability to scavenge free radicals. The same species, *Acacia nilotica*, is used for extraction. In the DPPH experiment, the successive extraction approach was more successful than the maceration method in concentrating the active ingredients in the ethanol extract.

Our findings show that an ethanol extract high in phenolic and flavonoid content has strong antioxidant activity when compared to all of the positive controls in this investigation. The ethanol extracts potential antioxidant mechanism could be due to its hydrogen or electron donating and direct free radical scavenging characteristics[69].

The bark powder of *Acacia nilotica* (L.) Willd. Ex Del was extracted using the maceration extraction method with several solvents of increasing and decreasing polarity and the water extract was then partitioned with ethyl acetate and water. The results of the lipid peroxidation scavenging activity assay were compared to those of standard antioxidants (butylated hydroxytoluene). The activity of the extract was observed to increase after fractionation. In vitro antioxidative activities in rat tissue homogenate were investigated, including radical scavenging effects, hydroxyl radical scavenging potential, reducing power, chelating abilityand lipid peroxidation inhibition.

The antioxidative impact of extract/fractions was shown to be concentration dependent and increased when the extract was fractionated into ethyl acetate and water fractions. Extract or fractions appeared to be more effective in scavenging DPPH and hydroxyl radicals than reducing; chelating heavy metals and lipid peroxidation inhibitory potential, based on a comparison of antioxidant capacity and IC50 values for different antioxidative reactions. NMR and mass spectroscopy were used to identify a polyphenol component isolated from methanol extract of *Acacia nilotica*Willd. Ex Del. [70].

In vitro assays were used to demonstrate the AN-5's antioxidant potential, including measuring proton radical scavenging activity (DPPH scavenging assay), hydroxyl radical scavenging activity (deoxyribose degradation assay), metal chelating activity, reducing power, and inhibition of lipid peroxidation. The effect of the chemical AN-5 was shown to be dose dependent up to doses of 1–50 g/ml in DPPH assay and 1–100 g/ml in deoxyribose degradation assay, but did not change significantly above these concentrations [71].

The antioxidant activity of bark extracts from four distinct trees (*Azadirachta indica, Acacia nilotica, Termenaliaarjuna*and *Eugenia jambolana Lam*.) was tested in three different solvents: 80 % methanol, 80 % ethanol, and 80 % acetone (solvent: water, 80:20 v/v).

Antioxidant activity (AA) was assessed by assessing reducing power, peroxidation inhibition using the linoleic acid method, and radical scavenging activity using the 2, 2'-diphenyl-1-picrylhydrazyl radical (DPPH). Total phenolics, total flavonids, inhibition of linoleic acid oxidation, and DPPH scavenging activity of various bark extracts were shown to differ significantly ($P < 0.05$). Total phenolic content ranged from 7.8 to 16.5 gallic acid equivalents, and total flavonoid content ranged from 1.59 to 4.93 catechin equivalents in all bark extracts. At a concentration of 10 mg/ml extract, the reducing power ranged from 1.34 to 1.87.

Various bark extracts reduced linoleic acid oxidation by 44–90%, while DPPH radical scavenging activity ranged from 49 to 87 %. The extraction efficiency of antioxidative components decreased in the following order: ethanol > methanol > acetone. Total phenolics in bark from *A. nilotica* ranged from 9.2 to 16.5 g/100 g, while bark from *E. jambolana* Lam exhibited the highest Antoxidant activity as measured by prevention of linoleic acid oxidation. The maximum DPPH scavenging activity and lowering power were found in the same tree[72].

Abortifacient Activity: The effects of aqueous or 90 % ethanol extracts of the plants of interest orally dosed for 10 days after insemination on foetal development were examined in rats. At dosages of 175 mg/kg of beginning dry material, leaf extracts of *Moringa oleifern* and *Adhatodavasica* were completely abortive. At the doses studied, only the blossoms of *Hibiscus rosa-sinensis*and*Acacia arabica* showed to be teratologic [73].

II. CONCLUSION:

Acacia arabica is the plant which is generally found in diverse climate. It have various clinical activities which has been traditionally. Its bark, leaf, pod and gum parts are used for the medicinal use. The manuscript describes the various pharmacological effect and different types of studied which is performed to determine the activity of extracts. Manuscript mainly describes the nematicidal, antioxidant, abortifacient, antiviral, antidiarrhoeal, antifungal, antidiabetic, antibacterial, antimicrobial, antifertility, antimutagenic and antiproteolytic activity of *Acacia arabica*. It is concluded from the literature survey that it shows great efficiency effect in the treatment of various disease.

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