

Phytochemical and Biological Potential of *Acacia* Species: A Review

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ABSTRACT

This Review Comprehensively Examines the Phytochemicals Composition and Biological Activities of for *Acacia* Species: *Acacia nilotica*, *Acacia catechu*, *Acacia senegal* and *Acacia auriculiformis*. These species are renowned for their rich diversity of secondary metabolites, including alkaloids flavonoids, tannins, and terpenoids. The paper highlights the pharmacological potential of these compounds, including their antimicrobial, antioxidant, anti-inflammatory, and anticancer properties. Additionally, we discuss the traditional uses and emerging therapeutic applications of *Acacia* species in modern medicine, emphasizing the need for further research to explore their full medicinal potential.

Keywords: *Acacia* species, Phytochemical, biological activity

INTRODUCTION

Acacia genus belongs to family fabaceae. The heartwood of *Acacia catechu* L. is extracted using 10% hydro-alcoholic solution to produce katha in marketing (Sharma P., 2020). Many thousands of years before the ayurvedic and Unani medical systems, it was widely used in holistic medicine (Hashmat M.A. and Hussain R., 2013). *Acacia catechu*'s entire plant has a wide range of therapeutic properties, including anti-inflammatory, antibacterial, antifungal, astringent, anthelmintic, analgesic, anti-diabetic, Wound-healing, anti-tumor, and immune-boosting properties. (B. Aggarwal, B., *et al.*, 2011) Because they are natural, affordable, and effective, plants and plant extracts are utilized for medical purpose and are crucial in underdeveloped nations. Plant parts like roots, bark, leaves, flowers, gum, and ponds were traditionally utilized as medicine (HM, S., 1997). This plant is used to cure a variety of illnesses, including colds, coughs, sore throats, diarrhea, dysentery, TB, piles, hepatitis C virus, burns, and scalds. It also processes anti-microbial, antiplasmodial, anticancer, antimutagenic, and antioxidant properties. *Acacia senegal* founds in south Africa, Zimbabwe, Senegal, Sudan, Kenya, Nigeria, chad, Ethiopia, Tanzania, Cameroun, and other

African nations are also home to this indigenous species. (Mokwunye, M. U. B., & Aghughu, O., 2010). The tree yields gum Arabic, a material that is frequently used as an emulsifier, glue, and microencapsulating agent. Additionally, the textile, lithography, cosmetics, pharmaceutical, and lessen chronic renal failure when taken as a dietary supplement. (Matsumoto N., *et al.*, 2006) Furthermore, gum Arabic had antibacterial and antioxidant qualities. (Montenegro M. A., *et al.*, 2012) The deciduous or evergreen *Acacia auriculiformis* tree can reach a maximum height of thirty meters. Akis,"Which meaning "Spike" or "point" in Greek, is the root of the common name for acacia. It contains high levels of galactose, arabinose, rhamnose, glucuronic acid, and methyl glucuronic acid. It is claimed to have spermicidal, filaricidal, and central nervous system depressive qualities due to the presence of tannins and triterpenoid saponins (Dobariya R., *et al.*, 2024). It usually occurs in parks and by the side of the road in India. "Akkis" Which meaning "spike" or "point" in Greek, the root of the common name for acacia. On the other hand, the Latin term "auricula" indicates shape of leaves or seed pods, which resemble a small ear. This review focuses on the phytochemical composition and biological activities of various *Acacia* species, highlighting their

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potential therapeutic applications. A comprehensive analysis of the secondary metabolites, such as alkaloids, flavonoids, and tannis, is presented alongside their pharmacological effects, including antimicrobial, antioxidant, and anti-diabetic properties.

***Acacia catechu* (L.F.) Willd**

Average height of an *Acacia catechu* plant ranges from 5 to 15 meters (Qadry J. S., 2008) with bipinnate leaves with 20-50 Pairs of leaflets and 10-30 pairs of pinnae that are unique (Wallis TE., 2005) and has a straight, greyish brown stem (Dhruve K., *et al.*, 2011). The inflorescence has auxiliary pedunculate spikes and small, hooked spines.

***Acacia nilotica* (L.) Willd. Ex Delile**

Antioxidant activity

Rajbir S. *et al.* obtained the antioxidant kaempferol from the methanol extract of *nilotica* Willd. Ex. Del (Kalaivani T. and Mathew I., 2010) While the antioxidant Umbelliferon was also recovered from the bark and leaves of *Acacia nilotica* (L.) Willd. Ex. Del (Singh R., *et al.*, 2010). Plant parts of *Acacia nilotica* possess the antioxidant potential. Bark and leaves methanol and Ethanol extract of *Acacia nilotica* respectively were showed the antioxidant activity (Singh R., *et al.*, 2010) (Osman Z., *et al.*, 2014) and Ethyl gallate, an active antioxidant component also identified by Kalaivani T. *et al.* in *Acacia nilotica* leaves.

Antidiabetic and antihypertensive Activity:

Acacia nilotica seed shows the significant effect of alloxanized diabetic rabbits. (Wadood, A. B. D. U. L., *et al.*, 1989). Lukman A. Fatty acids and lignin, Vitamin-C, Quinones and alkaloids, Resin, phenols respectively.

***Acacia senegal* (L.)**

Acacia senegal founds in south Africa, Zimbabwe, Senegal, Sudan, Kenya, Nigeria, Chad, Ethiopia, Tanzania, Cameroun, and other African nations. (Mokwunye, M. U. B., & Aghughu, O. 2010). The tree yields gum Arabic, a material that is frequently employed as an emulsifier, glue, and microencapsulating agent. Additionally, also used in

textile, lithography, cosmetics, pharmaceutical (Ali, B.H. *et al.*, 2009) (Montenegro M. A., *et al.*, 2012)

Phytochemical properties

Renuka Jain reported that heartwood and roots of the *acacia senegal* tree possesses the Phytochemicals and Antibacterial Properties and also isolated a four Waxy compounds three Steroids, 3 triterpenoids, a novel quinic acid diester, a cyclohexitol, and Substance eicosanyl 3-O-feruloyl quinate Okoro S.O. reported the sterols, tannins, and saponins in bark of the *Acacia senegal* and also reported the Antibacterial potential against. (Okoro S.O., *et al.*, 2012) The bark of the *Acacia senegal* have antidiabetic properties (Agrawal, T., 2018)

***Acacia auriculiformis* A. Cunn. Ex Benth**

Acacia auriculiformis is a medium-sized, straight, or evergreen tree that can reach up to height of 30 metres. It usually occurs in parks and by the side of the road in India. "Akis," which meaning "spike" or "point" in Greek, is the root of the common name for *Acacia*.

Antimicrobial Properties

Chew reported that funicles of *Acacia auriculiformis* possess the acacisides a and b demonstrated antibacterial activity by inhibiting *Salmonella typhimurium*, *Pseudomonas aeruginosa*, and *Bacillus megaterium*. Leaves and Flowers of *Acacia auriculiformis* also possess the antibacterial activities against *Escherichia coli*, *Klebsiella pneumonia*, *Bacillus cereus* and *Staphylo aureus*.

CONCLUSION

Since ancient time, Traditional system medicine as used *Acacia catechu* Heartwood to treat a variety of illness. Its antidiabetic, Antihypertensive, Antibacterial, Antifungal, Antiplatelet, Antioxidant, Antiviral, Anti-inflammatory, Anti-cancer, and Wound-Healing Properties. Since ancient times, *Acacia nilotica* has been used in traditional medicine to cure a variety of illness. Its antibacterial, Antifungal, Antioxidant, antidiabetic, antihypertensive, antispasmodic, antiviral properties. Overall, this is a brief overview of *Acacia senegal* that highlights phytochemical properties and biological potential. Because of many therapeutic uses, *Acacia auriculiformis*, a multipurpose shrub that is widely

spread throughout Asia, has long been used in conventional medicine. The plant is useful for treating a variety of medicinal ailments because of its bioactivity and the low toxicity of its phytoconstituents

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